

womeninoss.com: Supporting women participation in OSS communities with an online platform

Gessyca Moreira
Department of Information Systems
Federal Institute of Minas Gerais
Ouro Branco, BR
0027559@academico.ifmg.edu.br

Juliana Freitas
Department of Computer Science
Federal University of Rio Grande
Rio Grande, BR
juliana.freitas@furg.br

Sarah Burvant
Department of Computer Science
Louisiana State University
Baton Rouge, USA
sburva1@lsu.edu

Caitlynn Sengchiam
Department of Computer Science
Louisiana State University
Baton Rouge, USA
csengc1@lsu.edu

Suelen M. de Paula
Department of Information Systems
Federal Institute of Minas Gerais
Ouro Branco, BR
suelen.mapa@ifmg.edu.br

Felipe Fronchetti
Department of Computer Science
Louisiana State University
Baton Rouge, USA
ffronchetti@lsu.edu

ABSTRACT

Women are severely underrepresented in open-source software (OSS) communities, accounting for only 10% of overall contributors [20]. Unlike their male counterparts, women often face gender-specific barriers that diminish their participation in open source, including issues such as impostor syndrome, gender bias, and a lack of visible role models [20]. These challenges create a compounding effect that perpetuates their underrepresentation and limits their contributions within OSS projects, highlighting the need for interventions that can foster more inclusive and equitable environments. To support women to overcome these challenges and promote their participation in OSS, we propose the development of *womeninoss.com*: an online platform designed to educate, empower, and support women’s involvement in open-source communities. Designed to support both newcomers and maintainers in OSS, our web-based platform offers research-driven insights on gender inclusion in open source, along with a suite of practical tools to help individuals and communities increase and sustain women’s collaboration in OSS projects. In a preliminary evaluation of our platform, we invited 15 software developers to provide feedback on its significance, content relevance, and potential impact on fostering women’s participation in OSS. Our preliminary findings suggest that the platform was well-received, with participants highlighting its potential to serve as a valuable resource for both newcomers and community maintainers.

Demo video: <https://zenodo.org/records/15465699>

KEYWORDS

open source software, women, participation, platform.

1 Introduction

Open-source software (OSS) communities play an important role in the global development of software projects. Even individuals who never directly contributed to OSS projects often benefit from their widespread solutions and innovation. Notable examples include Firefox, a popular web browser maintained by the Mozilla free software community, and Python, one of the most prominent programming languages in the software industry, maintained by

the Python Software Foundation. OSS projects have a profound impact on the evolution of modern software, and most of the software products we use nowadays depend on them to exist [12].

Different from projects maintained by software companies, where employees are paid to continuously contribute to private repositories, OSS projects rely on a community-driven approach, with the source code of their projects being publicly available for anyone to access, modify, and contribute [12]. Progress in OSS projects is primarily performed by volunteers dedicated to keeping these projects active. For example, the Linux kernel (*the foundation of many operating systems used worldwide*), has registered contributions from over 16,000 volunteers on GitHub¹ alone. Similar values hold for other popular OSS projects, like the MySQL database management system and the Ruby programming language.

While the idea of developing software through voluntary efforts may seem idealistic, the reality is far more complex. Many OSS communities — *particularly the less-popular ones* — often struggle to attract and retain contributors [9]. Newcomers attempting to join OSS projects also often face significant onboarding barriers that discourage participation and hinder integration into these communities [2]. As a result, many developers abandon the process before even submitting their first contribution. These challenges are even more critical for developers from underrepresented groups. Women in OSS, for instance, not only face the technical and societal hurdles common to all contributors in OSS, but also face additional gender-related challenges such as the *lack of peer parity*, *stereotyping*, and the *impostor syndrome* [20].

To support the ongoing development of OSS projects, several online platforms have emerged. GitHub, for example, introduced a dedicated website (named *opensource.guide*) featuring guidelines for both newcomers and maintainers in the OSS ecosystem. Similarly, a group of software developers created *up-for-grabs.net* to help newcomers identify beginner-friendly tasks. While many platforms appeared with the common goal of facilitating OSS contributions, all of them largely overlook a critical aspect: the inclusion and participation of women in OSS projects.

