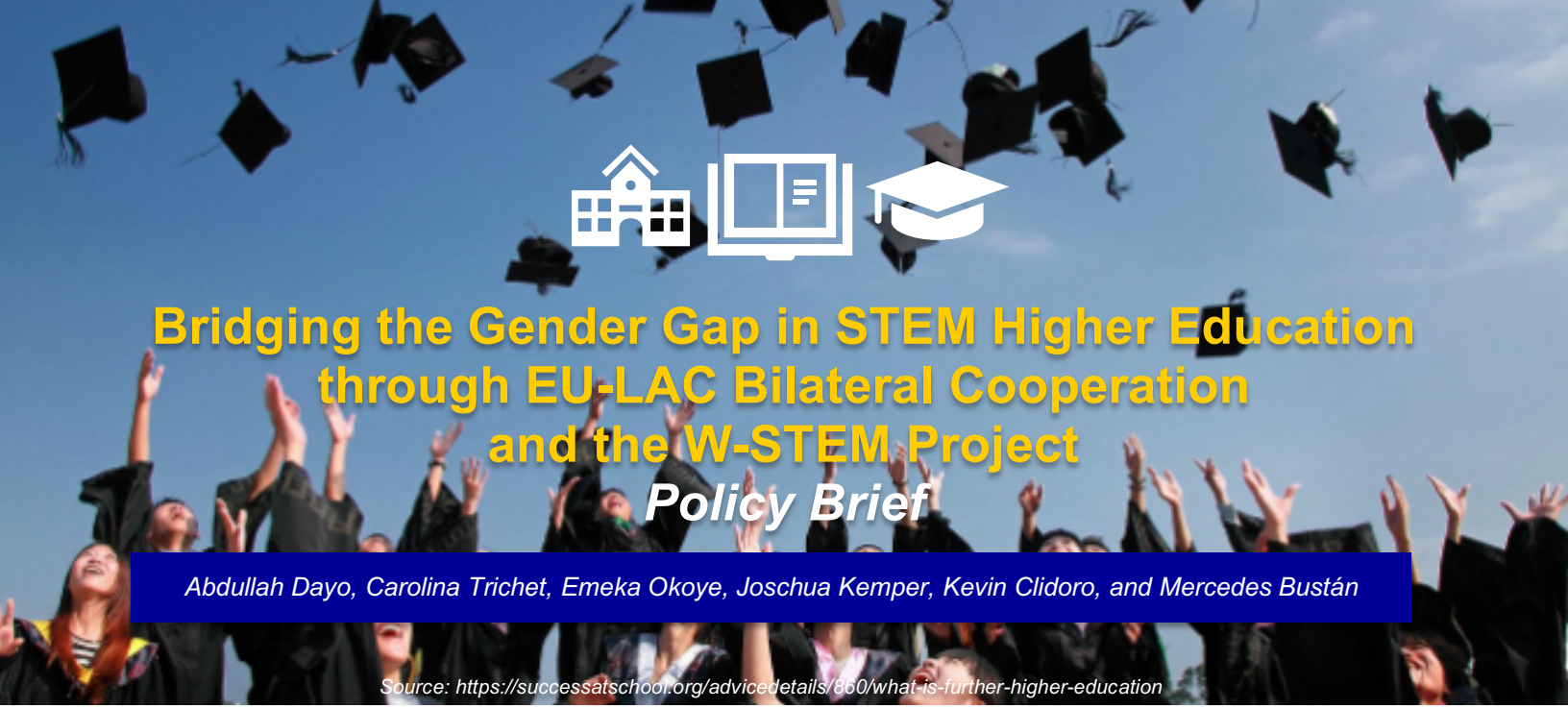

Bridging the Gender Gap in STEM Higher Education through EU-LAC Bilateral Cooperation and the W-STEM Project

Policy Brief

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Source: https://successatschool.org/advicedetails/860/what-is-further-higher-education

