



Gender Balance Actions, Policies and Strategies for STEM: Results from a World Café Conversation

Acciones, políticas y estrategias para el balance de género en el ámbito STEM: Resultados de una dinámica World Café

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ABSTRACT

W-STEM project is working to reduce the existing gender gap in Science, specifically in STEM fields in Latin America. During an International Leadership Summit, held in Cartagena de Indias (Colombia) on November 26th, 2019 within the project scope, forty-four people, including researchers and policymakers at the higher education institutions, participated in a World Café conversation to discuss about the potential actions, policies and strategies might be develop in the universities to reduce the above mentioned gender gap in STEM studies. Four tables were conducted, and this paper summarizes the most outstanding conclusions of the conversations.

RESUMEN

El proyecto W-STEM se orienta en reducir la brecha de género existente en la ciencia, específicamente en los campos STEM en América Latina. Durante el *International Leadership Summit*, celebrado en Cartagena de Indias (Colombia) el 26 de noviembre de 2019 en el marco del proyecto, cuarenta y cuatro personas, incluyendo investigadores y cargos directivos de instituciones de educación superior, participaron en una dinámica World Café para discutir sobre las posibles acciones, políticas y estrategias que podrían desarrollarse en las universidades para reducir la mencionada brecha de género en los estudios STEM. Se realizaron cuatro mesas y este artículo resume las conclusiones más destacadas de las conversaciones mantenidas.

1. Introduction

Today's society claims for women's equality in all the spheres of life. Goal #5 of the United Nations Sustainable Development Goals (SDG) (United Nations, 2019) is devoted to achieving gender equality and empower all

women and girls (<https://bit.ly/2PiX8PA>). Providing women and girls with equal access to education is crucial to ending the gender-based discrimination prevalent in many countries around the world. This objective should be achieved in all the educational levels and disciplines. In Science, specifically in STEM (Science, Technology, Engineering, and Mathematics) (Ramírez-Montoya, 2017), the gender gap is highly significant all around the world (García-Holgado, Verdugo-Castro, Sánchez-Gómez, & García-Peñalvo, 2019; Verdugo-Castro, Sánchez-Gómez, García-Holgado, & García-Peñalvo, 2019), but mainly worried in some regions with low level of development. Although significant progress has been made in recent years, for example, the UNESCO SAGA (STEM And Gender Advancement) (UNESCO, 2017) that is focussed on offering governments and policymakers a variety of tools to help reduce the current global gender gap, the situation varies from country to country, but the participation of women in STEM areas remains low.

W-STEM project (Camacho Díaz & García-Peñalvo, 2019; García-Holgado, Camacho Díaz, & García-Peñalvo, 2019a, 2019b; García-Peñalvo, 2019a, 2019b, 2019c) funded by the European Union through the Erasmus+ Capacity-building in Higher Education programme arises in order to develop concrete actions to modernize the government, management and operation of higher education institutions in Latin America to improve women's access to STEM programs.

Within the W-STEM project activities, 44 people, including researchers and policymakers at the higher education institutions, participated in the W-STEM International Leadership Summit, celebrated in Cartagena de Indias, Colombia on November 25-26, 2019. One of the developed activities was a World Café with the primary goal of stimulating a collective brainstorming for suggesting for institutional strategies and actions for the next stage of the Erasmus+ W-STEM project. This paper summarizes the most outstanding conclusions of the conversations.

Further sections introduce the W-STEM project (Section 2), define the World Café activity (Section 3), present the most representative remarks from the conversations (Section 4) and conclude the paper (Section 5).

2. W-STEM project

The European W-STEM project is an initiative coordinated by the University of Salamanca through the GRIAL Research Group (Grupo GRIAL, 2019). The Capacity-building in Higher Education programme in which the project is funded aims to develop capacities in Higher Education through international cooperation projects managed by a consortium formed by European countries and associated countries belonging to different regions of the world.

