Digital Girls Program – Disseminating Computer Science to Girls in Brazil

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ABSTRACT

The decrease in the number of women working with Information Technology and Engineering is a worldwide concern. Several movements have emerged that aim to encourage the presence of women in these fields. This article presents the Digital Girls Program (*Programa Meninas Digitais*) developed by the Brazilian Computer Society, which aims to disseminate the many facets of computer science for high school and elementary school students in Brazil. The article presents the strategies adopted for implementing the program in the country and the actions of the program's sister projects. The idea is to publicize the program and to share the experiences gained and challenges met in the field.

CCS CONCEPTS

• **Social and professional topics → User characteristics**; *Gendery*

KEYWORDS

Gender, digital girls, women in computer science

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1 INTRODUCTION

The decrease in the number of women working with Information Technology (IT) and Engineering is a worldwide concern [1]. Consequently, governments, companies and educational institutions from several countries have launched campaigns and executed special programs and projects that aim to encourage women who wish to follow a career in the field, young women who are interested in starting an academic or professional activity, and even children and teenagers of the female sex.

In Brazil, the scenario is not different [2], mainly in the number of students in the country enrolled in higher education courses within the computing field. Data from the National Institute of Educational Studies and Research (*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira - INEP*) [3] reveal that, since 1991 in Brazil, women in higher education courses related to computing have decreased 19.37%, representing only 15.53% of the number of students enrolled in Computer Science, although they compose the majority of students attending university.

One of the actions suggested for encouraging Brazilian women to become full agents in an information society, mentions Medeiros [4], who conducts pioneering research on the gender and computer debate in Brazil, is laying the foundations for an adequate training of girls and teachers/professors. In Medeiros' opinion, we must reconsider the educational structure and develop new types of content that should be addressed in the courses. Moreover, these changes should start at an initial stage, as early as childhood.

Initiatives that seek to neutralize the gender bias in higher education in computing courses are starting to appear in Brazil [5]. Most of these actions are lectures and events that attract mainly female students already enrolled in computer majors.

In this scenario, the Digital Girls Program (*Programa Meninas Digitais*) of the Brazilian Computer Society (*Sociedade Brasileira da Computação* - SBC) stands out from the rest of the national programs. Unlike the latter, the former is aimed at disseminating information about different features of the computing world to spark the interest of girls attending high school or technical school [6]. The program is geared specifically to female students, so that they get to know more about the field's characteristics and opportunities and possibly feel motivated to pursue a career in

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computing or gain enough confidence to employ and create technologies in whichever career they choose.

Developing skills related to computational thinking from early childhood is essential and this development should not be restricted to a single gender, since it is an important advantage for all students in modern times. However, because of the lack of women and unequal opportunities in this field, as still experienced by Brazilian children and teenagers due to gender, economic and cultural factors, the Program focuses on the young female public.

The Program's actions are diversified, including: both technical and motivational short courses and workshops; seminars in which students and professional women share their experiences working in the field; participation in events and tech competitions etc. The Program emerged from discussions at an event called Women in Information Technology (WIT), within the SBC Conference[2].This program started in 2011 under the coordination of the SBC Regional Secretariat of the state of Mato Grosso and, in 2015, was institutionalized by SBC as a program of national interest for the community. Since Brazil is a country which extends across a large diverse territory, many educational institutions have joined Digital Girls. Currently, several sister projects have been implemented in these institutions all over the country, in order to reach as many girls with different backgrounds as possible.

Given the relevance of the action in Brazil, this article aims to describe the Brazilian Computer Society's Digital Girls Program, presenting the program's trajectory from its inception, some of the strategies adopted for its implementation, the historical background of some of the program's sister projects, and the actions conducted by the latter to attract female high school and elementary school students that are crucial to the Computer Science field. The idea is to broaden the dissemination of the program and to share the experiences gained and the challenges met.

2 A HISTORY IN CONSTRUCTION

The story of Digital Girls begins with the workshop "Motivating Teenagers to Enroll in Information Technology Courses", held at the 4th WIT - 2010, in the city of Belo Horizonte (state of Minas Gerais). Through a practical workshop, employees from Microsoft, from both the United States and Brazil, showed the DigiGirlz program to 25 previously registered multipliers. During this Workshop was disseminated the intention of the WIT to have a working group aimed at including girls in Computer Science.

