



How ICT Encourages Informal Mentoring Networks to Promote Gender Equality in Times of Pandemic

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Abstract: Gender equality promotion initiatives are increasingly needed to foster the choice of the scientific area of engineering. Currently, in higher education, it is observed that regarding engineering courses women practically have no representation in relation to the number of male students. The article presents the problem in the field of Gender Equality interrelating with the Sustainable Development Goals. The research methodology adopted is Design Science Research, given the specificity of the problem. The main results and contributions are the literature review in the field of the theme under study, as well as the various initiatives in the national Portuguese context and focus on a set of instruments of debate and dissemination involving testimonies of former students and the community. These initiatives promote Gender Equality in engineering courses in Higher Education, enhancing the choice of these courses.

1. INTRODUCTION

The use of Information and Communication Technologies (ICT) can enhance the transformation of the Society by incorporating sustainability concerns, including the Sustainable Development Goals (SDGs).

The main objective of this work is to give the SDGs (UNDP, 2021) a broadness from a perspective of ICT sustainability, promoting gender equality between women and men in the fields of science and technology. The numbers are staggering, women make up less than 25 percent of the Science, Technology, Engineering, and Mathematics (STEM, STEAM represents STEM plus the arts) workforce in the United States; also in the United States, the number of women who graduated in computer science between 2006-2014 decreased (Stofan, 2017). One of the important questions to be asked is: why is the fact that women are not represented so important? Research shows that mixed teams perform better, that is, people of different genders, races, backgrounds and experiences bring different perspectives that can lead to innovative solutions (Stofan, 2017).

In fact, a set of strategies and actions is needed at the secondary level to raise the interest of girls to enter higher education in engineering areas. ICT is encouraging tools for informal mentoring networks in promoting gender equality. It is considered that Information and Communication Technologies may play a fundamental and disruptive role in enhancing the aggregation of crucial information in the field of the theme. The paper is structured in six sections: introduction, background, methodology, experiences with higher education students, future research directions and conclusion.

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2. BACKGROUND

The use of Information and Communication Technologies (ICT) can enhance the transformation of the Society by incorporating sustainability concerns, including the Sustainable Development Goals (SDGs). On September 25, 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development (UNDP, 2021), setting 17 objectives and 169 targets, covering social, economic and environmental dimensions around the world. The objectives focus on people, human rights and responding to growing social inequalities, as well as core concerns such as peace, security and climate change. This study focuses on the issue of gender equality, aggregating two SDGs in particular: SDGs 4 and 5. Figure 1 shows some indicators related to education and gender equality, reinforcing the need for concrete actions to achieve some goals.

