CHAPTER 11

Voices of Change: Gender and Knowledge Journeys in the Construction of Public Policies for Women in STEM in Bolivia

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Introduction

Women's access to Bolivian universities began in the 1950s and gained visibility in the 1970s, with women's significant participation in Science, Technology, Engineering and Mathematics (STEM) fields emerging in the 1990s. Despite increased enrolment, women's representation in engineering and technology in Bolivia remains low; in 2015, women comprised 40% in natural sciences and only 29% in engineering (UNESCO, 2017).

Barriers to women's participation in STEM begin early in life, with girls losing interest in science as early as primary school. Although young girls perform well in math competitions – holding 70% of top positions in primary school – representation drops to approximately 25% in secondary school (Guevara, 2021). In secondary school, problem-solving skills and teachers play vital roles in encouraging science careers. However, gender stereotypes and discriminatory behaviours by teachers often deter students (Cerinsek et al., 2013; Radovic et al., 2021). Gender barriers persist in undergraduate programmes, further limiting women's opportunities (De Urioste, 2016).

Gender stereotypes and hierarchical discrimination exacerbate women's drop-out rates at all levels, reinforcing inequality in STEM (Radovic et al., 2021). Addressing these challenges requires multisectoral and sustainable measures that consider the complex barriers women face in these fields.

Understanding the low participation of Bolivian women in STEM fields requires a multidimensional approach. However, understanding data alone will not bring about significant change. It is necessary to create spaces for reflection and to work with stakeholders to co-construct solutions to gender inequality in STEM. This chapter narrates the journey through this process of understanding the experiences of women in STEM in Bolivia and using this information to design effective solutions. Our work is guided by the voices of successful women in STEM fields in Bolivia, as well as their parents, teachers and principals from secondary schools and universities.

This chapter details two key phases of the project. The first phase focused on data collection and analysis through three distinct approaches: (1) life stories of successful women in STEM; (2) social representations[1] within the community; and (3) statistical analysis of female participation (Avolio & Chávez, 2023). These methods provided a comprehensive understanding of the barriers and opportunities present in STEM. The second phase focused on the co-construction of participatory workshops with key stakeholders, culminating in the development of concrete proposals for extracurricular programmes to promote inclusion and gender equity in STEM (Arredondo Trapero et al., 2019; Mariaca, 1999). In these co-construction spaces, key stakeholders collaborate to provide solutions to this issue.

Developing the study: Reflection on women's participation in STEM in Bolivia

The motivation to study the gender gap in STEM in Bolivia emerged from the Research Committee of the Interuniversity Observatory for Gender Equality, composed of 14 universities in the city of Santa Cruz de la Sierra. This committee highlighted the urgent need to address the issue, as women's participation in STEM areas was significantly lower than men's. This gender disparity not only limits the personal and professional development of women but also hinders the country's innovative and economic potential (Paredes-Walker, 2020).

One of the main challenges identified by the research committee was the lack of detailed information on the factors that influence women's participation in STEM. A lack of data makes it difficult to have a comprehensive understanding of the phenomenon and, consequently, to implement effective

1 Social representations refer to the shared beliefs, values, ideas and understandings that people in a society or group hold about a particular topic or social phenomenon. These representations are constructed through communication, culture and social interaction, and they shape how individuals perceive and relate to the world around them.

strategies (Abdulkadri et al., 2022). To overcome this limitation, a mixed-methods research approach was adopted, integrating both qualitative (e.g. life stories and social representations) and quantitative methods (statistical data analyses) to provide a more complete view. Quantitative methods provide statistical data that reveal patterns of women's participation in STEM, while qualitative methods, through interviews and focus groups, explore the experiences and obstacles women face (Carrasco Mercado, 2018).

Life stories offer a qualitative perspective on personal challenges and achievements, revealing patterns of resilience (Denzin & Lincoln, 2018). These narratives, along with social representations of what it means to be a female engineer in Bolivia, uncover stereotypes and cultural barriers that influence women's aspirations (Connell, 2009). Additionally, statistical analyses provide a quantitative understanding of women's participation in STEM, identifying trends and critical areas. This comprehensive approach not only sheds light on the complexity of the gender gap but also facilitates the design of more effective policies and programmes to promote gender equality in STEM in Bolivia (UNESCO, 2017).