This type of project seeks to establish synergies between Europe and other regions of the world, as well as to support the participating countries in addressing the challenges in the management and governance of their institutions of higher education. In particular, W-STEM is a structural project that seeks a systemic impact in the Latin American region through the promotion of reforms in higher education systems, modernizing policies, governance, and strengthening relations between higher education systems and the economic and social environment. Besides, each of the regions that can participate in the call has associated a set of priorities eligible for funding. In the case of W-STEM, it focuses on the "Equity, access and democratization of Higher Education" priority, as it will contribute to increasing opportunities for women to enrol in STEM programs offered by Higher Education institutions.

The W-STEM primary data are presented in Table 1.

Title	Building the future of Latin America: engaging women into STEM
Acronym	W-STEM
Funding entity	European Union
Programme	ERASMUS + Capacity-building in Higher Education
Call	Call for proposals EAC/A05/2017
Reference	598923-EPP-1-2018-1-EN-EPPKA2-CBHE-JP
Main researcher	Professor Francisco José García-Peñalvo

Coordinator partner	University of Salamanca, Spain
Co-Coordinator partner	Universidad del Norte, Colombia
Partners	P1 University of Salamanca, Spain P2 Universidad del Norte – UNINORTE (Colombia) P3 Oulu University - OULU (Finland) P4 Politecnico di Torino - POLITO (Italy) P5 Technological University Dublin – TUD (Ireland) P6 Nothern Regional College - NRC (United Kingdom) P7 Tecnológico de Monterrey - ITESM (Mexico) P8 University of Guadalajara - UG (Mexico) P9. Federico Santa María Technical University - UTSM (Chile) P10 Pontifical Catholic University of Valparaíso - PUCV (Chile) P11 Technological University of Bolívar – UTB (Colombia) P12. Costa Rica Institute of Technology – ITCR (Costa Rica) P13 University of Costa Rica - UCR (Costa Rica) P14. Private Technical University of Loja - UTPL (Ecuador) P15 Technical University of the North – UTN (Ecuador)
Budget	862.268€
Dates	3 years: 01/15/2019 - 01/14/2022
Web	https://wstemproject.eu

Table 1. W-STEM datasheet

The W-STEM aims to improve strategies and mechanisms for attracting, accessing and guiding women in Latin America in STEM higher education programs. This means W-STEM looks for aims to guarantee the transformation of the current situation about the STEM gender gap in Higher Education Institutions in Latin America throughout the following actions:

- To measure the gender equality in enrolment and retention rates in STEM programs - Natural sciences and mathematics; Information and communication technology and Engineering, manufacturing and construction- at undergraduate levels.
- To implement Universities’ policies, strategies and organizational mechanisms for improving attraction, access and guidance at undergraduate levels in STEM programs.
- To promote STEM studies vocation and choice in girls and young women in secondary schools as well as guidance in the first year of the STEM programs.
- To develop an online training package for Higher Education Institutions to implement effective strategies to enhance attraction, access and guidance of Women in STEM programs.

3. W-STEM International Leadership Summit World Café

During the second face-to-face meeting of the W-STEM held in Colombia on November 2019, a Leadership Summit was celebrated in Cartagena de Indias (November 25-26, 2019) to disseminate the project principles and involve policymakers from the universities. One of the most important activities of this summit was a World Café conversation (García-Peñalvo, Bello, Domínguez, & Romero Chacón, 2019) to reflect about how the universities will define action plans to improve the three main W-STEM processes: attraction, access and retention/guidance of women in STEM disciplines. Forty-four people participated in the World Café conversation (see Figure 1 and Figure 2) with different roles: W-STEM researchers, Rectors, Vice-Rectors, Deans, Department Directors, and Students.



Figure 1. W-STEM International Leadership Summit attendants



Figure 2. W-STEM International Leadership Summit World Café tables

The World Café conversation (Brown & Isaacs, 2005) is an intentional and structured way of creating a living network of conversation around key issues. It is a creative process methodology that leads to a collaborative dialogue, where knowledge is shared, and possibilities for collective action are created.

The activity was organised in four conversation tables:

1. Public policies and institutional initiatives to promote the participation of women in STEM fields, led by Alessandro Bello.
2. Institutional policies and strategies to promote the participation of women in STEM fields, led by Francisco José García-Peñalvo.
3. Strategies and mechanisms of attraction and access of young women to STEM careers, led by Rosaura M. Romero Chacón.
4. Strategies and mechanisms of guidance, retention, and promotion of the scientific career for women, led by Ángeles Domínguez.