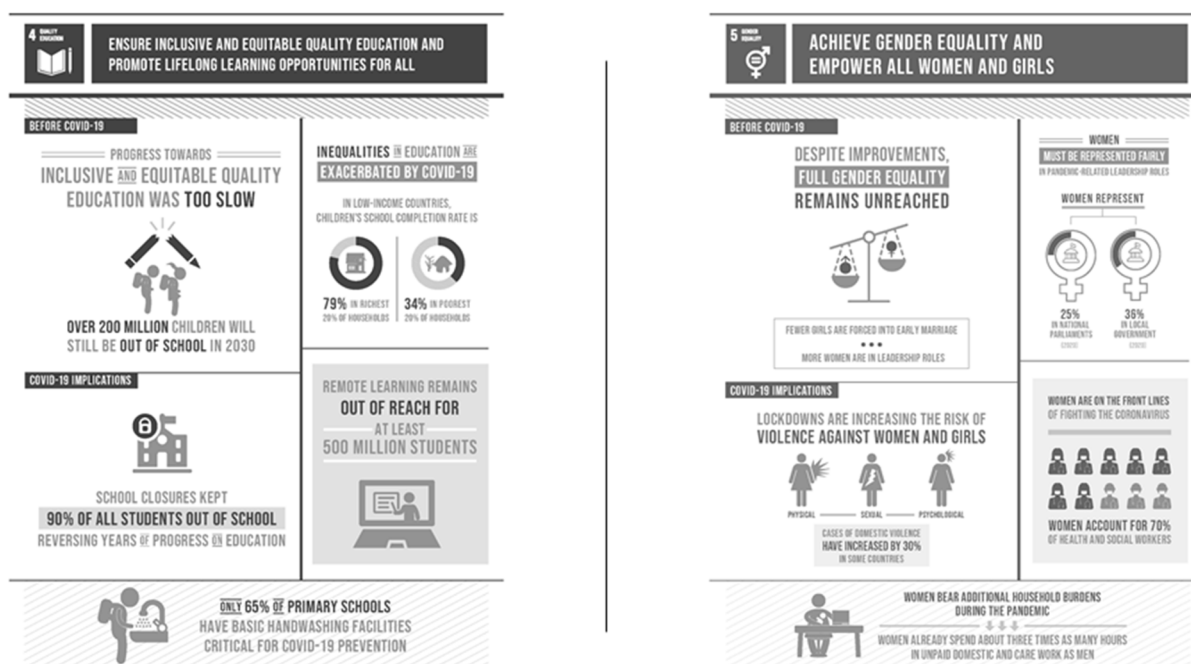


Figure 1. Sustainable Development Goals: Goal 4 and Goal 5

Source: <https://sdgs.un.org/goals>

As a part of the project under study, SDG 4 “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” and SDG 5 “Achieve gender equality and empower all women and girls”. It is important to highlight the lack of representation of women in the various sectors, namely in management positions.

Within the scope of the project also stands out ODS 5; this SDG emphasizes ensuring the full and effective participation of women and equal opportunities for leadership at all levels of decision-making in political, economic and public life. In this sense, it is considered to increase the use of basic technologies, in particular information and communication technologies, to promote the empowerment of women. It is also considered that adopting and strengthening sound policies and applicable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels, in this framework of performance of functions in the field of engineering and ICT, can contribute to gender development. It is also a challenge to encourage the incorporation of sustainability concerns in the different dimensions: economic, technical, social, human and environmental in the context of ICT.

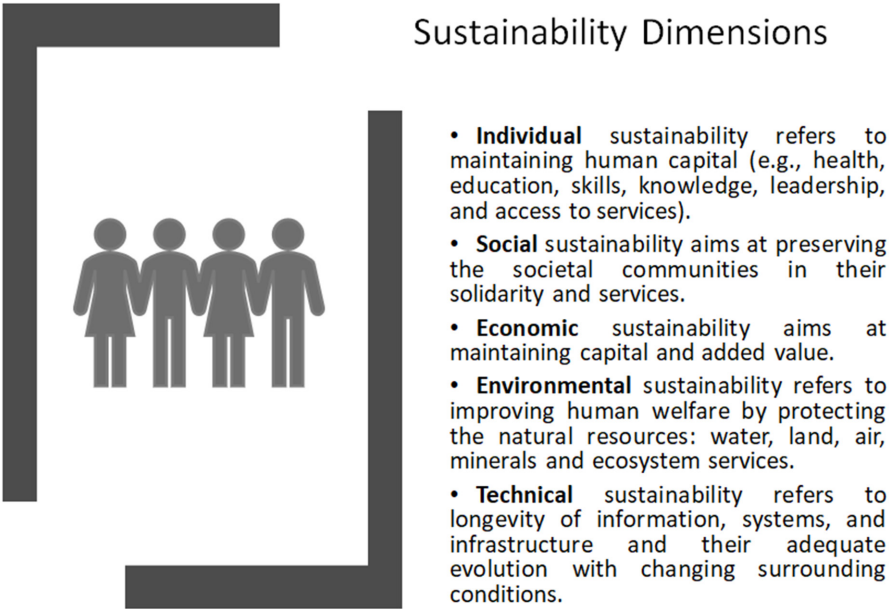


Figure 2. Sustainability Dimensions
Source: adapted from (Becker et al., 2015)

It is considered that, with regard to the dimensions of sustainability (Figure 2), ICT can enhance the incorporation of these dimensions to include concerns in the field of software reuse, open source, cloud computing, virtualisation, dematerialisation process, digital transformation and information security (Reis, Carvalho, Silveira, Marques, & Russo, 2021).

