MENINAS.COMP: COMPUTING FOR GIRLS IN ELEMENTARY SCHOOL IN BRAZIL

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Abstract

The Computing field has a gender diversity gap, with female participation much lower when compared to men. In this context, several activities have been developed to include more women in the field of Computing, and the Meninas.comp project has been working to introduce Computing to girls in elementary schools in Brasilia, the capital of Brazil. This article has two objectives: i) to present the activities of the Meninas.comp project for girls in elementary schools; ii) to present a mapping of the literature on computational activities with a focus on girls in elementary schools in Brazil. The systematic literature mapping found publications reporting a large variety of activities, such as unplugged computing, game development, card games, programming classes, competitions, lectures, and workshops. From the Meninas.comp project, this article highlights a smart garden developed by female elementary school students.

Keywords: girls, computing, elementary school, diversity, gender.

MENINAS.COMP: COMPUTACIÓN PARA NIÑAS EN ESCUELAS PRIMARIAS DE BRASIL

Resumen

El campo de la informática tiene una brecha de diversidad de género, con una participación femenina mucho menor en comparación con los hombres. Al respecto, se han desarrollado varias actividades para incluir a más mujeres en el campo de la Computación. El proyecto Meninas.comp ha trabajado en Informática para niñas de escuelas primarias en Brasilia, capital de Brasil. En este contexto, este artículo tiene dos objetivos: i) presentar las actividades del proyecto Meninas.comp en escuelas primarias de niñas; ii) presentar un mapeo de la literatura sobre actividades computacionales con enfoque en niñas de escuelas primarias en Brasil. El mapeo sistemático de literatura encontró publicaciones que informan una gran variedad de actividades, como computación desconectada, desarrollo de juegos, juegos de cartas, clases de programación, concursos, conferencias y talleres. Del proyecto Meninas. comp, este artículo destaca un jardín inteligente desarrollado por alumnas de primaria.

Palabras clave: niñas, computación, escuela primaria, diversidad, género.

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1. INTRODUCTION

In recent years, several discussions about the reasons for the incipient female participation in Computing have been held in academic and commercial institutions. Thus, some groups have developed strategies to attract more girls to this area, as it has not been the first choice of high school girls when deciding on options for their university degrees and future careers.

In Brazil, as in other countries, the number of female students in Computer Science courses is disproportionate to the number of male students. In Brazil, between the years 2000 and 2013, the number of male graduates from Computing courses increased by 98%, while the number of female graduates decreased by 8% (Maia 231). Recent data show that the percentage of women graduating from Computer Science courses in Brazil was 13% in 2019 (Nunes 53).

In order to reduce this difference and understand why it has arisen, several initiatives have been undertaken by educational institutions. In addition, in order to encourage more girls to pursue careers in the area, SBC (Brazilian Computer Society) created the Digital Girls Program which has over 100 partner projects in different regions of Brazil. SBC also highlighted seven reasons for increasing diversity in (Araújo *et al.* 9).

The Department of Computer Science at the University of Brasília has three main majors related to Computing: Computer Science, Computer Science Education and Computer Engineering. None of the Computing majors at this university has reached more than 20% enrollment of female students since the year 2000. The Computer Science major had its best entry with 17% in 2007, and the worst entry was in the first semester of 2021 when no women enrolled in the Computer Science major. The Computer Science Education major had the worst entry in 2000 with only 4%, and the best in 2010 with 17%. The Computer Engineering major

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started its activities in the second half of 2009 and had its best percentage of female entrants in 2010, reaching 19%. The worst year was 2016, with only 5%. Against this background a group of professors from the University of Brasília (UnB), in the Federal District, in 2010 created the Meninas.comp project, which focuses on attracting girls to computer courses.

The objectives of Meninas.comp are: to provide quality information about professional performance in the field of computing, in particular, in the Bachelor majors for Computer Science; encourage reflection on the limited role of women in these courses; obtain data on the perception of girls in Basic Education about the area of Computing; promote experimentation with play-based activities through programming, games and robotics, presenting their relationship with the professional's performance in the computing field; and the integration of girls in basic education with the university.