The general procedure for the development of the conversations was:

- The duration of the overall activity was two hours.
- Four groups of ten people were composed.
- Each table had questions to guide discussions. The facilitator was able to determine whether to expand some or add new dimensions.
- All the participants must contribute to all the tables. In the end, all must have passed through all the groups.
- The rotation was given every twenty minutes to make the table change.
- In the end, each facilitator had five minutes to share the main conclusions of his/her table.

4. W-STEM World Café tables' remarks

The following sections wrap-up the most outstanding conclusions of each table.

4.1. Public policies and institutional initiatives table

This table was devoted to the public policies oriented to promote the participation of women in STEM fields and was led by Alessandro Bello.

This table conversed around four main questions:

1. Which are the key stakeholders to build public policies to support the participation of women in STEM?
2. What kind of bridges from public policies could support the work of the university?
3. How can universities feedback into public policies?
4. What are good examples of public policies that have had a good impact?

4.1.1. Which are the key stakeholders to build public policies to support the participation of women in STEM?

The different groups highlighted the need for a new paradigm and a more systemic approach to achieve structural changes and promote and achieve gender equality in STEM.

Different actors from governments to private sectors play an essential role in reducing the gender gap in STEM and in elaborating and influencing public policies, among them:

- Various government sectors, such as ministries of education, women's affairs or gender equality, science, technology and innovation, labour and agriculture.
- Governmental institutions at the local level.
- Research centres, both private and public.
- Universities (public and private) and schools from primary to tertiary.
- Industries, enterprises and the private sector.

- NGOs (Non-Governmental Organizations) and other organizations of the civil society.
- International organizations, which, through incentives and norms, can have a direct impact on the government's policies and in influencing their agenda.
- Mass media and social networks, which play an important role also in changing social norms and stereotypes towards women in STEM and also support in increasing visibility of women scientists.

The group highlighted the importance of collaboration with multiple institutions at different levels. Thus, to ensure the effective implementation of policies and instruments, coordination between actors should be strengthened. Long term plans and policies are crucial. The use of enabling platforms could also support transforming policy into actions.

4.1.2. What kind of bridges from public policies could support the work of the university?

Governments through laws can support reducing the gender gap in universities and research centres. They can also support universities through resources to implement new programmes, reinforce the structure by creating offices in charge of gender equality in each institution as well as support universities through specific incentives.

Governments could impose universities the development of specific internal instruments and affirmative actions to reduce the gender gap in STEM, such as:

- Quotas (though this instrument should be implemented just during a transition phase).
- Additional points are given to women for stimulating the insertion of women in STEM.
- Link specific funds to the elaboration of gender equality plans.

4.1.3. How can universities feedback into public policies?

Universities can/should collaborate with governments to evaluate the impact of policies. They should also, through quantitative and qualitative research on the different facets of inequalities and on the benefits of reducing the gender gap in STEM, provide evidence to governments for building evidence-informed policies.

Strengthening collaboration among universities is also vital to have a more significant impact on policies and move forward towards the achievement of the SDGs (Sustainable Development Goals).

The elaboration of national policies on science, technology and gender equality is critical in a country, and universities play a central role in contributing to its development.

Universities should lobby to push for the implementation of specific laws focused on addressing the gender gap in STEM.

The offices in charge of gender equality should put pressure on rectors and deans so that they can advocate for changing to policymakers.

Universities can implement workshops for leaders so to generate awareness on the importance of addressing inequalities in STEM topic.

Universities also have the responsibility of training and coaching future leaders so that they are aware of the importance of the topic.

4.1.4. What are good examples of public policies that have had a good impact?

Advancement in the last decade, but there is still a long way to go. Just a few examples of good policies and instruments ongoing in countries, such as:

- Specific science clubs for women in science.
- Talent schools for women in science.
- Quotas.
- Protocols on harassments and violence.
- A couple of countries (Chile and Costa Rica) have specific national policies on addressing the gender gap in science and innovation.

