WIT comes of Age: The Successful Story of the Women in Information Technology Workshop

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Abstract Having more women in Computing, Information Technology, and Hard Sciences is a pressing matter that has been around for at least three decades. This article presents a success story about WIT (Women in Information Technology), an event part of the CSBC (Brazilian Computer Society Congress). It was created 18 years ago as an open space to discuss gender equity issues in Computing and is currently organized by *Programa Meninas Digitais* – PMD (Digital Girls Program). In this article, we present the impact of WIT within the Brazilian Computing community. Quantitative and qualitative analyses were carried out over data recorded throughout this period. The results show WIT's growing number of participants, citations to published papers, and submissions over the years prove its success. So, WIT was born as an embryo, then grew, matured, and created a personality. Today, upon reaching adulthood, it inspires thousands of women to begin working in computing or to thrive in it. WIT has also shown men that society benefits when diversity and respect exist for all minorities, especially women in Computing.

Keywords: Gender Equality, Women in Information Technology, WIT, Digital Girls Program

1 Introduction

The Women in Information Technology (WIT) event is part of the Brazilian Computer Society Congress (CSBC) as an initiative to discuss gender issues in Information Technology (IT) in Brazil and Latin America, including success stories, incentive policies, and ways of engaging and attracting young people, especially women, to IT-related careers. The workshop offers keynotes and panels on women and their access to IT from the perspectives of the job market, inclusion, and digital literacy. It also covers educating, recruiting, and training women as a strategic policy for national and regional development and prosperity.

Programa Meninas Digitais – PMD (Digital Girls Program) is an outreach program for the area of Computing and its technologies, and is responsible for organizing WIT yearly. PMD aims to incite girls (primarily elementary school seniors and high school students) to learn about the area and become motivated to pursue a career in computing. Its nationally spread partner (affiliated) projects have WIT as a space to strengthen the community and promote knowledge exchange with other partners. According to the last Annual Partner Project Report [Araujo *et al.*, 2024], PMD has 84 active partner projects throughout the Brazilian territory. The Southeast region has the largest number of partner projects (39), followed by the South (19). Overall, such projects have more than 1,407 team members. Further information is available on the official PMD website.[1]

In 2024, WIT comes of age by turning 18. To celebrate such a remarkable milestone, we have collected important information on its successful journey and now share it in this article. Hence, the goal is to overview its trajectory and impact on the Brazilian Computer Society community and thousands of people (especially girls and women) touched by its scientific knowledge, gender difference awareness, broad discussions, and outreach lessons.

This article presents research results to answer the question: "What is the potential impact of WIT within the Brazilian IT community?" Its research design includes qualitative and quantitative procedures [Creswell and Creswell, 2022]: a literature review; an investigation of WIT numbers (e.g., submissions and acceptance statistics, Program Committee distributions); and an empirical investigation of its impact. Our conclusions bring practical and intriguing contributions to the Brazilian community about how such an event positively impacts personnel, professional, educational, scientific, and community dimensions and has been crucial to moving SBC towards an equity and diverse scenario, as WIT keeps the flame burning among the PMD partners projects and their communities all year round. WIT discussions and results go beyond CSBC and universities, reaching undergraduate and

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[1]Programa Meninas Digitais SBC: `https://meninas.sbc.org.br`

primary education students and private institutions. However, our results also highlight this scenario is not a reality in national events in specific areas, which are not as inclusive in relation to gender diversity.

The article is structured as follows. Section 2 reviews publications on related issues by focusing on Brazilian and international gender-oriented initiatives. Section 3 describes WIT and highlights the key facts that made it the most significant Brazilian event to discuss gender diversity in Computing. Section 4 presents the methodology used for collecting data that work as input to our quantitative and subjective analyses. Section 5 describes and discusses analysis results, which emphasize WIT's implications for gender in Computing awareness and on motivating new projects throughout Brazil. Finally, Section 6 concludes this article and goes over future work by emphasizing WIT's growing relevance and importance to a society that still needs to discuss gender equality in IT.

2   Related Work

Nowadays, gender and minority-related issues have taken the spotlight in many societies and even whole countries. However, such issues are no novelty within Computing and IT spaces, as they have been around since the late 1970s [MIT, 1983]. As time passes, the IT profession has been consolidated, and gender-related issues become even more apparent and pressing [Frenkel, 1990; Medeiros, 2005; Moro, 2022]. For instance, gender balance is required in teams that develop computing-related technology, such as software and apps [Felizardo *et al*., 2017]. Likewise, in databases, the number of Brazilian women authoring papers in its main event within SBC has oscillated but never reached equality [de Lima *et al*., 2017]. Hence, the justified importance of women in IT has led to the current scenario where Academia and Industry have engaged in spreading awareness and creating inclusive environments (e.g., [Frieze and Quesenberry, 2019; Vasilescu *et al*., 2015]). Still, most issues are far from coming to feasible, sustainable solutions, for instance, gender bias. From Computing Education to Industry, small towns to big developed centers, gender equity may be a fair goal, but it needs hard work and breaking many barriers.

As international organizations, both ACM (Association for Computing Machinery) and IEEE (Institute of Electrical and Electronics Engineers) have specific chapters focused on gender diversity, ACM-W[2] and IEEE WIE.[3] Each branch has a catchy slogan that translates well to its mission: "*ACM-W Supporting, celebrating, and advocating for Women in Computing*"; and "*IEEE Women In Engineering, connecting, supporting, and inspiring females worldwide, and facilitating their recruitment and retention in STEM fields*". They provide many initiatives (both online and in person) that stimulate outreach, belonging, networking, and career support.

Still in the North Hemisphere, AnitaB.org is probably one of the most famous organizations that promote gender equality in technology. Since 1994, it has organized the most significant event for women in tech, the Grace Hopper Celebration,[4] which attracted more than 30 thousand participants in 2023. Although such a huge number is a valid metric of success, having smaller events in the hundreds of participants has its advantages as well [Townsend and Harriger, 2019].

The "lack of women in IT" that has motivated the aforementioned institutions and their actions is also present in Brazil: 51% of Brazilians are women (according to IBGE – *Brazilian Institute on Geography and Statistics*), but only 23% of researchers in Computing are women [Soares *et al*., 2023]. An extra issue is that Brazilian (and Latin American) women and girls have different needs than those in the Global North. Whatever solutions work for attracting and keeping more women in IT are not entirely applicable here. Differences in culture, funding, awareness, school system, industry size, location, maternity leave, child care facilities, cost, and even GPD (Gross Domestic Product) make Brazil a unique place that requires tailored solutions.

As aforementioned, one successful solution is creating conferences (workshops) for women in IT, "where role-modeling, networking, student speaking opportunities, and distribution of accurate career information take place" [Townsend and Harriger, 2019]. In this scenario, Women in Information Technology (WIT) was created within the Congress of the Brazilian Computer Society in 2007, first as a satellite event (it became a core event in 2016). Its main goal is clear: bring more women to IT and help those already in IT [Maciel and Bim, 2016]. Such a goal had taken new dimensions in 2016 when WIT published its first call for papers [Solis and Borin, 2016]. The reasoning for such an "upgrade" was fairly simple: there are so many projects sharing WIT goals that recording their initiatives, issues, solutions, and results is crucial.