To address this gap, we propose *womeninoss.com*, a web-based platform offering resources and tools to support women in OSS

¹<https://github.com/torvalds/linux/>

communities. Built using Jekyll, the website features gender-aware guidelines designed for both newcomers and project maintainers. It also includes two key tools: *PeerConnect*, a search engine that helps women identify and connect with peers in OSS communities on GitHub, and *BetterConduct*, a ChatGPT-powered tool that analyzes and suggests improvements to projects' codes of conduct with the aim of fostering greater respect and inclusion for women within these communities [17]. In a preliminary evaluation of our platform, we invited 15 software developers who identify themselves as women to evaluate the guidelines and tools available on our website. Our findings suggest that the platform successfully addresses key barriers faced by women entering OSS, particularly by increasing motivation and perceived preparedness to contribute. The high rates of reported motivation (93.3%) and improved confidence (86.7%) indicate that the combination of practical tools and gender-aware guidance is effective in empowering users, even those with minimal technical background. Although some participants still felt uncertain about overcoming structural challenges in OSS communities, the results demonstrate that *womeninoss.com* offers a solid foundation for fostering initial engagement and building inclusive pathways into open source participation.

2 Background

This section provides an overview of participation in OSS communities, with a focus on the gender-specific barriers that women face when contributing to open-source projects.

2.1 Participating in OSS communities

Different from private companies, open-source communities rely primarily on voluntary contributions to develop their software [6]. Developers interested in participating in OSS projects can engage with the community and submit their contributions through online coding platforms like GitHub and GitLab. Each OSS community establishes its own standards and practices for accepting contributions, often relying on structured workflows, such as *pull request systems*, to review, discuss, and integrate submitted changes [1]. Consistent contributions to an OSS project often lead to increased recognition and responsibility within the community, granting contributors greater influence in technical discussions and decisions. The more influential a developer becomes, the more responsibilities and rights within the community they will have. Developers who are new to a project are typically referred to as *newcomers*, while those with a long history of active engagement are considered *project maintainers* [14]. Maintainers are responsible for reviewing code, managing contributions, and guiding their community.

While the participation in OSS communities sounds like a promising and exciting idea for most developers, many newcomers tend to face challenges that discourage their participation in OSS projects. According to Steinmacher et al. [13], newcomers contributing to OSS projects often face challenges that extend beyond the technical aspects of software development. Many encounter social barriers that hinder their contribution process and discourage continued participation. Social obstacles identified in the literature include, for example, poor reception challenges, such as limited or delayed communication from maintainers, cultural differences among contributors, including exposure to rude or inappropriate messages,

and a general lack of guidance and mentorship. Without appropriate support and facing different barriers, newcomers give up on contributing to OSS.

However, as in software companies, OSS projects rely on a continuous onboarding of new contributors to remain sustainable, as older developers (e.g., *maintainers*) eventually step away from active involvement. This human dependency makes effective newcomer onboarding essential to the long-term health of open-source communities [23]. While studies show that common barriers often discourage newcomers from contributing to OSS, sometimes causing them to abandon contributions altogether, targeted support strategies are needed to reduce these obstacles and foster greater participation. No final strategy has been established yet across OSS communities to support newcomers' onboarding, and the challenge is even more rigorous for underrepresented groups in STEM, such as women, who face additional gender-related barriers that further hinder their participation in OSS [3].

2.2 Challenges faced by women

OSS communities rely on voluntary contributions to stay active. New contributors are expected, as veteran developers may eventually leave their projects. However, entry barriers often discourage new contributors from participating [16]. Women, a group already underrepresented in the broader software industry, face even greater challenges when attempting to engage with OSS projects. According to Trinkenreich et al. [20], while women are motivated to join OSS communities by factors such as learning opportunities and reputation building, they often encounter persistent gender-related obstacles in this context that reduce their interest in participating.



Figure 1: Challenges faced by women in OSS. Examples include toxic culture, stereotyping, and impostor syndrome. Illustration based on the work of Trinkenreich et al. [20].

