

*Empower Girls Creativity Through Use of Digital Technologies:
A Learning Programme for Girls (SparkDigiGirls)*

Célio Gonçalo Marques, Polytechnic University of Tomar, Portugal
Inês Araújo, Polytechnic University of Tomar, Portugal
Laura Grinevičiūtė, VIPT Asociacija, Lithuania
Brigita Dane, Simbioza, Slovenia
Renata Danielienė, Information Technologies Institute, Lithuania

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Abstract

Research shows that girls choose their professional future based on stereotypes, often under the family influence. The area of technology is the one where we find fewer girls, due to the lack of role models or examples of successful women. In response to this need, a group of partners involving universities and associations from Lithuania, Slovenia, Greece, and Portugal developed a project over two years. It started with a compilation of good practices and round table discussions with people who are relevant in the subject area in each country. With the data collected, it was possible to identify subjects and technologies to develop a learning programme for girls. A programme of 16 challenges was developed based on girls' interests that could be solved using technology. The Moodle platform was used to set up the whole structure. Each challenge includes theoretical information about the technology through video. Followed by tutorials where girls can learn how to use the tools. In the end, they must submit evidence of the challenge and fill in a quiz that tests their knowledge. A pilot test was then conducted with 279 girls from the four countries, aged between 14 and 18, for 2 months. The results were very positive, with the girls showing a change of view towards technology. All this experience made it possible to create a guidebook for mentors and organizations that work with girls, which will allow them to attract more girls to the area of technology.

Keywords: SparkDigiGirls, Learning Programme, Girl ICT Empowerment, STEM, Non-Formal Education

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Introduction

Persistent gender stereotypes and misconceptions about careers in technology and engineering contribute to disparity between male and female in ICT. In this context teachers and educators can play a crucial role in reshaping this perspective by providing guidance and opportunities for girls to experience a different narrative (Marques, Manso, Grinevičiūtė, Danielien, 2022; Marques, Araújo, Grinevičiūtė, Danielien, 2023).

From younger age, even in primary school, both boys and girls exhibit a similar inclination toward pursuing careers in science-related fields (Noonan, & Laffarge, 2017). Nevertheless, as they progress through subsequent school years, girls tend to shift their attitudes and preferences, showing a greater inclination towards careers in social, environmental, and medical domains rather than in science, technology, engineering, and mathematics (STEM) and ICT studies (OCDE, 2018). This shift can be attributed to biases, a lack of role models, and other factors that hinder girls from fully capitalizing on the opportunities presented by digital transformation (Lambrecht, & Tucker, 2019; Neerukonda, & Chaudhuri, 2018). Eurostat's 2021 data reveals that girls and women remain underrepresented, comprising only 19.1% of all ICT students in the EU. Among the focus countries of the SparkDigiGirls Project, Lithuania displays the highest percentage of women in ICT at 23.7%. Greece and Portugal follow with 21.3% and 20.7%, while Slovenia exhibits the lowest percentage at 16.6% (Eurostat, 2022).

Recognizing this need, partners from Lithuania, Portugal, Slovenia, and Greece initiated the two-year international project SparkDigiGirls, funded by the Erasmus+ strategic partnership in the field of youth, with the titled "Empower Girls Creativity Through the Use of Digital Technologies" (SparkDigiGirls)¹. The aim of the project was to inspire girls to explore digital technologies such as Augmented Reality (AR), Artificial Intelligence (AI), and other technologies, generating new and innovative ideas, leveraging their newly acquired digital knowledge to contribute creatively to the STEM industry, traditionally dominated by men (Marques, et. al., 2023).

It is recognized that increasing female participation in the IT sector is important for promoting diversity, economic growth, gender equality, and social impact (SparkDigiGirls, 2021). The project therefore emerged as a way of addressing these perceived needs. To this end, we will present the different phases of the project, identify the main results achieved and present all the outputs resulting from them.

SparkDigiGirls Project

The SparkDigiGirls project ran from 2021 to 2023 in a sequence of three main phases: 1) Diagnostic and curriculum definition; 2) Content development for the online programme and 3) Pilot study and dissemination.