The project focused on addressing the gender gap in STEM through an inclusive, collaborative and comprehensive approach. Led by the Interuniversity Observatory for Gender Equality,[2] this initiative emphasised the importance of plural participation from key stakeholders, including universities, the private sector, local governments and civil society organisations, to ensure sustainable and effective solutions.

Our mixed methods approach identified structural and cultural barriers that limit women's participation in STEM (Connell, 2009; Denzin & Lincoln, 2018; López, 2021). The intersectoral (i.e. involving key stakeholders from multiple sectors) reflection spaces facilitated the co-construction of public policies aligned with national and local priorities. Plural participation enriched the process, ensuring that the proposals reflected the actual needs of communities.

Additionally, pilot programmes, including mentorships and educational workshops, were developed, tested and adjusted to maximise their impact. This inclusive approach seeks to close the gender gap in STEM and create meaningful change within Bolivian communities.

Phase 1: Voices and data of women in STEM in Bolivia

The participation of women in STEM should be understood through their own experiences, which highlight both the barriers and empowering factors

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they face in their careers. Participatory action research (PAR) was used in this project to explore and promote female participation in STEM, offering a collaborative and inclusive approach that involves both researchers and the affected community (Kemmis et al., 2014). PAR is effective in addressing challenges faced by marginalised groups in STEM and provides a deeper understanding of power dynamics and inequalities (Somekh, 2006). Additionally, it empowers women by fostering the ability to transform their educational and professional environments (Bergman & Danermark, 2015).

PAR not only facilitates the co-construction of knowledge but also promotes transformative actions that go beyond the generation of academic data. These actions drive concrete changes in policies and institutional practices, strengthening gender equity and inclusion in scientific and technological fields.

The following section explains how we designed the project to understand women's participation in STEM. We began by investigating the characteristics, limitations and opportunities that affect women's STEM participation. We implemented three research strategies to understand how personal perceptions, social factors and institutional practices influence women's access to and development in STEM.

The first method (life stories) focused on how successful Bolivian female engineers overcame barriers, using the life stories of 40 accomplished Bolivian women in STEM. These women were selected based on specific criteria, including their professional trajectories, academic degrees obtained, publications and visibility in their respective fields. Another key criterion was that professionals in the field identified them as role models or exemplars of success. Additionally, their participation in leadership roles or mentorship initiatives within STEM was considered an indicator of their impact and influence. These life stories are complemented by interviews with 60 outstanding students, revealing that family support, motivation and resilience are key to overcoming gender barriers.

The second method (social representations) focused on how society perceives women engineers and how these perceptions affect their participation (family, school, universities and the labour market). The recruitment process for participants in the research was carried out at three educational levels, following the criteria of accessibility, convenience and gender equity. At the school level, participants were selected from public and private educational institutions, with preference given to those involved in STEM areas. The selection process focused on students, teachers and parents, prioritising individuals from the three study communities: (1) school directors; (2) teachers with experience in STEM areas; and (3) parents with children in secondary education. At the university level, professors and students enrolled in STEM programmes were recruited, along with administrators with relevant experience. For interviews with employers in the public and private sectors, participants were selected from nationally recognised companies in the fields of technology, mathematics and sciences, with preference given to those with experience in human resources management in STEM areas and those holding senior positions.

The study, conducted in five Bolivian cities, reveals through focus groups and interviews with 408 participants that women in STEM face unequal treatment in education, employment and professional development. This perpetuates stereotypes and cultural barriers that discourage their participation.

The third method (statistical analysis) focuses on women's participation in STEM and the factors that influence participation rates. The quantitative data show that although female participation in primary and secondary education is almost equal, it significantly decreases at university and in the labour market, particularly in engineering and technology. Qualitative analyses also reveal what factors are related to women's interest in STEM participation.

The combination of these approaches offers a multidimensional understanding of the gender gap in STEM in Bolivia. Social representations expose cultural barriers, life stories reveal individual experiences and statistical analysis quantifies these trends. Together, they highlight the need for comprehensive public policies to promote gender equality in STEM, which is crucial for the country's development.

Roots of success: Factors driving Bolivian women in STEM

In Bolivia, a total of 40 professional women in STEM fields were interviewed, representing five cities: three in the central axis – La Paz, Cochabamba and Santa Cruz – and two intermediate cities, Sucre and Tarija. In addition, eight Bolivian women living abroad participated in the study, each from a different region.