Since then, a visible outcome of WIT is its high percentage of female authors, especially compared to other events within CSBC [Carvalho *et al*., 2023b]. Moreover, as pinpointed by Carvalho *et al*. [2023b], WIT has not only a cohesive community of authors, with many collaborations, but also an impressive regional representation, with most authors' affiliations outside the Brazilian economy axis (Rio de Janeiro and São Paulo states).

Another research investigated six years of WIT from 2016 to 2021 to identify the leading bibliometric indicators [Bordin *et al*., 2022]. Interestingly, some indicators show the community profile. For instance, most of the articles belong to the experience reports category.

Recent research also celebrates WIT's 18 editions in 2024 and investigates the people who have composed WIT program committees since its first call for papers [Moro *et al*., 2024]. The results show diversity has been indeed a constant keystone of its program committees on different perspectives: geography distribution, type of affiliation institution, age, PhD provenance, among others.

CSBC WIT has a homonym, the Women in Technology Program,[5] a nonprofit *organization* dedicated to addressing

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[2]ACM Women: `https://women.acm.org`
[3]IEEE Women in Engineering: `https://wie.ieee.org`

[4]Grace Hopper Celebration: `https://ghc.anitab.org`
[5]WIT Program: `https://mywit.org`

the under-representation and challenges women and girls face in STEAM. It was founded in Georgia, United States, in 1992, and it has no relationship to neither SBC nor PMD.

Overall, this section shows workshops or conferences worldwide that share WIT's goal of promoting and discussing women's equality in IT. Furthermore, some researchers have been investigating specific dimensions of WIT, such as WIT article citations, female representation in WIT articles, and the evolution of program committees regarding sex and geography. Still, this paper focuses on exploring other dimensions of how far WIT has impacted the Brazilian community over the last 18 years.

3   Women in Information Technology

This section presents a brief history of WIT and summarizes relevant information on the people involved in its organization. Going through its history and organizing teams is essential for understanding the results in the upcoming section. Furthermore, this section creates a valuable collection that can be used for reference in future research, helping to replicate studies and validate findings.

3.1   History

The first **WIT** happened in 2007 in Rio de Janeiro, organized by professors Claudia Bauzer Medeiros and Karin K. Breitman during CSBC [Ribeiro, 2016]. The initial proposal was to create a space for the computing community to discuss gender diversity in IT. Its first edition aimed to build a space to recognize success stories of women working in the area and promote inclusive policies and strategies to attract more women to work in computing-related careers.

In 2007, when WIT was created, it humbly arrived at CSBC to mark its territory. From the moment it was born, it gave its first cry (the that every healthy baby makes at birth) to tell society a strong idea that would make history had been born there. This "crying" was recorded with a photo, in which all participants wore the same t-shirt. This t-shirt would become the symbol of everyone who supports the cause. Today, the moment of this photo is part of the official WIT program and is expected by many participants.

WIT grew up like a child who never accepted hearing phrases like "That's a boy thing", "Would you rather get a doll or a set of pans?" or "Don't do that, that's for the boys." These phrases, unfortunately, have been said for decades. Also, from a very young age, girls are conditioned (by family and society) to believe that they must work professionally in tasks aimed at caring for families and houses and never in activities aimed at reasoning, logic, or science.

Thus, WIT has soon become a motivational space that creates (for a few days) a territory of equality, a place to widely discuss, together with the Brazilian Computer Society, how the area of Computing (and other sciences) should be diverse and inclusive; a forum to ponder on the reasons for fewer women in these areas, and its relation to the beliefs and expectations created by society – as

scientifically, it has already been proven there is no physical difference in male and female ability to work in the area [Brizendine, 2006].

Then, when WIT turned four years (2010), it got a brother, called *Fórum Meninas Digitais*, **FMD** – the Digital Girls Forum. FMD was created as a space to carry out actions aimed at stimulating girls' and young women's interest in the area of computing when making their professional choices.

By creating FMD, the debate on gender within Computing could not be further ignored. Such a realization gave rise to the *Digital Girls Program*, **PMD**, which was created under the coordination of Professor Cristiano Maciel (who was SBC Regional Secretary in Mato Grosso state), currently SBC vice-president. The paper by Maciel *et al.* [2021] creatively describes how PMD was born.

PMD started with the audacious spirit of integrating all academic initiatives that worked towards achieving more female participation in Computing. Thus, between 2011 and 2013, PMD embraced its first partner projects, including: Meninas.comp [Araujo and Holanda, 2021], MD - Regional Sul-UFSC [Moro *et al.*, 2021], Women in Computing, Meninas++, and Emíli@s – Armação em Bits. In 2015, PMD was formalized by SBC as a program of national interest to the community. Hence, in the following year, PMD received its seal of approval, being the first Brazilian initiative to receive such a recognition [Maciel and Bim, 2016].

In fact, within WIT, FMD is where PMD partner projects come together annually. In addition to participating in the Forum, all projects engage with WIT by submitting and presenting technical-scientific papers and attending and participating in talks and panels. With each edition of WIT, new themes are discussed. In 2024, for example, WIT offered training lectures on gender and intersectionality, panels on leadership, and the need for new public policies. In addition, FMD promoted an encounter of invited projects to share lessons learned and tips for success.

In such a context, WIT (as an "older sister event") drives project activities and provides a means for project coordinators and members to meet each other, exchange experiences, form partnerships, and present ideas and results on their teaching, research, and outreach initiatives.

PMD partner projects are present in 22 Brazilian states, ensuring the program's representation in all five Brazilian regions. According to the most recent data [Araujo *et al.*, 2023], PMD partner projects gather 1,301 individuals, of which 1,095 are women, and outreach activities were carried out in 643 schools in the 2022-2023 year. From 2021, the number of PMD partner projects has healthily increased at a rate of 24.7%, which rises after each WIT edition when more partner projects register. For example, in 2022 and 2023, there was an average of five new partner projects per year after WIT. Furthermore, there has been an annual growth of 73% in the publications of partner projects at WIT, making the workshop the event where such projects have had the highest number of publications in recent years.

Since its creation in 2010, FMD has been known as an open space to strengthen PMD's various partner projects and agenda. By running in all five regions of Brazil, partner

Table 1. Type of call for papers and respective chairs of WIT editions 2016 to 2024.