Knowledge of Computing is as important for life in contemporary society as basic knowledge of Mathematics, Philosophy, and Physics, among others (Brackmann 79). Computing content in Basic Education allows students to understand the world to which they are connected. The SBC states that the teaching of Computing in Basic Education is fundamental because it allows students to fully understand the world, which is increasingly connected and immersed in digital technologies; it also improves the ability to learn and solve problems, provides new ways of expression and thinking, and serves as a tool to support the learning of other subjects.

In articles such as (Holanda *et al.*, "Brazilian school girls', 3) and (Holanda *et al.*, "What do female", 5), data are presented which show that students in public schools in Brasilia, the capital of Brazil, lose the desire to take computer courses when they are in the final years of high school. During elementary school, many girls still don't have a formed concept of what career to pursue. Therefore, addressing the issue of women in Computing, from their earliest school years, is a contemporary and important agenda.

In this context, this article has two objectives: I) to describe the activities of the Meninas.comp project in elementary schools for girls; II) to show a mapping of the literature on computational activities with a focus on girls in elementary schools in Brazil in the years from 2010 to 2020. This article is an extended version of the article presented at LAWCC 2021, where, in addition to mapping Brazil's actions for primary education, we present the activities that Meninas.comp is implementing in the elementary school Vargem Bonita in the Federal District.

The remainder of this article is divided into the following sections: Section 2 presents Menina.comp in elementary schools; Section 3 presents the results obtained on literature mapping; and Section 4 concludes this article and presents some suggestions for future work.

2. MENINAS.COMP IN ELEMENTARY SCHOOLS

In 2012 the Meninas.comp project started collaborations with high schools in the Federal District in Brazil. In 2019, the methodology was adapted for elementary schools and put into practice in the elementary school Centro Educational Vargem Bonita of the Federal District Government. The methodology comprises the phases: defining the team, planning the challenges, developing the challenges and presenting the results.

Define the Team

The project team is defined at the beginning of the school year. The team is made up of elementary school students (seventh, eighth and ninth grades). At the beginning of the year, the coordinators of the Meninas.comp project give a lecture promoting the area of computing for girls. Following this lecture, the students are invited to participate in the project. The school teacher is responsible for putting together the students' team, in which the project will be developed, he/she will monitor the project's activities at the school.

Plan the Challenges

Meetings are then held to discuss possible problems (challenges) at the school. At this stage, university and school teachers define the major themes, but it is important that elementary school students develop ideas to be implemented during the project period (one school year). Thus, the challenges are defined by the students.

Develop Challenges

Before the beginning of the project's implementation, a set of workshops is held to level the students' knowledge. The project has programming activities, Arduino, robotics (sensors and components) and 3D printing. The teaching material was produced by the university professors and students and is available free of charge for anyone wishing to use it.

The implementation of the challenges is developed weekly by the school students. For this, elementary school students are divided into groups, in which each group must implement a different challenge. Although the challenges are different, a strong integration between all the girls is encouraged, so that each student can participate in more than one challenge, promoting interdisciplinarity between the subjects of that year.

While completing the challenges, visits are made to the laboratories of the University of Brasília, in which themes related to these challenges are discussed. These meetings are important because the girls can have direct contact with the

students of the university working on similar research topics, and thus they can see that there are other girls working in the area. The results of this stage are: leveling of basic knowledge in programming and Arduino for elementary school students to develop the projects; division of the groups that will develop the projects; project implementation.

Present the Results

The presentation of the developed projects is carried out by the students, and this is a point that brings a lot of satisfaction to the people involved. In the Federal District there are several national and local science fairs, such as the National Week of Science and Technology, promoted annually by the Ministry of Science, Technology, Innovations and Communications (MCTIC), the Science Fair of Government Schools in the Federal District, the University of Brasília extension projects fair, the Robotics Challenge of the Federal District Government Public Schools, and the edition of Campus Party. In the 2017 edition of Campus Party, the Meninas.comp project received an honorable mention for its work.