The research, which followed a qualitative approach, utilised grounded theory to analyse life stories, identifying eight categories of analysis: (1) family context; (2) self-perception; (3) education; (4) teacher influence; (5) career choice; (6) university life; (7) labour market integration; and (8) gender treatment. The information was coded and analysed using Atlas.ti. The results reveal how women from various regions and ethnic groups are forming a new generation of middle-class professionals with a more homogeneous culture, highlighting their experiences and challenges in science and technology.

One of the key findings from our analysis was around the intersection between gender and generation (see similar results from Mexico in Chapter 5).

While the grandmothers, coming from rural farming areas, faced the transition to urban life through precarious jobs, the mothers reached technical and, to a lesser extent, university levels. Finally, the daughters achieved university degrees in fields that are not traditionally pursued by women, breaking barriers that their predecessors never imagined possible.

> *We don't come from a financially well-off family; my grandmother was a farmer, my mother moved to a small city, but for my parents, education was important … They always say that: 'Your inheritance is your education'.* (Engineer, 43 years old, La Paz)

We also find that Bolivian women in STEM mostly come from upwardly mobile middle-class households, where gender equity was promoted, and self-esteem and discipline were encouraged. Despite challenges, such as discouragement from some teachers, these women managed to excel in STEM.

In general, the school context in Bolivia tends to discourage girls' interest in STEM, with factors like the curriculum and teacher interactions playing a role. Teachers were of particular importance; some inspired girls to challenge norms, while others demotivated and rendered them invisible, limiting their progress. "*They respond rudely … They leave you with unresolved doubts, they don't acknowledge you when you raise your hand to answer*" (Systems Engineer, 40 years old, Tarija).

Parental support contributed to women choosing STEM careers, and mothers seemingly contributed the most in supporting their daughters. By the time these women reached university, they had a clear understanding of their academic choices, showing that gender biases have significantly diminished compared to previous generations. The gender perspective of the younger generations is more focused on freedom of choice and the right to exercise their individuality, marking a departure from past generations where marriage was seen as the main path. As a 43-year-old systems engineer from Santa Cruz notes, "*The path before was marriage, now it's the profession*."

This younger generation of women engineers arrives at university with a clear vision of their academic choices, indicating that gender biases are no longer as relevant. However, these women face discrimination and sexism at university, reporting derogatory and sexist comments from both peers and professors. The women interviewed reported feeling forced to normalise such language to fit into a male-dominated environment. This sexist environment has had severe consequences, such as some women abandoning their careers after feeling harassed and devalued.

> *There were sexist professors who made very inappropriate comments. For example, in engineering, we measure the volume of things, so the professor would say, 'Let's say I want to measure the volume of Miss X,' referring to a female student present in the course, 'then I would have to completely undress her and put her in a bathtub full of water.' I mean, how did we, as young people, tolerate those kinds of comments? What mindset did we have, what immaturity, what kind of upbringing, that we couldn't stand up to those comments and instead laughed – it all seemed natural.* (Chemical Engineer, 48 years old, Santa Cruz)

In the workplace, these women struggle with the difficulty of balancing family and professional life, especially in male-dominated environments where gender discrimination limits their opportunities. A key finding was their tendency to postpone marriage and question the possibility of having children due to a work culture that demands total dedication, making it difficult to reconcile work and family life. Male-dominated work environments often show a lack of empathy toward their family needs and impose barriers to career advancement due to gender discrimination: "*Getting married is not in my plans, and if I ever do, I don't plan on having children*" (Industrial Engineer, 35 years old, Cochabamba).

While the first generations of women in STEM were better able to balance professional life and childcare thanks to family support, the new generations lack this level of support, as their mothers are typically also active professionals. Despite this, STEM professionals have achieved good job placement, especially in the public sector, where it is easier to balance work and caregiving responsibilities. The private sector, although generally more hesitant to hire women, is showing greater openness in regions like Santa Cruz and in sectors such as banking.