Proper assessments and mapping, but there is a need for more specific policies and instruments.

Education policies should be revised to include a gender and STEM component.
Need for more awards and specific scholarships and long-term policies.

4.1.5. World Café Table 1 mindmap

The mindmap of Figure 3 wraps-up the conversations developed in this table.

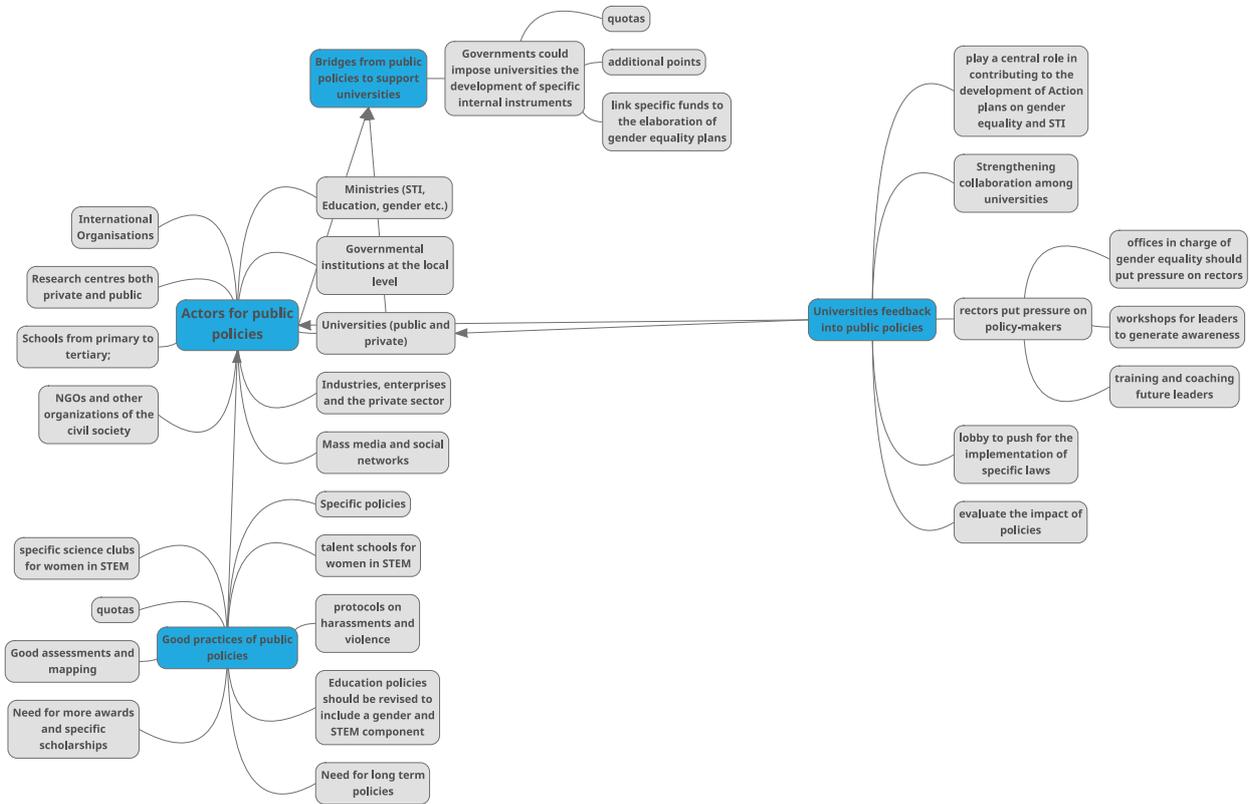


Figure 3. World Café Table 1 mindmap

Moreover, Figure 4 presents a word-cloud with the most used topics that appeared in the conversations.



Figure 4. World Café Table 1 word-cloud

4.2. Institutional policies and strategies table

This table was devoted to the institutional policies and strategies oriented to promote the participation of women in STEM fields and was led by Francisco José García-Peñalvo.