Executive Summary

The European Union and Latin America and the Caribbean (EU-LAC) bi-regional cooperation has been at the forefront of supporting programmes to close the gender gap in the Science, Technology, Engineering, and Mathematics (STEM) programmes in higher education. The Erasmus+ Programme's *Key Action 2* or the "Capacity-building in Higher Education" funds the W-STEM Project, which aims to improve the attraction, access, and guidance of women in STEM higher education in Latin America. Despite significant strides, the problem still persists. This policy brief presents the extent and causes of gender inequality in STEM higher education in the EU and LAC regions. Through a systematic review of literature and semi-structured interviews, the authors were able to establish the severity of the problem and draw from the immense experiences, perspectives, and visions of institutional stakeholders, students, and researchers from the EU-LAC regions. To further support the visions and goals of the W-STEM Project, the EU-LAC bi-regional cooperation is encouraged to support efforts toward ramping up enrollment figures, work with stakeholders to co-create projects that addresses gender stereotypes in the field, and advocate for and support the project's extension and expansion in order to include more universities in the EU-LAC regions.

EU-LAC Bilateral Cooperation and the W-STEM Project

The EU-LAC regions established a strategic and bi-regional cooperation in 1999 within the framework of the first EU-LAC Summit of Rio de Janeiro. One of the key accomplishments of the cooperation was the founding of the EU-LAC Foundation in 2010 to transform the strategic partnership between the two regions into an invigorated and visible reality that has the active participation of the respective societies (European Union, 2016). The EU-LAC Foundation reinforces tools and instruments to support the development of capacity and retention of knowledge within and between two regions, including the area of mobility in higher education.

One of these efforts is the Erasmus+ Programme, which is an EU-led exchange academic programme that sets out to improve the mobility of individuals, among other key action points. To respond to women's participation in STEM as one of its sector-specific priorities, the Erasmus+ Programme launched the W-STEM Project under the "Capacity-building in Higher Education". The W-STEM project is a three-year (05/01/2019 to 14/01/2022) endeavour worth 862,268.00 Euros that aims at improving strategies and mechanisms of attraction, access, and guidance of women in higher education in Latin America (W-STEM Project, n.d.).

The W-STEM Project, which is coordinated by the University of Salamanca through the GRIAL Research Group, currently organises and implements various activities and events through its 15 partner universities across the two regions. These include webinars, roundtable discussions, conferences, and online courses. Additionally, the W-STEM Project also facilitates and supports the establishment of local chapters to promote the presence and participation of women in STEM higher education.

The Research Process

The research process for this policy brief was two-fold. First, the authors scanned available literature, official reports, and peer-reviewed scholarly articles related to gender inequality in STEM fields in EU-LAC regions. Second, the authors interviewed five female students to understand their personal experiences, reflections, and recommendations related to being female STEM students. The students are from the LAC region and are either currently enrolled in a STEM programme or have recently earned a STEM degree from EU-LAC higher education institutions. Additionally, the authors interviewed four stakeholders to elucidate the issues, challenges, and potential recommendations related to addressing gender inequality in STEM fields in higher education. The authors conducted the interviews between December 2021 and January 2022 through recorded video calls. The research process gave the authors a general overview of the gender inequality problem in the EU-LAC regions and insights on

how to address them through the visions of the young generation of students *(see Table 1 below for the profile of the interviewees)*.

Table 1. Profile of the interviewees.

N°	Location	Degree Programme / Current Role
Student 1	Spain, Belgium, and United Kingdom	Civil Engineering
Student 2	Brazil	Systems Development
Student 3	Spain, Belgium, and United Kingdom	Urban Planning
Student 4	Chile	Mechanical Engineering
Student 5	El Salvador	Environmental Engineering
Stakeholder 1	Chile	STEM Researcher
Stakeholder 2	Chile	STEM Professor
Stakeholder 3	Germany	Start-up Founders
Stakeholder 4	Spain	W-STEM Project Representative

Gender Inequality in STEM Higher Education in the EU-LAC Regions

The recent decades saw an unprecedented rate of female enrollment, participation, and completion in STEM programmes in higher education in the EU-LAC regions (Schwab et al., 2019). However, the gender inequality between males and females in STEM education still persists. According to the report Cracking the code: girls' and women's education in STEM by UNESCO (2017), only 35% of all students enrolled in STEM programmes in higher education are female and only 28% of the world's researchers are women.

