

A Literature Mapping of the Congress of Latin American Women in Computing (LAWCC) Papers*

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Abstract

The lack of gender diversity in the field of Computer Science and Engineering is a challenge in Latin America (LA). The Congress of Latin American Women in Computing (LAWCC) has had an important role in publishing inclusion activities in Latin American countries. This is carried out as part of CLEI (Conferencia Latinoamericana de Informática, in Spanish). The objective of this paper is to show a historical vision of the 15 years of LAWCC publications, and how these have reported on the challenge of disseminating the computing field to the female audience in LA. This would help researchers understand how knowledge has progressed and topics that address gender disparity. This is one of the reasons why we need to have this information documented. These works are allowing us to foster collaboration and synergy with other groups, strengthening solidarity among women. The methodology used for this paper was based on literature mapping of the publications in LAWCC during these conference years.

Keywords

Women, Latin American, Computing, STEM

1. Introduction

As elsewhere in the world, the computing area in Latin America has been mostly male. To reduce the gender diversity gap, several countries have developed activities to include more women in computing.

The Latin American Women's Congress in Computing (LAWCC) is an important space for women from this region to meet. LAWCC provides a space for discussion, integration, and sharing for women in computing in Latin America.

In this context, this paper presents a literature mapping of papers published in LAWCC. The papers were written by more than 240 authors from 15 different countries. Brazil and Costa Rica stand out as the countries with the highest number of authors.

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Table 1
LAWCC

Edition	Year	City	Country	Chair
I	2009	Pelotas	Brazil	Claudia B. Medeiros and Gabriela Marín Raventós
II	2010	Asunción	Paraguay	Gabriela Marín Raventós
III	2011	Quito	Ecuador	María E. Urquhart
IV	2012	Medellín	Colombia	Gabriela Marín Raventós
V	2013	Naiguatá	Venezuela	Yudith Cardinale and Maria Carolina Monard
VI	2014	Montevideo	Uruguay	Andrea Delgado and Yudith Cardinale
VII	2015	Arequipa	Perú	Raquel E. Patiño Escarcina and Andrea Delgado
VIII	2016	Valparaíso	Chile	Marcela Varas and Gabriela Marín Raventós
IX	2017	Córdoba	Argentina	Rosiane de Freitas and Irene Loiseau
X	2018	Sao Paulo	Brazil	Gabriela Marín Raventós and Rosiane de Freitas
XI	2019	Ciudad de Panamá	Panamá	Donna Angela Roper and Ariella Quesada
XII	2020	Loja	Ecuador	Germania Rodríguez and Alicia García-Holgado
XIII	2021	San José	Costa Rica	María Estrada and Alicia García-Holgado
XIV	2022	Armenia	Colombia	Maria Elena Garcia-Díaz and Maristela Holanda
XV	2023	La Paz	Bolivia	María Elena García-Díaz and Veronica Gil-Costa

The rest of this paper is divided into the following sections: Section 2 describes the Methodology, Section 3 provides the Results, in Section 4 there is the Discussion and finally in Section 5, the conclusions.

2. History of LAWCC

LAWCC has been held since 2009 as an associated Centro Latinoamericano de Estudios en Informática (CLEI) conference. The main objective is to highlight the research, interest, and achievements of women in the various areas of computing to encourage the active participation of more women. With this effort, it is expected to identify the challenges of women in the area of Information Technology and Telecommunications (ICT), in teaching, in the labor market, and research. It seeks to find ways to address recurring problems related to gender and interaction with society in this context.

Table 1 presents all LAWCC editions. Brazil, Colombia, and Ecuador hosted the conference twice. Professor Gabriela Marín Raventós stands out as having participated in the organization of LAWCC five times.

3. Methodology

This literature mapping used the LAWCC public proceedings. The LAWCC papers were distributed on the event's edition websites since its first edition in 2009. We searched the internet to find papers from 2009 to 2019. Starting with the 2020 edition, the proceedings were indexed in CEUR and Scopus. All the papers presented in this paper are open-access. This mapping aims to answer the following questions:

- RQ1: How many papers were published by year?
- RQ2: Which languages are used to write the papers?
- RQ3: Which countries published in LAWCC?
- RQ4: Who are the authors with the highest number of published papers?
- RQ5: What topics do the paper cover?

4. Results

4.1. RQ1: How many papers were published by year?

Figure 1 shows the number of papers published yearly in LAWCC. The first edition of LAWCC was in 2009, but in 2012 articles began to be published. The average number of papers published in the last six years was 13.5, with the year 2023, having the highest number of papers, 19.

