

Women in STEM and Cultural Diversity: an international experience

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Abstract. *‘Spread the message’ was the motto of our meetings. The most important was that the message that girls and women have a place in STEM courses and careers reached as many people as possible. So, with this project, funded by the British Council, we joined forces here in Brazil, with professors from the United Kingdom to, first, understand the differences in reality and, then, act in our communities. The project had seven phases and there was a lot of exchange of ideas, visits, lectures, workshops, interviews and much more. The results and impact are countless. Also with the interaction with the British Council and professors from other approved projects, we created the proposal of the Brazil Gender Equality Framework for Higher Education Institutions.*

1. Introduction

The situation of women in STEM (Science, Technology, Engineering and Mathematics) is described in many reports and papers. According to [Rocha et al. 2021], data from the Brazilian Institute of Geography and Statistics (IBGE), only 20% of people working in the area are women. Statistics show that in 2019, 50,000 women enrolled in courses in the field of Computing, a low number compared to male enrollments, which exceeded 350,000 [SBC 2019]. Data released by the PNAD - National Household Sample Survey indicate that 79% of students in courses related to Information Technology drop out in the first year [Programaria 2023].

Silva and collaborators (2021) suggest that women capacity, competence and stereotypes attributed to them are some of the common attitudes that can end up discouraging the few women who work in the STEM areas [Silva et al. 2020]. Feelings of insufficiency and demotivation accompany even women who outperform in STEM courses and who identify with them [Amaral et al. 2017, Bloodhart et al. 2020].

In this way, initiatives that foster the participation and inclusion of women in STEM (Science, Technology, Engineering and Mathematics) courses are really important, for many reasons. It is important to be conscious of the situation, involve stakeholders and spread the message to the various kind of public. In this context, we present our project

Messenger: Women in STEM and Cultural Diversity, which was one of the only 9 projects funded by the British Council to share UK Athena Swan knowledge and experience with Brazilian counterparts. More information about the British Council and the Athena Swan Framework are in the next section.

The project Messenger focuses on empowering women in science through mentoring and exchanging experiences. This phenomenal initiative, UK-Brazil Gender Equality Partnership is funded by the British Council (2021-2022) and led by Professor Alexandra I. Cristea, from Durham University in the UK. This project aims to reduce the gender disparity in the fields of STEM as seen all over the world by promoting the participation of women in undergraduate courses in STEM both in basic and higher education.

The UK-Brazil Gender Equality Partnership Initiative is a ground breaking collaboration aimed at promoting gender equality in science, technology, higher education, and research institutions in Brazil. The partnership brings together one university from the UK represented by Professor Alexandra I. Cristea and Professor Sue Black, with two Brazilian institutions: Federal University of Amazonas represented by Professor Elaine Harada T. de Oliveira and Santa Catarina State University represented by Professor Isabela Gasparini. The goal of the initiative is to shape institutional policies and practices that will drive progress towards gender equality in these fields.

This initiative was structured in 7 main phases, each featuring a variety of interactions and activities, to create an inclusive and supportive environment for girls and women in STEM. The goal was to ensure that they feel welcome, safe, and confident in their studies and future careers, and have access to the resources and support they need to succeed.

As mentioned, the next section presents the initiatives for Women in Science and explains the role of the British Council in this initiative and the Athena Swan Framework that guides the UK policies. In Section 3, the project phases are detailed and the Section 4 presents the outcomes of the project. Finally, the paper ends with some conclusions and projects that we envision to the future.

2. Initiatives for Women in Science

It was a great opportunity to bring together professors from Brazilian and British institutions, with experience in initiatives that promote women in science. On the Brazilian side, the professors and their teams participate in the SBC's Digital Girls Program in various areas, both local and regional. In Santa Catarina, the program is called 'Catarinas' and in Amazonas, 'Cunhatã Digital'. The initiatives seek to disseminate STEM courses to the primary and secondary education public and welcome those who enter the universities.

On the British side, the professors lead research [Yu et al. 2020, Aduragba et al. 2020] and initiatives such as TechUP¹, with three strands:

- **Women** is a multi award winning, trailblazing programme developed closely with industry, which takes women from underserved groups and retrains them into tech careers.
- **Training** is based on skills bootcamps which are free adult courses designed to boost career prospects in the technology sector and are available to those aged 19+

¹<https://www.techup.ac.uk/>

who are seeking to retrain into a tech career. The Lifetime Skills Guarantee aims to provide adults with the relevant skills to progress in work and ensure employers have access to a skilled workforce.

