




# The impact of belonging to a women network in STEM: A Latin American sorority network

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**Abstract**—Addressing the gender gap in STEM fields remains a global challenge that resonates throughout society. To effectively narrow this gap and increase female representation in Engineering and Sciences, a multifaceted approach involving educational institutions, companies, government bodies, and society at large is imperative. This work presents some of the initiatives carried out over the course of a year by the Matilda Latin American Open Chair for Women in Engineering, a group of persons advocating for the empowerment of women in STEM disciplines. The Chair's mission is rooted in increasing the visibility of women in Engineering and Sciences, inspiring new vocations, and retaining and developing those women who are pursuing a career in STEM. Implementing a mixed methods approach, this study highlights the impact of these actions on both the broader public and the personal and professional lives of its members. Notable initiatives that have reached a substantial audience include the Matilda book series, enlightening talks and conferences, the research symposium, and the WhatsApp group facilitating communication among Matilda Chair members. Regarding the impact of participating in these initiatives, most members mention the value of collaborating with other people in Latin America who share a common commitment to advancing gender equality in STEM. The spirit of camaraderie has fostered a sense of community and sorority within the network, and a collective dedication to inspiring more women to see engineering as a viable and fulfilling professional and life pathway.

**Keywords**— *Educational Innovation, Women in STEM, Higher Education, Women networks, Gender Equality, Sorority*

## I. INTRODUCTION

The longstanding issue of gender gap in Engineering, Science, and Technology is a cultural problem. Addressing it needs a multifaceted approach, involving reforms within higher education systems, the development of strategic public policies, and the strengthening of relations between academia and the broader socio-economic landscape.

In the pursuit of gender equality in these fields, the selection and implementation of actions become fundamental. It is crucial to discern initiatives that exhibit best practices, ensuring that the institutional and individual efforts invested yield the anticipated outcomes and can be celebrated as valuable sources of knowledge transfer and experience sharing. It is widely acknowledged that achieving this

demands a combined, integrated, and collective effort, with active participation from educational institutions, companies, and governmental bodies. Only through such collaboration can we hope to witness the transformative impact of these actions, ultimately contributing to the enhancement of key performance indicators and a reduction in the evident gender disparity within engineering.

This work presents the main projects of the Matilda Latin American Open Chair for Women in Engineering implemented during 2022 – 2023. The objective of this study is to assess the personal impact of being part of a women's network that aspires to foster a culture of gender equality at an individual level. This is accomplished through the collaborative development and execution of initiatives. By sharing our experiences, we aim to inspire other institutions to embark on similar efforts, advocating equal rights and opportunities for women in both academic and professional fields. Furthermore, we seek to introduce a sense of aspiration for engineering vocations among girls and young women, leading to a future where gender is no longer a barrier to success and fulfillment in these fields.

## II. WOMEN NETWORKS

The Sustainable Development Goal (SDG) number 5 is dedicated to achieving gender equality and empowering all women and girls. SDG 5 involves a range of targets, including promoting women's participation in leadership and decision-making across various sectors, ensuring equitable access to education for girls and women, leveraging technology for women's empowerment, and strengthening policies and legislation to advance gender equality [1]. Gender equality, as reflected in SDG 5, has gained significant importance on the agendas of educational institutions, corporations, and governments worldwide.

Universities can proactively engage in efforts to identify women with engineering interests, provide guidance, connect them with other women in engineering, and provide advice about engineering academic and career pathways. Research has demonstrated the deep influence of social networks on women's pursuit of engineering degrees [2]. For instance, a Mexican university's leadership team has strategically incorporated actions into its plans, including initiatives like women's networks, mentoring programs, leadership development training, flexible scheduling policies, and internal recognition programs [3]. Similarly, a study in the United States evaluates letters of advice from undergraduate women to younger female peers in STEM, emphasizing the

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importance of seeking women role models, forming supportive communities, securing family support, and prioritizing academic improvement [4]. Such letters motivate women to embrace STEM careers, emphasizing that resilience and dedication are the keys to success. Retaining women in higher education STEM programs requires a multifaceted approach. This includes mentoring and regular monitoring of enrolled female students, the implementation of digital platforms for students and faculty, faculty awareness workshops, and discussions featuring successful women in STEM [5].