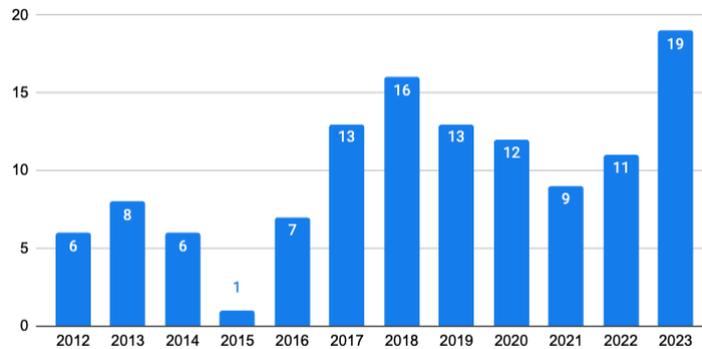


Figure 1: Number of papers by years.

4.2. RQ2: Which languages are used to write the papers?

LAWCC papers can be written in Portuguese, English, and Spanish. Most papers were written in English (39.2%), Portuguese (32%), and Spanish (28.8%). The countries of Latin America have Spanish as their first language, except Brazil, which has Portuguese as its language, Figure 2 presents the papers' languages by year. Papers written in English had a constant growth from 2019. In the 2021 edition, all papers were written in English and in 2022 and 2023, there were no papers written in Spanish. The increase in articles in English happened because LAWCC has made an effort to increase the dissemination of work carried out in LA, and the publication of papers in CEUR encouraged the writing of papers in English.

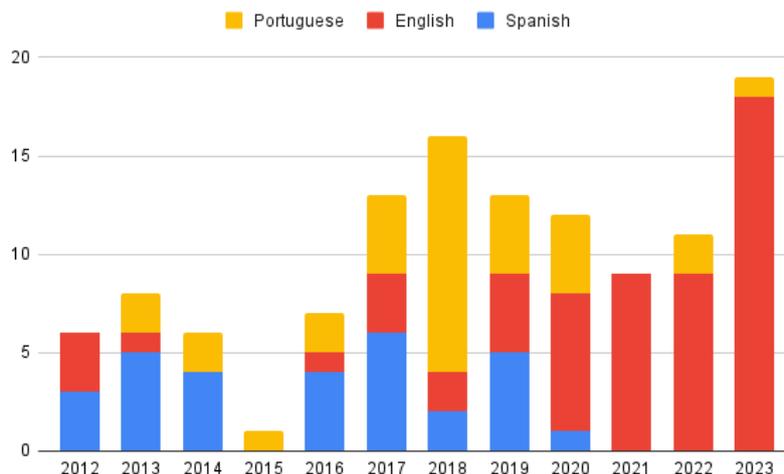


Figure 2: Number of papers by Years.

4.3. RQ3: Which countries published on the LAWCC?

The papers were written by authors from 14 countries in Latin America. Three papers had a collaboration with authors from Spain. Brazil and Costa Rica had the highest number of papers. Table 2 presents the

countries with their papers.

Table 2
Countries and Paper

Countries	Quantity	Papers
Brazil	50	[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23][24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35][36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51][52][53][54][55][56][57] [58][59][60][61][62]
Costa Rica	26	[63][64][65][66] [67][68][69] [70][71][72][73][74] [75] [50]
Ecuador	7	[76] [77] [78] [79] [80] [81] [82]
Colombia	5	[83] [84] [85] [86] [87]
Bolivia	5	[88] [89] [90] [91] [87]
El Salvador	5	[92] [93] [94] [95] [96]
Paraguay	5	[97] [98] [99] [100] [101]
Argentina	4	[102] [103] [104] [105]
Panama	4	[106] [107] [108] [50]
Uruguay	4	[109] [110] [111] [112]
Spain	3	[72] [113] [86]
Venezuela	2	[114] [115]
Chile	2	[116] [117]
Cuba	1	[118]
Mexico	1	[119]

4.4. RQ4: Who are the authors with the highest number of published papers?

More than 240 authors wrote LAWCC papers. Table 3 presents the authors with at least four papers. As may be seen, all authors are from Brazil or Costa Rica. This answer is related to the previous one, where Brazil and Costa Rica are the countries with the highest number of papers. Cristiano Maciel (9 papers), Rosiane de Freitas Rodrigues (8 papers) and Aleteia Patrícia F. de Araújo (7 papers), Gabriela Marín Raventós (7 papers), and Maristela Holanda (7 papers) are the authors with the highest number of papers.