Obstacles commonly found in other professional environments, such as non-inclusive communication, stereotyping, and bias, are equally present in open-source communities (See Figure 1). However, these challenges are often amplified for women. Issues related to community reception, previously identified as a general barrier for all newcomers, tend to be even more severe for female contributors. According to Trinkenreich et al. [20], developers reported instances where male contributors misinterpreted mentorship interactions as dating opportunities, an entirely inappropriate and unprofessional behavior. Additionally, the toxic culture that persists

in certain OSS communities has driven some women to conceal their identities when contributing, highlighting the extreme measures taken to avoid harassment or discrimination. The lack of peer parity in these communities reveals an even deeper issue: when confronted with barriers or inappropriate behavior, female developers often have no allies or support systems to turn to within the project. Supporting strategies and guidelines must be implemented, and that is why we created *womeninoss.com*: a web-based platform to support women in OSS.

3 Related Platforms

In this section, we review related work focused on supporting the onboarding of newcomers in OSS projects. We discuss how their efforts contribute to the onboarding process and outline how our platform is different from their approaches.

3.1 opensource.guide

The challenges faced by newcomers (*and ways to support them*) in OSS have attracted attention not only from academia but also from industry, as software companies increasingly recognize the importance of OSS communities to software development. GitHub, the leading coding platform owned by Microsoft, developed *opensource.guide*: a static website with guidelines designed to support both newcomers and maintainers in navigating and contributing to OSS projects. The website is organized into sections illustrated in cards, each addressing key aspects of OSS development. Some topics, such as “*How to Contribute to Open Source*”, are tailored specifically for newcomers seeking to join OSS communities. Others, like “*Finding Users for Your Project*”, are aimed at maintainers focused on fostering healthy, engaged communities. No additional resources are provided on the platform, only text-based guidelines written by experienced developers.

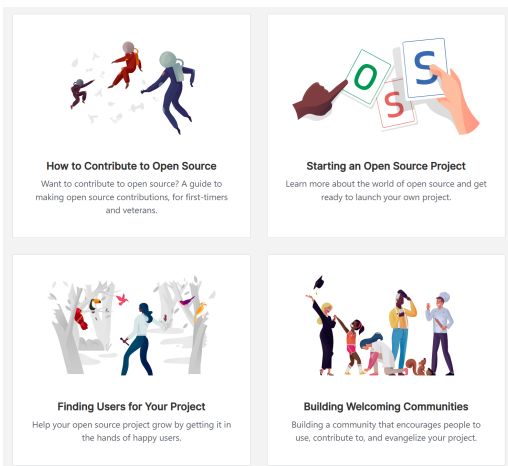


Figure 2: Examples of topics available on *opensource.guide*.

Although the *opensource.guide* serves as a primary resource for supporting newcomers in OSS, the platform does not address gender-related challenges, nor does it focus on promoting women’s participation. While the guidelines available on the platform are

valuable for all newcomers, they are not focused on fostering more diverse and inclusive environments. To address this gap, we position *womeninoss.com* as a gender-focused ally for *opensource.guide*, sharing a similar mission but tailored to the unique needs of women in OSS. Rather than replacing their guidelines, our platform is intended to work in harmony with GitHub’s initiative to promote participation in OSS communities, providing gender-related guidelines for newcomers and maintainers.

3.2 up-for-grabs.net

While *opensource.guide* offers text-based guidance for newcomers and maintainers in OSS, other online platforms focus on providing practical tools to support active collaboration. One such platform is *up-for-grabs.net*, a website that curates lists of newcomer-friendly tasks available for contribution in OSS projects. These tasks are marked with labels assigned by project maintainers on GitHub, the environment where OSS repositories are usually located. Newcomers interested in contributing to a project can use these labels to identify the tasks on the issue tracking system of the project. Common labels include terms like “*good first issue*” or “*beginner friendly*”, and *up-for-grabs.net* helps newcomers identify what labels the projects they want to contribute to are using. The platform also allows newcomers to filter OSS projects by language, name, and metadata information.