This table conversed around four main questions:

1. Which strategies within the University would promote effective participation of women specifically in STEM?
2. How to impact teaching to avoid bias in STEM programs: language, bibliography, resources, curriculum, examples, teaching, referents, etc.?
3. Which internal actors should participate in the promotion and application of these policies/strategies?
4. How to prevent written policies without implementation? From strategy to concrete actions.

4.2.1. Which strategies within the University would promote effective participation of women specifically in STEM?

From a strategic perspective, the action plan about gender equality must be based on the institutional strategic plan, which should derive in a set of specific commitments, defined with dates, that combine both short-term and long-term objectives, underlining the issues about academic progression and the creation of new offices with new organisational structures.

The gender equality policies developed so far in universities suffer from being defined as silos compartments, so that actions are not permeable between different units and services, causing mutual ignorance or duplication of actions that end up overwhelming the most receptive public and feeding those who oppose these policies. Thus, a cross-cutting approach is needed to define these policies and strategies.

Transparency must be one of the pillars for monitoring the proposed action plans. To achieve this, a new set of indicators should be established, aligned with a robust technological ecosystem (García-Peñalvo, 2018; García-Peñalvo et al., 2017) that allows the data flows can be easily processed and visualised for decision-making procedures.

Moreover, it is crucial to disseminate these policies and strategies to all the stakeholders, both inside and outside of the universities. This needs communication channels and discourses adapted to the different kind of audiences.

These gender equality policies are valid for all the disciplines presented in a specific university to define a common framework of principles in which one more STEM-oriented actions might be established.

4.2.2. How to impact teaching to avoid bias in STEM programs: language, bibliography, resources, curriculum, examples, teaching, referents, etc.?

The solution is to introduce gender equality within the usual teaching activities in every subject of the university. This means to develop a co-education policy based on training plans for the faculty to facilitate these teachers introduce the gender equality in their lectures to disseminate the principles to the student jointly with the knowledge.

Throughout this approach, empowerment of the gender equality policies will be achieved by all the involved stakeholders, in conjunction with the dissemination strategy.

4.2.3. Which internal actors should participate in the promotion and application of these policies/strategies?

Taking into account the transparency premise, more open-wall universities are required. The university people should go and collaborate with pre-university institutions and society in general. Nevertheless, this does not refer only to the faculty but to all the different roles, with a special mention to the STEM students who should be ambassadors of this discipline. Besides, University must be involved in the promotion of the computational thinking skills (García-Peñalvo & Mendes, 2018; Wing, 2006) from the early ages (González-González, 2019; Zapata-Ros, 2019).

4.2.4. How to prevent written policies without implementation?

The organisational knowledge should flow both the institutional government to the faculty, the students, and service staff in a top-down orientation, which means that the strategy and policies defined in a top-level arrive at the people that should implement them. However, the bottom-up flows also must be taken into account to (re)-define the policies and evaluate their impact. This implies more complex knowledge management systems (Fidalgo-Blanco, Sein-Echaluce, & García-Peñalvo, 2014, 2015) that reflect the complexity of the new learning and social ecologies (Rubio-Royo, Cranfield McKay, Nelson-Santana, Delgado Rodríguez, & Occon-Carreras, 2018).

4.2.5. World Café Table 2 mindmap

The mindmap of Figure 5 wraps-up the conversations developed in this table.