2.1. Implementing the Methodology at the Vargem Bonita School

The first elementary school that implemented the Meninas.comp methodology was CED (Education Center, in Portuguese Centro Educacional) Vargem Bonita from GDF (Federal District Government) and this section describes the project developed by the school students in 2019.

Define the Team

In 2019, CED Vargem Bonita's elementary education team consisted of 1 professor and 10 students, 4 ninth grade students, 3 eighth grade students, and 3 seventh grade students, 4 of whom were scholarship holders in scientific initiation programs in partnership with the National Council for Scientific and Technological Development (CNPq). CNPq has supported the scientific initiation project for high school and elementary school students. The UnB team consisted of 3 professors and 1 student from the Computer Engineering course.

Plan the Activities

In the initial planning, the students' concern with the community where they live and how the Meninas.comp Project could contribute to improving living conditions in some way was remarkable. In view of the water crisis in the Federal District, the need to optimize the use of water in a vegetable garden and electricity costs guided the work of the students in choosing the smart garden project.

The students were concerned about the lack of water that affected several farms that produce vegetables in the Vargem Bonita region, so the objective was to develop a simple, cheap and efficient project that could be transferred to small producers in order to make their business viable and sustainable.

Thus, the construction of a real working model built with recycled materials using the Arduino platform and its sensors was conceived. The Smart Garden had its irrigation automated through soil moisture sensors that identify the need for irrigation or not. Upon reaching the ideal humidity, the sensor provides information to the system that will turn off the pump, avoiding the lack or excess of water in the plantation. The smart garden also has a humidity information panel built with LEDs and a digital water consumption meter that provide information to the system board identifying the amount of water consumed in liters.

The students were divided into teams to develop the Smart Garden and the robotics teacher followed the progress and deliveries through the Logbook weekly.

Develop Challenges

So that the students could properly understand a vegetable garden, visits were made to three vegetable farms in the region, where they collected information on the difficulties and needs that the Intelligent Garden project might respond to. Such needs guided the elaboration of the project, focusing on small producers.

Knowledge of disciplines such as Science helped to identify what is wet and what is dry in the garden soil. Mathematics helped to calculate the amount of water dispensed in each irrigation cycle. English helped to understand the logic of the coding of the program thus promoting interdisciplinarity.

Extra classes were necessary for them to complete the project in time for the Science Fair at CED Vargem Bonita, FESTIC–Innovation Technology Festival and Science and National Robotics Exhibition.

Present the Results

The robotics projects culminated in a presentation of the Intelligent Garden in operation, followed by visitors' questions. The project was presented at the National Robotics Exhibition, at the regional FESTIC and at the Science Fair of CED Vargem Bonita and CRE-Regional Coordination of Education of Nucleo Bandeirante (figure 1).

The Meninas.comp is a project which has a local scope, but there is an increasing number of related initiatives being developed in all regions of Brazil. Despite having similar objectives, these initiatives vary in terms of the educational interventions they practice and their targeted age groups. In this work, by means of a literature mapping, we identified and characterized some of these initiatives targeted at girls in elementary schools.

Figure 1. Girls in CED Vargem Bonita (elementary school).

3. LITERATURE MAPPING IN BRAZIL

The methodology applied in this article is based on a systematic literature review process defined in (Kitchenham *et al.* 8). The first step in mapping the literature was the definition of research questions, which were: RQ1) What has the distribution of articles on this topic been like in recent years?; RQ2) Which Brazilian states publish the most?; and RQ3) What are the educational interventions aimed at girls in elementary school?

For the selection of articles, the following inclusion criteria were chosen: IC1) Has been published from 2010 to 2020; IC2) Is related to the theme of women in computing; and, IC3) Is linked to elementary school educational level.

To complement the choice of articles, two exclusion criteria were defined, which were: EC1) Documents that are not journal or conference articles; and EC2) Documents with less than four pages.