While *up-for-grabs.net* helps newcomers to find potential contributions, it does not address the gender-related challenges that women face when participating in OSS projects. Although identifying beginner-friendly tasks is a common barrier for newcomers joining OSS [13], we believe that additional aspects of the onboarding process, particularly those affecting women, should also be supported. Based on this, our website also introduces two tools: *BetterConduct*, which suggests inclusive improvements to OSS projects’ codes of conduct, and *PeerConnect*, which helps female newcomers identify and connect with other women contributors within OSS communities. Both tools are available within our web-based platform. As with *opensource.guide*, we envision *up-for-grabs.net* as a valuable ally in advancing women’s participation in OSS. Our platform complements their efforts by highlighting gender-related issues and providing extra support for women in OSS.

3.3 Honorable mentions

Other online platforms also aim to support newcomer participation in OSS. For instance, *firsttimersonly.com* offers guidance specifically tailored for individuals making their first contributions, while *codetriage.com* helps connect new contributors with OSS projects actively seeking participation. However, to the best of our knowledge, no existing platform focuses specifically on supporting and promoting women’s participation in OSS.

4 Our platform: womeninoss.com

If gender-related challenges create additional barriers for women to participate in OSS communities, action must be taken. To address this issue, we propose *womeninoss.com*: an online platform designed to educate and support both newcomers and maintainers in fostering women’s participation in OSS projects. The platform is

organized around three key components. First, it offers research-based guidance through a series of evidence-driven discussions that provide insights into how women can effectively join OSS communities and how projects can better support their onboarding process (See Figure 3). Second, it features *PeerConnect*, a built-in tool that helps women identify and connect with other female contributors (i.e., *peers*) within an OSS project of their choice. Third, it provides *BetterConduct*, a large language model (LLM)-powered assistant that helps project maintainers improve their codes of conduct with inclusive, gender-sensitive guidelines. In the following sections, we discuss the features and applications of our online platform.

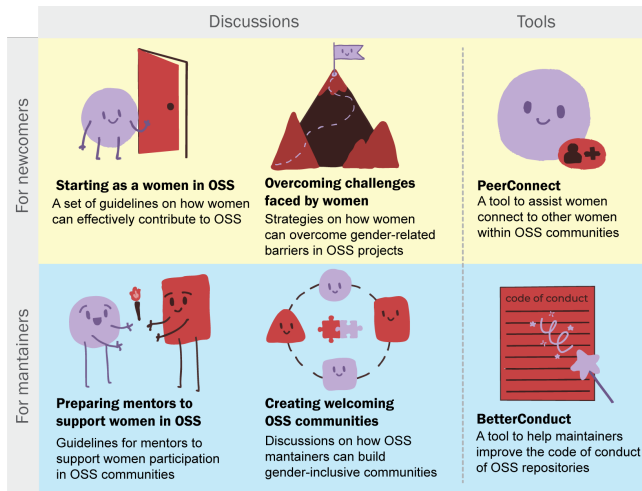


Figure 3: Description of components in womeninoss.com: Four research-driven discussions and two built-in tools, *PeerConnect* and *BetterConduct*.

4.1 Research-Driven Discussions

At first, our idea was to implement an online platform equivalent to the *opensource.guide* developed by GitHub. Similar to them, our goal was to provide orientation to newcomers and maintainers through text-based discussions, but with two major differences: (a) our website would be based on research-driven discussions (not experience-based), (b) our website would be focused on women's participation in OSS. We decided to focus the writing of our discussions on research-driven literature, as significant contributions are being made to the topic recently (e.g., [19, 20]). To do so, four authors were responsible for conducting an exploratory search for scientific papers related to women's participation in OSS projects. The engine used to perform the exploratory search was *Google Scholar*. In a preliminary meeting, authors were oriented to look for keywords associated with the topic to be discussed on our website, including but not limited to words such as: *women*, *open source*, *communities*, *development*, and *participation*. Although the search was not intended to follow a formal systematic review protocol, it was guided by relevance, recency, and accessibility of peer-reviewed literature. The authors were instructed to read the abstracts of the

research papers they found on *Google Scholar* and to record summaries of those relevant to the topic of our website in a shared online document.