Women's networks are a powerful tool to support women to build connections and develop skills, as well as to encourage women to advance and grow on their professional careers. A study in Australia assesses the transformative potential of women's networks. It concludes that women-only networks have a valuable role to play in securing greater equity for women in management [6]. Research conducted in Germany highlights the significance of social support from supervisors, role models, colleagues, and women's networks in helping women navigate gender-specific workplace challenges and reconcile their roles as women, mothers, and engineers [7]. The need for an inclusive work culture is highlighted as well as the potential of women's networks to impel women to achieve leadership positions in engineering fields. A research work on women networks highlights what motivates women to belong to a women network, like Lean In Circles, which are peer-mentoring sessions between engineering faculty on topics such as leadership, self-confidence, work and personal life time balance, and unconscious bias [8].

The following section presents the Matilda Latin American Open Chair for Women in Engineering and analyzes the impact of its work on the lives of its members.

### III. THE MATILDA CHAIR

The saga of books "Matilda and the Women in Engineering in Latin America" has 4 editions and the 5th edition is beginning to take shape. The book started as a joint project between the Federal Council of Engineering Deans of the Argentine Republic (CONFEDI) and the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) which made possible the editions of Matilda 1 in 2019 and Matilda 2 in 2020. In July 2020, the Colombian Association of Engineering Faculties (ACOFI) joined the project. Inspired by previous joint work that was very mobilizing and had an excellent impact, the Latin American Open Chair Matilda and the Women in Engineering was created with the support of the three institutions: ACOFI, CONFEDI and LACCEI. The Chair is named Matilda from the "Matilda Effect", a bias against acknowledging the work and achievements of female researchers whose accomplishment is attributed to their male colleagues. The Chair aims to give visibility and value to women in engineering, inspiring new vocations, and retaining and developing the ones that are already in the path. [9]

Thus, in 2020, the mission was defined in its founding document as "It is an academic space for debate, reflection, the collective construction of knowledge, teaching and research, and carrying out revitalizing and promoting activities of equal rights, opportunities and spaces for women in the academic and professional field and for the promotion

of vocations for engineering in girls and young people in Latin America and the Caribbean". (<https://catedramatilda.org/>)

On that occasion, the founding board members CONFEDI, ACOFI, LACCEI will be joined by other institutions of the academic sector as "Institutional Members", people as "Individual Members", companies, other organizations not related to the academic sector may sign cooperation agreements that contribute to the accomplishment of the stated mission. Likewise, "Accompanying Institutions" can be incorporated, as long as they pursue the same goals as the Chair, generate synergies in their actions and collaborate with the Chair's activities.

The activities are organized within the framework of a structure made up of an Executive Committee, the Assembly and 6 Thematic Committees: Education, Research, Vocations, Mentoring, Communication, and Professional Practice. The Executive Committee and each Committee, through specific strategic planning and in accordance with the Matilda Chair plan, have developed projects and carried out to date numerous individual and joint activities such as: symposiums, webinars, conferences, workshops, publications in scientific events, podcasts, broadcasts, and the Matilda books. These activities have become a valuable contribution to the construction of rights and opportunities related to the visibility and appreciation of women in engineering, who become important models in the construction of engineering vocations for girls and young people. Today, the Matilda Chair has 218 individual members from 18 countries in Latin America, 75 institutional members and 11 accompanying institutions, all working together towards the same goal: inspiring more women to study STEM careers and support those women that are already on the way to help them grow both professionally and personally.

### IV. METHODOLOGY

Given that the objective of the research is to know the impact on the personal and professional life of the members belonging to this initiative, a mixed methodology is developed, which consists of the following stages: a) research design, b) instrument design, c) application, d) analysis of results and conclusions.