The search string for choosing the relevant articles for the mapping of literature was then defined. For Google Scholar, the search *string "(Computação) AND (mulher OR gênero OR garota OR estudante)"* was used, with a publication period from 2010 to 2020. We used the string in Portuguese for Google Scholar. In this search *string*, the term "elementary school" was not used, as one of the objectives of the research was to know how many articles on the topic of women in computing in Brazil are published. Therefore, after the initial search, only articles that address activities for the elementary school level were selected. Among the academic documents found on Google Scholar, there were four graduation theses, three master's dissertations and a doctoral thesis. For Scopus and Web of Science, the *string* search "*(Computing OR 'Computer Science') AND (women OR gender OR girl OR female)*" was used and publications from 2010 to 2020. We included in the literature review papers from CLEI-LAWCC (Latin American Women in

TABLE 1. NUMBER OF DOCUMENTS IN ACADEMIC DATABASES ABOUT WOMEN IN COMPUTING IN BRAZIL	
Academic Bases	Documents
Google Scholar	82
LAWCC-CLEI	34
WIT-CSBC	82
Scopus	4
Web of Science	1
Total	203

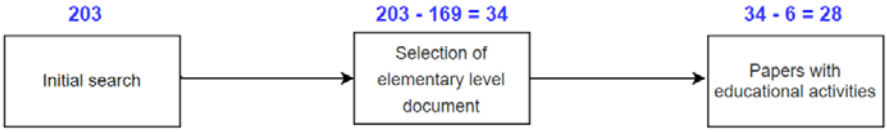

Figure 2. Steps of the methodology used and the number of publications.

Computing Congress supported by the Latin American Center for Computer Studies), and WIT-SBC (Women in Technology event supported by the Brazilian Computer Society).

Initially, as shown in table 1, 82 documents were found in Google Scholar, 4 in Scopus, only 1 in Web of Science, 34 in LAWCC-CLEI and 82 in WIT-CSBC, totaling 203 academic documents. Among these articles, 194 were written in Portuguese, 8 in English and one in Spanish, the proceedings of the LAWCC–CLEI from 2014 and the period from 2016 to 2020 are available on their website (LAWCC-CLEI 1), while the records for WIT-CSBC, between 2016 and 2020, can be found in SBCOpenLIB (SBC 1).

Figure 2 shows the activities carried out for the selection of articles relevant to the research questions. The first activity was the Initial Search, in which 203 documents were found. These documents were classified in a spreadsheet, with the columns: Academic database (Google Scholar, Scopus, Web of Science, LAWCC-CLEI and WIT-CSBC), Title, Author(s), Year of publication, Institution, Type (article, graduation, Masters dissertation or doctoral thesis), Type of article (conference or journal), State and Educational Level (elementary, high school, undergraduate, master, doctoral).

The data collection process was divided into two phases. In the first phase, titles, authors and article abstracts were collected; in the second stage, all articles were read and analyzed. Using the exclusion criteria and considering only the articles that addressed elementary education, from a total of 203 articles, 34 were filtered. Most of the 203 articles are about activities in secondary education. Of

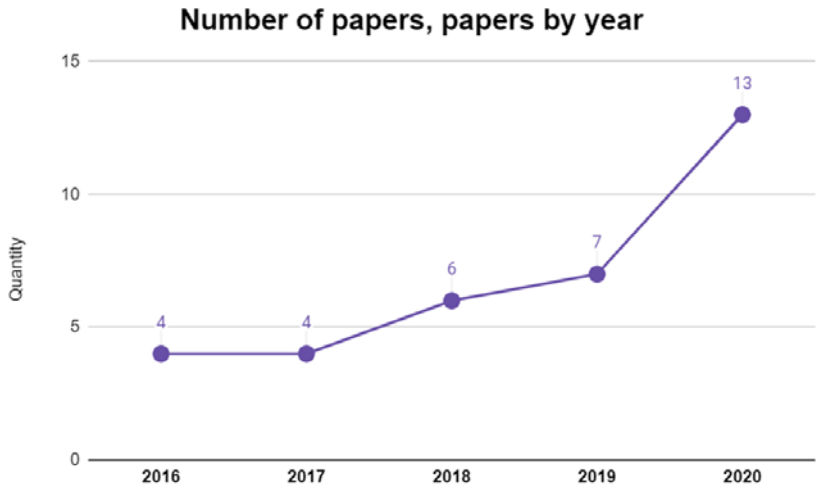

Figure 3. Number of papers per year.

