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Educathon 23 – Girls in Science: An Educational Experience for Teaching Technology with a Gender Perspective

Cristina Garcia-Ruiz
University of Málaga

Elisabet Luque-Henares
University of Málaga

Carolina Martin-Gamez
University of Málaga

Abstract: Hackathons are events and work sessions derived from the technological field in which the participants work collaboratively around different challenges and, in a short period of time, seek innovative solutions, presenting them formally at the end of the session. Given the potential of this type of activity related to promoting the development of skills such as problem-solving, teamworking and creativity, among others, and with previous experience and success of its application in science educational contexts, we decided to apply it in the event of the International Day of Women and Girls in Science. Considering the significant concerns in the access of girls to science and technology professional areas, mainly due to gender stereotypes and biased as well as the lack of referents, we held the Educathon 23 - Girls in Science (www.educathonencic.com), aiming to promote equity access to science and technological education. Hence, working collaboratively in multidisciplinary teams, the 15 participants (students mainly from educational degrees) designed an educational resource aligned with the game-based learning methodology and addressed technology content, making the role of female researchers at the University of Málaga who work on related topics visible. To do so, they worked in groups of three during two sessions (five hours each) on the assigned tech topic and selected the stage (Early with a final five-minute presentation of each group. To analyse the experience, at the end of it, the participants responded to a questionnaire in which they generally expressed their satisfaction with the experience, how it had made them aware of the importance of making visible female references in their future teaching practice, and how it had provided them with examples of how to accomplish it.

Keywords: Technology education, Gender issues, Educational resources

Introduction

During the year 2013, the General Assembly approved the resolution on science, technology and innovation for development, in which it recognized that full and equal access and participation in science, technology and innovation for women and girls of all ages were essential to achieving gender equality and the empowerment of women and girls. Thus, the General Assembly declared February 11 as the International Day of Women and Girls in Science, in recognition of the key role played by women in the scientific and technological community. Under these premises, and knowing the importance of developing actions from the field of education that promote the access of women and girls to scientific education, the *Educathon 23 – Girls in Science* arises, a space designed for the creation of didactic proposals, that contribute to gender equity and equality in access to scientific education and make visible the role of women in science.

Gender-related Problems in Science and Technological Education

There is widespread concern about the relatively small number of students, in general, and girls, in particular, who opt for science and technology as fields to develop their professional future (Holmegaardet al., 2012). In other words, there needs to be more representation of women in higher education and careers related to STEM areas (Science, Technology, Engineering and Mathematics). In this sense, a UNESCO report (2021) shows the surprising inequality between genders, revealing that only 35% of students in STEM careers are girls and only 28% of researchers worldwide are women. More specifically, in Spain, in 2021, with 56% representing women in university degree studies, the rate of these in Degrees such as Computer Science was only 13% (Ministerio de Educación y Formación Profesional [MEFP], 2021).

This situation is surprising since students commonly consider science and technology areas of great relevance and importance for society (Vázquez, 2012). Given this contradiction, certain factors must influence this biased choice in higher education. Differential psychology research has revealed that men and women can study science and technology similarly. For this reason, the low representation of women in higher education and the exercise of careers related to these areas must attend to other factors. In this sense, authors such as Archer et al. (2014) and Rossi and Barajas (2015) point to the lack of female references as one of the keys that could explain why girls do not opt for these disciplines, which can also generate economic and social consequences, among others. In this sense, the experts stress that to prosper sustainably, the countries' economies require not only a scientifically literate population but also a significant workforce of professionals in science, technology, engineering and mathematics, as has been demonstrated in the health crisis due to COVID-19. Also, since STEM careers often offer higher pay, this would open the door to a better socio-economic gender balance (Chachashvili Bolotin et al., 2016).

On the other hand, considering the comprehensive training of people, it is important to highlight what STEM areas can contribute to collective and personal development (Zouda, 2018). In other words, we must consider the discrimination that, for the purposes of personal fulfilment, the deprivation of their presence in the scientific-technological and mathematical areas entails for women. Ultimately, ignoring the underrepresentation of women in STEM fields has serious economic consequences and perpetuates gender inequality and social injustice.