Table 3
Authors, Papers and Country

Author	Quantity	Country
Cristiano Maciel	9	Brazil
Rosiane de Freitas Rodrigues	8	Brazil
Gabriela Marín Raventós	7	Costa Rica
Aleteia Patrícia F. de Araújo	7	Brazil
Maristela Holanda	7	Brazil
Karen da Silva Figueiredo Medeiros	6	Brazil
Ariella Quesada Rosales	6	Costa Rica
Iyubanit Rodríguez Ramírez	5	Costa Rica
Luciana Bolan Frigo	4	Brazil
Eliane Pozzebon	4	Brazil

4.5. RQ5: What topics do the paper cover?

To comprehensively analyze the covered topics in the papers, we established 11 categories based on the themes addressed by the papers, which were analyzed by a Text Mining analysis. These categories

were identified through a review of the papers by deep learning algorithms and LLM models, to capture the diversity and complexity of the topics discussed. Finally, the results were analyzed and validated by experts. The categories are:

1. Women’s Participation in Education and the Tech Industry
2. Gender Studies and Analysis in Computer Science and Technology
3. Initiatives and Programs for Women’s Inclusion and Promotion in STEM
4. Analysis of Public Policies and Institutional Strategies
5. Professional Development and Entrepreneurship in Computing for Women
6. Experiences and Case Studies in Education and the Tech Industry
7. Reflections and Perspectives on Women’s Participation in STEM
8. Sociocultural Analysis and Studies in the Context of ICT
9. Early STEM Education and Awareness
10. Research on Female Participation in Computer Science and Technology
11. Challenges and Opportunities in Career and Job Market

As observed in Figure 3, the largest number of articles are found in category 3, which present various initiatives and programs aimed at promoting the inclusion [63, 33, 41], advancement, and empowerment of women in STEM fields [6, 4, 87]. It covers a wide range of efforts, including mentorship programs [21, 43, 111, 80, 112], outreach initiatives [4, 5, 18, 77, 36, 113], and advocacy campaigns [13, 109, 119, 45, 120].

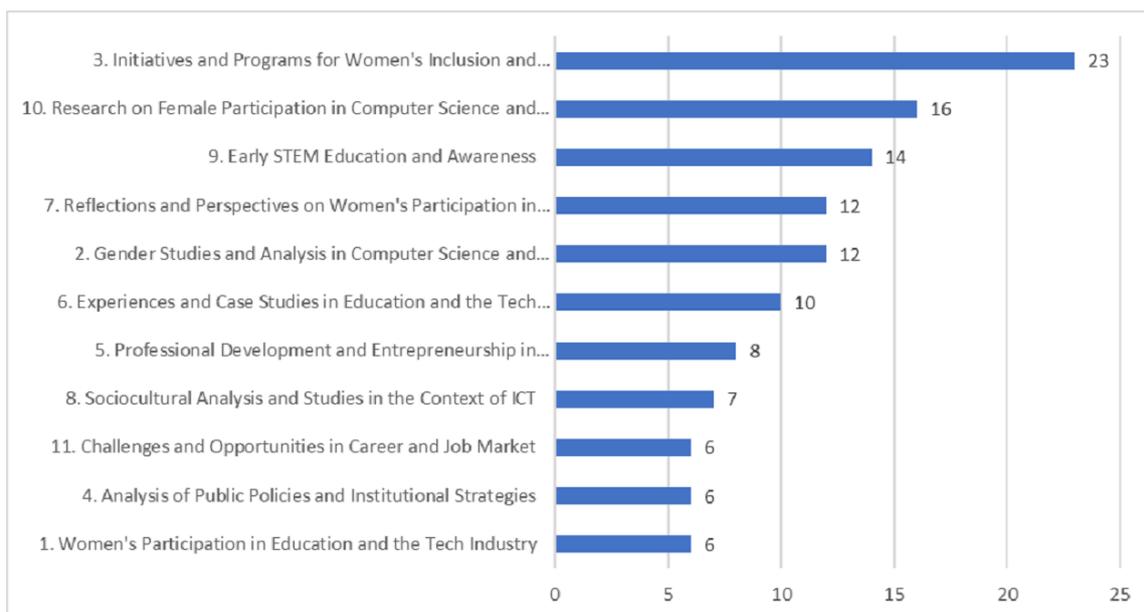


Figure 3: Research category.