the 34 articles from elementary school, a new analysis of the articles was performed and 28 contained educational activities for girls, thus, 82.35% presented some educational computer intervention for elementary school students. The answers to research questions RQ1 to RQ3 were consolidated after the second phase and are presented in the next section.

3.1. Results

The purpose of this section is to present the answers to the three research questions defined in this literature mapping.

RQ1) What has the distribution of articles on this topic been like in recent years?

Figure 3 shows the distribution by year of publication of the articles found. The survey was conducted between 2010 and 2020, but the first articles found with educational activities for girls in elementary school were only published in 2016. Of the four articles from 2016, two were in WIT-CSBC, one in CLEI-LAWCC and one at the CBIE (Brazilian Congress on Educational Informatics). Since then, the number of articles has grown, with 2020 being the year with the most publications, totaling 13 articles, that is, 38.23% of the total number of articles collected.

An important point that may have contributed to this increase is the national discussion on the changes to guidelines in elementary education in Brazil, in which computing has been analyzed as an important issue for the education of elementary

and high school students. In addition, the WIT-CSBC event, which had its first edition in 2007, began publishing the activities in academic articles as of 2016.

RQ2) Which Brazilian states publish the most?

The second research question "Which Brazilian states publish the most?", aims to assess the density of publications by Brazilian states. This is a relevant analysis given the fact that Brazil is a country with regional, cultural and social differences.

Figure 3 shows the Brazilian states that published most articles on the topic of girls in elementary school with a focus on computing. The three states with the highest number of publications in descending order are: Mato Grosso, Rio Grande do Sul and Amazonas. The State of Mato Grosso had the highest number of publications, 6 articles, published by authors from the Federal University of Mato Grosso and the Federal Institute of Mato Grosso. This is followed by the State of Rio Grande do Sul with 5 articles, at the institutions of the Federal University of Rio Grande do Sul, Federal University of Pampa and Regional Integrated University of Alto Uruguai e das Missões. Finally, we have the state of Amazonas (4 articles) in the institutions of the Federal University of Amazonas and the State University of Amazonas.

However, when it comes only to articles with educational activities, the states of Amazonas, Rio Grande do Sul and Mato Grosso have the same number of publications with 4 articles published. Next are the states of Minas Gerais, Paraná and Rio de Janeiro with three articles each.

In this mapping, it was possible to identify publications in all Brazilian regions. The regions that had the most publications were the South and Southeast, with 10 publications each. Then there is the Midwest Region with 8 articles, Northeast and North with 6 articles. This distribution can be easily visualized in the heat map in figure 4.

RQ3) What are the educational interventions aimed at girls in elementary school?

To answer RQ3, table 2 presents an overview of the activities covered in the collected articles for girls in elementary schools. Among them, the most prominent are Unplugged Computing (10 articles) and Workshops (9 articles). Unplugged Computing is an educational method for introducing concepts of Computing through hands-on activities that don't require the use of a computer (NISHIDA, Tomohiro 1).

Table 3 presents a summary of the unplugged activities. Articles (Lomas, Figueiredo and Maciel 12) and (Bolan Frigo *et al*. 6) presented unplugged activities related to binary numbers. In (Marquiori, Oliveira and Nascimento 3) algorithm writing activities in the context of everyday tasks such as baking a cake, putting on makeup and walking from home to school were presented. (Passos *et al.* 2) presented an activity on the representation of digital images using paper plates, (Ferreia