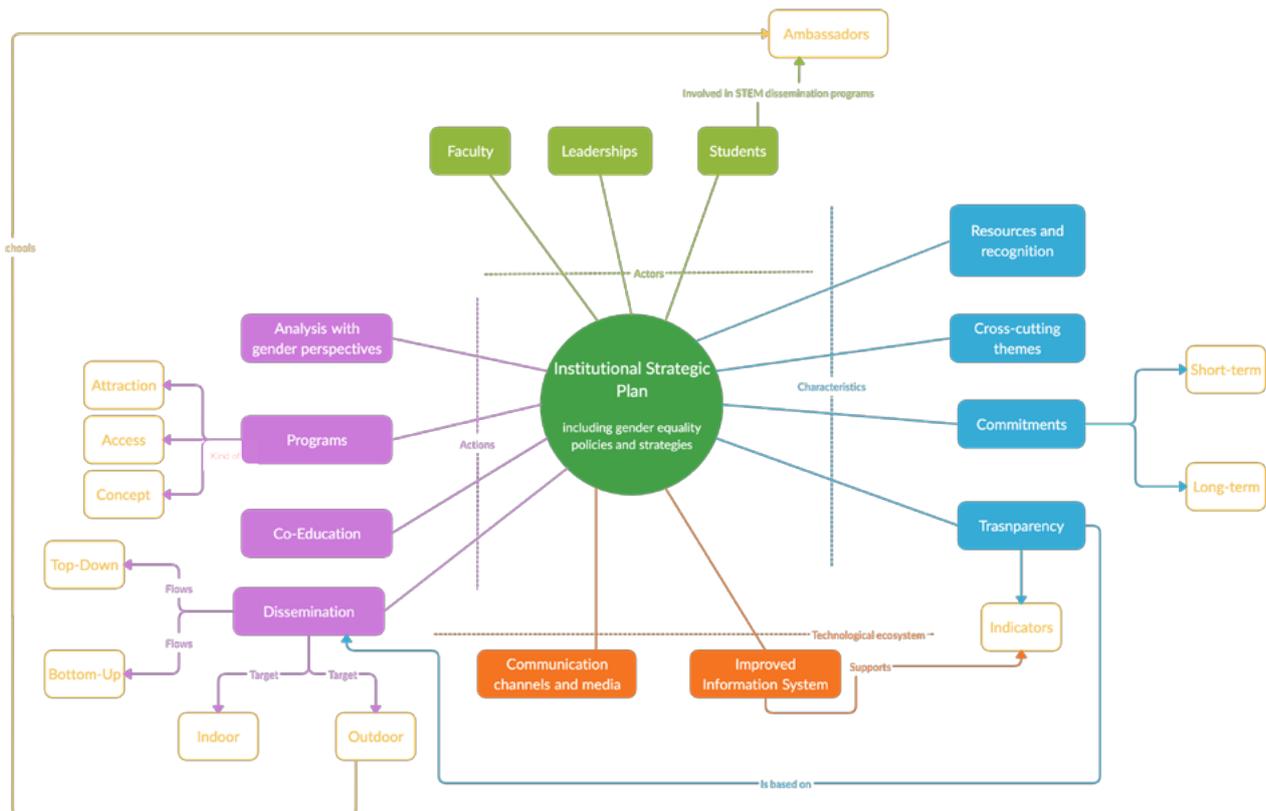


Figure 5. World Café Table 2 mindmap

4.3. Attraction and access young women to STEM careers table

This table was devoted to defining strategies for attraction and improving the access of young women to STEM studies at the universities. This table was led by Rosaura M. Romero Chacón.

This table conversed around three main questions:

1. What types of strategies and actions could be focused to give good results in attracting and accessing STEM careers for girls and young women?
2. With which actors inside and outside the university is it key to work to establish sustainable attraction and access mechanisms?
3. How can attraction be turned into effective enrolment? From attraction to recruitment.

4.3.1. What types of strategies and actions could be focused to give good results in attracting and accessing STEM careers for girls and young women?

When thinking about strategies and actions, it should be clear which groups to focus on. For this reason, it is essential to define them. Apart from elementary and middle school students, pre-schoolers must be included, given that children start to develop an understanding of gender from a young age. Also, teachers and family play a key role. They must be included in activities to promote women in STEM, eliminate stereotypes and the perception that STEM is a male domain.

On the other hand, any activity that is planned must always be evaluated to measure its impact and if it is adequate for the group to which it is directed. Also, the use of social networks is significant, to reach the most considerable number of people and that any action or strategy is thought, analysed and executed with gender perspectives, and that also integrates professionals who can ensure its most significant impact.

Even though many actions may be applied, every institution must think which are more suitable for each one.

4.3.2. With which actors inside and outside the university is it key to work to establish sustainable attraction and access mechanisms?

Actors are many. Industries, professional associations, Ministries of Education, communities and, of course, schools and colleges and institutions of higher education can contribute much for the attraction to STEM careers.