Different publications show that exposure to inspirational role models is crucial to foster student engagement with STEM disciplines, with a significantly pronounced effect in women exposed to role models of the same gender (Lookwood, 2006). Consequently, the educational approach must adopt an adequate understanding of science and technology in order to be able to challenge the stereotypes that persist in the curricula and among the teaching community itself.

For this reason, it is necessary to work from scientific and technological education, providing scientific and technological female references as close and current as possible and promoting awareness in future teachers of this teaching approach so that students not only contemplate these areas as essential but as something they want to be a part of.

Hackathons as Innovative Strategies to Promote Equity Access to Science and Technological Education

Considering the educational framework stated, it is essential to find new ways to promote the gender perspective through innovative tools of a technological nature that allow the adoption of examples of good practices. These tools have to promote the management of tensions and dilemmas while promoting autonomy and community work, innovation and continuity in democratic decision-making processes through integrated thinking (Kienzler & Fontanesi, 2017).

This innovation, referring to learning and teaching methods, is frequently enhanced through networked collaborative learning in multidisciplinary environments. Under these premises, during the last two decades, the so-called hackathons have emerged, events adapted from the business world, focused on new technologies and used as a practical means to improve learning and motivation (Maaravi, 2018).

Hackathons are events derived from the technological field in which participants form work teams around different challenges and collaboratively seek innovative solutions, presenting them formally at the end of the session and evaluating their capacity in terms of suitability to the problem, design and innovation. In this way, innovative features are incorporated, such as team-level cooperation or product launches through condensed presentations (Suominen et al., 2018). Although its application in the field of education is still limited, with

some experiences applied in Higher Education (Islind & Norstrom, 2020; Kuznecova et al., 2020; Steglich et al., 2020). The basic principles of the hackathon, related to intensity, collaborative work or the approach to real-life projects, contextualized, can be successfully applied to other disciplines, such as the Science and Technological Education.

Goals

The general goal of the proposal was to make visible referents of STEM researchers through the creation of educational resources for Early Childhood, Primary or Secondary Education that linked the basic knowledge specified in the LOMLOE curriculum with the research carried out by women in the STEM fields at the UMA, using the work strategy of hackathons.

By doing so, we hypothesized that the participant students would become aware of the importance of adopting gender approaches in scientific-technological teaching, fostering the capacities of teamworking, problem-solving and decision-making skills, and promoting entrepreneurship and innovation in this way.

Method

Research Context: The Educathon 23 – Girls in Science

With the gather experienced we accumulated in the development of Educathon21 and Educathon 22 (García Ruiz et al., 2021), addressed to promote inquiry skills in pre-service science teachers through the design of inquiry activities aligned to the SDG (García Ruiz et al., 2022). We decided to extend its application to the International Day of Women and Girls in Science.

Sessions Development

The first and only edition to date was held in February 2023 on the occasion of the International Day of Women and Girls in Science. Students enrolled in the 2022/2023 academic year in any of the degrees, masters, or doctorates at the University of Malaga were summoned. The participant students worked in multidisciplinary cooperative groups on an assigned challenge linked to the knowledge and contents of the Spanish Education Curriculum. The work groups, which also received a training workshop on the *App Inventor* application, were mentored by a group of experts in Science Education, designing resources that made visible the role of reference researchers in STEM areas of the University of Malaga. These researchers attended the conferences to discuss and collaborate with the working groups, thus bringing the main findings of their lines of research closer. Finally, five innovative educational proposals were developed, aimed at the levels of Early Childhood Education and Primary Education, which made visible and brought the UMA female research references closer to the students of these cycles, thus contributing to the creation of resources for the promotion of STEM vocations and the reduction of the gender gap in access to these areas. The proposals were publicly presented and evaluated by a panel of experts in educational research with a gender perspective, awarding a first prize according to the criteria established in the call.

Participants

A total of fifteen students, from multidisciplinary Bs and Ms degrees such as Philosophy, Social Education, Environmental Science or Teacher Education, among others, participated in the edition of the Educathon 23 – Girls in Science. None of them had experience designing or practising game-based educational resources aimed to contribute to equity in science education. All fifteen participants worked collaboratively in groups of 3 people, contributing to the design of the educational proposal from their expertise.