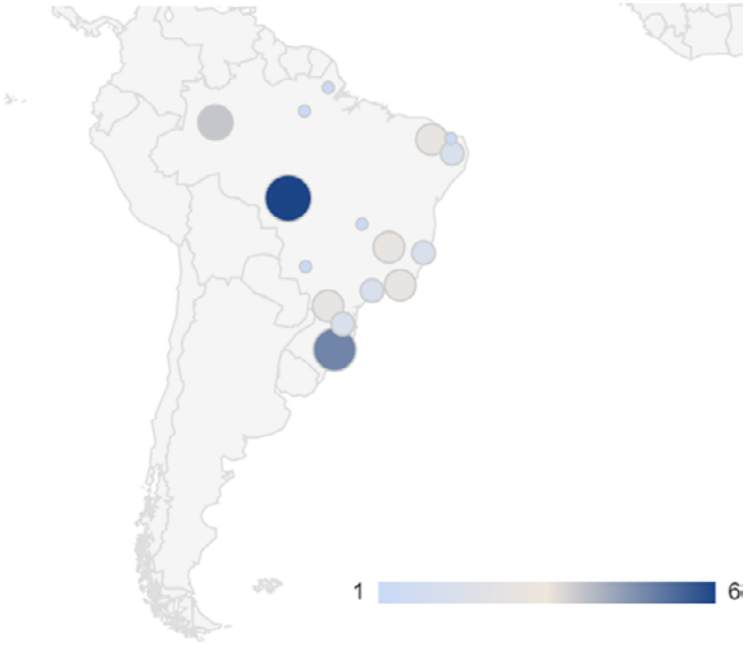

Figure 4. Density of publications by state.

TABLE 2. EDUCATIONAL ACTIVITIES IN ELEMENTARY SCHOOL	
Activity	Document
Unplugged computing	(Bim *et al.* 3) (Lomas, Figueiredo and Maciel 12) (Marquiori, Oliveira and Nascimento 3) (Bolan Frigo *et al.* 6) (Galeno *et al.* 7) (Passos *et al.* 2) (Ferreia and Lucchese 3) (Lopes and Odakura 2) (Oliveira, Maciel and Souza 3) (Bim and Berardi 4) (Oliveira *et al.* 3)
Workshop	(Rodrigues and Francês 3) (Catilho, Rapkiewicz and Fogazzi 3) (Salgado, Cappelli and Avelino 2) (Bolan Frigo *et al.* 3) (Ferreia and Lucchese 3) (Lopes and Odakura 2) (Oliveira, Maciel and Souza 3)
Programming Classes	(Bolan Frigo *et al.* 6) (Fernandes *et al.* 5) (Sousa *et al.* 3)
Development of Games	(Freitas, Pires and Bernardo 3) (Scaccol *et al.* 3) (Bolan Frigo *et al.* 6) (Fernandes *et al.* 5) (Oliveira, Maciel and Souza 3)
Competitions	(Neto and Casagranda 2) (Ridel *et al.* 2) (Santiago and Andrade 2) (Galeno *et al.* 7)
Code.org	(Oliveira, Santos and Almeida 5) (Azevedo, Figueiredo and Maciel 3) (Fiori *et al.* 2)
Games Card	(Alencar, Pinheiro and Marques 2) (Bolan Frigo *et al.* 6) (Oliveira, Maciel and Souza 3)
Inventor app	(Ridel *et al.* 2) (Oliveira, Maciel and Souza 3) (Bolan Frigo *et al.* 6)
Arduino	(Bolan Frigo *et al.* 5) (Sousa *et al.* 3) (Oliveira, Maciel and Souza 3)
Motivational Speeches	(Oliveira *et al.* 4) (Ridel *et al.* 2) (Galeno *et al.* 7)
Design Thinking	(Ridel *et al.* 2) (Fernandes *et al.* 5)
Learning of Circuits Electrical	(Bolan Frigo *et al.* 3) (Sousa *et al.* 3)