3. METHODOLOGY

The research methodology adopted is Design Science Research, given the specificity of the issue.

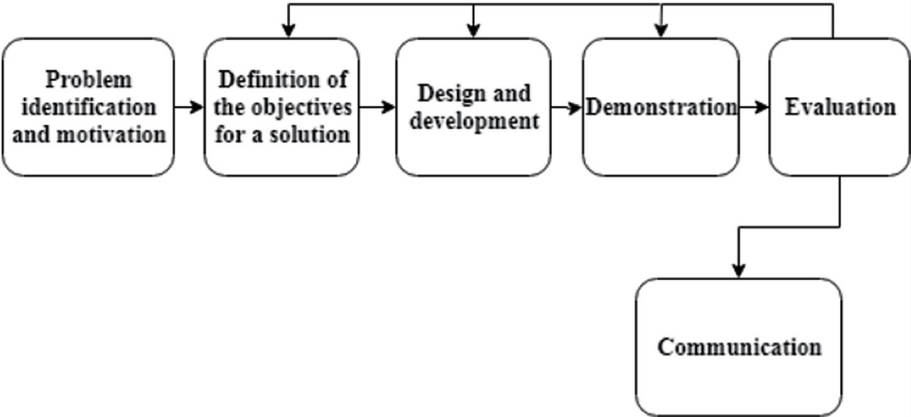


Figure 3. Design Science Research steps
Source: Adapted from (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007)

The methodology scheme is shown in Figure 3. The DSR iterative process includes six steps: problem identification, the definition of expected results, design and development, demonstration, evaluation and communication. Thus, applying the DSR methodology, in this context, allows us to identify the problem underlying the theme of gender equality, enhancing the design of instruments that allow the development of awareness-raising actions, namely, through testimonies and successful professional experiences.

4. EXPERIENCE WITH HIGHER EDUCATION STUDENTS

Given the scope of the phenomenon under study, it is intended to create a multidisciplinary team whose objective is to create synergies in order to characterize the state of the art in the field under study and act accordingly, making the best use of the various areas involved. They are, therefore, specific objectives of the project, the use of instruments/tools in order to characterize the state of the art in several scientific areas inherent in the characterization of Gender Equality in the fields of science and technology, as well as the design of instruments to develop awareness-raising actions to break the socio-cultural taboos, namely through successful professional testimonies and experiences.

It is intended to create working tools to raise awareness among students, initially at the level of secondary education, about the role of women in the field of engineering/information and communication technologies. It is also considered that this objective should be reconciled with sustainable development in order to also include the importance of women's participation in engineering/technologies. Thus, and in view of the objectives of the Organization of United Nations that has been developing efforts in order to promote the participation of women.

As an example, the “Engineers for a day” project is presented, which responds to the objectives of the Agenda for Equality in the Labour Market and in Companies (Comissão para a Cidadania e a Igualdade de Género, 2020). In this way, it aims to contribute to the Program to combat choice by women and men from different professional areas. The project led to the realization of several activities, namely: thematic events, expert lectures, sessions with female engineers (Commemoration of the International Day of Girls in ICT), sessions with engineering and/or technology students, visits to companies and Universities/Polytechnics, integration in the contents of subjects in the curriculum of primary and secondary education, campaigns, exhibitions, news, information sheets, among others.