Instruments

Regarding the monitoring and evaluation of the experience, participants fulfilled a questionnaire developed in Google Drive, which included the assessment of the soft skills developed and the awareness of the gender

perspective developed through the event as well as the valuation of the educational resources designed, altogether contemplating the emotional aspects of the whole process (García Ruiz et al., 2020).

The questionnaire (table 1), designed *ad hoc* for the occasion, was then divided into two parts. The first one, concerning the cognitive profile, was composed by eight items in a four-point Likert-type scale (1: poor, 2: average, 3: good, and 4: excellent). On the other hand, the second part, concerning the emotional profile, referred to the emotions associated with the stages experienced through the sessions, and include achievement (confidence, satisfaction, shame, and dissatisfaction) and epistemic emotions (interest, concentration, boredom, rejection, and insecurity), and the participants could choose more than one emotion per stage.

Table 1. Questionnaire of the Educathon 23 – Girls in Science

In which grade has Educathon 23 contributed to developing the following **soft skills**? Choose from 1 (poor) to 4 (excellent)
Teamworking
Problem-solving
Creativity
Communication
In which grade has Educathon 23 contributed to developing the gender perspective? Choose from 1 (poor) to 4 (excellent)
Raising awareness of the importance of addressing STEM education from a gender perspective
Importance of making women researchers visible
Knowledge of the role of women in research
Willingness to adopt measures to promote an approach with a gender perspective in STEM education
Indicate how you felt while carrying out each process (you can mark more than one emotion): boredom (BOR), concentration (CON), confidence (CNF), dissatisfaction (DIS), insecurity (INS), interest (INT), shame (SHA), rejection (REJ), and satisfaction (SAT)
Group formation
Challenge approaching
Workshop
Collaborative working
Mentoring
Female researcher deepening
Resources presentation
Awards granting

Data Collection and Analysis

Data were collected at the end of the last session through the online questionnaire described previously. We performed a descriptive study for the quantitative data, collecting the frequency of each value per item study using Jamovi software (version 2.3.21.0). For the emotions data analysis, we collected the frequencies of emotions and their percentage of representation per stage, providing in this way a whole picture of the emotions experienced by the participants.

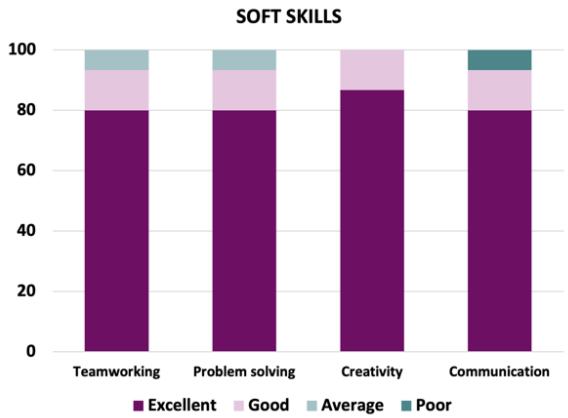

Figure 1. Frequency of results on the soft skills developed

Results and Discussion

About the Soft Skills Promoted by Educathon 23 – Girls in Science

The valuation of the soft skills developed through the Educathon 23 was quite positive, with 80% of participants considering it excellent in terms of team working, problem-solving or communication. The percentage is even more favourable regarding creativity, with the totality of participants expressing either excellent or good (Figure 1).

About the Gender Perspective Approached by Educathon 23 – Girls in Science

It is with great satisfaction that, regarding the gender perspective approached, circa 80% of participants considered that Educathon 23 – Girls in Science was excellent either for highlighting the importance of making women researchers visible, offering knowledge of the role of UMA women researchers, and creating the willingness to adopt measures to promote an approach with a gender-perspective in scientific-technological education. An even more significant percentage is considered in Educathon 23 – Girls in Science, helping to create awareness about the gender perspective (Figure 2).