TABLE 3. UNPLUGGED PROGRAMMING ACTIVITIES	
Theme	Document
Binary numbers	(Lomas, Figueiredo and Maciel 12) (Bolan Frigo *et al.* 6)
Algorithm writing in the context of everyday activities	(Marquiori, Oliveira and Nascimento 3)
Representation of digital images using paper plates	(Passos *et al.* 2)
Magic trick to illustrate information transmission errors	(Ferreia and Lucchese 3)
Programming on paper	(Lopes and Odakura 2)
Computational thinking through the *Moodle of Lovelace* for deaf girls	(Oliveira *et al.* 3)
Activities on database and computational thinking for Basic Education teachers	(Bim and Berardi 4)
Others	(Bim *et al.* 3) (Oliveira, Maciel and Souza 3) (Galeno *et al.* 7)

and Lucchese 3) used cards and a magic trick approach to illustrate information transmission errors. In order to introduce basic programming concepts, (Lopes and Odakura 2) reported on an activity for programming on paper. Other similar activities were described in (Bim *et al.* 3), (Oliveira, Maciel and Souza 3) and (Galeno *et al.* 7).

Article (Oliveira *et al.* 3) brought computational thinking activities through *Moodle de Lovelace* for deaf girls. (Bim and Berardi 4) also presented computing Unplugged activities on databases and computational thinking for teachers of Basic Education. The latter activity is a very important initiative as the training of teachers is critical to the realization of computing activities in elementary and high schools.

In relation to Workshops, many initiatives were also found. (Catilho, Rapkiewicz and Fogazzi 2) presented workshops to build an Ada Lovelace sculpture in which participants were able to disassemble a computer, learn about its physical parts and create the sculpture using the computer components. In (Salgado, Cappelli and Avelino 2) a Human Computer Interaction workshop was presented evaluating a messaging application; Web 2.0 tools and block programming workshops were presented in (Lopes and Odakura 2). Several workshops were presented in (Bolan Frigo *et al.* 3), among them a podcast and a comic book workshop, robotics, Arduino and 3D printing.

Three articles were also found that described programming classes. (Fernandes *et al.* 5) showed the work experience of the SuPyGirls project, which presents the results of using *Design Thinking* and computational thinking to build a game and teach programming. Among the activities presented in (Bolan Frigo *et al.* 6), one of them describes specific programming workshops that used the HTML and Python languages. Finally, (Sousa *et al.* 3) presents a theoretical-

TABLE 4. TOOLS USED IN GAME DEVELOPMENT ACTIVITIES	
Tool	Documents
Scratch Jr.	(Freitas, Pires and Bernardo 4)
Scratch	(Oliveira, Maciel and Souza 3)
Game Maker	(Scaccol *et al.* 4)
KODU	(Bolan Frigo *et al.* 6)
Language Python	(Fernandes *et al.* 7-9)

practical course containing programming logic, classes on electrical fundamentals, Arduino, among others.

The article (Galeno *et al.* 7) reports on a *Hackathon* that set the challenge of developing, using the Figma tool, a prototype application that would promote the education of girls and women in areas of social vulnerability. (Neto and Casagranda 2) and (Santiago and Andrade 2) relate to the *Technovation Challenge*, for high school and elementary school students, which consists of a competition to create applications aimed at a social cause. The first article described the experiences of students from Mato Grosso do Sul in the competition, while the second presented a case study of the 2017 edition, using questionnaires to extract data and analyze the Brazilian participation in the event. Another competition was also described in (Ridel *et al.* 2), at the *Technovation Hackday* event held by the Institute of Mathematical Sciences and Computing at the University of São Paulo. In this, the participants also developed applications, and in addition the event presented some lectures, including one on *Design Thinking*.

Game development is another common application of computing, and this type of activity was also found in some articles (Table 4). (Freitas, Pires and Bernardo 3) presented the activity "Little Computer Scientists" for children from 4 to 7 years old, which involved the development of a game, using Scratch Jr. However, before developing the game, an opportunity was created for the immersion and socialization of the children. Similarly, the Game Maker tool was proposed to develop the Breakout game for students in the sixth and eighth academic years at a public school in Rio Grande do Sul in (Scaccol *et al.* 4). A game development workshop using the KODU tool was described in (Bolan Frigo *et al.* 6), furthermore a paper prototyping was performed. In the activity presented in (Fernandes *et al.* 7-9), the girls decided on the theme of the games developed and used the Python language for implementation after going through digital literacy. Another activity of the same kind was mentioned in (Oliveira, Maciel and Souza 3) using the Scratch tool.