Phase 1 - Diagnostic and Curriculum Definition

Through the diagnostic and curriculum definition phase, the first task was to identify the factors that prevent young girls from pursuing careers in computing and technology, and to

¹ For more information visit: <http://www.digigirls.eu/>

provide practical examples and initiatives aimed at increasing girls' and women's interest in digital technologies. By conducting focus groups in the different countries, it was possible to gather insights, best practices, and perspectives from experts in the ICT-related sector on how to address these challenges and inspire and support girls to explore their creative potential in the field of digital technologies.

During the Focus Group, women were identified as being important to get involved in IT for the following reasons (Grinevičiūtė, et. al. 2021):

- **Diversity:** Women bring different perspectives, experiences, and skills to the IT sector, which can lead to more innovative and creative solutions. A diverse workforce can also help companies better understand and meet the diverse needs of their customers.
- **Economic growth:** The IT sector is a fast-growing industry and increasing women's participation can help address the skills gap and talent shortage in the sector. This can lead to increased economic growth and job creation.
- **Gender equality:** Increasing female participation in the IT sector can help address gender inequality and promote equal opportunities for women in the workforce.
- **Social impact:** The IT sector has a significant impact on society, and increasing women's participation can help ensure that technology is developed and used in ways that benefit all members of society.

From the analysis of the results obtained during the focus group (Marques, et. al. 2022), it can be concluded that there are several effective ways to increase girls' interest in technology, such as:

- **Hands-on experience with ICT, products, and tools:** Providing opportunities for practical application of new IT, products and tools can increase girls' interest in ICT. The more hands-on experience a girl has during her education, the greater her interest in ICT. Creativity in the classroom could also increase girls' interest in ICT and should be an integral part of the use of ICT.
- **Female role models:** Having visible female role models stimulates girls' interest in ICT careers and helps them to imagine themselves in these fields. Female IT students could be mentors and good role models, especially in their schools. This would be the kind of real action that would encourage other girls to choose IT. Girls and women need to see inspiration and role models.
- **Teachers as mentors and non-formal education:** If educators talk to girls about ICT subjects and actively encourage them, girls will be more attracted to these disciplines. Non-formal education, academies and educational projects encourage girls to think about studying ICT. Participants also emphasized the creation of mentoring programmes to foster girls' interest in ICT.
- **Real life applications:** Girls become more interested in ICT when they can imagine what they can do with these subjects, how they can be applied in real life situations and how they can be relevant to their future. Therefore, it is important to teach girls not only to play, but also to use technology in a meaningful way, whether exploring or creating.

Phase 2 - Content Development for the Online Programme

In the second phase of the project, the curriculum for the learning programme was developed: "Unleash Your CreativITy with Technology" programme. A MOODLE-based platform (figure 1) was used to create a sequence of sixteen challenges that the girls could complete

asynchronously and to be used in non-formal education context. This consists of sixteen separate learning modules covering specific topics or areas of interest for young girls age 14+ using several technologies. The learning programme was initially developed in English and then translated and adapted into the languages of each of the partner countries.

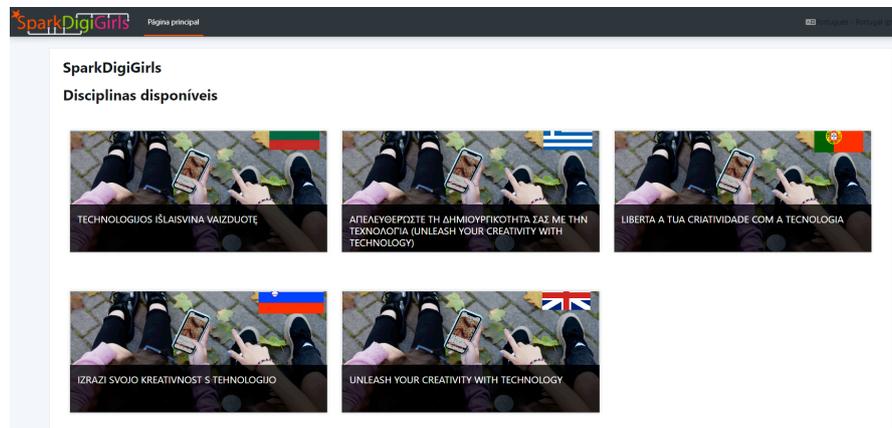


Figure 1 - Online training programme in five languages (<https://moodle.digigirls.eu/>)