Women in STEM are committed to continuous training and international networking, which has allowed them to access global networks and receive recognition. Despite facing sexism and harassment in male-dominated environments, many have overcome these adversities by consistently demonstrating their skills, creating support networks among women engineers and strengthening their positions. Perseverance and personal effectiveness are key to their success in male-dominated fields. Some of these sexist experiences are reflected in the following quote:

> *They talk to you as if you were a little girl. Consistent with the anonymity they try to impose on women, they limit our right to speak. I told them I wanted to invite them to the business roundtable, and I clearly remember*

> *one of them, an older man, said to me: 'Little girl, look, those women over there might be talking about soap operas, maybe they're talking about something else, but we're talking business here. Go chat with them for a bit and then come back.'* (Systems Engineer, 40 years old, Cochabamba)

Social barriers faced by Bolivian women in STEM

We analysed the social representations of women in STEM in five Bolivian cities with 412 participants. The recruitment process for the research ensured diverse and equitable participation, with 58% women across all study groups. The selection criteria were both rigorous and tailored to each educational level and type of informant. At the school level, priority was given to students, teachers and parents of 5th- and 6th-grade secondary school students, preferably from STEM fields, ensuring representation from both major and intermediate cities. At the university level, faculty members, administrative authorities and students from STEM disciplines were selected, with a strong emphasis on gender equity. For the in-depth interviews with employers, human resources managers or executives from leading national companies in technology and engineering were chosen, for their expertise in human resources management and their holistic understanding of the sector. In all cases, gender equity was prioritised, and participants were selected based on their willingness to share their experiences.

We conducted qualitative analyses with focus groups and interviews in three key communities: (1) schools; (2) universities; and (3) employers. These communities were selected to shed light on the social representations derived from cultural practices. The results reveal a gender gap where women face detrimental treatment compared to men, affecting their educational experience, access to jobs, and professional progression in STEM. The low female participation reflects complex and subtle mechanisms of segregation that perpetuate this inequality.

Women facing significant barriers to accessing and thriving in STEM fields reflects a deeply rooted gender gap in Bolivia's cultural, social and structural dynamics. Through 50 focus groups and eight interviews with key informants, we investigated the complexities of this inequality. Women, from their school years to their entry into the workforce, faced unfavourable treatment compared to men, affecting their educational experiences, access to job opportunities and professional growth.

The school environment is where these barriers first become evident. Although progress in female participation in STEM has been recognised, particularly in private schools, family and cultural prejudices persist as significant obstacles. Teachers and parents, consciously or not, tend to reinforce gender stereotypes that limit girls' aspirations. A secondary school teacher observed:

> *Society conditions men and women to differentiate which careers they can study. There are few people who say you can study whatever career you want. From my point of view, a more male-oriented career would be engineering or automotive mechanics, while careers more encouraged for women are teaching subjects like literature, biology and social sciences.*

These practices are more pronounced in rural cities like Sucre and Tarija, where traditional careers are still preferred, compared to urban places like La Paz or Santa Cruz, where women in STEM are more recognised. Many students face pressure to conform to societal expectations that confine them to traditional roles, while others challenge these norms, often at a significant personal cost.

As they transition to university, women begin to encounter new forms of social pressure. Some students, initially interested in fields like civil engineering, describe how the predominantly male environment and discouraging comments from peers and family led them to change majors. A private-school student shared:

> *My cousin started studying civil engineering, but she felt a bit intimidated by the men there, so she didn't feel very comfortable in that environment and ended up switching to financial engineering. Even her family would ask, 'Why are you studying a man's career?' So, with all that social pressure, including from people at the university, she decided to change her major.*

This shift reflects not only an internal struggle but also a battle against societal norms that continue to assign genders to academic disciplines. However, higher education also presents opportunities to overcome these barriers. With adequate support, students can develop competencies that empower them to face a demanding job market.

The labour market, however, presents even greater challenges. Women in STEM face subtle and sometimes explicit discrimination, particularly regarding motherhood. A human resources manager explained:

> *In practice, when there is an obvious case among executives or staff, there are committees that try to avoid hiring women who are at a stage where*

they might start a family, as they would need to be given leave, subsidies, etc. In this sense, some women manage to get hired without problems and perform well during the first few years, but then their performance and participation in the company decline due to pregnancy and the 'young child' stage, where they request transfers to more family-friendly environments.

These dynamics perpetuate a cycle of inequality in which women face a "career tax" associated with motherhood.

Motherhood is seen as a public good from an economic standpoint, but this responsibility disproportionately falls on women. As a technology area manager noted:

Motherhood, from an economic standpoint, is seen as a public good – everyone wants it, but the career tax is always applied to women. Often, domestic activities fall on the woman, creating a slight disadvantage in the labour market because men do not always take responsibility for these tasks. Some women even choose to delay motherhood because otherwise, they risk their careers. Cases like this are caused by inflexible labour policies. This is the big dilemma where motherhood is always the turning point that decides the future of Bolivian women's careers. I believe this needs to evolve because we need women to continue wanting to have children, as it is a societal need, and policy should align with society's needs.