Secondly, there is category 10 which involves academic research specifically dedicated to understanding and analyzing the factors influencing female participation in computer science and technology fields [88, 1], including quantitative and qualitative studies investigating barriers [2, 3, 30, 79, 24, 74], motivations [61, 106, 92, 97], and trends [8, 65, 94, 65] related to women in these domains.

Thirdly, category 9 comprises articles emphasizing initiatives and efforts aimed at introducing STEM education [11, 28, 29, 69, 91] and fostering awareness among young learners [17, 25, 32, 78, 44], particularly focusing on encouraging girls’ interest and participation in STEM from an early age [10, 23, 39, 12].

Fourthly, categories 2 and 7 where the category 2 is focus on academic research and analysis regarding gender dynamics within the fields of computer science and technology [114, 103, 72], involving studies examining gender disparities [14, 104], biases [102, 15, 16], and perceptions in these areas [53, 118, 20, 67].

Otherwise category 7 encompasses reflective pieces and diverse perspectives on women's participation in STEM fields [89, 116, 105], including personal narratives [37, 116, 34], opinion pieces [90, 76, 35], and scholarly reflections on the status, challenges, and opportunities for women in STEM [42, 70, 81].

In fifth place is category 6 which involves sharing and analyzing real-life experiences and case studies related to education and employment in the tech industry, with a focus on women's perspectives [83, 121, 46, 98, 93]. It provides insights into challenges, successes, and best practices in promoting gender diversity and inclusion [26, 66, 71, 110, 84]. In sixth place is category 5 which addresses the professional growth and entrepreneurial endeavors of women in computing, including discussions on career advancement opportunities [57, 58, 62, 47], skill development programs [75, 82], and initiatives supporting women-led startups in the tech industry [108, 99]. In seventh place is category 8 delves into the sociocultural aspects influencing ICT (Information and Communication Technology) adoption and usage, with a specific focus on gender dynamics [36, 31, 98], examining societal norms, cultural perceptions, and social structures shaping women's engagement with ICT [68, 19, 117, 100].

Finally, in eighth place are categories 11, 4, and 1, where the category 11 focuses on examining the involvement and representation of women in educational settings related to technology and their participation in the tech industry [56, 59, 60], emphasizing the educational and professional pathways for women in the tech sector [38, 107, 95]. Otherwise, category 4 analyzing governmental policies and institutional strategies aimed at promoting gender diversity and equality in STEM fields [55, 64, 73], assessing the effectiveness of existing policies and recommending improvements [27, 86, 100]. Finally, category 1 addresses the challenges and opportunities encountered by women in pursuing careers in STEM fields and navigating the job market [52, 7, 22], exploring issues such as gender-based discrimination, work-life balance, and career advancement prospects [51, 54, 85].

4.6. Publication trend of the topics over time

Figure 4 shows the publication trend of the topics and the number of articles in each category over the years; as can be observed, the category Women's Participation in Education and the Tech Industry has a total of 6 publications over the years, concentrated in the years 2012, 2017, 2018, and 2023, with a single publication in each of them; the category Gender Studies and Analysis in Computer Science and Technology has 14 publications, increasing from the year 2016, with a peak in 2018 with 4 publications. In the category Initiatives and Programs for Women's Inclusion and Promotion in STEM, there are 23 publications, with a steady increase from 2014 to 2020, with a maximum of 4 publications in 2017, 2020, and 2023. The category Analysis of Public Policies and Institutional Strategies has 6 publications, which are irregularly distributed, with peaks in 2018 and 2023 with 2 publications.

5. Discussion

Since 2018, the LAWCC conference has maintained an average number of papers published at 13.5 per year. In this way, the LAWCC, with its 15 years of the edition, has shown its importance in disseminating publications of actions to include women in computing in Latin American countries.

LAWCC has expanded the publication of papers in English since 2018. In the year 2021, all published papers were in English. Writing an paper in English facilitates access to the world of actions carried out in Latin America on the subject.

Brazil and Costa Rica have the most publications. Brazil is the largest country in Latin America and has a project by the Brazilian Society of Computing called Digital Girls, which justifies being first on this list. Regarding Costa Rica, it is possible to observe that the researcher Gabriela Marín Raventós has carried out many actions in Costa Rica for the inclusion of women in Computing.

Regarding the authors who published the most in LAWCC, all of them are involved with the inclusion project of women in Computing in their countries. A highlight for Professor Cristiano Maciel who was one of the co-founder the Digital Girls project of Sociedade Brasileira de Computação.