To establish the research design, collaboration with the leadership team was essential. This collaboration aimed to define research objectives, expected outcomes, and the overall research process. The research design serves a dual purpose: gaining insights into the perspectives of chair members participating in various initiatives and conducting a diagnostic process to evaluate the impact of their involvement on their personal and professional lives.

For the design of the instrument, 3 main elements are considered: the authorization to consider the participants' answers for research and planning of the Chair activities, data that allow us to know the sample population that participates, and qualitative and quantitative questions that allow us to evaluate the impact on personal and professional life.

The instrument was distributed to the Matilda Chair members over a one-month period through various channels, including the committees within the Chair and social networking groups (WhatsApp, Facebook and Instagram). The gathered data were analyzed to draw conclusions aligned with the study's research objectives.

## V. MATILDA PROJECTS

Among the population belonging to the Matilda Chair, approximately 35% responded to the instrument, providing valuable feedback on the initiatives and reflecting on their impact. Importantly, 100% of the participants who responded authorized the sharing of the information collected, with strict adherence to data confidentiality.

The participants who answered the instrument have the following characteristics:

1. Gender: 91% are women, while 9% are men.
2. Country of Origin: As illustrated in Fig. 1, most participants are from Argentina (35%), Colombia (35%), and Mexico (19%).
3. Initiative Participation: Fig. 2 shows the initiatives in which they have participated as active members of the Matilda Chair. These initiatives include committee participation, collaboration in events (conferences, symposiums, mentoring programs), and contributions to the Matilda and Women in Engineering Book (as authors, reviewers, or editors).

The following section explains each of the initiatives in order to facilitate understanding of their impact on the lives of Matilda Chair members.

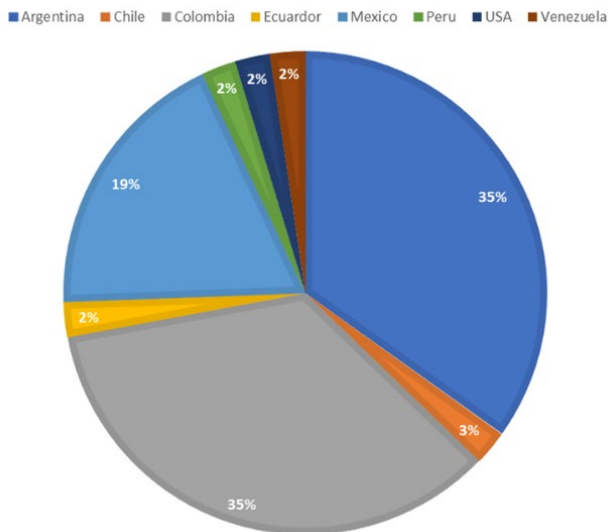


Fig. 1. Participants' country of origin

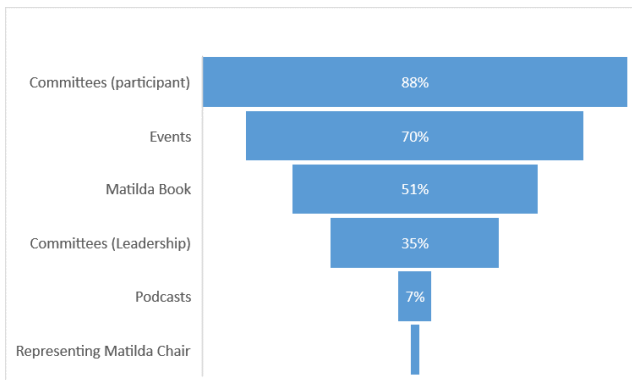


Fig. 2. Percentage of members participation in the initiatives

The members of the Matilda Chair are actively engaged in a wide range of initiatives aimed at achieving several critical objectives. These initiatives collectively strive to enhance the visibility of women in STEM, inspire young women to embark on STEM careers, provide support to women currently studying or working in STEM fields, and foster their ongoing personal and professional growth, ultimately enabling them to ascend to leadership roles within their respective organizations. Among the many impactful actions undertaken, some of the most notable include the Matilda book, the research symposium, the mentoring program, and a series of podcasts.