The list of recorded papers included discussions on the relationship between gender and participation in OSS communities [7, 18], the nature of contributions made by women in OSS projects [5], and the challenges they face [19, 20]. During a second group meeting, the same four authors reviewed the selected papers, and each was assigned to write a specific discussion for our website. The topics of these discussions were collaboratively defined during the meeting, based on recurring themes from the literature and from the *opensource.guide* platform. Two authors were responsible for reading the final drafts of each discussion and making any necessary adjustments (e.g., fixing typos), and one author was responsible for creating illustrations for each discussion.

The discussions, primarily written as text-based documents, were translated to web-based format using Jekyll², a static site generator made in Ruby. A website template following the Jekyll standards was written using HTML and CSS, following the same practices of *opensource.guide*. Four discussions are available on our website at the moment. Two focused on newcomers, with one describing how to get started as a woman in OSS, and another on strategies for overcoming common gender-related challenges. And the other two discussions focused on project maintainers, one addressing how to prepare mentors to support women in OSS and another on how to foster welcoming and inclusive OSS communities for women's participation. Our goal is to add more discussions in the future.

4.2 PeerConnect

One of the key challenges women face in OSS communities is the difficulty in finding other women with whom to collaborate [20]. As minorities in most projects, the lack of peer parity can lead to feelings of isolation, often discouraging women from contributing or engaging fully with OSS communities. To support women in identifying potential peers within OSS projects, we developed *PeerConnect*: an automated tool that analyzes contributor data from GitHub-hosted repositories and recommends community members with whom women might share common ground. The tool offers a straightforward interface: on a dedicated page of our website, users can input the URL of a GitHub repository they are interested in contributing to. Once a URL is submitted, our backend system retrieves the list of contributors using the GitHub API. It then employs an external library to infer the gender of each contributor, highlighting those who are potentially identified as women. The list of potential women contributors is displayed on our website, along with relevant information that newcomers can use to connect with these peers (See Figure 5).

The backend system is implemented in Python using the *requests*³ library to parse information from the GitHub API and the *GenderComputer*⁴ library to guess the potential gender of each contributor. *GenderComputer* is a research-based [21], open-source library designed to infer an individual's gender based on their name and country of origin. It has been widely adopted in studies

²<https://jekyllrb.com/>

³<https://github.com/psf/requests>

⁴<https://github.com/tue-mdse/genderComputer>

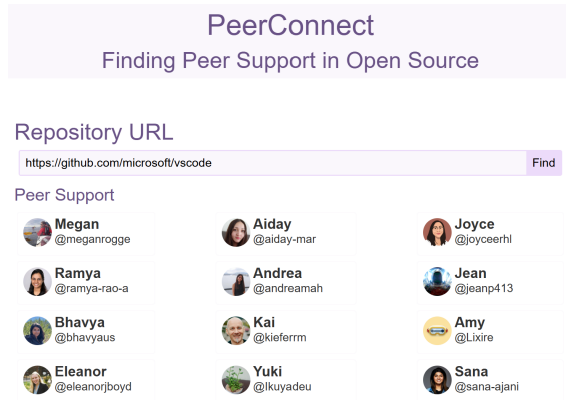


Figure 4: Example of *PeerConnect* usage with Microsoft's Visual Studio Code repository.

related to gender dynamics in software communities (e.g., [8, 22]). While effective in identifying potential peers for women, our tool does not account for other important factors that influence OSS collaboration, such as the contributors' availability to serve as mentors or their level of experience within the project. For further iterations, we plan to extend our tools with more in-depth functionalities, including practices used in other research-based tools such as YODA (*Young and newOmer Developer Assistant*) [4] and FLOSSCoach [15].

4.3 BetterConduct

Another critical challenge faced by women in OSS communities comes from cultural and social behaviors, including non-inclusive and toxic communication, and gender-based stereotyping [20][11]. Similar to the effects of limited peer parity, these factors can discourage women from participating in OSS projects, further contributing to gender disparities in the open source domain. To help prevent misbehavior in OSS communities, coding platforms like GitHub⁵ recommend that OSS projects include a Code of Conduct (CoC) file within their repositories. This file outlines the expected behavior of contributors, defines unacceptable behavior, and provides guidance on how to report conduct violations. By establishing clear community guidelines, communities can create a more inclusive and respectful environment for all contributors.