Year	Call	General Chair	PC Chair	Local Chair	Forum Chair
2016	Short	Priscila Solis, UnB Juliana F. Borin, UNICAMP	Sílvia A. Bim, UTFPR	Ana Cristina Benso, PUCRS	Cristiano Maciel, UFMT Sílvia A. Bim, UTFPR
2017	”	Sílvia A. Bim, UTFPR Tanara Lauschner, UFAM	Claudia Cappelli, UNIRIO Luciana Salgado, UFF	Ana Cristina dos Santos, Mackenzie	Cristiano Maciel, UFMT Karen Figueiredo, UFMT
2018	”	Tanara Lauschner, UFAM Cláudia Cappelli, UNIRIO	Aleteia Araújo, UnB Maria Clicia de Castro, UERJ	Angélica de Castro, UFERSA Cláudia Ribeiro, IFRN	Cristiano Maciel, UFMT Karen Figueiredo, UFMT
2019	Full + Short	Tanara Lauschner, UFAM Renata Viegas, UFPB	Sílvia A. Bim, UTFPR Luciana Bolan Frigo, UFSC	Yomara Pires, UFPA	Cristiano Maciel, UFMT Sílvia A. Bim, UTFPR
2020	”	Renata Viegas, UFPB Fabíola Nakamura, UFAM	Maristela Holanda, UnB Mirella M. Moro, UFMG	Karen Figueiredo, UFMT	Cristiano Maciel, UFMT Luciana Frigo, UFSC
2021	”	Fabíola Nakamura, UFAM Rita Berardi, UTFPR	Isabela Gasparini, UDESC Luciana Salgado, UFF	Luciana Frigo, UFSC	Aleteia Araújo, UnB Luciana Frigo, UFSC
2022	”	Adriano Braga, IF Goiano Ceres Claudia Cappelli, UERJ	Mirella M. Moro, UFMG Anna Beatriz Marques, UFC Russas	Luciana Salgado, UFF	Aleteia Araújo, UnB Luciana Frigo, UFSC
2023	”	Adriano Braga, IF Goiano Ceres Renata Viegas, UFPB	Anna Beatriz Marques, UFC Russas Caroline Reis, IFSC Gaspar	Vanessa Dantas, UFPB	Aleteia Araújo, UnB Mirella M. Moro, UFMG
2024	Three Tracks	Renata Viegas, UFPB Aleteia Araújo, UnB	Caroline Reis, IFSC Gaspar Raquel Cabral, UFAL Arapiraca	Maristela Holanda, UnB	Aleteia Araújo, UnB Mirella M. Moro, UFMG Luciana Salgado, UFF
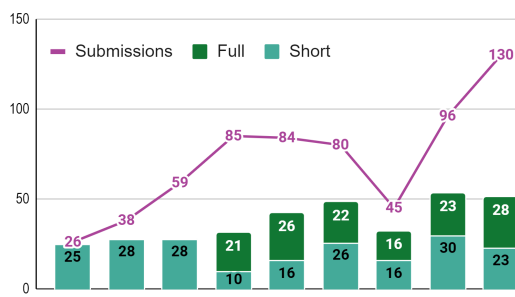
Figure 1. WIT submission and acceptance statistics.

Figure 2. WIT Timeline of key milestones.

projects ensure the debate on gender diversity is a live topic in more than 90 Brazilian teaching and research institutions [Araujo *et al.*, 2023].

Back to WIT, when this child learned to "read and write", it made its first call for (short) papers (2016). Then, given its impressive performance, after three years, WIT made its first call for full papers (2019) – see Table 1. In 2023, WIT broke a historical record in the number of submissions (96), shown in Figure 1. At 17 years old, WIT was in full "teenager mode", breaking long-standing barriers and becoming notoriously social, having its room complete in practically all sessions during CSBC 2023. By turning 18, it was time to have new responsibilities more appropriate for its mature status. Hence, in 2024, WIT debuts its first call for papers separated by tracks of interest and broke its record on the number of submissions - 130.

Upon turning 18 and reaching the age of majority, WIT is the most significant event in Brazil to discuss gender diversity in Computing and IT. It is part of CSBC (South America's largest Computing event), aggregating 10 base events and 17 satellite events. Currently, WIT is one of the most significant base events of the SBC Congress, with an average audience of around 800 people/day. Having the PMD Directive Committee as responsible for its editions, WIT has also expanded on the importance of being more diverse and egalitarian, expressed by seven reasons (7Ps) [Araujo *et al.*, 2021; Moro *et al.*, 2023]: Productivity, Pioneering, Pertaining, Partnership, Practicality, Plurality and Persistence. Therefore, at the age of many decisions, WIT is confident its mission is to strengthen and spread its

cause across the country: for more women to work and thrive in Computing.

In summary, WIT was born as an embryo, then grew, matured, and created a personality. Figure 2 summarizes the timeline of WIT, from its inception to the time of writing this article. This figure also presents the iconic t-shirts worn in each of the years presented. Today, upon reaching adulthood, it inspires thousands of women to begin working in Computing or thrive in it. WIT has also shown men that society benefits when diversity and respect exist for all minorities, especially women in Computing.

3.2 Organization and People

It takes a group of talented people to organize WIT yearly. Table 1 presents its coordinators between 2016 and 2024, i.e., editions with call for papers. With few exceptions (2016, 2017, 2022), most editions in this time frame were coordinated by one previous organizer teamed with a new person. The same is true for program committee chairs from 2022 onwards. Then, the Local Chair is always one person (or two) from the institution in charge of CSBC, and the Forum Chair is usually those in charge of PMD.

As with most high-quality scientific events, WIT has a technical Program Committee (PC) that evaluates submissions on relevance, coherence, contributions, potential impact, organization, and language. Currently, it accepts short (4 to 6 pages) and full papers (8 to 12 pages) divided into three tracks: Research, Tools, and Experience Reports (from teaching and outreach projects). WIT PC is
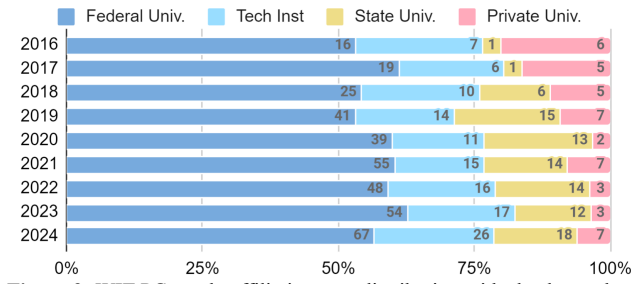
Figure 3. WIT PC yearly affiliation type distribution with absolute values.
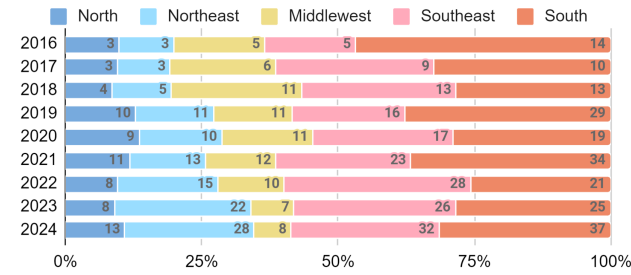

Figure 4. WIT PC yearly regional distribution with absolute values.

formed by (mostly) professors, as informed by the number of members affiliated with Federal, State, and Private Universities in Figure 3. This figure also includes people affiliated with Technical Institutions, most of which offer professionalizing high schools and higher education degrees. Besides those, only three people from Industry and international institutions have participated in WIT PC throughout the years.

Again, an essential criterion for defining a PC is regional distribution, as seen in Figure 4.[6] Such distribution is akin to the number of institutions and population within each region, most of which are in Southeast and South regions. Two other PC members' features are sex and city location (either the state capital or its countryside), illustrated in Figure 5. As expected, WIT PC is consistently formed by women, historically in the state capitals (usually the largest city and economy center within each state), a scenario that changed in 2024. This is WIT PC's and General Chairs' conscious decision: bringing more women to the spotlight. Indeed, the two most recent editions of WIT (2023 and 2024) have PC Chairs from institutions in the countryside (see Table 1).
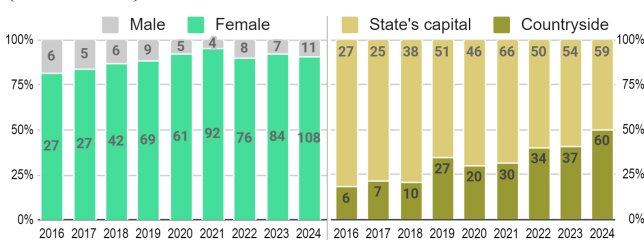

Figure 5. WIT PC yearly distribution by sex and location.