### A. Matilda Book

The book “Matilda and the Women in Engineering in Latin America” integrates the stories, journeys, and reflections of Latin American women in engineering and sciences. The authors share their stories and thoughts hoping to inspire other women to pursue professional careers in these fields and inspire those in the pipeline to continue the path and grow within this professional field. These stories share insight about the challenges women have faced, the lessons they have learnt along the way and advice they give to other women and men, elevating their voice to create consciousness on the gender gap and the cultural bias experienced in this part of the globe. These stories not only captivate but also pave the way for future generations of women in STEM. Men are also invited to write and tell the story of amazing women in STEM.

On December 2022, the 4th edition of the Matilda book series was released [10]. Fig. 3 shows the book cover. This book includes 42 articles, written by 48 authors (46 women and 2 men), from 9 countries: Argentina, Colombia, México, Perú, Chile, Guatemala, Brazil, Bolivia, and Ecuador. Regarding the author's profile, 55% are faculty at a university, 21% are professionals at different companies, 11% are graduate students and 11% are undergraduate engineering students. The book is freely available at the Matilda Chair website (<https://catedramatilda.org/category/publicaciones/>).

The main topics covered on these stories are career decision making process, career trajectory, unconscious bias, work-life balance, and women networks. The stories reveal that some factors that impact the career choice are the access to quality education, family socio-economic level, lack of female role models, unconscious bias, the need of having a strong educational background to understand physics, mathematics and basic science, and the support given by family and friends. Several authors coincide on the advice given through the articles stating the relevance of having a purpose, describing the potential of engineering as a toll to understand how things work and transform the environment, the importance of resilience and hard work, that it is ok to fail and ask for help, and to foster self-confidence and mentor women that are pursuing engineering careers. [11]



Fig. 3. Matilda and the Women in Engineering in Latin America 4 [10].

### B. Research Symposium

The Research committee within the Matilda Chair created a space to: 1) reflect about the insertion and participation of women in engineering in diverse contexts, 2) communicate the research and innovations generated within the Matilda Chair, and 3) share and make visible PhD and Masters' projects in topics aligned with goals of the Chair. The organization of the research symposium joined efforts from the different Chair committees for this online event.

The symposium took place on October 2022. It had 259 participants joining online to 5 keynote talks, 2 panels and three thematic tracks where researchers presented their work on new women vocations in STEM fields, women in academia, and women in professional practice. 38 research studies were presented from Colombia, Argentina, Mexico and the United States. Each research work, besides the article, presented a video which is available in the Matilda Chair YouTube channel.

Organizing and implementing this symposium was a challenge by itself given the fact that it was completely remote, with organizers from different countries, and that had never met before in person. The commitment, trust, and hard work of each of the members is invaluable. Likewise, the trust, work, and time that the researchers and keynote speakers put into the event was much appreciated. It is encouraging the will and time volunteered to make these initiatives happen.

### C. Mentoring Program

The Mentoring committee has defined the Matilda Chair mentoring model, based on research and the members' experience. Mentoring is when someone (a mentor) puts on service their skills, experience, and knowledge to help another person (a mentee) to grow and progress. Mentoring has proven to be a powerful tool to support women to grow on their professional lives.

In July 2022, a mentoring workshop took place as an introduction to the mentoring model. Then, in October 2022, during the research symposium, the kickoff session of the pilot mentoring program took place. The program had 40 participants from different countries that met over several months, having mentoring sessions in small groups, focused on work-life balance and on career selection topics. The pilot program objective was to train mentors on this model so that they can then put in practice their knowledge and skills helping other women at their universities through mentoring.

The pilot mentoring program was a great experience that led to useful insight and takeaways about what worked and what can be improved. Overall, the participants enjoyed the experience. However, there are some opportunity areas that need some work to have better results. Now, the mentoring committee is working on a mentoring manual describing the mentoring model as well as the steps to follow and recommendations for a successful mentoring program. The goal is to inspire universities and other institutions to implement mentoring programs to support and empower women.