Statistical analysis of women's participation in STEM in Bolivia

This exploratory research utilised document analysis to systematise data on enrolment, academic performance and employment outcomes in Bolivian public and private schools and universities. We use historical and statistical data from both secondary and primary sources, covering education from primary school to the labour market.

The study followed a non-experimental, cross-sectional design with a descriptive and correlational approach. Data analysis involved the application of univariate and bivariate statistical methods, such as correlation and regression, using R (R Core Team, 2020), SPSS (IBM Corp., 2021) and EViews (IHS Markit, 2020). The integration of these three software platforms enabled a comprehensive and rigorous analytical approach, accommodating diverse data types and research needs.

The findings offer valuable insights into women's participation in STEM fields, providing a foundation for developing interventions aimed at promoting gender equity in these disciplines.

Table 1: Statistically representative samples

Universities														
Group	**Women and men**		**Women**		**Women STEM**		**Women STEM Private**		**Women STEM Public**		**Women STEM Rural**		**Women STEM Language**	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sample	3.643	100	2.427	66.6	1.863	51.1	1.293	35.5	570	15.6	1.085	29.8	1.236	33.9
Educational units														
Group	**Women and men**		**Women**		**Women STEM**		**Women STEM Private**		**Women STEM Public**		**Women STEM Rural**		**Women STEM Language**	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sample	1.389	100	948	68.3	365	26.3	92	6.6	273	19.7	246	17.7	295	21.2

The results are presented in two groups: (1) educational units, focusing on the entry of girls into STEM; and (2) universities, addressing both entry and retention of women in STEM. Educational units provide information on education at the primary and secondary levels. They are regulated by ministries of education at the national or regional level and aim to offer basic and secondary education. In contrast, universities are higher education institutions that grant professional and academic degrees such as bachelor's, master's and doctoral degrees. They focus on specialised training, research and innovation.

Significant correlations were found among different groups of women in educational settings who are interested in STEM. We investigated how specific questionnaire items were correlated with demographic (e.g. gender, rural background and use of another language) and contextual (e.g. area of study – STEM or otherwise, and school – educational unit or university) factors (see Table 2). For ease of interpretation of the table, non-significant correlations are not included.

In addition to the correlations presented above, a multivariate analysis was conducted with interest in STEM subjects as the dependent variable and 44 potential explanatory variables. Using the Stepwise Regression technique in R software, the final model was reduced to 15 statistically significant variables (α=0.05) that best explain interest in STEM in educational units. To determine the significance of the variables, confidence levels of 95% (α=0.05) were established, prioritising those with greater statistical robustness. The final model

Table 2: Correlations between the items of the questionnaire and gender, area of study, school, rural area and other language

Dimensions		Variables	Bivariate Pearson Correlations (*r*)				
			Gender	Study area	School	Rural area	Another language
Individual dimension	Self-perception	My favourite subjects are mathematics, chemistry and physics.					
		I feel that I have an ease in learning mathematics, physics and chemistry.		.635**			
		6. I think it's easier for men to learn mathematics, chemistry and physics than women.	.166**	.086**			-.129*
		7. I think the engineering profession is more suitable for men than for women.	.220**				
		8. I think that service careers such as psychology, social work, medicine and other assistance to people are best suited for women.	.132**	.086**			
	Personal effectiveness	9. I am confident that I will be successful in any career I study.	.058*	.150**			.104*
		10. I would like to study a career related to mathematics, physics or chemistry, but think I do not have the capacity to succeed in it.		.098**			
Familiar and peer dimension	Socio-cultural characteristics of parents	11. My parents or guardians spent their childhood:			.312**		-.179**
		12. One of my grandparents was born and lives in a rural area or province.		-.094**	.214**		
		13. In addition to Spanish, my parents, guardians or grandparents speak any of these languages:					
		14. My parents are of religion:		.087**			
		15. The highest level of education of your mother or guardian is:			.309**		
		16. The highest level of education of your parent or guardian is:	-.074**		.297**		
		17. My parents would like me to study a career related to mathematics, chemistry or physics.		.350**			
		18. My parents would like me to study a service career such as psychology, social work, nursing, law or other similar.	.196**	.094**	-.109*		
	Socio-economic level	19. My parents have an economic level that would allow me to support myself financially until the end of a university degree.	.067*	.092**			
		20. I don't think my parents support me in the career I chose.		.087**			