4 Methodology

This section goes over the methodology for a qualitative-quantitative study on the impact of WIT within the Brazilian community. The study has three parts: a survey of WIT numbers, an empirical investigation through opinion research, and analyses of results.

The first step is a simplified literature review of publications mentioning PMD, WIT, and related words in their title or abstract. The sources are SBC-OpenLib[7] and Google Scholar. After a complete analysis, five publications stood out and are detailed in Section 5.1.

The second step is to assess people's opinions about WIT and its potential impact on their lives and organizations. The investigation method is online opinion research with open-ended and closed questions. Opinion research (Survey) is defined by Molléri *et al.* [2016] as a method to collect and summarize evidence from a large representative sample of the population's general interest, whose response results are combined to identify patterns that can be generalized to the general population or yet compared with different populations and evaluated over time. Hence, the research was organized into three stages: (*i*) Planning; (*ii*) Execution; and (*iii*) Analysis and Communication of Results.

Planning entails defining the research objective and target audience. Then, the following research question is defined: "What is the potential impact of WIT within the Brazilian community?" As the target audience, this study considers professors, teachers, students, and industry professionals who have participated or heard about the event, including WIT authors, readers, coordinators of partner projects, and students participating in PMD partner projects.

Next, *Execution* includes the instrument design activities, instrument evaluation, and response management. The Survey consists of 33 questions directly related to the research objective, plus others based on related literature [Alvarado and Judson, 2014]. Specifically, it covers the following aspects: Participants Profile; Previous Participation in WIT; Meaning and Impact of WIT; Computing, and Gender.

Some questions were specifically designed to capture the participant's perceptions about WIT's impact. Firstly, about the participant's perception of the successful story of WIT, with two questions, "What is your perception of the following statement: WIT is a success case!" and "Could you give us examples, without identifying yourself, that illustrate your perception recorded in the previous question?". Secondly, there are three different questions to investigate WIT's impact: "What is the impact of WIT on your life/partner project/Brazilian Computer Society?". Such questions were only asked to people who have participated at least once in WIT. Additional questions were designed to capture participant's perceptions about how inclusive the events are regarding gender diversity. We used the Lickert scale with the following questions: "CSBC and most SBC events are inclusive concerning gender

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[6]Currently, each region is formed by the following states: North – Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, Tocantins; Northeast – Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Sergipe; Midwest – Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul; Southeast – Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo; and South – Paraná, Rio Grande do Sul, Santa Catarina.

[7]SBC OpenLib: `https://sol.sbc.org.br`

diversity" and "The national events in my area are inclusive about gender diversity".

The Survey was available from February 2 to February 18, 2024. The authors have distributed it through social networks, to specific groups of women with ties to the Brazilian Computer Society, via email to coordinators of partner projects, and to authors of WIT proceedings 2019 to 2023 – all of which are publicly available.

This Survey observes ethical aspects from the research design stage during data collection and analysis. The main definitions include that the data collected should not allow identifying participants and should only be reported in an aggregated form, guaranteeing anonymity and privacy. Its first section discloses a FICT (Free and Informed Consent Term), which details the research (objectives, responsible researchers, benefits, and risks) and collects the consent of respondents agreeing to participate.

Finally, for *Analysis and Communication of Results*, the data obtained from the questionnaire were analyzed quantitative and qualitatively. In the former, descriptive statistics represent and inform the data and participants' opinions through absolute values, percentage values, and graphs. Then, in the latter, we conducted a top-down analysis of the collected data to identify relevant codes [Charmaz, 2006] that emerged from the participants' answers. Coding-wise, we took an inductive approach, allowing our codes to emerge from our initial contact with the data while recognizing that abductive reasoning played a role. As our study focuses on the participants' opinions about WIT's impact, most of the code had to do with it. Two of the authors coded the data. Each coded the data related to all participants and arrived at an initial set of independent codes without a dedicated data analysis tool.

In investigating the participants' perception of WIT success, we put the data through three coding cycles and then generated 45, 32, and 12 codes. This process resulted in 153 highlights. The subsequent codification was over data about WIT's personal and Community Impacts. We considered two cycles of coding, which resulted in nine and seven codes, with 56 coded excerpts as a result (see specifics within Section 5.2). The analysis of the answers for WIT's impact on the participants' activities and organizations went through two coding cycles, which generated 12 and 8 codes, with 90 coded excerpts as a result.

Finally, the analysis of the answers for WIT's impact on the Brazilian Computer Society (as institution) and as a community took place through three coding cycles, which generated 14, 12, and 7 codes, with 67 coded excerpts as a result.

5 Results

This section presents the impact of the history of WIT during these 18 years through quantitative and qualitative analyses. Section {5.1 discuss the results of the simplified literature review of publications. Section 5.2 shows the empirical study results.

5.1 Survey over WIT Numbers

A dozen publications are analyzing the impact of WIT, mainly from a bibliometric point of view. The study by Cesario *et al.* [2017] was the first article to highlight WIT impact by analyzing the publications from its first call for papers through a systematic review. The authors mapped the projects and actions in Brazil that were presented in such publications. Although evaluating papers from a single edition, the study emphasizes the relationship between WIT and projects to get more girls into Computing. Such projects are spread across all Brazilian regions, and most are linked to public universities. Hence, the intrinsic view of WIT as a space to report outreach female-oriented actions in Computing has been noticeable since its first call for papers. Meanwhile, most projects identified are partners with PMD, which indicates the consolidation of the program at a national level.

Santana and Braga [2020] ran a scientometric analysis over CSBC events (including WIT) from 2017 to 2019. The study showed WIT was the third CSBC event with the most significant number of works among the congress' base events, although it is the newest among them. Also, within the events analyzed, WIT had the most women as the main authors. Hence, WIT appears as a factor in increasing the number of female authors and participants at CSBC.

After, Bordin *et al.* [2021] focused on WIT editions from 2016 to 2020, and expanded the indicators related to its scientific outcomes and collaborations. By then, 154 papers had been published in WIT, and those from the 2016 edition had the highest number of citations. Moreover, there was significant progress in the WIT number of authors, from 82 in 2016 to 155 in 2020. The study also highlighted that WIT has been strengthening itself as a space for exchanging experience and knowledge within an active community engaged in discussing women in technology, and the indicators improvement is directly related to PMD, which shares its initiatives through scientific publications by its partner projects.

By 2023, in no edition did the amount of authorship by men exceed 20% [Carvalho *et al.*, 2023b]. Considering the other CSBC events, this phenomenon is unique: when analyzing the authorship of a decade of CSBC longest-running events, in no year, in any edition, and any event has the amount authored by women surpassed that of men [Carvalho *et al.*, 2023a] (i.e., such finding reinforces WIT agenda). The closest to a tie happens at both the Computer Education Workshop (WEI) and WPerformance in 2021, when the number of primary authors divided by sex is the same.