### D. Podcasts

The Matilda Chair Podcasts emerged from reflecting on the effectiveness of outreach efforts targeting girls and young people in STEM and considering how to reach this audience more meaningfully. Two decisions were made: to continue with the Matilda books and create a fourth volume, and to leverage the expertise of the team in the field of podcasts.

The creation of the podcasts aimed to reach a wider audience and attract more girls and young people to STEM disciplines. The interviewees were carefully selected with the assistance of the Matilda Chair thematic committees to share their life experiences and dispel the uncertainties of those hesitant to pursue a STEM career. The podcasts were launched in September 2022 featuring 12 episodes that provide valuable insights into career choices in engineering and overcoming challenges.

These podcasts seek to broaden the diversity of voices and experiences in STEM, inspiring girls, and young people to explore these disciplines. The initiative has successfully reached this audience more effectively, offering a diverse and accessible platform. Through the shared stories in the podcasts, the goal is to open minds, foster creativity, and empower future generations in the fascinating world of STEM. After 10 months, the podcasts have had 508 reproductions. The Matilda Chair is looking forward to increasing this impact by encouraging educational institutions to promote this valuable resource.

## VI. DISCUSSION AND RESULTS

The purpose of initiatives and networks is to have an impact through the commitment of the people who are part of them with common interests and values. Moreover, by collaborating, the people themselves are impacted by these actions. That is why it was decided to focus on three points:

- The initiatives in which they have participated
- The initiatives they consider having the most impact

- The impact that their participation on the Matilda Chair and its initiatives has had on their professional and personal lives.

In relation to the initiatives in which they have participated, of the 43 participants who responded to the consultation instrument, 88% are members of one of the committees of the Chair, and 70% have participated in events such as symposia, seminars, talks and conferences, as shown in Fig. 2. A project that was engaged 51% of the Matilda Chair members is the Matilda Book series where the members have had an active participation either as article authors, article reviewers, book edition and/or administration to publish the book and promote the book to reach potential audience. It is relevant to mention that the book series have been used as study material within some engineering courses to reflect about the role of women in engineering and create consciousness among the students about the gender gap. Regarding the Matilda Chair leadership roles, 35% of the respondents have engaged in some kind of leadership role during these three years either in the executive committee or coordinating a thematic committee.

The survey participants expressed their perception about the impact of the main efforts that the Matilda Chair has conducted (see Fig. 4). The initiative that was voted with more reach, engagement and impact was the Matilda book series, with 81% of the votes. Next, 67% of the participants mentioned that the conferences, webinar, panels or talks in which they participate are impactful. In the third place, the Research Symposium (which has been held once in 2022) was mentioned by 54% of the participants. Interestingly enough, the members' WhatsApp group was voted by 51% of the respondents since it is the main communication tool between all the Chair members and somehow result rather more effective than other social media. The Chair has accounts in Twitter, Facebook, Instagram, LinkedIn and YouTube and these channels are used to communicate the activities, events, and projects mainly to the external audience, whereas the WhatsApp group helps to coordinate the internal group (the Chair members).

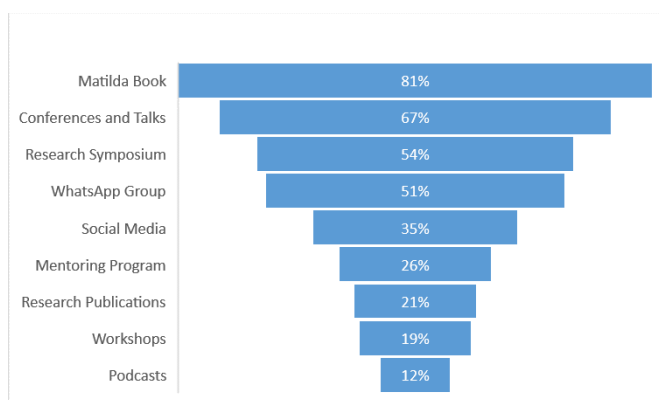


Fig. 4. Initiatives with the greatest impact

Regarding the question of impact on their life by participating in the Matilda Chair initiatives, the answers were classified into impact on personal life and impact on professional life. Being an open-ended question, the answers were classified by common themes. In terms of the impact on

their working life, the answers ranged from a change in their perspective, learning about gender issues, a link with people with common interests, the possibility of sharing projects, and mainly the impact on the growth of their professional life and the networking with people from other countries (see Fig. 5).