- **Online** is the Women Taster Course available to everyone for free. Created using resources custom made for the Women programme, these resources were pulled together to give an impression of both the technical and pastoral elements of the programme and create a pipeline of potential future Women learners. Over 400 learners have enrolled on the course to date.

We see that the two countries have different initiatives, contexts and support. It is not a question of comparison or of one being better than the other, but of exchanging experiences. We think this is a good opportunity to present them, as well as briefly introducing the British Council and how the Athena Swan charter impacts initiatives in the UK and Brazil.

2.1. The Athena Swan charter and British Council

Athena SWAN (Scientific Women's Academic Network) is an equality charter mark framework and accreditation scheme established and managed by the UK Equality Challenge Unit (now part of Advance HE) that recognises and celebrates good practices in higher education and research institutions toward the advancement of gender equality: representation, progression, and success. Advance HE is a British charity and professional membership scheme promoting excellence in higher education. It advocates evidence-based teaching methods and awards fellowships as professional recognition for university teachers [AdvanceHE 2023].

The Athena Swan Charter is a framework that is used across the globe to support and transform gender equality within higher education (HE) and research. Established in 2005 to encourage and recognise the commitment to advancing the careers of women in science, technology, engineering, maths and medicine (STEMM) employment, the Charter is now being used across the globe to address gender equality broadly, and not just barriers to progression that affect women. Advance HE members can apply for institutional and departmental Athena Swan awards recognising their gender equality efforts. Universities (and their departments) who sign up for the charter can apply for an Athena SWAN award at Bronze, Silver, or Gold level.

According to Advance HE UK, the Athena Swan Charter “helps institutions achieve their gender equality objectives; assists institutions to meet equality legislation requirements, as well as the requirements and expectations of some funders and research councils; uses a targeted self-assessment framework to support applicants identify areas for positive action as well as recognise and share good practice; and, supports the promotion of inclusive working practices that can increase your the retention of valued academics and professional and support staff, demonstrating your an institution's commitment to an equitable working environment” [AdvanceHE 2023].

The British Council is the United Kingdom's international organisation for educational opportunities and cultural relations. The British Council creates international opportunities for the people of the UK and other countries and builds trust between them worldwide [BritishCouncil 2023].

In 2021, the British Council launch a call named “Women in Science: UK-Brazil Gender Equality Partnerships Call”. The Women in Science: UK-Brazil Gender Equality Partnerships Grant is one of the newest initiatives of the British Council. The purpose of this call was to influence the development of institutional policies and practices that allow the establishment of gender equality in science and technology in higher education and research institutions in Brazil. The public notice seeks to promote the development of the capacities of Brazilian institutions through partnerships with British institutions certified by the Athena Swan Charter, a reference framework used worldwide to support and transform gender equity in higher education and research institutions.

Nine proposals were selected, and each proposal should have a British institution with an Athena Swan award and at least two Brazilian institutions. It is observed that 4 of the 5 regions of Brazil were included in this call, and this project MESSENGER was one of the selected projects. The next section presents in detail our project phases.

3. Project Phases

The project was organised in 7 main phases with diverse and multiple types of interaction, to create a space where girls and women feel safe and welcomed, so that they do not drop out of their courses or find it too difficult to adapt, and are able to find the support needed for their future career in STEM. Overall, the workshop goals have been reached, and the work that has been performed broadly fits with the initial plan, and the original phases 1-7 have been performed. Next, the 7 phases will be briefly presented to give an overall idea of the project. Figure 1 presents the main phases of the project.