As for regional distribution, Carvalho *et al.* [2023b] show the first 12 institutions with the highest number of authorships are outside the Southeast region (i.e., the one with the largest population and highest number of universities). Furthermore, all the other Brazilian regions are covered by UnB and UFMT (Midwest), UTFPR (South), UFC and UFPB (Northeast), and UFAM (North).
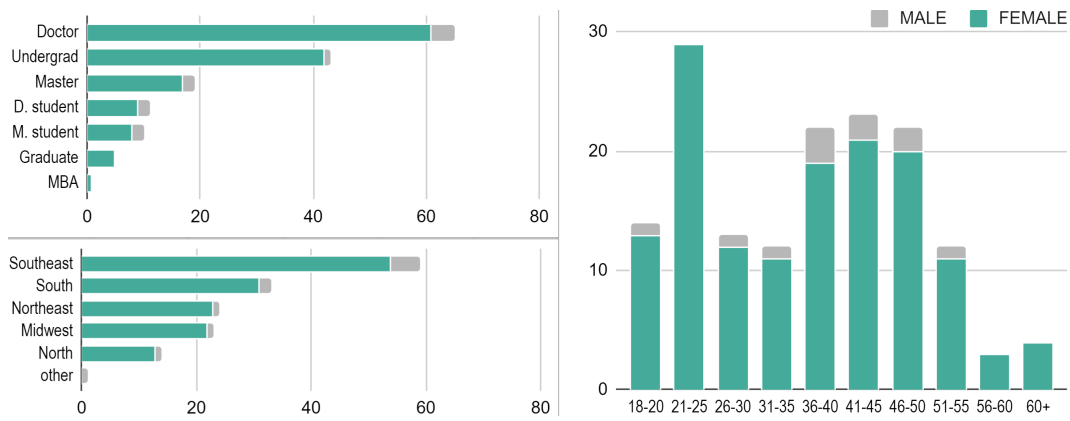
Figure 6. Respondents' profile in absolute numbers: education level (top left), location (bottom left), age group (right).

Table 2. Respondents' participation at CSBC (rows) and WIT (columns).

	WIT Participation			
CSBC	Never	1 time	2 - 5 times	6+ times
Never	**34**	1		
1 time	5	**30**		
2 - 5 times	4	12	**44**	
6+ times	1	1	11	**11**

5.2 Empirical Study Results

This section groups the results into the following categories: Participants' Profile; Participation in WIT; WIT's personal impact; WIT's community impact; WIT Experience and Meaning; Other Computing and Gender issues.

5.2.1 Participants' Profile

The survey obtained 154 valid responses, of which 143 people (92.9%) identified as female and 11 as male. There were no answers for "prefer not to answer" and "others". All respondents are over 18 years old. The age group with the highest number of responses (29,2%) is 36 to 45 years old, followed by the 18 to 25 age group (27,9%); then, the age group of 46 to 55 represents 22,1% of the responses; 26 to 35 years old, 16,2%; and 4,6% of participants are older. Figure 6 (right side) presents the absolute numbers for age groups divided by sex.

Regarding education, 41.6% participants hold doctorate degrees; 27.9% are undergraduates; 12.3% hold master's degrees; 8% are doctoral students (or candidates); 6.5%, master's students; 2.6% are graduated; and the remaining 1.1% fall into the specialization level such as MBA. Figure 6 (top left) presents the absolute numbers divided by sex.

Another relevant profile feature is where each respondent lives. The survey considers the Brazilian regions to be the granularity for such a question: North, Northeast, Midwest, Southeast, and South. Figure 6 (bottom left) presents the absolute numbers of respondents for each region, which translate to the following percentages: Southeast 38%; South 21%; Northeast 16%; Midwest 15%; and North 9%.

Regarding current occupation, most respondents are teachers or professors (51.9%), followed by 24.7% undergraduate students, 9.1% Industry professionals, and 6.5% Graduate students. The remaining 7.8% include retirees, post-docs, federal employees, and primary education teachers.

As for academic education or training area, practically half of the respondents (49.4%) selected Computer Science, followed by 15.6% Information Systems, 6.5% Computer Engineering, 4.5% Software Engineering, and 4.5% other Engineering majors. The remaining participants include those from: Mathematics, minor degrees in Computing, Chemistry, Pedagogy, Statistics, Psychology, among others.

5.2.2 Participation in WIT

Of 154 respondents, 110 (71%) have previously participated in WIT. As WIT happens as a CSBC core event, the survey has two correlated questions regarding both events. The first covers participation (or **not**) in both CSBC and WIT. Table 2 shows the results: each line has the amount of respondents who have never been to CSBC, and those who have participated once, two to five times, and six or more times; accordingly, each column shows the same statistics regarding WIT. For example, out of 154 respondents, 34 have never participated in either CSBC or WIT; five have participated once in CSBC but never in WIT; and so on.

Second, for those who have been to WIT previous editions, the survey provides an opportunity to inform the first and the most recent editions a person has participated in. Table 3 shows the results: each line has the amount of respondents who have participated in WIT for the first time that year; accordingly, each column amounts to the most recent participation (i.e., the most recent participation happened that column year). For example, out of 110 respondents, only three have participated in WIT for the first time in its first edition (2007) and the most recent one (2023) as well; 18 people participated in WIT for the first time last year (2023); and so on. The yellow-colored cells represent those who have been only once to WIT, where the first and the most recent participation fall into the same year.

5.2.3 Participants' Perception about WIT Success

This section presents the opinions of those respondents who participated at least once in WIT about how successful WIT is. Figure 7 shows the results on the Likert scale, from rating **5** (totally agree) to **1** (totally disagree), where **3**

Table 3. 110 Respondents' first (rows) and most recent (columns) participation in WIT.

First participation	2013	2014	2016	2017	2018	2019	2020	2021	2022	2023
									Most recent participation	
2007 (Rio de Janeiro)									1	3
2008 (Belém)										1
2009 (Bento Gonçalves)										3
2010 (Belo Horizonte)								1		
2011 (Natal) - 1st Forum										1
2012 (Curitiba)										1
2013 (Maceió)	1									1
2014 (Brasília)		2						2	1	1
2015 (Recife)										1
2016 (Porto Alegre)			1				2		1	1
2017 (São Paulo)				1					1	5
2018 (Natal)					2					4
2019 (Belém)						2			1	4
2020 (online)							1	3	4	12
2021 (online)								6	2	4
2022 (Niterói)									8	6
2023 (João Pessoa)										18
Total	1	2	1	1	2	2	3	14	20	64

means neutral for WIT participants on "WIT is a success case'. Out of 110 respondents that have previously participated in WIT, 96 (87%) "totally agree" that "WIT is a success case", nine (8,18%) "partially agree", and four (3,63%) are neutral.