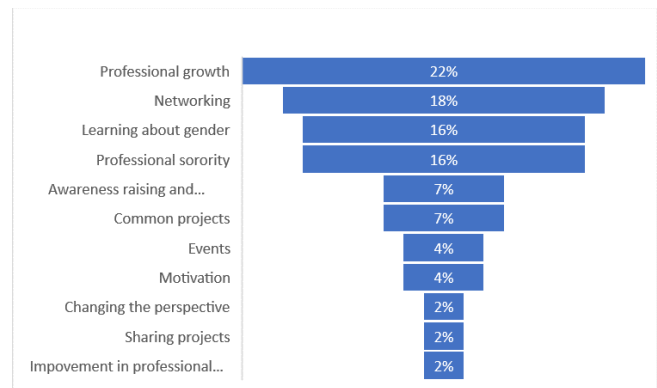


Fig. 5. Impact on their working life

Finally, in relation to the impact on their personal lives, 75% of the comments were related to the bonds of affection, sisterhood and bonding that have been generated and that they now count on. The other 25% were comments about an impact on their growth as individuals. Examples of the phrases they shared with us about the impact on their work life or personal life are:

- “Professional: relationships with engineers from other professions and countries, to work together on internationalization activities, training and collaborative work. Personal: great colleagues and people committed to the same objectives, creating bonds of affection.”
- “Personally, it impacted me as a project that I fell in love with, where I was able to find in other diverse voices an enrichment of ideas that contribute to reflection and personal growth. Professionally, it transformed the focus of the research and teaching in science that I carry out, and the sum of a commitment to leave a legacy so that more women see engineering as a professional and life possibility.”

In summary, they were asked to share in 3 words what the Matilda Chair means to each of the participants; the responses are shown in the word cloud in Fig. 6. It is interesting to note that the most frequent responses are: equality, empowerment, sorority, community, mentoring, collaboration, and commitment. These words express the positive impact that this sorority network has had on their lives and on their communities and are source of inspiration to keep planning new strategies and keep working towards gender equality.



Fig. 6 Meaning of the Chair for each of its members.

## VII. CONCLUSION

The gender gap in STEM fields is a global challenge. To be addressed, it requires a joint effort from educational institutions, companies, government, and society. It is a complex challenge since it encompasses cultural factors and unconscious bias that are formed given the environment, family, upbringing, and experiences along life. This study presented some of the work done by the Matilda Latin American Open Chair for Women in Engineering and the impact this work has had on broader public but also within its members that actively participate organizing and engaging on several initiatives.

It was identified that the initiatives that have reached more people are the Matilda book series, the talks and conferences, the research symposium, and the WhatsApp group for internal communication between the Matilda Chair members. Regarding the impact of participating in these initiatives and belonging to the Matilda Chair, most members consider relevant the value of collaborating with other people in Latin America working towards the same goal of gender equality, a sense of community and sorority within the network, and a group commitment to inspire more women to see engineering as a professional and life possibility.

After three years of work of the Matilda Chair, we are very proud of the strong sorority network as well as of the different achievements. There is still work left to do and some of the strategies for the future of this group include focusing efforts on reaching young girls and women (elementary school, middle school, and high school), look for scholarships and development opportunities for women in engineering across the globe, collaborate with government, seek external funding to strengthen the reach and impact of our activities, strengthen the collaboration with other organizations, partnerships and institutions working towards the same goal, among others. We hope this work inspires and helps other groups and institutions working towards narrowing the gender gap in STEM fields.

Together, we strive to break down barriers and pave the way for a more inclusive, equitable future in STEM fields.

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