Dimensions		Variables	Bivariate Pearson Correlations (*r*)				
			Gender	Study area	School	Rural area	Another language
Familiar and peer dimension (con.)	Other family characteristics	21. In my family there are several professional engineers that motivate me to study a similar career.			-.126*		
		22. My relatives (grandparents, uncles, cousins, others) consider that I should choose a career appropriate to my gender.					
	Peers or friends	23. My friends would support me if I told them I wanted to study a career related to mathematics, physics or chemistry.	.182**	.262**			
		24. My friends would support me if I told them I wanted to study a service career such as psychology, social work, nursing, law or others similar.	.225**	.119**			
Academic dimension	School experience	25. My educational unit is:				.214**	
		26. The educational unit where I did primary school is:	.054*	.069*	.202**		-.126*
		27. My mathematics, physics and chemistry teachers have a way of teaching that makes me interested in those subjects.	.055*	.354**	.144**		
		28. My mathematics, physics and chemistry teachers demonstrate mastery of the subjects they teach.		.195**	.125*		
		29. Having teachers of my sex teaching mathematics, physics or chemistry at my school motivates me to study a career related to those areas.	.210**	.207**			
		30. To choose which career to study in the future, in my school:		.081*	.196**	.152**	
		31. While I was studying at school, I participated in the scientific olympiads in the area of:	.096**	.356**	.178**		-.145**
		32. At my school, the physics and chemistry laboratory is used:		.090**			
		33. At my school, the library, videos and other teaching materials for mathematics, physics and chemistry were used:		.137**	.285**		
		34. At my school, the teachers think materials related to mathematics, physics and chemistry are more suited to boys than girls.	.108**			.226**	-.106*
		35. My classmates see the female students as less intelligent for mathematics, physics and chemistry due to their being female.		.127**		.122*	
		36. I think my class teachers see female students as less intelligent for mathematics, physics chemistry because they are female.		.124**		.119*	

Dimensions		Variables	Bivariate Pearson Correlations (r)				
			Gender	Study area	School	Rural area	Another language
Academic dimension (con.)	School experience (con.)	37. My teachers prefer to select boys for scientific olympiads.	.116**	.141**	.142**		
		38. At my school, the teachers valued the work of students of the opposite sex to mine.	.173**			.133*	
		39. At my school, I have been harassed in exchange for receiving support with homework and exams.		.112**			
		40. I feel that my teachers evaluate me more strictly because of my gender.	.104**	.115**		.139**	-.106*
Social dimension	Social perception	41. Who do the media promote most as typical of an engineering professional?	-.097**	-.140**	-.213**		
		42. For whom is university education more important?	.145**			-.111*	
		43. In general, in terms of gender, who are better leaders?	.182**				
		44. Who is the best boss?	.252**		.184**		
		45. When jobs are scarce, who should have more right to a job?	.118**				
	Job prospects	46. I thought it would be easy to find a job in the career I want to study.		.082*			
		47. I think it could take time to find a job once I graduate as a professional due to my gender.					
		48. Career area you want to study:	-.191**	.118**			

Notes
**. Correlation is significant at 0.01 level. (two-sided).
*. Correlation is significant at 0.05 level. (two-sided).

was optimised using the Akaike Information Criterion (AIC) to ensure model parsimony and minimise overfitting.

Significant variables explaining women's preference for STEM subjects include: the perceived ease of mathematics, physics and chemistry; perception that service-based careers such as psychology, social work, medicine and other careers that help people are the most appropriate for women; place where the parents spent their childhood; grandparents' rural origins; parents' religion; fathers' education levels; parental influence on STEM career choices; parental interest in a service-based career such as psychology, social work, nursing, law or similar; perception of lack of parental support in the chosen career; support from friends; teaching methods used by STEM teachers that generate interest in these subjects; the quality of STEM teaching; participation in science olympiads; teachers' preference for selecting boys for the science olympiads and whether men, women or both make better bosses.

The analysis of dimensions reveals several key insights. At the individual level, only two survey questions were significantly related to interest in STEM subjects. In the family and peer dimension, eight out of 14 survey questions were significantly related to interest in STEM subjects. In the academic dimension, four out of 16 survey questions were statistically significant. At the social level, only one out of eight survey questions were significantly related to interest in STEM subjects. While it is important to note that the number of questions in each dimension differed, it seems clear that family-level factors are of particular importance to Bolivian women based on the statistical analyses above.