Considering only people who "totally agree" ("WIT is a success case"), we coded their 96 answers to "Give us examples that illustrate your perception about the affirmative" and arrived at a code book. Figure 8 presents the high-level categories derived from aggregating the consolidated codes. The most frequent category is WIT's **Annual Growth**, which characterizes instances where participants stated the event's growth is noticeable regarding the number of participants, sponsorship, submissions, and days. For example, one person stated, "*WIT always has large attendance, with full sessions and an ever-increasing number of submissions.*"

Next, **Diverse and high-level programming** (with high-quality keynotes, papers, and organization) was also highlighted as a reason for WIT's success. For instance, one respondent argued that "*The work generated at WIT is of high quality and guides ideas and projects throughout Brazil.*"

The next most frequent category is WIT's **Participants' engagement**, which highlights that WIT is a strong community of engaged people. The event promotes and stimulates engagement between teachers and students, with a lively and interactive space as shared by one respondent: "*The event gives visibility to partner projects, allows interaction between students and teachers, and encourages the academic community's engagement in the cause.*" Another respondent informed "*I feel myself represented and part of a strong and impressive community.*"

Another recurrent topic was its **Large audience**, which includes professors, teachers, researchers, students, professionals, women, and men. One of the respondents sums it up by stating, "*WIT is the event with the highest attendance, participation of CSBC.*"

Other categories are related to WIT's upbeat atmosphere. For example, **Warm environment** characterizes instances
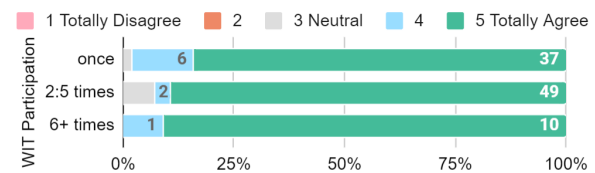
Figure 7. Likert agreement for WIT participants on "WIT is a success case", sorted horizontally by the number of times a person has participated in the event (no one has marked ratings 1 and 2) – absolute values within the bars.
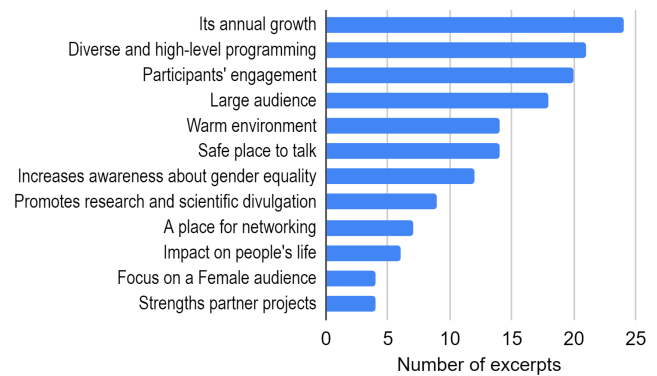
Figure 8. Distribution of coded excerpts per code for the question "Why is WIT a success case?"

with statements on WIT offering an environment where women feel welcome to discuss and share. WIT also causes feelings like the sense of belonging, excitement, inspiration, and pride. Then, the **Safe place to talk** category shows WIT is a place for open dialogue between professionals and students about challenges, solutions, and collective and personal obstacles as stated by one respondent: "*It is a space for important discussions and an opportunity for students to present highly relevant work.*" Plus, WIT has a **Focus on a Female audience**, as shared by "*It's important for us as women to have an event so rich in knowledge and focused on us.*"

The category **Strengths partner projects** refers to the positive effects WIT has on Partner Projects, then being a place where project members can meet others, interact, share initiatives, and even combine forces into new endeavors. The category **Impact on people's life** also gives examples about how WIT is transformative: "*The feedback from students who participated in person or online was very positive; they often report transformative experiences.*"

Then, WIT **Increases awareness about gender equality** is an interesting category, as highlighted by one respondent: "*The event has existed for almost two decades, being responsible for placing gender issues in the spotlight on an ongoing basis, promoting research, extension, and education. It seems difficult to imagine greater success!*"

Regarding the answers from people who "partially agree" with WIT being a success case, we cannot find any divergent category. Still, one excerpt showed expectations and opportunities to improve the event: **Lack of data about students**, on whether students participating in PMD actions have continued in the area.

Last, we coded the remaining five answers from people who are "neutral" to WIT being a success case. We arrived at two categories derived from two excerpts: **Doubts about the benefits**, and **Lack of interaction between teachers and students**. Both categories are divergent from some of

Figure 9. Distribution of coded excerpts per code for the question "What impact does WIT have on your life?"

Figure 10. Distribution of coded excerpts per code: "What is the impact of WIT on the project you participate in and/or the organization you work for?"

the previous twelve codes. Precisely, **Doubts about the benefits** belittles positive views about WIT benefits: **Promotes research and scientific divulgation**; **A place for networking**; **Impact on people's lives**; and **Strengths partner projects**. From the same perspective, the code **Lack of interaction between teachers and students** diverges from the positive category **Safe place to talk**.

5.2.4 WIT's Personal Impacts

This section starts with the results of a sequence of three questions that form further qualitative analysis, i.e., the codes and categories that emerged from the study and their relationships to answering three distinct questions. The first question is (*i*) "What impact does WIT have on your life?"

After coding all 81 answers for question (*i*) – limited to those from respondents who have participated at least once in WIT, the categories that emerged from the data are illustrated in Figure 9. The categories show WIT positively impacts students, teachers, and researchers in many ways. The most frequent category is **Motivation to act**, which characterizes instances where participants stated how the event motivates them to continue with their projects, create new projects, and take the ideas discussed back to where they live/work. One respondent informed "*WIT is the fuel we need to encourage us to work more engaged every day, as while participating in the event, we come across many brilliant ideas, so we get excited, and want to do something incredible to share in a future edition of the event.*"

The other categories reveal deep personal and professional impacts. WIT **Improves my knowledge** is about how the event provides a foundation to work with the problem (gender gap in STEM) and increases awareness about the challenges. A respondent illustrates this by stating, "*Professionally, it provides a significant foundation to deal with the Computer Education projects that I have been working on.*"

Some respondents also shared how the opportunities for talking and discussing during the event and the welcoming environment promoted by WIT make them feel part of the community and improve their **Sense of belonging**. For instance: "*Participating in WIT made me feel like I belonged to the field of Computing*", and "*It made me feel part of something much bigger, bringing together girls and women with common purposes.*"

WIT also encourages the participants **To keep up in the field** and **To research**, as exemplified by the following excerpts: "*WIT encourages women to continue in the field, which is mostly male, as well as to compete for leadersh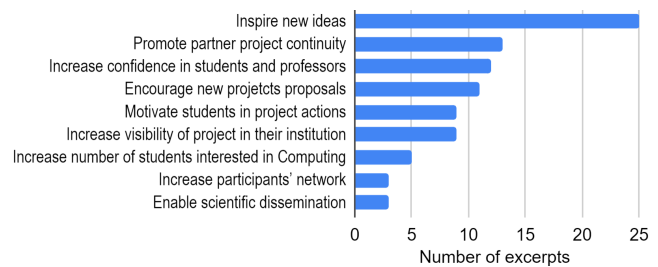ip positions*", and "*It completely changed my undergraduate experience, being the event that sparked my interest in the world of research.*"

Finally, WIT **Empowers** and strengths people to keep going and understand their role in the field by increasing self-esteem and belief in oneself, as stated by: "*WIT helped me understand my role in supporting STEM*", and "*Meeting women who are very successful in the field made me believe in myself more.*"

5.2.5 WIT's Community Impacts

After presenting personal impact (previous section), we complete the impact analysis at the community level through two further questions: (*ii*) "What is the impact of WIT on the project you participate in and/or the organization you work for?"; and (*iii*) "What is the impact of WIT on the Brazilian Computing Society?"