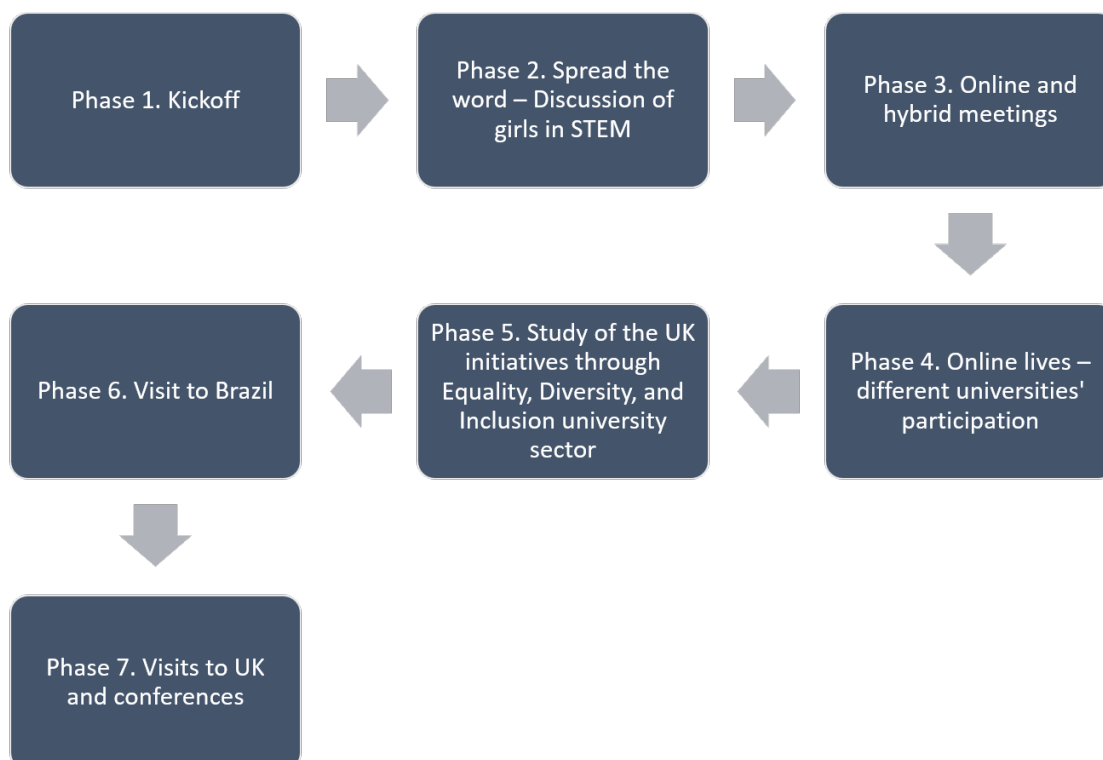


Figura 1. Main phases of our project

In Phase 1, we have had the Kickoff, with discussions on how important it is to

have girls in STEM. One notable change is that we have found that, across all phases, and across all meetings, we have had to reiterate this message again and again.

The selection process of women professors and students to be mentors, which was Phase 2, has shown to be harder than originally planned. One thing we noticed is that Brazilian professors (and definitely students) did not feel confident to be in the role of the mentor. Hence, we have introduced a special workshop on mentoring, which was one of the notable successful outcomes of the project. As a result, this was another message that we had to repeat at different meetings, and wish to focus on more in the final Open Workshop, in Phase 7.

In Phase 3, the online and hybrid meetings, we have had several such meetings, each focused on different aspects, sharing doubts, concerns - but also lack thereof. We have also organised face-to-face meetings, where possible (e.g. we had online only meetings, hybrid meetings, where local audiences meet face-to-face, but are in contact online with remote participants, and finally, in July and September, face-to-face only meetings).

Phase 4, online lives, was aimed to be an umbrella theme, and has thus guided us throughout the project. The women (and men) at various development points in their lives were invited to the various activities we have set up, and we had discussions on how important it is to work with and in technology, and how important diversity is in this context. We have also integrated the promised expansion to our project, by including a visit to a separate Brazilian university, outside of our consortium, São Paulo University. Noteworthy was that there seemed to be little understanding of similar initiatives in the same university, although this university was part of other consortia. We did our best to link the participants we invited with the other sister initiatives, for wider spread of the messages.

Phase 5, the study tour to the UK, was performed in July, with 2 academics and 1 student from Brazil, who were able to meet with both the UK partners, but also with the Head of Equality, Diversity, and Inclusion (EDI) for Durham University, and other students and staff members.

Phase 6, the visit to Brazil, was especially intensive, and we can claim, successful, with the two UK PI (Principal Investigator) and CoI (Co-Investigator) visiting 3 different Brazilian universities, with events organised at each of them. Figures 3 and 4 show the nice moments in Brazil.