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Taken together, these three methods illustrate key factors related to women's participation in STEM in Bolivia. Our work highlights that women's preferences for STEM careers in universities are influenced by factors such as an interest in theoretical and numerical subjects, the perception of good career opportunities despite challenges, and concerns about balancing family and work life. Support from teachers and effective teaching methods are critical, as is parental approval, particularly in private universities. Academically, no significant discrimination is reported, and satisfaction with STEM teaching remains high. However, social and cultural barriers, such as gender stereotypes and harassment, continue to affect women's access to and retention in STEM fields. Despite these challenges, family support and perceptions of gender equality in private universities act as facilitating factors.

Overall, this research provides an in-depth understanding of the factors influencing female participation in STEM in Bolivia. Through the analysis of life stories, it becomes evident that female engineers overcome gender barriers with the support of their families, motivation and resilience. Social representations highlight the persistence of stereotypes that limit opportunities, while statistical analysis confirms significant disparities despite advances in equity. These findings underscore the need for educational policies and strategies that promote gender equality – essential for personal development and the country's social progress.

Collaboration among educational institutions, government, the private sector and civil society is crucial for achieving gender equality in STEM. Proposals such as teacher training programmes and curriculum redesign illustrate the potential for progress through joint efforts.

Phase 2: Co-construction of the pilot project

Despite these challenges, women in STEM in Bolivia demonstrate resilience and determination in overcoming the barriers they face. However, to truly transform these dynamics, structural change is necessary. Public policies must address not only the visible barriers but also the subtle mechanisms that perpetuate inequality. This includes improving vocational guidance in schools, creating support programmes in universities and developing labour policies that allow for a balance between personal and professional life.

Gender equity in STEM is not only a matter of social justice but also an opportunity to harness human potential and foster the country's economic and technological development. Ultimately, closing this gap will benefit Bolivian society by building a more inclusive, equitable and innovative environment for future generations.

The challenges women face in STEM in Bolivia are compounded by intersectional factors such as gender, ethnicity and region (see Chapter 5 for further discussion on how intersectional factors may be considered and addressed). Women from rural or Indigenous backgrounds encounter layered barriers, including limited access to quality education, fewer role models and entrenched cultural norms that reinforce traditional gender roles. Further, while younger generations, especially in urban areas, show greater support for gender equity, traditional norms continue to constrain progress in rural regions. As Crenshaw

(1989) highlights, addressing these disparities requires an intersectional approach that considers the interplay of social categories. Public policies and programmes must go beyond gender equality to include tailored strategies for women from diverse ethnic and regional backgrounds, fostering a more inclusive and equitable STEM environment.

With this understanding, we piloted a project that brought together key stakeholders in STEM field education to propose policy-level changes designed to improve women's participation in STEM in Bolivia. Stakeholders represented the following three groups:

- University directors and professors: Comprising directors and professors from public and private universities, this group analysed the institutional and professional challenges faced by women in STEM fields.
- School system faculty and staff: Composed of teachers and educational coordinators, especially in psychology, pedagogy and STEM, this group proposed solutions to increase female participation in STEM starting from basic education.
- Women engineers, professors and entrepreneurs in STEM: Prominent women in engineering, academia and business contributed an analytical perspective on the problems and offered proposals to overcome structural and cultural barriers in the workplace and education.

Methodology

The workshop methodology was based on a participatory approach inspired by Orlando Fals Borda's concept of popular education and grounded in participatory action research (PAR). This approach empowers communities through the collective construction of knowledge, fostering reflective and educational processes rooted in participants' realities. The workshops were designed as spaces for horizontal dialogue, integrating local knowledge and individual perspectives to identify problems and generate meaningful learning. In response to the pandemic, some workshops were adapted to a virtual format, reorganising dynamics and schedules while maintaining the participatory spirit, the centrality of lived experiences and the transformative practice of PAR (Fals Borda, 1987, 2001).

The facilitation was led by experts in gender and education, professionals with experience in educational projects with a gender perspective in universities, secondary education institutions and programmes in collaboration with local governments. The workshops were structured into the following phases:

programme presentation, problem identification and proposed solution development. Open and constructive dialogue was promoted throughout all phases.

Participatory techniques such as brief presentations, plenary discussions and the use of cards were employed to capture diverse perspectives and co-create proposals. The contributions were systematically organised in Microsoft Excel matrices, categorising the information according to the programme's objectives. This methodology allowed for in-depth analysis and the formulation of effective proposals to reduce the gender gap in STEM, ensuring that all voices were heard and valued.