After coding all 81 answers for question (*ii*), Figure 10 presents the resulting codes. The most common one is **Inspire new ideas**, which is also reinforced by **Encourage new project proposals**. One participant shared that WIT "*encourages and inspires them to carry out project actions with high school and undergraduate girls*", and another said that "*I already wanted to do something; and after being at WIT, I started to formalize the idea of an extension project.*"

A significant one comes in second place, **Promote project continuity**, i.e., WIT positively impacts the will of coordinators to keep going further with their project initiatives. It recognizes WIT efforts towards helping the whole community of projects in their endeavors, working to applaud their achievements through awards during WIT, and giving voice to their coordinators who work voluntarily throughout the years. Evidence from participants' answers shows how WIT is relevant in the National scenario of creating projects to tackle the issues of gender inequality in Computing. Participants share that WIT promotes "*High impact as it encourages and values projects engaged on this front*" and "*WIT has been the moment for the project to rethink and redefine its goals internally; it is the event where we always submit articles associated with our project.*"

Another key perspective on WIT's impact relates to **Motivate students in project actions**. As the previous code is essential to project coordinators, this affects their teams, as each project cannot depend solely on its coordinator to do everything. One respondent revealed that WIT "*(...) allows girls/students to feel part of a group, increasing their confidence in themselves. (...) Girls feel more motivated to act, interact, publish and share their*

work." Another respondent highlighted that WIT "*Increased motivation of scholarship holders participating in the project.*"

Still, from the students' perspective, an important code is **Increase number of students interested in Computing**, as this is the ultimate goal for PMD and WIT. Our survey has at least five participants informing that "*The number of students has increased a lot, thanks to the project of the teachers involved in WIT*;" "*The project has been active since <ommited> and has had excellent results: attracting female high school students to the area of Computing and encouraging students who are already at the University in Computing to stay and complete the course*;" and "*The project impacted high school girls, who became students of the computing course and are now colleagues!*"

Now, putting together students' and coordinators' perspectives, **Increase confidence in students and professors** has a severe impact. As related literature points out, lack of confidence jeopardizes both women's academic path and professional careers [Baker and Bourke, 2022; Efe and Hallegraeff, 2020]. When people experience a lack of self-confidence, they are more likely to give up, choose more straightforward tasks, or pursue activities in another domain [Helgeson, 2016]. On the other hand, "The positive impact that self-confidence has on a person's performance consequently stimulates action" [Helgeson, 2016]. Having WIT playing a pivotal impact on their confidence is a noticeable result on the faces of participants at the end of the event, as well as at the group picture as shared by one respondent: "*The feeling that you are not alone; there are other people who share the same goal of a stronger presence of women in computing.*"

Different facets of impact were also coded from (potentially) coordinators' perspectives: **Increase visibility of projects in their institution**. This is mainly due to the buzz WIT creates (mostly online) during the event and in its preceding and following weeks. One respondent shared that "*The participation of our project in WIT brought us visibility and greater institutional support. I have already managed to organize a caravan with a bus provided by the institution to participate in the event in another state.*" Another informed that "*Today the project is almost seven years old and has great relevance at an institutional level with good representation in the region.*"

Finally, the last two codes for these answers are somehow expected due to the nature of any event: **Increase participants' network** and **Enable scientific dissemination**, as shared by respondents: "*WIT is an opportunity for the students who accompany me to broaden their horizons, network and really understand that Computing is a concrete career option*;" and "*WIT is always the time to take the results of activities and actions to the scientific community, and still be able to learn and have new ideas from the dedicated work carried out by other projects*."

Now, the final question on community impact (*iii*) relates to the Brazilian Computing Society. Figure 11 shows most categories are optimistic about how WIT impacts the Brazilian Computing Society. The most common category, **Fight gender bias**, shows the feminist activism
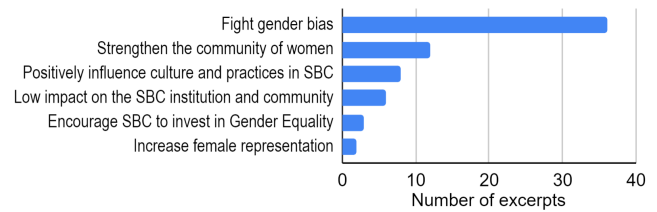

Figure 11. Distribution of coded excerpts per code: "What is the impact of WIT on the Brazilian Computing Society?"

characteristic of WIT. Through discussion spaces, panels, lectures, conversation circles, and more, the event enlightens data and evidence from private and public organizations and scientific research. Participants do recognize it with claims such as: "*(WIT has) a significant role within the Computing Community; for encouraging women to enter the Computing area, promoting diversity and inclusion, creating opportunities for women to participate in network initiatives, and fighting gender bias associated with the area technological*"; and "*In general, (...) WIT brings more visibility to gender issues in technology and is concerned with the continuity of actions and research in the same.*"

A related code is in second place, **Strengthen the Community of Women**. Not surprisingly, participants recognized the importance of WIT and SBC being aligned to bring the spotlight to its female force. As one participant claims: "*Through WIT, SBC opened a space for dialogue with its women's community, attracting specialists from different areas of expertise.*"

An important dimension of how WIT impacts the community comes to light with two codes: **WIT Positively influences culture and practices in the Brazilian Computing Society** and **WIT increases female representation** in our community. According to some respondents, "*WIT goes beyond promoting debate; it manages to impact all areas of computing and promotes discussion at a national level, mainly because it is involved with the SBC.*"; "*The event has a great impact as many men started to participate and see our struggle, as well as support and reduce differences*; and "*Establish the idea that it is necessary to continue fighting for inclusive spaces.*"

Still, SBC members are male in the majority, as claimed by one respondent "*WIT increases the representation of women in the computing field, which men have historically dominated.*" The lack of female role models, for instance, in various areas of knowledge, professions, and leadership positions, also reinforces the stereotype and creates a feeling of "exclusion" or "not belonging" [Steele and Aronson, 1995]. Hence, a cultural evolution based on science supported by SBC, through discussion and concrete actions within all community levels, is essential to changing cultural obstacles to gender equity.

In such a context, the code **Encourage SBC to invest in gender equality**, in turn, shows the fundamental role of WIT in the issue of women in technology, as it is responsible for capturing the attention of SBC to the subject. From the perspective of some respondents, "*WIT has a positive impact in the sense that it increases SBC's interest in investing in the issue of gender and equity*", and "*WIT*
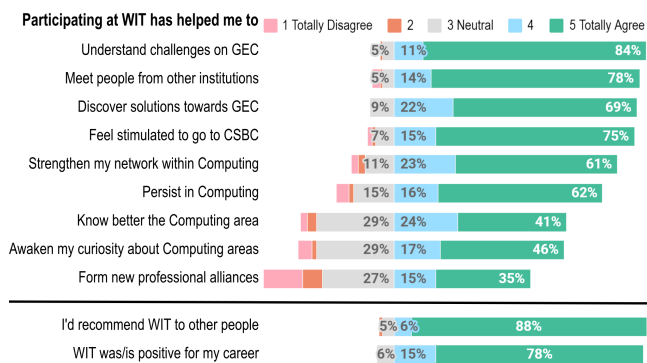
Figure 12. Agreement Likert scale for nine claims on the potential benefits of participating at WIT (sorted by ratings 4 and 5 combined), and two overall claims (recommendation and career) – absolute values within bars; GEC stands for Gender Equality in Computing.

assists SBC in being recognized as an inclusive organization."