Phase 7, which was the UK meetings and workshop, was organised under the umbrella of the two international conference series organised at Durham University, the Educational Data Mining 2022 and the Artificial Intelligence in Education 2022 international conferences. An additional event that was co-organised at the time was the Alan Turing Artificial Intelligence in Education Event - AIED2022, part of the Alan Turing at Durham project (ATI@Durham Network - AIHS). The Brazilian guests were invited without any additional costs to these events. The final part of Phase 7 was held in January 2023. See Figure 2 for the technological settings of the UK visits.

Among internal online meetings and other activities, we've had, as said:

- KickOff Workshop, March 2022 (online), Introduction by PI Professor Alexandra I. Cristea.
- Mentoring Workshop, May 2022 (online), with Donna Herdsman (Home – Tal-



Figura 2. Picture from the 2022 UK visit

king Talent (talking-talent.com)) and Sue Black.

- MESSENGER meeting at Durham (hybrid - face-to-face participants and online) University, July 2022.
- MESSENGER meeting at São Paulo University (face-to-face), September 2022.
- MESSENGER meetings in Joinville (face-to-face), Santa Catarina State University, September 2022.
- MESSENGER meetings in Manaus (face-to-face), Federal University of the Amazonas, September 20a 22.
- MESSENGER meetings in Durham (hybrid - face-to-face participants), Durham University, January 2023.

The changes performed in the original plan have been only with the focus on reaching our goals, but also to expand the outcomes of the project to their full potential (e.g. connecting to external events, connecting to further institutions, etc.). Thus, the main change relates to the timing of activities, as well as changing activities or adding activities where the goals needed more activities to support them.

4. Outcomes

The project had different outcomes, directly and indirectly. It had the direct participation of more than 200 people, including (male and female) undergraduate and graduate students and professors. But we are certain that the number of people reached by the project's actions goes far beyond the number of people participating. We think that the



Figura 3. Picture from Brazil (2022) Joinville meetings

tutoring of the meetings, mentoring and discussions can be applied by the participants, spreading the movement to their communities.

The project also provided us with several disclosures, through local radio stations, podcasts, and news articles, among other actions of dissemination and community involvement. We were also able to present Athena Swan's initiatives to the respective university deans.

In addition, the project actively participated in meetings with the British Council. The Women in Science: Gender Equality Partnerships Call, had the goal of influencing the development of institutional policies and practices that allow the establishment of gender equality in science and technology in higher education and research institutions in Brazil. Each project accepted in the call was invited to a series of online meetings with the British Council.

In the first meeting, the British Council presented their work in Education and Science, the Women in Science Program, their diverse scholarships for women in STEM, the timeline of the respective call, and the introduction of the Equality charters modules, which are the pillars of commonality and comparability that span all iterations of the global Equality charters. Also, a presentation on Higher Education (HE) in Brazil was presented, where an overview of the Brazilian HE sector, the types of HE institutions, regional differences, funding and gender and race in hiring and career progression were discussed.



Figura 4. Pictures from Brazil (2022) Manaus meetings

The second workshop meeting targeted gender and race barriers in Brazil's Higher Education. The topics included gender, race and the organisation of the labour market, gender and race barriers in HE, and major challenges identified by this cohort. In the third workshop, the meeting focused on the Introduction to Athena Swan in the UK and Globally, and the start of Brazil's Gender Equality Framework was initiated. In the fourth meeting, all participants of all projects could have a brainstorming processes, in groups, discussing the proposal of the Brazil Equality Framework Principles. There was a moment for group discussion on the principles, pre-existing committees we may have to support the self-assessment needed for the framework and/or the need to create new structures, and other aspects shared during the event. The fifth meeting was also about discussing the Brazil Gender Equality Framework for Higher Education Institutions, a more consolidated document. These meetings with all participants of the call and initiatives collaborated with the creation of the Brazil Gender Equality Framework for Higher Education Institutions, available in [BritishCouncil 2022].

This framework is underpinned by a set of 10 principles². These principles set out the commitments that institutions taking part in this framework agree to uphold, provide a foundation for the work that will be carried out and represent the ambitions that all those participating in the framework share.