A total of sixteen challenges (figure 2) have been created and organized with

- A learning guide with an introduction and instructions.
- Videos from YouTube to introduce different digital technologies that will be used in the challenge. Each video aims to explain how these technologies work and what they are used for. In some of the videos, an interactive layer has been added using the H5P tool to point out important information in the video or to answer questions.
- Presentations in pdf or ppt files are used to present concrete tutorial tools or step-by-step activities in a clear and summarized way.
- At the end of the challenge, the girls must take a quiz, which is a way to test their knowledge in each challenge.
- It is also necessary to submit evidence of having completed the proposed challenge, it can be an image, link, video, audio, etc.
- After completing each challenge, a certificate is automatically issued by the platform.

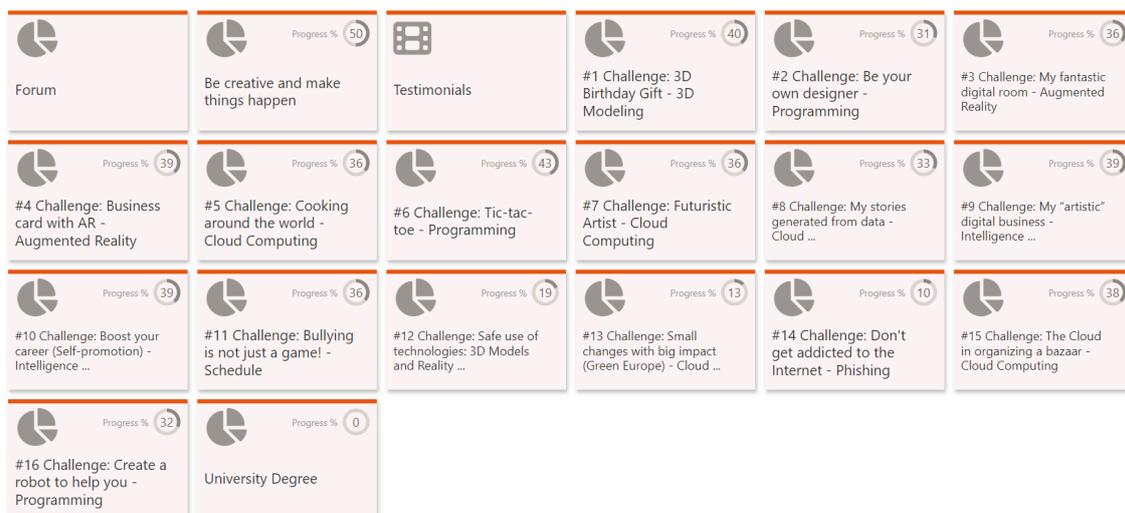


Figure 2 - Module organization of 16 challenges
- Unleash Your Creativity with Technology

The challenges were designed to develop girls' digital skills and critical thinking skills, covering specific topics or areas of interest to the young girls using different technologies, such as:

- Artificial Intelligence (AI): AI was used in several challenges, such as the 'Futurist Artist' challenge, where the girls created an online gallery and put all their art in NFTs format.
- Augmented Reality (AR): AR was used in the 'Be your own designer' challenge, where girls created a fashion game using Scratch and drawing using SketchAR.
- Internet of Things (IoT): IoT was used in the "Small changes with big impact" challenge, where girls developed their own carbon footprint.
- Programming: Programming was used in several challenges, such as the "Pinch of food creations" challenge, where the girls created a website using Wix, and the "Tic-tac-toe" challenge, where they created a fun tic-tac-toe game.
- 3D modelling and printing: 3D modelling and printing was used in the "Birthday present in 3D" challenge, where girls learned how to make a birthday present in 3D.
- Cloud computing: Cloud computing was used in several challenges, such as the "Tic-tac-toe" challenge and the "Pinch of food creations" challenge.
- Blockchain: Blockchain was used in the "Small changes with big impact" challenge and the "Futurist artist" challenge.