Gender inequality in STEM higher education in LAC is very evident in the student population and teaching staff of engineering programmes. For instance, according to a study by Contreras-Ortiz et al. (2020), the enrollment rates in nine universities[1] in Latin America in 2018 revealed that only 28% of the total student population in engineering, manufacturing and construction, and information and communication technologies (ICTs) programmes are female. Meanwhile, female students in the natural sciences, mathematics, and statistics programmes comprised 51.6% of the total student population *(see Figure 1 below)*.

[1] Universidad del Norte (UNINORTE) – Colombia; Universidad Tecnológica de Bolívar (UTB) – Colombia; Tecnológico de Monterrey (ITESM) – México; Universidad de Guadalajara (UDG) – México; Universidad de Costa Rica (UCR) – Costa Rica; Instituto Tecnológico de Costa Rica (ITCR) – Costa Rica; Universidad Técnica del Norte (UTN) – Ecuador; Universidad Técnica Particular de Loja (UTPL) – Ecuador; and Pontificia Universidad Católica de Valparaíso (PUCV) – Chile

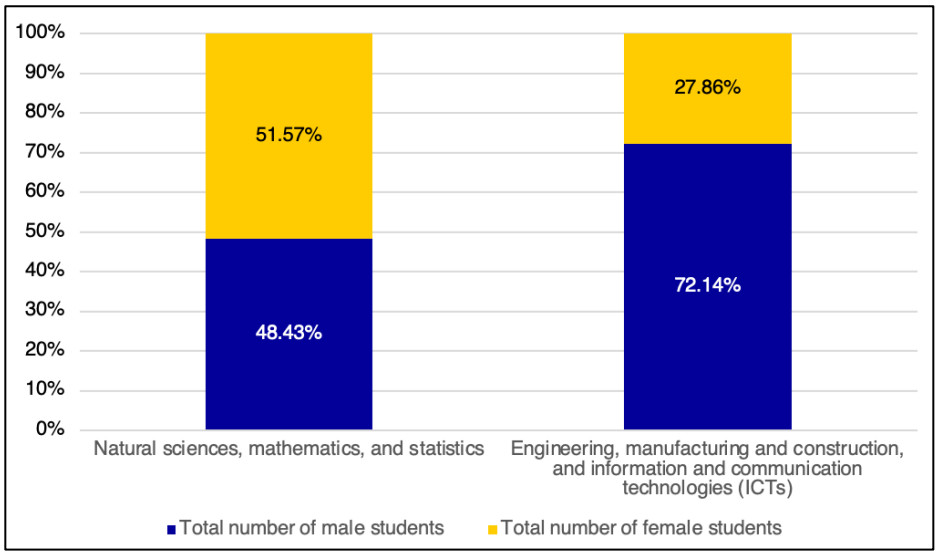

Figure 1. Student population in science and engineering programmes by gender in nine Latin American universities (Adapted from Contreras-Ortiz et al., 2020).

The same study highlighted that in 2018, only 12,101 or 38% of all applicants to STEM programmes in six universities[2] in Latin America are female (Contreras-Ortiz et al, 2020). The gender inequality problem is also observable in the low number of female applicants that are accepted in STEM programmes and those that enrolled. The percentage of female students that eventually earned a STEM degree in 2018 is 57% of the enrollment rate *(see Figure 2 below)*.