The key actors, when thinking about access, are higher education institutions and secondary schools, which must maintain two-way communication to have sustainable access to STEM careers.

4.3.3. How can attraction be turned into effective enrolment?

In the case of the conversion of the attraction to an effective enrolment, some aspects should be considered, both with an economic and emotional nature. Therefore, it is crucial to carry out pre-university courses so that students have the minimum necessary knowledge required in the different careers, the guidance or mentoring necessary to clarify doubts and support students during critical moments of admission, enrolment and permanence in careers and financial support for those who require it.

4.4.4. World Café Table 3 mindmap

The mindmap of Figure 6 wraps-up the conversations developed in this table.

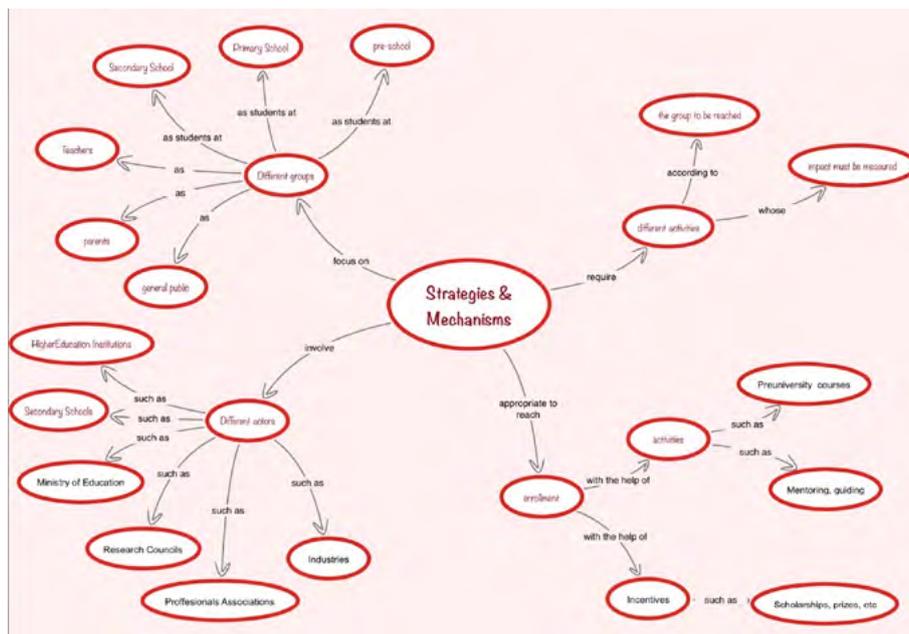


Figure 6. World Café Table 3 mindmap

4.4. *Guidance, retention, and promotion of the scientific career for women table*

This table was devoted to defining strategies for guidance, retention and promotion of the STEM women's scientific careers. This table was led by Ángeles Domínguez.

This table conversed around four main questions:

1. What strategies would allow women's talent to be retained in the early years of study?
2. How to stimulate the participation of women in other links of the STEM career: master's degrees, doctorates, scientific careers, scientific-academic leadership positions?
3. What types of incentives can be stimulated?
4. Which actors can play a crucial role in this challenge?

4.4.1. What strategies would allow women's talent to be retained in the early years of study?

Universities must develop policies, regulations and institutional actions devoted to promoting the gender perspective across all the institutional units and services.

In this sense, it would be desirable the implementation of gender-sensitive pedagogical methodologies, levelling workshops and academic support sessions. Training for the faculty to raise awareness about the use of language, contexts, examples that promote gender equity inclusion.

4.4.2. How to stimulate the participation of women in other links of the STEM career: master's degrees, doctorates, scientific careers, scientific-academic leadership positions?

The creation of women's support groups at STEM is considered a good practice, where seminars, talks, gender awareness meetings will be held.

From a social perspective, there must be campaigns to raise awareness of the gender perspective, psychological support to improve self-esteem, events leading to a change in culture, breaking stereotypes, etc.

Also, a bridge with the undergraduates is needed. Creation of bridges both from professional to postgraduate (to promote academic development) and from professional to work practice (to facilitate insertion into working life).