The objectives presented by the initiative, “Engineers for a day”, emphasize (Comissão para a Cidadania e a Igualdade de Género, 2020): to combat sexist prejudices and stereotypes about what is supposed to be proper and suitable for women/girls and men /boys; to demystify the dominant idea that there are academic and professional areas more typical of men and others that are more typical of women; to deconstruct, with students, prejudices and stereotypes about the professional and knowledge areas associated with Engineering and Technologies; to promote a freer choice of these areas of study by girls; promote informal mentoring networks at local and regional level, with female professionals and with girls who study these areas; sensitize schools and educational agents to the problem of the separation of the sexes by occupations, including professionals, and in particular to the scarcity of women in the fields of Technology and Engineering; mobilize educational agents for cross-cutting strategies for this issue in their activities; involve local authorities and encourage them to fight and prevent occupational imbalances between women and men.

Another experience carried out with students from a technology college (Silveira, Reis, Carvalho, Tomé, & Sanches, 2020), in which the challenge of developing sustainable software was proposed, revealed that students are motivated to link software development with the issue of sustainability in the various dimensions. This experience also allowed us to assess the relevance of developing more actions in order to encourage participation, thus fostering the students' hunger for software development, combining the scientific component with solving practical and social problems. In this initiative, it was possible to see the special commitment and moti-

vation of the female elements of the team, as they planned a solution with a social impact, and which contributes to the sustainability of the planet.

Palma (2001) states that “to make computer science more attractive to women, make it more like mathematics”. In this perspective, computer science courses should emphasize the teaching of mathematical logic so that girls feel attracted to the area. Another perspective of attracting girls is to include the concepts of sustainable software development in computer science courses.

5. FUTURE RESEARCH DIRECTIONS

Previous studies (Reis, & Silveira, 2020) show that it is possible to assess the implementation of awareness-raising actions, within the scope of gender equality, incorporating concerns about sustainability in the five dimensions: human, technical, economic, social and environmental.

Given the scarcity of women in the fields of Technology and Engineering, it is considered that identifying the effects/impacts that ICT projects may have on technical, economic, environmental, social and individual sustainability, teaching how to incorporate sustainability factors and dimensions into daily practice, can be very inspiring goals.

As future work, we intend to continue teaching the incorporation of the principles and dimensions of sustainability in software design. It is also considered the development of an approach that analyses (initially through the questionnaire) the reasons for choosing engineering courses (secondary education students) and then implement concrete actions. Another aspect of future work involves incorporating actions from the “Impulso Jovens STEAM” Program. The “Impulso Jovens STEAM” Program aims to promote and support initiatives aimed exclusively at increasing the higher graduation of young people in the fields of science, technology, engineering, arts and mathematics (STEAM), in line with the new needs of the labour market (Governo da República Portuguesa, 2021).

6. CONCLUSION

Building on concerns in the field of IS and ICT sustainability, it is considered that this research can contribute to the creation of integrated solutions, in various axes, to help solve the most pressing challenges in the world and enhance the use of IS for people, always bearing in mind sustainability and the SDG (UNDP, 2021). Concerns underlying sustainability, more specifically in terms of the human dimension, are linked to SDS 5 gender equality and in this sense women’s participation in engineering courses is urgent given their potential for society (Silveira & Reis, 2021).

Regarding the experience reported by the students (Tomé & Sanches, 2020), it is emphasized that with this type of projects: we intend to outline a future, a future that we as students would like to be implemented and, in this way, it is important to ensure that there is sustainability in software development. Therefore, the intention is to prepare a survey in order to gather information about the subject. Another component of future work that is also considered relevant is the search for successful cases in order to disseminate this information as a motivating factor. It is also intended to promote the factors and dimensions of sustainability as an inspiring aspect.

From the perspective of students, it is important to carry out awareness-raising/dissemination actions with practical applications that incorporate the Sustainable Development Goals from a

perspective of sustainability in ICT, as well as to disseminate testimonies and successful professional experiences in the field of the subject, as well as to promote mentoring networks. Indeed, it is urgent to promote the balance between women and men in the STEAM areas, promoting equal opportunities and moving towards a fairer and more sustainable world.

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