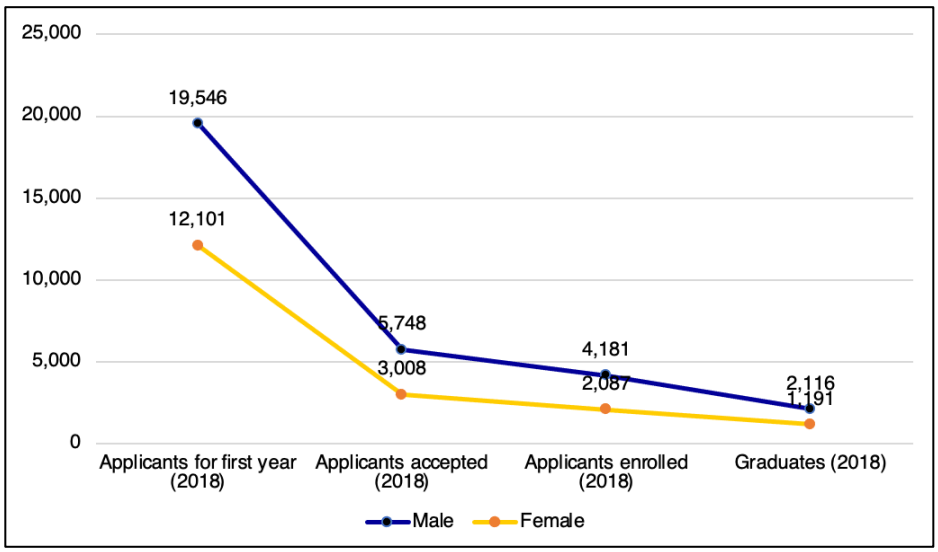

Figure 2. Number of applicants, admitted applicants, enrolled students, and graduates in STEM programs of six Latin American universities (Adapted from Contreras-Ortiz et al., 2020).

[2] UTB; UNINORTE; UCR; ITCR; UTPL; and PUC

Although the EU region has considerably mature procedures, experiences, and regulations in addressing gender inequality in higher education (Morales, Carrión, & Jaramillo, 2020), women remain underrepresented in STEM education and careers in the region (Rhawi, 2021). The challenge of closing the gender gap in STEM education and careers are not only a matter of justice and creating equal opportunities in the labour market, but it is also a matter of intensifying the region's scientific and technical development and creating benefits for society as a whole (*ibid*, 2021). According to the European Institute for Gender Equality (2021), increasing the participation of women in STEM subjects will have a strong positive GDP impact at EU level. In their estimation, closing the gender gap in STEM would contribute to an increase in EU GDP per capita by 2.2% to 3.0% in 2050 (European Institute for Gender Equality, 2021). In monetary terms, closing the STEM gap leads to an improvement in GDP by €610 - €820 billion in 2050.

The gender inequality between male and female students in STEM higher education in the EU and LAC regions is a challenge that needs urgent policy action. STEM careers are often referred to as the jobs of the future, driving innovation, social wellbeing, inclusive growth, and sustainable development (UNESCO, 2017). The challenge persists primarily because of institutional cultures that are neither inclusive nor geared towards broader sociocultural change for greater gender equality (Hurtado, 2021).

Causes of Gender Inequality in STEM Higher Education

Gender inequality in STEM education can be visible early on and increases with every education level. Barriers to and in careers in STEM can be encountered at any point in time, and they may take a variety of forms; some may be more influential at one stage of life than others (UN WOMEN, 2020). The range of factors influencing girls' and women's participation, achievement, and progression in STEM studies and careers overlap with each other and interact in complex ways (UNESCO, 2017). These factors stem from the:

- Individual level: biological factors that may influence individuals' abilities, skills, and behaviour. It also considers psychological factors, including self-efficacy, interest, and motivation.
- Family and peer level: parental beliefs and expectations, parental education and socio-economic status, and other household factors, as well as peer influences.
- School level: factors within the learning environment, including teachers' profile, experience, beliefs and expectations, curricula, learning materials and resources, teaching strategies and student-teacher interactions, assessment practises, and the overall school environment.
- Societal level: social and cultural norms related to gender equality, and gender stereotypes in the media (UNESCO, 2017, p. 40).

The interviews conducted with female STEM students revealed that comments adhering to traditional gender norms, bias, and stereotypes related to STEM education and careers happen at all levels. According to Stakeholder 2, this is evidently manifested in the patriarchal disdain and *machista attitude*[3] experienced by female STEM students at the University of Chile. Most of the students did not particularly experience difficulties in enrolling in a STEM programme, owing to the fact that there are existing gender equality policies that guide enrollment decisions in some universities, as described by Stakeholder 1.