While CoC files are a great start for more inclusive communities, they do not necessarily address gender-related issues such as stereotyping and non-inclusive communication [20][11]. For this reason, we also made available on our website a secondary tool for project maintainers called *BetterConduct*. The functionality of this tool is also simple: On a dedicated page of our website, users can input the URL of a GitHub repository containing a code of conduct. If the file is publicly available, our backend parses the file content using the GitHub API and feeds its content to a custom LLM. This custom language model, built on a *ChatGPT-4o* instance, provides recommendations to enhance the CoC with the goal of fostering a more gender-inclusive community. The recommendations are displayed to the user on the website as a set of bullet points. A draft of

⁵<https://opensource.guide/code-of-conduct/>

the CoC file addressing the suggested recommendations, generated by the *ChatGPT-4o* instance, is also displayed for reference.

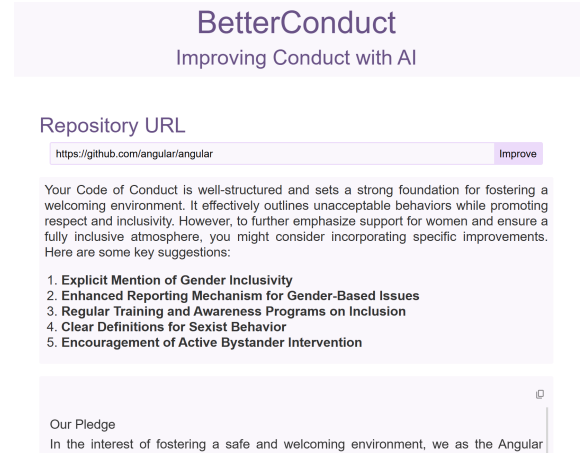


Figure 5: *BetterConduct* usage with Angular's code of conduct.

The backend of this tool was implemented in Python using the *requests* library for parsing information from the GitHub API, and the *openai* library to connect our script with the ChatGPT API. For now, the custom LLM model is based on a simple prompt (*available in our replication package*⁶) that instructs the AI agent to suggest gender-based recommendations for the code of conduct. In future iterations, we plan to expand the customization of our LLM model to adopt guidelines and practices suggested by the research literature we investigated in Section 4.1.

5 Preliminary Evaluation

To evaluate the potential impact of our platform on OSS participation, we conducted an online survey targeting women in the software industry. We chose this audience as they are potential (*if not*) contributors to OSS. We asked the survey participants to explore our platform and answer a set of questions. The questionnaire was adapted from a self-efficacy scale developed by Ann Quade [10] to fit the OSS context. The first two questions captured demographic information about participants. The following questions captured participants' knowledge and perceived challenges in contributing to OSS. The survey also included questions on how the *womeninoss.com* platform could support their participation in communities within this context (See Table 1). All questions, except for the demographic ones, were answered using a Likert scale ranging from 1 (*low confidence*) to 5 (*high confidence*).

5.1 Preliminary Results

The survey was distributed across two women-focused technology communities in Brazil to obtain feedback from developers: the women-in-tech laboratory at the Federal Institute of Minas Gerais (IFMG) and the Google Developers Group (GDG) in Pelotas, Rio Grande do Sul. Fifteen participants completed the survey. We break down our preliminary results as follows:

⁶<https://github.com/lisrobotics/womeninoss.com/blob/main/api/definitions.py>

Category	Survey Question
Demographics	How much experience do you have in the software development field? Have you previously contributed to OSS?
Experience with OSS	I feel capable of identifying the first steps to start contributing to OSS projects. I feel capable of understanding how the contribution flow works in an OSS project. I feel capable of searching for and selecting a suitable OSS project to begin contributing. I feel capable of identifying common challenges women face when contributing to OSS. I feel capable of overcoming challenges related to a lack of support or non-inclusive environments in OSS communities.
Platform Evaluation	I feel more confident about contributing to OSS projects after using the Women In OSS platform. I feel more prepared to face challenges in contributing to OSS projects after using the Women In OSS platform. The content motivated me to participate more actively in OSS communities.
PeerConnect Evaluation	I feel capable of finding a support network using the PeerConnect tool. I feel that the PeerConnect tool was easy to use and understand.