Regarding the topics covered by the analyzed articles, it can be observed that the categories "Initiatives and Programs for Women's Inclusion and Promotion in STEM" and "Professional Development and

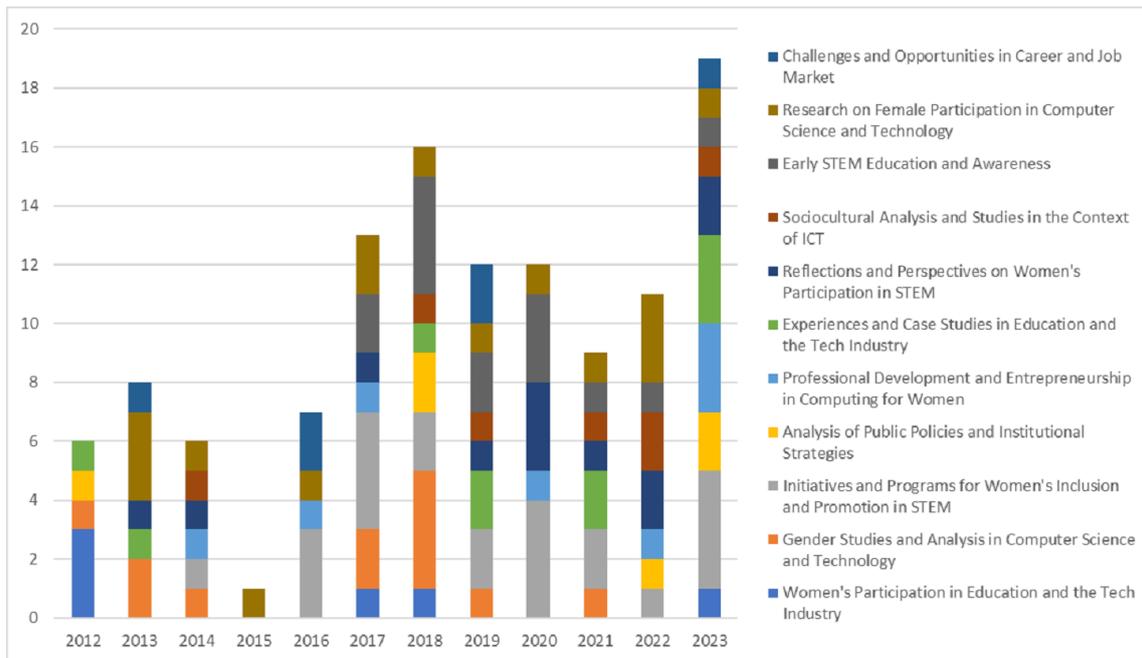


Figure 4: Trend of the topics.

"Entrepreneurship in Computing for Women" show a steady increase in publications over the years. This suggests a growing interest in developing programs and policies aimed at fostering women's participation in STEM and promoting their professional development in the field of technology. Additionally, the category "Gender Studies and Analysis in Computer Science and Technology" also shows an increase in publications starting from the year 2016, indicating a heightened interest in understanding and addressing gender issues in the field of computer science and technology.

Similarly, categories such as "Research on Female Participation in Computer Science and Technology" and "Experiences and Case Studies in Education and the Tech Industry" demonstrate a more even distribution of publications over the years, suggesting a continuous focus on researching and analyzing women's participation in computing and technology. On the other hand, although categories like "Analysis of Public Policies and Institutional Strategies" and "Challenges and Opportunities in Career and Job Market" have fewer publications compared to other categories, they still reflect the importance of addressing policies and institutional strategies to foster gender equity in STEM and overcome challenges in the job market.

6. Conclusion

This paper presents a mapping of papers published at LAWCC, the Latin American congress that works to disseminate Latin American work on the topic of women in computing. During the 15 years of publication, 120 papers were published from 14 countries in Latin America, and three papers in collaboration with researchers from Spain. In terms of the topics addressed by the articles, these categories reflect a comprehensive exploration of various aspects related to women's participation in STEM. This ranges from academic research and analysis to practical initiatives and policy considerations. Additionally, they demonstrate a trend suggesting a growing interest and commitment to addressing women's participation in computing and technology, as well as developing initiatives and programs to promote inclusion and professional development for women in STEM. However, there are still areas that require more attention and focus, such as the development of policies and institutional strategies to address the specific challenges faced by women in the field of technology.

In future work, an analysis of published papers will be carried out to have a literature review of the effective actions for including women in computing. To conduct a deeper exploration of the topics and

the impact of the analyzed articles, aiming to identify specific themes and trends for potential research topics, through content analysis strategies.

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