For educational activities related to mobile application development, the App Inventor tool is usually used. It has an intuitive interface which allows the game to be developed through components and blocks, facilitating the creation of a mobile application even without having much knowledge of programming. Three articles

were found that bring activities with games to elementary school girls. In (Oliveira, Maciel and Souza 3) the students were instructed to develop a game using the App Inventor. In (Ridel *et al.* 2-3), App Inventor was the platform used for development in the *Technovation Challenge* described in the article. Among the activities presented in (Bolan Frigo *et al.* 6), one of them is a mobile application development workshop in which the same platform is used, with the target audience being girls of 8 years old or older.

The Code.org tool is used worldwide for teaching Computing in an easier way. In Brazil, three articles were found that used this platform with the issue of gender and elementary education specifically. One of these articles, (Fiori *et al.* 3), presents the experience, carried out by the project Meninas Digitais do Vale, of introducing concepts of programming logic using the Code.org platform in a class of 91 students, 45 of whom are girls. (Azevedo, Figueiredo and Maciel 3) reports on the experience of a workshop, carried out by the Projeto Meninas Digitais Regional do Mato Grosso, to introduce programming based on Code.org activities, to children aged 7 to 12 and their families. Finally, (Oliveira, Santos and Almeida 5) also presents a workshop introducing basic programming concepts for girls in elementary school, in this case high school too, using Code.org.

As presented in this section, Brazil has many educational activities for girls in elementary school in Computing, which are aligned with tools that are applied worldwide.

3.2. Limitations of the literature mapping

This literature mapping was based on academic articles published in conference proceedings and in journals. Thus, it was not possible to capture educational initiatives in elementary education for girls in Computing that were not published in conference proceedings or journals. It was also not possible to include the articles from CLEI 2015, as they were not available for access.

To reduce the bias in the exclusion of articles, weekly meetings were held in order to analyze the conflicts between researchers involved in mapping the literature. As mentioned above, these comprised a professor who is a researcher in the field of women in Computing and three undergraduate students from the Department of Computer Science at the University of Brasília.

4. CONCLUSION

This article presented two contributions, the first was the methodology applied in elementary education of the Meninas.com project and the second was the literature mapping of activities in Brazil for the inclusion of girls in computing.

The Meninas.com project in the CED Vargem Bonita of the Federal District, with girls in the seventh, eighth and ninth grades, as described, lasted a school year. The students developed a Smart Garden with the aim of helping their region. The

project was implemented and presented at various events, winning awards as the best project at local events.

As shown in this literature mapping, the number of educational activities for students in elementary school, with a focus on gender diversity in computing, has been increasing since 2016, with a sharp increase in the year 2020. Events such as LAWCC-CLEI and WIT-CSBC have a fundamental role in publicizing the activities carried out in Brazil.

Although Amazonas and Mato Grosso are among the states publishing most on activities for elementary education in this literature mapping, if we look at the Brazilian regions, the South and Southeast regions are highlighted, which is not new, since these regions have the greatest number of universities in Brazil. Most of the activities are partner projects of the *Meninas Digitais* of the Brazilian Computer Society.

Among the activities presented, Unplugged Computing was highlighted, and this may be related to the social issues in Brazil, since many public schools do not have a good infrastructure of Computing laboratories. However, there were also activities with Scratch, App Inventor, Code.org which are worldwide platforms used for teaching Computer activities at elementary school level.

As future work, the Meninas.comp project is going to apply this methodology in other schools. Regarding the mapping of literature, it is intended to do a literature review analyzing the effectiveness of these activities in elementary education. The idea of the review is to identify the impact caused by these activities in terms of reducing the gender diversity gap in computing.

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