To promote female role models, interviews were conducted with IT professionals or women in leadership positions. This resulted in the production of several videos, which are available on the project's YouTube channel (figure 3). These are also available as the testimonial module to the learning programme (figure 2).

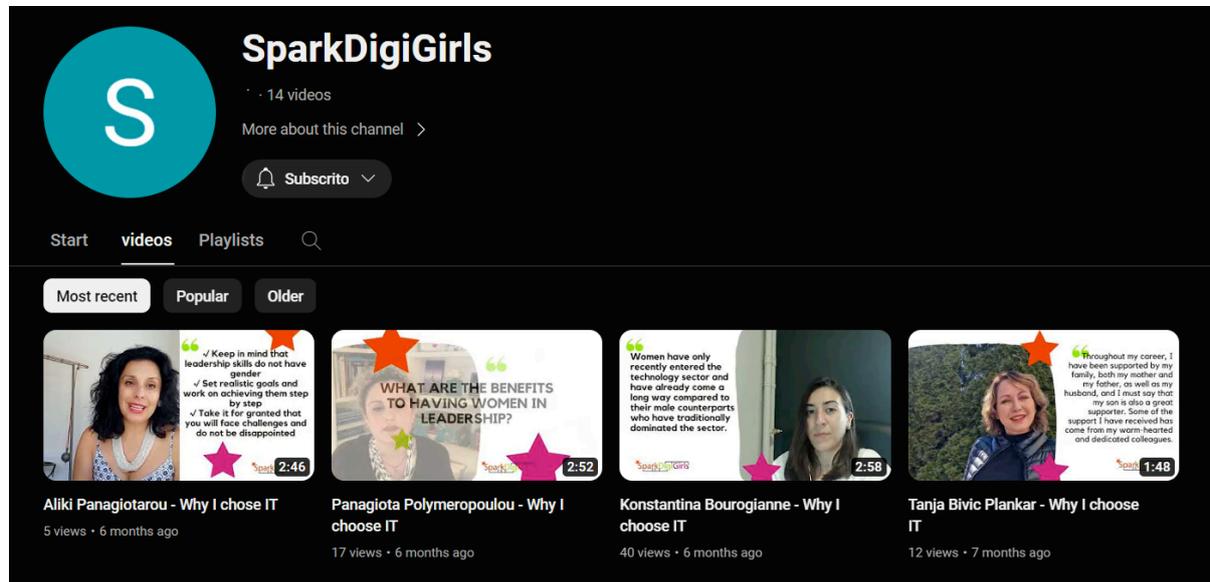


Figure 3 - Youtube channel with female testimonials
(<https://www.youtube.com/@SparkDigiGirls1>)

The project created two levels of certificates: one for each learning mode (Challenge) and a Grand Certificate (it depends on the number of Challenges completed by the learner).

To obtain a Grand Certificate, it is necessary to complete a challenge from six different technologies (artificial intelligence, augmented reality, Programming, etc.). After completing each challenge, the learner receives the challenge certificate, which has a specific key. When

the learner has collected six keys (one for each technology), he can unlock the Grand Certificate of the Programme.

The certificates are designed to recognize learners' achievements and provide them with tangible evidence of their skills and knowledge. They can be shared on social media or printed as a symbol of the learner's achievement.

Phase 3 – Pilot Study and Dissemination

During the final phase of the project, a pilot test was developed and implemented in the different partner countries. From January to March 2023, a group of 279 girls between the ages of 14 and 18 wanted to develop their creativity using digital technologies.

The pilot test of the SparkDigiGirls programme produced interesting results. It took place over two months and each partner had the autonomy to organize the way they worked with the girls. The initial work was proposed to be entirely online, with the girls able to ask for support from youth workers or partner experts. However, only the Portuguese partner maintained this methodology, while the others opted to organize face-to-face sessions with the girls to motivate them to complete the challenges (Marques, et. al, 2023).

The results of the pilot test showed that the average number of challenges submitted per active girl was similar between Portugal and Lithuania, indicating that the girls found the challenges stimulating, even if they completed them autonomously. The use of the challenges varied between partners, with some partners choosing to set up regular face-to-face sessions with the girls, while others integrated the challenges into activities already planned with groups of girls (Marques, et. al, 2023; SparkDigiGirls, 2023). This enabled more girls to complete the challenges in groups in countries with regular sessions.