After that, the Digital Girls Program was created in this event and the 1st Digital Girls Forum was held in 2011 as part of the program of 5th WIT - 2011 in Natal, Rio Grande do Norte. The first open meeting of the Forum was attended by representatives of the SBC regional offices, the students of the project "Digital Metropolis", a government project aimed at public and private high school students in Natal, and the general public. The Panel "Sharing Experiences and Practice Areas in Computing" was also held, with representatives from academia and industry discussing the role of women in technology. Finally, the program ended with an open meeting with multipliers to define the program actions, which exchanged experiences on the theme and discussed strategies for the program. From this experience, a mailing list[3] was created, which has been periodically fed with debates about the theme.

It was defined that the Digital Girls Forum would be an annual event. This way, new themes are addressed every year. With the panel "Projects Encouraging Girls in Computer Science: Experiences and Perspectives", three representatives of higher education institutions, who had created sister projects in the field from their participation in the 1st Forum, presented their ideas in Curitiba, state of Paraná, during the 2nd Forum at the 6th WIT - 2012. The following year, at the 7th WIT - 2013, in Maceió, state of Alagoas, another panel was held called "Projects and actions for including girls in fields of technology: sowing the seeds", which shared the results of five projects executed by multipliers of the program in Brazilian universities. The first strategic meeting of the sister projects was held with multipliers and interested parties.

In the fourth edition of the program's annual forum, held in Brasília (capital city), once again as the official program of the 8th WIT, the panel Encouraging actions for including Digital Girls in Brazil was held, in which representatives of three higher education institutions with research, teaching and/or extension projects showed the public how they designed projects that were approved and funded by different development agencies and institutions. Still in 2014, among other actions, the Emil@s project - a sister of Digital Girls - held a workshop with 16 girls from a state school with a view to stimulating their curiosity about Computer Science, especially concepts, models and uses of databases [7].

In 2015, the Forum, held in Recife (state of Pernambuco), at the WIT, stimulated discussions about the theme with the panel "Projects and actions for including girls in fields of technology: reaping rewards". It included eight panelists from different sister projects presenting their actions and results. In this forum, researchers were more interested in rendering visibility to their work. This demand shows the Program's consolidation, since it has considerably increased in only five years of existence. Furthermore, the government and private companies made efforts to finance new projects, which were at the final stages of implementation. Within this forum, a workshop for mobile software engineering prototyping was held with public high school girls and employees, called Prototyping technological solutions for a better life [5].

In the 2016 edition of the WIT, as the Program expanded, it became necessary to acquire a channel in which researchers could publish their experiences. Therefore, the first call for papers of the Women in Information Technology + Digital Girls (WIT+MD) forum occurred, in which abstracts were submitted, and included the publication of 25 articles in 2016 and 28 articles in 2017 about the topic. The proceedings can be accessed for free online[4] and present different actions throughout all the regions of Brazil. This initiative resulting in a space for national publication of the Computer Science field is very important for disseminating research studies and extended research about gender and technology that are being developed in the country, as well as to amplify the visibility of the issue in our academic settings. In the

[2]http://www.sbc.org.br/eventos/csbc
[3]meninasdigitais@googlegroups.com

[4] http://ebooks.pucrs.br/edipucrs/anais/csbc/#/evento/10wit and http://csbc2017.mackenzie.br/anais/eventos/ 11-wit

same year, in the VII Brazilian Conference on Software: Theory and Practice (CBSoft 2016), the Emili@s project did other activities, representing the Digital Girls Program. The activities included software engineering artifacts and the 20 girls from a public school were asked to project solutions for daily problems by using techniques as prototyping. Still in 2016, the Program participated in a major Latin American conference about women in computer science (8th Latin American Women in Computing Congress - LAWCC). On that occasion, valuable contact with the Latin American community was initiated. For the program, international expansion and visibility is very important. Also in 2016, the event "Computer on the Beach", held in the southern region of Brazil, included discussions on gender and technology in its agenda and reserved space for the Digital Girls' activities.

In 2017, in São Paulo, the activities of the Program were once more expanded. In addition to the 7th Forum and the strategic meeting with more than 15 sister projects, a technical workshop was offered in partnership with Pyladies São Paulo to public high school girls and a presentation of computational tales (mixing programming concepts and dramatization) was performed by girls from public middle schools. That year, the Program's actions achieved greater repercussion in the media with greater visibility. In the end of 2017, the Digital Girls participated in the 9th LAWCC by presenting research results [8], a panel and a workshop to multipliers about computational fairy tales. Also, a national data collection effort was initiated with the Program's sister projects. These data are still being collected and will soon be analyzed, in order to get a national overview of these projects.