4.4.3. What types of incentives can be stimulated?

Incentives are needed to reduce the gender gap in STEM and promote the scientist women's careers. For example, offering scholarships, awards, and payment flexibility to encourage and support young women at STEM or supporting them with kindergartens, listening to needs, and social security spaces.

4.4.4. Which actors can play a crucial role in this challenge?

A mentorship program to support for young women. This mentoring can be between peers of students, or teachers who accompany them continuously throughout the career.

4.4.5. World Café Table 4 mindmap

The mindmap of Figure 7 wraps-up the conversations developed in this table.

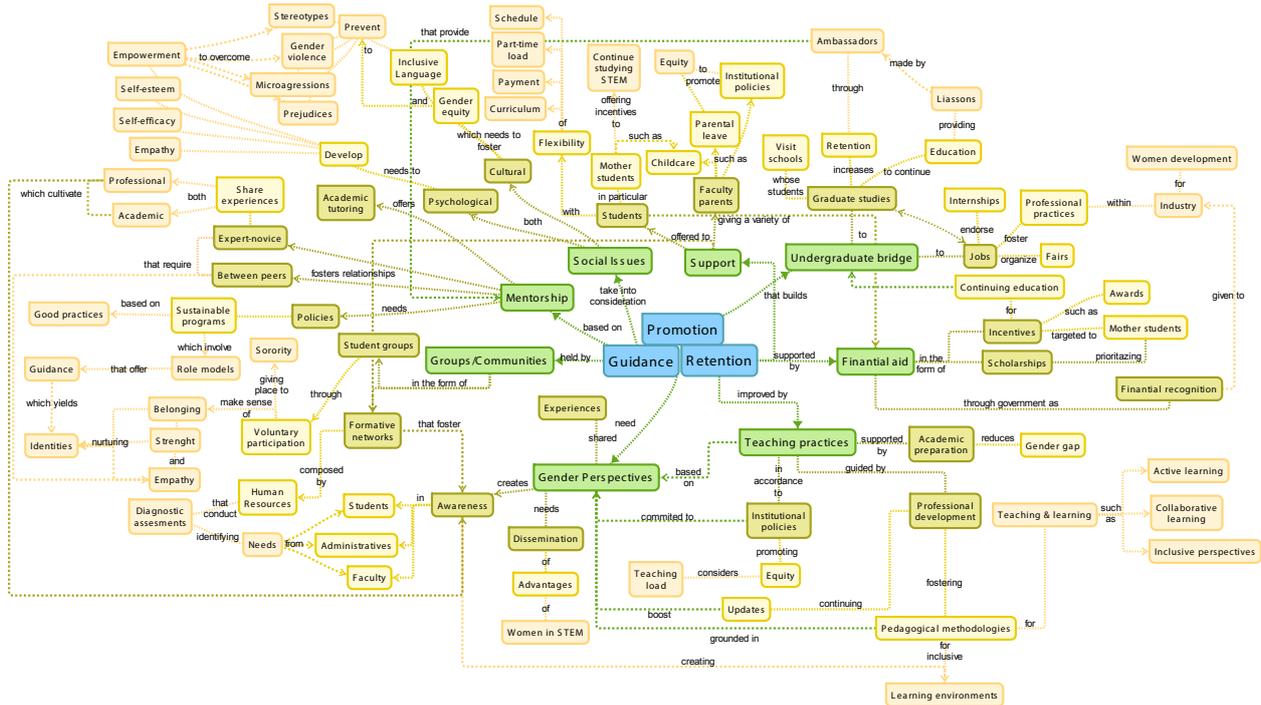


Figure 7. World Café Table 4 mindmap

Quantitatively, the frequency of topics was as follows in Table 2.

Categories	Frequency
Gender perspectives	11
Groups/communities	12
Mentorship	16
Scholarship	13
Social issues	17
Support	15
Teaching practices	10
Undergraduate bridge (to job/to grad studies)	16
Grand Total	110

Table 2. Frequency of topics that appeared in table 4 conversations

Figure 8 presents a word-cloud representation of the most used topic in the conversations (it must be considered that most of the participants used Spanish as conversation language. Thus, this graphics translates all the terms into Spanish).

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