Table 1: Survey questions grouped by category.

5.1.1 Demographics. Regarding their experience in software development, 26.7% (4 participants) reported having less than six months of experience, 20% (3 participants) had between six months and one year, and 6.7% (1 participant) had between one and two years. The majority, 33.3% (5 participants), had between two and five years of experience, while 13.3% (2 participants) had more than five years. When asked about prior contributions to OSS, 86.7% of participants (13 out of 15) reported they had never contributed before, while 13.3% (2 participants) indicated previous involvement in OSS communities.

5.1.2 Experience with OSS. Although most participants had never contributed to OSS, all of them were invited to visit our platform and read the discussions available. To better understand their perceptions on OSS collaboration after visiting *womeninoss.com*, we included introductory questions about the theme. When asked if they feel confident in identifying the first steps to begin contributing to OSS, the majority expressed moderate to strong confidence, with 40.0% (6 participants) selecting moderate confidence on the Likert scale and 13.3% (2 participants) selecting strong confidence. Similar values appeared for the following question, where 66.6% (10 participants) reported feeling moderate or strong confidence in understanding how the contribution flow works in OSS after visiting our platform.

In terms of confidence in selecting a suitable OSS project, the majority of 53.4% (8 participants) reported feeling moderate or strong confidence in the process. Twelve participants (80%) also reported confidence in identifying potential gender-related challenges when contributing to OSS, and 53% (8 participants) expressed moderate to strong confidence in understanding how to overcome such challenges.

5.1.3 Platform Evaluation. To confirm that their confidence is impacted by our platform resources, we also asked participants three

other questions. The majority of 13 participants (86.6%) expressed feeling more confident about how to contribute to OSS after visiting our website, 14 participants (93.4%) also expressed feeling more prepared to face the existing challenges in OSS after visiting the website. The majority of 14 participants (93.4%) also expressed feeling more motivated to participate in open-source communities after visiting *womeninoss.com*.

5.1.4 PeerConnect Evaluation. To finalize our preliminary evaluation, we also asked participants about the *PeerConnect* tool. Eleven participants (73.3%), with strong or moderate confidence, expressed feeling capable of finding peer support in OSS communities using our tool, and 12 participants (80%) evaluated *PeerConnect* as easy to use and understand. As our target audience for this preliminary evaluation did not include OSS maintainers, we decided to evaluate *BetterConduct* in a future study.

6 Conclusion

Gender-related challenges impact the participation of women in OSS communities. Although several tools (e.g., <https://opensource.guide/>) have been developed to reduce the barriers software developers face, none have specifically addressed the exclusive difficulties women face within the OSS context. In this paper, we introduce *womeninoss.com*, an online platform designed to foster women's participation in OSS projects. The platform offers resources designed for both newcomers and project maintainers, including tools such as *PeerConnect*, which helps female contributors connect with peers in OSS communities, and *BetterConduct*, an AI-powered tool with the potential to enhance the inclusiveness and gender sensitivity of codes of conduct. In a preliminary evaluation of our platform, we invited 15 developers to provide feedback on their experiences with OSS and to assess whether our platform could support their engagement within communities in this context. The results suggest that *womeninoss.com* has the potential to serve as a valuable support hub for female developers beginning their journey in open source, helping to bridge gender-related gaps between contributors and OSS projects.

ARTIFACT AVAILABILITY

All resources related to this work are publicly available. The tool is accessible via the hosted website⁷, and our replication package is openly maintained on GitHub⁸. On our replication package, readers will find both the website's source code and the data from the preliminary evaluation. Everyone is invited to join *womeninoss.com*.

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⁷<https://womeninoss.com/>

⁸<https://github.com/lsurobotics/womeninoss.com/>

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