However, almost all students said that they personally heard some of their family members, classmates, and even school personnel, including professors, making comments related to traditional gender norms, biases, and stereotypes that impacted their decision to enroll in a STEM programme. For instance, Student 5 shared the view that while her parents were supportive of her enrolling in a STEM programme in university, her grandmother specifically told her that an engineering degree is intended for males. When deciding to enroll in a STEM programme, Student 2 heard comments like:

"*You are trying technology. That is too hard for you. Why don't you try other things?"*.

How the W-STEM Project Addresses Gender Inequality

One of the key outputs of the W-STEM Project thus far is the situational analysis of gender inequality in its partner institutions. At the start of the project in 2019, the partner institutions were provided with a survey tool, which was developed based on the STEM and Gender Advancement (SAGA) survey by UNESCO, to measure different indicators of gender equality by collecting, organising, analysing, and monitoring that information. The universities will use the survey to measure the impact of the W-STEM Project. This will be done by comparing indicators at the baseline and endline terms after the implementation of the strategies and mechanisms of attraction, access, retention, and guidance of women in STEM programmes. Additionally, part of the W-STEM Project activities includes the development, maintenance, and promotion of the W-STEM Mobile Application to make the project accessible to its target beneficiaries and promotion of publications, including articles, book chapters, and conference papers, and presentations for various events such as conferences; and the maintenance of a library of deliverables.

[3] By patriarchal disdain, we mean the disrespect and rude comments directed towards women, who are studying STEM courses. For example, such unsavory comments come off as dismissing the potential of women to pursue an engineering degree/math-inclined courses, and perhaps telling them to return to their traditional homemaking duties. By machista attitude, we refer to the male hegemony of the study environment, mostly related to gender stereotypes (Villaseñor, Celis, Queupil, Pinto, & Rojas, 2020).

The array of activities and events that have been implemented during the COVID-19 pandemic to support the accomplishment of the W-STEM Project's goals and objectives, was met with issues and challenges. Stakeholder 4 shared that the W-STEM Project team has:

- experienced difficulties collecting baseline information because the monitoring and data systems of the partner universities were not aligned with the adapted SAGA survey tool;
- recognized that activities focusing on young girls' interest in STEM topics are important, although they had implemented activities targeting high school girls; and
- discussed that the sustainability of the project lies in the strengthening of partner universities' capacity to co-create and implement strategies and mechanisms to increase female applications and enrollment in STEM programmes.

Recommendations

The current EU-LAC bi-regional cooperation programme within the framework of the Erasmus+ Programme's Key Action 2 "Capacity-building in Higher Education" has supported the implementation of the W-STEM Project to improve gender equality in STEM higher education in the EU-LAC regions. Taking into account the project's well-defined set of strategies focusing on the attraction, access, and guidance of women in higher education in Latin America, the authors recommend three key action points to further support the achievement of the project's goals.

1. Extend and expand the W-STEM Project

The EU-LAC bilateral cooperation is recommended to support the extension and expansion of the W-STEM Project to include as many partner institutions and universities in the EU-LAC regions as possible. At the moment, only four countries in Europe and five countries in Latin America are part of the project. There is no partner institution from the Caribbean, which makes the case for expansion even more compelling considering the severity of the problem in these regions *(see Box 1 below for the full list of the project's partner institutions)*.

Box 1. The W-STEM Project Partner Institutions

Coordinating institutions

- University of Salamanca – USAL (Spain)
- Universidad del Norte – UNINORTE (Colombia)

Consortium

- Oulu University – OULU (Finland)
- Politecnico di Torino – POLITO (Italy)
- Technological University Dublin – TUD (Ireland)
- Nothern Regional College – NRC (UK)
- Tecnológico de Monterrey – ITSM (México)
- Universidad de Guadalajara – UG (México)
- Universidad Técnica Federico Santa María – UTSM (Chile)
- Pontificia Universidad Católica de Valparaíso – PUCV (Chile)
- Universidad Tecnológica de Bolívar – UTB (Colombia)
- Instituto Tecnológico de Costa Rica – ITCR (Costa Rica)
- Universidad de Costa Rica – UCR (Costa Rica)
- Universidad Técnica Particular de Loja – UTPL (Ecuador)
- Universidad Técnica del Norte – UTN (Ecuador)