1. We acknowledge that academia cannot reach its full potential unless it can benefit from the talents of all.

²https://www.britishcouncil.org.br/sites/default/files/brazil_gender_equality_framework_for_higher_education_institutions_en_0.pdf

2. We commit to advancing gender and race equality in academia, in particular, addressing the loss of women in general and black, indigenous, quilombola women and women from other under-represented and historically marginalised groups across the career pipeline and the absence of women from senior academic roles.
3. We commit to addressing unequal gender and race representation across academic disciplines. In this we recognise disciplinary differences including the particularly high loss rate of women in science, technology, engineering, mathematics and medicine (STEMM).
4. We commit to tackling the gender and race pay gap.
5. We commit to tackling bullying and harassment including moral harassment, sexual harassment and gender-based violence.
6. We commit to removing the obstacles faced by women, especially black, indigenous, quilombola women, women with disabilities and women from other under-represented and historically marginalised groups and women who have care responsibilities at major points of career development and progression including the transition from PhD into a sustainable academic career.
7. We commit to addressing the negative consequences of using short-term contracts for the retention and progression of staff in academia, particularly women and black, indigenous, quilombola women and women from other under-represented and historically marginalised groups.
8. We commit to tackling the discriminatory treatment often experienced by gender nonconforming people, including trans, non-binary and gender-fluid people.
9. We acknowledge that advancing equality demands commitment and action from all levels of the organisation and in particular active leadership from those in senior roles.
10. We commit to making and mainstreaming sustainable structural and cultural changes to advance equality, recognising that initiatives and actions that support individuals alone will not sufficiently advance equality

The results were quite positive, and other projects are under construction for the continuity of the established partnerships.

5. Conclusions and Future Work

It was extremely useful to be able to choose which kind of project we would like to develop. From the Brazilian side, it was particularly enriching to get the first contact with the Athena Swan framework and figure out that we do not have that in Brazil yet. However, from the very beginning, our focus was on collaboration, and we shared and listened to many professors' and students' experiences. From the UK perspective, finding out similarities, but also differences between the UK and Brazilian situation was enlightening.

From our experience, what worked well was that all partners were very responsive and collaboration was very easy to implement. What didn't work so well was that timing was an issue, due to the mismatch of academic years in the UK and Brazil. Another challenge was the buy-in from the higher-ups in the Brazilian institutions - but we believe our partners were able to meet this challenge during the duration of the project.

To conclude, we would like to share some key learnings, some things we would do differently and some final thoughts looking forward to future work.

Some key learnings:

- Dealing with the status quo is different, and bias is present everywhere (both in women and in men) and it takes time to even highlight it, let alone actually tackle it;
- Some means that are quite standard in the UK (e.g. mentoring) are not that common in Brazil, and needed additional time to be implemented;
- The message of the benefits coming from diversity need to be very well received and understood, before other steps are to be taken;
- Whilst some Brazilian counterparts were already very active in women in STEM activities, it was clear that some of the participants heard the message for the first time; this is an achievement of our project, but it also shows that follow-up activities are necessary.

What we would do differently:

- Follow up is necessary, as once we have brought the message across, further meetings and workshops would help in the implementation; this involves further mentoring, data gathering, and further spread of the message;
- Timing was a little tight, but it was great that the project allowed for flexibility; as meetings had to be scheduled taking into account timezones, term-time, as well as availability, that meant that some meetings were closer together than necessary - follow up meetings at an interval would ensure wider uptake, and this is something we wish to follow up with further Calls.

From the UK perspective, finding out similarities, but also differences between the UK and Brazilian situation was enlightening. To give some examples, the first one is one of scale - only the campuses in the Federal University of Amazonas are distanced way beyond any UK campus - at the distance between European countries! Other things to note is that the university types are different; state, federal, private universities in Brazil differ from their UK counterparts. Issues are also different - e.g. Brazil has issues to tackle with the native population, which is underserved and underrepresented. This is different from the UK. Similarities include ambitious women in STEM on both sides, wishing to progress in their careers, and often encumbered by also wishing to make a home, have children, bias against women, etc.

Our plans are to create a UK-Brazil network of academics and researchers in STEM, and keep collaborating in research and other women in science projects. We also would like to apply for further funding, to build on the excellent platform we have created here and inspire others to seek for more collaboration.

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