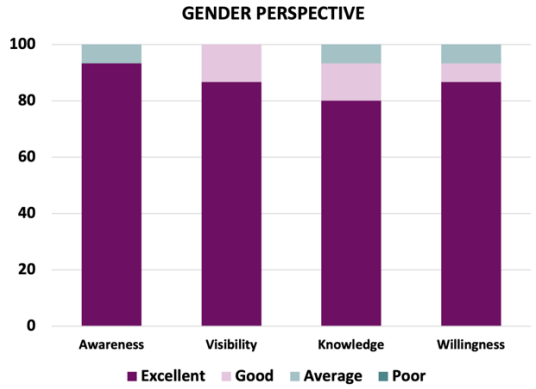

Figure 2. Frequency of results on the gender perspective approached

About the Emotional Profile Expressed during Educathon 23 – Girls in Science

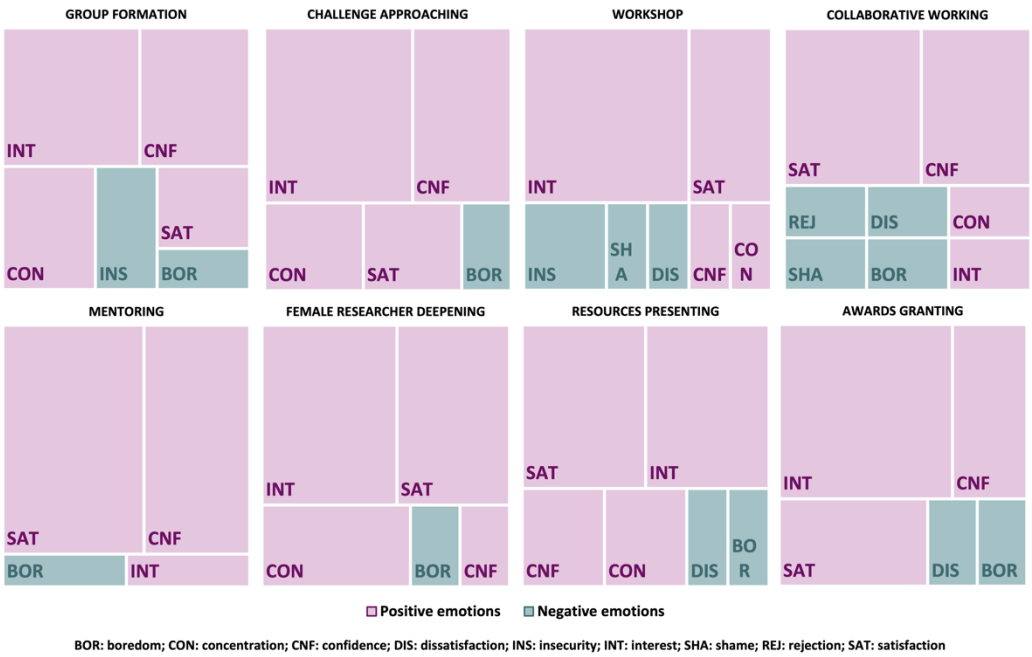

Figure 3. Emotional profile per stage of the Educathon 23 – Girls in Science

With reference to the emotional profile experienced during the Educathon 23 – Girls in Science, Figure 3 shows the emotions expressed by typology and step, observing how most of them are positive (up to 70% in each stage), being the most expressed "interest", followed by "satisfaction". It is worth mentioning that the stage of female researcher deepening and the presentation of the resources reached 94% of positive emotions. Negative emotions were represented in less than 22% in all the stages, but for mentoring stage, which reached 27%, being the most manifested "boredom", followed by "insecurity" (Figure 3).

Conclusion

Participants' assessment of the Educathon 23 – Girls in Science and their presentations were very satisfactory, finding them generally very interesting and related to the objectives set. Designing and presenting concrete examples of resources developed to approach the gender perspective since Early Childhood and Primary Education was highly valued, thus highlighting the importance of these kinds of exchanging scenarios and learning opportunities in students' formation. Thus, participants expressed an appropriate relationship between the development and the application of the contents addressed, with an emotional profile accompanying the results.

Recommendations

With the acceptable panorama revealed, and after revising the results of the assessment questionnaire completed by the participants and evaluating the organization's development, we consider as recommendations for subsequent editions to increase the number of days of the sessions, in similarity to other hackathons, also involving participants in the possibility of continuing with the optimization of their resources designed.

Scientific Ethics Declaration

The authors declare that the scientific, ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

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Author Information

Cristina García-Ruiz
University of Málaga
Málaga, Spain
Contact e-mail: *crisgarcia@uma.es*

Elisabet Luque-Henares
University of Málaga
Málaga, Spain

Carolina Martín-Gámez
University of Málaga
Málaga, Spain

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