It is hoped that the entire Brazilian community will be better integrated with LAWCC organizers in 2018, since the Latin American Computing Conference (CLEI) and its satellite events will be held in São Paulo and rely on the commitment of Digital Girls partners. This network composed of partners and actions allows the topic to be widely shared and discussed in Brazil.

3 DIGITAL INITIATIVES

Many initiatives conducted since the program's inception, were funded through the Brazilian system of "public calls" for proposals and are configured as research and extended research in universities. Each institution is responsible for the project plans and the execution of their actions according to their interests and resources. Although their goals are practically the same, different strategies are formulated according to specificities such as location, culture, economic situation etc.

Digital Girls currently consists of a partnership network with more than 40 projects, duly registered at the official website of the Program[5]. Table 1 presents a few examples of the program's sister projects by region in Brazil. Fig. 1 shows the distribution of sister projects in Brazil, in which it is possible to notice that there are projects functioning in all regions of the country.

A website was created to gather information about the Program and the several initiatives developed. This helps in the dissemination of information about the topic and in attracting new interested parties.

Figure 1: Map showing sister projects of the Digital Girls

Table 1: Examples of Sister projects of the Digital Girls Program in Brazil

PROJECT NAME BY REGION	PROJECT ACTIONS
SOUTH: Emíli@s – Bits in Frames in reference to Emília, a character from the popular literature written by Monteiro Lobato	Conferences including lectures, meetings, and practical workshops in partnership with companies and other groups within the region. The events occur in the university or in partner schools (both public and private). The workshops focus on Human-Computer Interaction and programming languages.
SOUTHEAST: #include<girls.UFF> (university where the project is executed)	Same as above, but the workshops focus on programming languages and software engineering. Actions also include technical visits by female high school students in universities, companies and technological centers.
MIDWEST: Digital Girls from Mato Grosso (name of project' state)	Same as Emíli@s, but the workshops focus on the development of apps, software engineering, robotics and history of computer science. Actions also include regional forums, film exhibitions followed by a debate about technology and gender and participation in competitions with female teams such as Technovation Challenge and ACM-ICPC.
NORTHEAST: Digital Girls from Bahia (name of project' state)	Similar to projects above, but the workshops also focus on unplugged computing techniques for the community, especially for public school girls living in city outskirts.
NORTH: Digital Cunhantã. Cunhantã means girl in Tupi, a popular regional indigenous language	Similar to projects above. Actions also include computational tales workshops for the community, participation in scientific fairs and courses disseminating the courses and careers related to technology.

[5] http://meninasdigitais.sbc.org.br/

In addition to the website, Digital Girls owns a communication channel on Facebook[6] with more than five thousand followers who use the social network to follow the program's updates, news and events, as well as to exchange messages with the coordination of the program. Another important channel is the previously mentioned mailing list for direct communication among partners of the program and people who are interested in the theme.

4. FINAL CONSIDERATIONS

This article documented the strategies and partnerships established by the Digital Girls Program of the Brazilian Computer Society in order to attract teenage girls from middle school and high school to the Computer Science Field. We believe that disclosing and publishing the history of this program is of paramount importance to the Brazilian and Latin American IT community.

Some points deserve special attention. It is possible to notice that, in the last few years, there have been several financial subsidies by funding organizations dedicated to research in this field. The application process to obtain these funds encouraged many teachers to direct actions to this field, thus adding value to the Program insofar as such the actions were shared in events and digital media. However, there is still pressing need for further encouragement. Another point to highlight is the presence of other genders who are interested in the movement. The participation of men salutes the cause, since extending female participation to the computer science field is beneficial to everyone, not only to women or a sector of the population. There is also growing interest from private companies in supporting the movement.

It should be noted that in certain fields like Software Engineering, Human-Computer Interaction (HIC), Databases, Artificial Intelligence etc., specific actions have been performed [8–10]. However, one may notice that the activities conducted with specific techniques and artifacts from some of the harder areas, such as Networks, Infrastructure, etc., are still timid, so it is possible to develop new actions in this direction and acquire an interdisciplinary approach with computer science.