Workshops were initially held separately for the three stakeholder groups (university, school and workplace groups). However, towards the end of this phase, the groups of stakeholders were brought together.

Presentation

The workshops began with a presentation of findings from previous research, providing a scientific framework to contextualise the causes and factors affecting women's participation in STEM. This enabled participants to reflect and debate in an informed manner during the participatory phase, enriching proposals with data and evidence.

Problem identification

The inputs collected during the participatory workshops focused on identifying problems and formulating proposals based on the presented findings. Based on the presented research, workshop participants identified five barriers that limit women's participation in STEM:

- **Gender stereotypes:** Perceptions of women's abilities in STEM are shaped by stereotypes that discourage them from pursuing these fields from basic education through to university.
- **Lack of institutional and family support:** The lack of motivation from teachers, the absence of family support and the scarcity of role models prevent many women from choosing STEM.
- **Workplace challenges:** Women face wage discrimination, inadequate infrastructure and biases in hiring practices that favour men for certain roles.

- **Cultural barriers**: Cultural norms and caregiving responsibilities limit women's professional development, and policies like maternity leave can act as additional obstacles.
- **Educational inequality:** STEM education is not sufficiently integrated, resulting in inadequate preparation in key areas and a lack of proper vocational guidance for female students. This stems from the insufficient integration of STEM subjects into the curriculum, reliance on traditional teaching methodologies and inadequate training in critical subjects such as mathematics and technology. Furthermore, vocational guidance is often limited, and when combined with persistent gender stereotypes, it further discourages female students from pursuing STEM careers.

Proposed solutions

The participants formulated various proposals to address these barriers:

- **Training and awareness:** Develop training programmes for teachers, counsellors and families to raise awareness about the importance of female participation in STEM and to include gender topics in the educational curriculum.
- **Promotion and visibility:** Create communication campaigns that highlight women's achievements in STEM and establish scholarships and specific competitions for women.
- **Educational strengthening:** Review curricula to include incorporating playful activities and workshops to foster interest in STEM from an early age, as well as specific programmes to strengthen soft skills, mathematical competencies and entrepreneurship among final-year high school and first-year university students.
- **Institutional alignment:** Create partnerships between universities, businesses and governments to promote gender equity and encourage the hiring of women in male-dominated fields.
- **Support for work–life balance:** Establish policies that allow women to balance their work and family responsibilities, thereby facilitating their professional development in STEM.

The co-construction of the pilot project in the workshops was a collaborative process focused on addressing the barriers that perpetuate the gender gap in STEM. Participants identified problems and formulated proposals to develop programmes that strengthen basic mathematics skills, soft skills and entrepreneurship, particularly for students transitioning from high school to university. These contributions are key to empowering young women and promoting a more equitable and inclusive environment in STEM, driving lasting transformation in Bolivian society.

To evaluate the effectiveness of these proposals in reducing the gender gap, the pilot project will include a comprehensive evaluation framework. This framework will establish clear indicators to assess teacher training, visibility campaigns, curriculum improvements, institutional partnerships and work–life balance policies. The evaluation process will involve data collection through surveys, interviews and focus groups, complemented by longitudinal studies, to provide insights into both short- and long-term outcomes. Guided by the principles of PAR, this inclusive approach will empower stakeholders to refine and scale the most successful initiatives, promoting sustainable gender equity in STEM across Bolivia.

Conclusion

This chapter reflects on the barriers that limit the access and development of women in STEM in Bolivia. The participatory action research (PAR) approach employed here gathers data while actively involving teachers, students, professionals and decision-makers as co-creators of solutions. The participatory workshops became spaces of empowerment, generating concrete proposals to overcome these barriers.

The study's findings challenge us to question the structures that perpetuate gender inequality in STEM. The life stories reveal that family support and resilience are crucial for women to overcome stereotypes and advance in their careers. The social representations analysed show how negative expectations continue to limit career options for women. These findings are not merely observations but a call to action for those who seek social justice.

Collaboration across sectors – educational, governmental, private and civil society – is essential to achieving gender equality in STEM. The proposals, ranging from teacher training to curricular redesign, demonstrate what can be achieved through joint effort. Our multi-pronged approach to understanding and promoting women's participation in STEM is yet to be evaluated in terms of efficacy. That said, we hope our approach can serve as a blueprint for others looking to engage in similar efforts across other contexts.

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