To achieve this objective of expansion, the current timeframe of the project should be extended by supporting another funding period for the W-STEM Project. Extending the project is important because achieving its goals requires time and should not be treated as a haphazard measure with a fixed duration. Extension will give stakeholders from both the W-STEM Project coordinating team and the partner institutions enough latitude to craft a sustainable blueprint for the future. That said, a considerable financial outlay from the EU is required to enable and expedite policy implementation. According to Stakeholder 3, future funding should be factored-in to support underprivileged female students from indigenous communities in Latin America, who desire to study STEM programmes but are excluded in the grand scheme of things through institutional discrimination. This vision can only be turned into reality if there is a solid commitment on the part of the EU to bankroll this program to olympian heights of new achievements.

2. Further support efforts related to increasing female STEM applicants and enrollees in higher education institutions

Female STEM students are more likely to leave school than their male counterparts, in part because they lack similar role models (Herrmann et al., 2016). The lack of female role models, such as researchers, professors, and mentors, in higher education institutions, was a recurring issue mentioned in the interviews with female STEM students and stakeholders. Institutionally, thought should be given to increasing the presence of female mentors to increase female student enrollment and retention rates in STEM programmes. For instance, a qualitative study of a mentoring programme of the Centre for

Gender and Science at the Institute of Sociology of the Czech Academy of Sciences found that it is crucial to provide female students with positive female role models (Cidlinská, 2019).

Another effort should be geared toward institutionalising mechanisms to increase female STEM applicants and enrollees in higher education institutions. According to Student 4, who is pursuing a double degree in Astronomy and Mechanical Engineering, she obtained admission at the University of Chile via an affirmative action programme by the Faculty of Mathematical and Physical Sciences called the Gender Equality Admissions Programme (PEG). As described by the student, this programme accepts 40 extra female students into engineering and science degree programmes in the university. A study about the programme revealed that the number of women accepted into the engineering and science programmes at the University of Chile increased from 19% to 32% in the last five years since its inception in 2013 (Bastarrica et al., 2018).

The W-STEM Project currently focuses on increasing female participation in Latin American higher education institutions. It is a window of opportunity for the project to engage with education policymakers and other stakeholders to advocate for and support programmes that specifically provide female applicants to STEM programmes more opportunity to get accepted.

3. Co-create with stakeholders a project component that addresses gender norms, bias, and stereotypes at the family and peer levels

Gender inequality, particularly young girls' engagement, interest, enjoyment, and future career aspirations, in STEM education, is shaped by traditional gender norms, bias, and stereotypes (UNICEF, 2020). They permeate across the plethora of factors, including the family and peer levels, that cause gender inequality in STEM education. This points to the importance of including family members and the immediate surrounding of a young girl in programmes, such as the W-STEM Project, addressing gender inequality in STEM education levels in order to genuinely and holistically close the gender gap. Thus, it is vital to support projects targeting not just the young girls' interest in STEM topics, but also the families' and peers' gender biases and stereotypes.

With this, the EU-LAC bi-regional cooperation is recommended to support the co-creation of a component within the W-STEM Project that focuses on breaking the traditional gender norms, bias, and stereotypes that exist at the family and peer levels. For instance, the W-STEM Project facilitated a co-creation process in 2020 to develop bootcamps focused on encouraging and strengthening STEM interest. The process included workshops involving male and female high school students in Ecuador to diagnose the perception of young people about STEM careers and to design action plans for the

bootcamps (Morales, Carrión, & Jaramillo, 2020). In coming up with a new project and/or project component related to addressing gender norms, bias, and stereotypes at the family and peer levels, it should be ensured that the process includes young male and female students, their family members, and their peers. This way, there will be a holistic and genuine incorporation of the stakeholders' vision of addressing the problem.

The Authors

The six authors are Master of Public Policy candidates at the Willy Brandt School, Universität Erfurt in Germany. This policy brief is a product of a project group under the supervision of Dr. Pau Palop-García. The project does not establish a legal relationship between the WBS, the EU-LAC Foundation, the organisation with whom the project was co-developed.

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