Among the strategies planned for consolidating the program, we believe it is still necessary to: i) support the continuation of current sister projects and expand the network of knowledge multipliers in Brazil; ii) develop studies, at national level, of female representation in computer science, with data analysis; iii) build a collective project about the topic to send to funding organizations that are interesting in supporting the cause and encourage partnerships with the private sector, in which there is increasing common interest with the program; iv) obtain support from more regional SBC centers and events, which represent all Brazilian states; v) stimulate events geared towards girls and knowledge multipliers; research and publication of articles describing the actions that have been carried out; and finally, vi) Develop material for workshops and intensify communication channels between partners and the dissemination of actions.

It is also necessary to reflect and register opinions on how we can address the causes of the problem regarding the reduced number of women in the IT field; the factors related to the unrepresentative presence of girls in undergraduate courses in Computer Science; and how is the situation in vocational and post-graduate education. Among the many claims arising in the Program is the assistance to people who are interested in creating projects. We realized that, in the last few years, the program has grown considerably and there are still several demands that should be met in order to sensitize and motivate the community around the cause. The association between extension and research is very strong in this area. We have also sought to publish the results of the program and its projects. Registering experiences in form of articles is very important, since research reinforces existing developments and the exchange of experiences.

The program's collaborators have been successfully working in consolidating and expanding the program for 7 years now with determination, optimism and efficient organization. However, seeking financial resources for the Program has been a constant concern. We have been recognized by private companies, which have, when requested, supported the implementation of the Program's activities. However, without a fixed partnership. We believe that registering these actions and sharing them with society will encourage new initiatives, and it will consequently be possible to mitigate a visible problem in the admittance of higher education courses. This is an opportunity for research and extension that can be explored by universities so that there is a possibility of increased gender balance in terms of quantitative access in education.

[6] http://www.facebook.com/MeninasDigitaisSBC

REFERENCES

[1] PISA. 2015. O que está por trás da desigualdade de gênero na educação? OCDE. Available on <http://www.oecd.org/pisa/pisaproducts/pisainfocus/PIF-49%20(por).pdf> Access on aug., 25, 2015.

[2] C. Medeiros, R. Coelho, and C. Maciel. 2012. Participação Feminina na Computação. *Computação Brasil*. 19, 28–29.

[3] INEP. 2015. Resumo Técnico da Educação Superior 2013. Diretoria de Estatísticas Educacionais DEED, Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, Brasília-DF, 82.

[4] C. B. Medeiros. 2005. From subject of change to agent of change: women and IT in Brazil. In *Proc. of the International Symposium on Women and ICT: creating global transformation (CWIT '05)*, C. Morrell and J. Sanders (Eds.). ACM, New York, NY, USA, Article 15.

[5] S. A. Bim, et al. 2016. Programa Meninas Digitais – prototipando soluções tecnológicas para uma vida melhor. In *Proc. of VIII CLEI@LAWCC: – Latin American Women in Computing Congress*, Valparaíso.

[6] C. Maciel and S. A. Bim. 2016. Programa Meninas Digitais–ações para divulgar a Computação para meninas do ensino médio. In *Proc. of Computer on the Beach 2016*, 327–336.

[7] J. J.Rodriguez, N. P. Kozievitch, S.A. Bim, M.de O. G. Setti, M.C. F. P. Emer, and M. A. Amaral. 2016. Uma proposta para apresentar a Computacão/Banco de Dados no Ensino Médio para o Público Feminino. In: XII Escola Regional de Informática de Banco de Dados, SBC, Londrina/PR, pp 155-158.

[8] S. A. Bim, K. S. Figueiredo, and C. Maciel. 2017. Por Mulheres na Computação no Brasil: análise das ações e publicações do evento Women in Information Technology. In: *Proc. of IX CLEI@LAWCC – Latin American Women in Computing Congress*, Córdoba.

[9] M. A. Amaral, et al. 2015. Introducing Computer Science to Brazilian Girls in Elementary School through HCI Concepts. In: *Marcus A. (eds) Design, User Experience, and Usability: Users and Interactions. DUXU 2015. Lecture Notes in Computer Science*, vol 9187. Springer, Cham, 141–152.

[10] C. Maciel, S. A. Bim, and C. Boscarioli. 2013. HCI with Chocolate: Introducing HCI Concepts to Brazilian Girls in Elementary School. In HCI with Chocolate: Introducing HCI Concepts to Brazilian Girls in Elementary School. In: Collazos C., Liborio A., Rusu C. (eds) Human Computer Interaction. Lecture Notes in Computer Science, vol 8278. Springer, Cham, 90–94.