The pilot also showed that some challenges had low submission rates and that some materials needed to be revised for language details and to replace a digital tool that did not work as originally intended. In addition, the youth workers agreed that the challenges created could be integrated into girls' non-formal education and run as a club, and they suggested that a mixed format of online and face-to-face training would be most appropriate for the programme.

In summary, the pilot allowed each partner to test the appropriate conditions for the local context and to validate the materials provided for each of the languages. The results showed that the programme has the potential to engage and empower girls to use technology, solve real-life problems, develop creativity, and enhance personal development.

In order to disseminate the learning programme to those interested in working with girls, an e-guidebook (SparkDigiGirls, 2023) has been published that aims to empower youth workers to act as mentors and support girls' creativity in digital technologies.

The e-guidebook is divided into five units, each covering a specific aspect of the project (SparkDigiGirls, 2023):

- Unit 1 introduces the project and the Unleash Your CreativITy with Technology learning programme. It also discusses the lack of female participation in IT and the factors and stereotypes that influence girls' low involvement and interest in digital technologies.

- Unit 2 focuses on youth workers as mentors and provides guidelines for supporting and activating girls' creativity in digital technologies. It discusses the results of the SparkDigiGirls pilot training.
- Unit 3 discusses empowerment and communication practices for blended learning in ICT. It suggests a blended learning approach for the learning programme after the results are achieved and discusses ways to sustain the learning process and maintain attention.
- Unit 4 presents best practices and success stories from the SparkDigiGirls pilot and ways to engage girls in digital technologies. It also includes reflections and feedback from the pilot training.
- Unit 5 provides additional resources, including toolkits and case studies, to enhance teaching and learning activities. The e-guide concludes with a summary of key points and references.

The e-Guidebook is expected to provide valuable information and best practices for youth workers to support girls' creativity in digital technologies. It highlights the importance of mentorship and empowerment in the development of opportunities for young girls in the IT world.

Conclusion

This paper presents the Erasmus+ SparkDigiGirls project, which ran from May 2011 to July 2023. The inspiration behind the project was to address the low participation and interest of girls in digital technologies and to empower them to explore their creative potential in the IT sector. The project aimed to identify the factors that prevent young girls from pursuing careers in computing and technology, and to provide practical examples and initiatives focused on increasing girls' and women's interest in digital technologies. The project sought to gather insights, best practices and perspectives from experts in the ICT-related sector to address these challenges and to inspire and support girls to explore their creative potential in digital technologies.

The findings from the different phases of the project allow us to conclude that providing hands-on experiences, female role models, mentoring programmes and real-life applications can be effective ways to increase girls' interest in technology (SparkDigiGirls, 2022).

The learning programme developed aimed to empower young girls in the digital world, give them the skills, knowledge and confidence to pursue careers in technology and encourage them to become creators and innovators, not just consumers of technology. The project involved a pilot training programme that provided an exciting opportunity for girls to learn about digital technologies and develop their skills (Marques, et al., 2023).

The results of the pilot training were positive, with the girls showing enthusiasm and interest in learning about digital technologies (Marques, et. al, 2023; SparkDigiGirls, 2023). The project partners reported that the girls had the opportunity to be trained and to share their experiences (Marques, et al., 2023). The supportive environment, the role of the mentors and the engaging activities played a positive role. The blended delivery of the programme together with effective communication tools, supportive mentors and peer and collaborative learning were some of the key factors in improving girls' participation in technology projects (SparkDigiGirls, 2023).

At the end of the project, several resources were made available for students and teachers that can be used to enhance their teaching and learning activities. These resources include toolkits, case studies and good practices that can be used to support and activate girls' creativity in digital technologies.

Finally, the SparkDigiGirls project can be considered successful in empowering young girls in the digital world and increasing their interest in IT (Marques, et. al, 2023; SparkDigiGirls, 2023). The project provided valuable resources and best practices for youth workers to support and activate girls' creativity in digital technologies and demonstrated the importance of mentoring and empowerment in increasing opportunities for young girls in the IT world.

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