However, the final category **Low impact on the SBC as institution and community** requires thinking. Some respondents point to barriers within SBC to advance the agenda of closing the current gender gap. One of them affirms that "*the events have individually handled how to add more women as panelists and table participants, but there is still a lot of improvement needed because, unfortunately, women still need to prove how competent they are to be recognized.*" And another respondent highlights that "*WIT gives more visibility to SBC, than SBC gives visibility to WIT.*"

5.2.6 WITs Experience and Meaning

In addition to the open questions from the previous sections, the questionnaire also presented a set of claims about what it means to participate at WIT. The respondents who had participated at least once in the event evaluated these claims using a Likert scale. Figure 12 shows the results, from rating **5** (totally agree) to **1** (totally disagree), where **3** means neutral. The figure is separated into two parts: the top has nine claims on what WIT has provided to its participants. The bottom finishes with two general affirmatives on whether the respondent would recommend it to other people and whether it is/was favorable to their career.

For all affirmations, at least half of the respondents "Agree" or "Totally Agree". The first four claims have at least 90% of agreement. On the other side, forming new professional alliances is not a reality for half of the respondents. Still, an impressive 94% of respondents would recommend WIT, and 93% have positively impacted their careers due to WIT.

5.2.7 Computer and Gender Issues

Finally, it is important to try to understand why people would not go to WIT and compare their feelings about gender diversity with those of those who have participated in it. We do so in two sets of questions.

First, the questionnaire presented a list of eight potential reasons for the respondents who have never participated in WIT (44), and each person could select more than one. The

results include: "Lack of financial resources" (29 respondents selected it); "Scheduling conflicts" (12); "Lack of time" (11); and "No paper accepted for presentation at WIT" (7). Only two respondents selected "Lack of interest in the issues addressed at the event".

Then, the last part of the questionnaire is the same for everybody and presents two claims on how the respondents perceive CSBC and SBC *events* in general, as well as events in their areas of expertise, and two on the importance of working towards greater *diversity and gender equity* and having moments within the events to discuss such issues. All claims were evaluated with a Likert scale.

Figure 13 presents the results: at the top for the first two (events); at the bottom for the other two (diversity and gender equity); on the left side for WIT participants; and on the right side for people who have never participated in WIT. The results are enlightening. Everyone agrees that greater diversity and gender equity are essential and should have their moment within events (bottom). Now, more WIT participants "(Totally) Disagree" with inclusive events! Such results show people who go to WIT are either more aware of bias and prejudice (among other obstacles) against women in Computing or genuinely bothered by it. Still, whether WIT causes such awareness or bother is a chicken-egg situation.

6 Concluding Remarks

For the last 18 years, through WIT, SBC has met annually to discuss and share challenges, barriers, opportunities, and achievements related to Gender Equity in Computing. WIT's growing number of participants, citations to its published papers, and submissions over the years are clear evidence of its success. Still, this article aimed at exploring "What is the impact of WIT within the Brazilian community¿' The various facets of its answer are explored here through an online survey.

Our results show that the majority of its participants recognize WIT as a successful event. The number of articles submitted for evaluation has increased in most years, showing significant growth in both PMD partner projects and the WIT audience. Moreover, WIT has been promoting relevant impact on people, institutions, and the SBC (community).

Regarding personal impact, the results show the event stimulates feelings, thoughts, and behaviors such as motivation, empowerment, sense of belonging, and confidence that promote self-efficacy (i.e., perceived capabilities to learn or perform well in a specific field) for both students and professors. As discussed by Social cognitive career theory (SCCT) [Lent *et al.*, 1994], individuals are more likely to show interest in the domain in which they believe they are capable. By increasing its participant's self-efficacy, WIT has an enduring, unmeasurable impact on their personal and professional lives.

At institutional levels, results indicate WIT goes beyond CSBC borders by breaking barriers at the institutions that house PMD partner projects. Clear examples include the
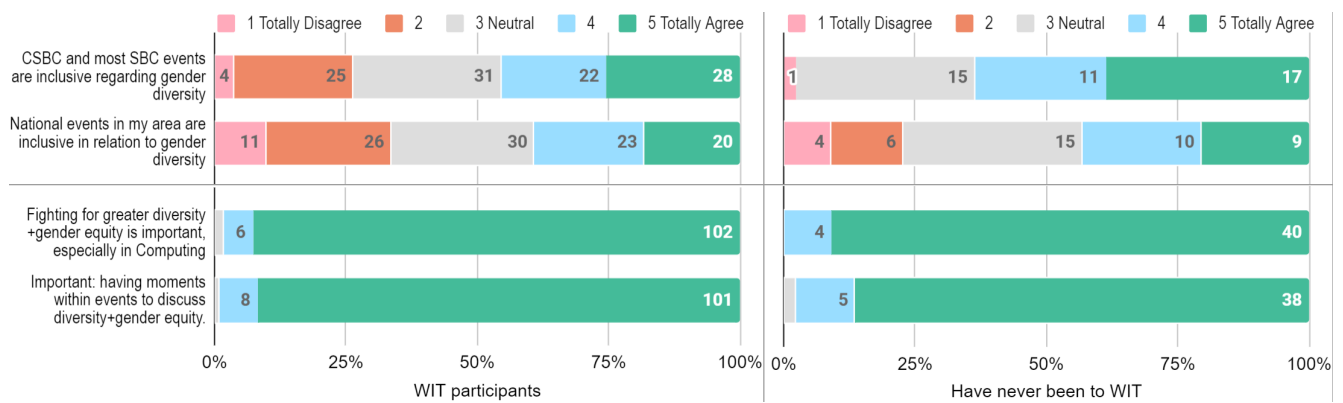
Figure 13. Agreement Likert scale for four final claims according to: WIT participants (left) and people who have never been to WIT (right) – absolute values within bars.

motivational actions of coordinators and student volunteers in their schools and an increasing number of students interested in Computing.

Then, the overall computing community will also be positively affected! WIT trailblazers the path to deconstructing stereotypes by promoting cultural changes, improving gender representation, and strengthening the female community. Such actions are essential to fight male dominant *status quo* and feelings of "exclusion" or "not belonging", leading the Computing community to a broader, more equitable future.

As a conclusion of our findings, we highlight three main contributions. First, the mappings resulting from this research may guide SBC and PMD community towards a working agenda (with policies and strategies) for encouraging/enabling women's participation in CBSC; promoting gender equity in all National events; expanding PMD even further to all Brazilian regions (especially North, Northeast, and Central-West); and increasing insertion in the countryside. Second, WIT plays a fundamental role in attracting more women to Computing by stimulating discussion, engagement, continuity, and innovation among PMD partner projects during the event. Thus, this event should be considered strategic to SBC since it brings value to the society and its members. Third, our research contributions highlight the importance of praising women's leadership (primarily through PMD partner project coordinators), as results show how the event supports them to see themselves and others as leaders.

This is PMD's first nationwide study on WIT impact. Hence, questions derived from its limitations need to be answered by further research. Specifically, an organized effort should continue collecting feedback from WIT participants for comparison and evaluation analyses, as well as extending the questionnaire to even broader discussions.

Declaration

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Authors' Contributions

Luciana C. C. Salgado, **Mirella M. Moro**, and **Aleteia Araújo** are the main contributors and writers of this manuscript, with the other authors aiding in specific sections. **Cláudia Cappelli**, **Fabíola Nakamura**, **Thalia S. de Santana**, and **Renata V. de Figueiredo** were responsible for data curation. **Luciana C. C. Salgado** leads the qualitative analyses, whereas **Mirella M. Moro** leads quantitative analyses and visualizations. All authors read and approved the final manuscript.

Competing interests

The authors declare they have no competing interests.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available in: `https://zenodo.org/records/11092393`

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