



Pros and Cons of running educational Hackathons in a gender-neutral fashion

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ABSTRACT

Our work builds knowledge on gender-neutral hackathons in educational context. Hackathon itself is an intensive project-based event, requiring participants to make results in a short timeframe, which stimulates creative thinking, knowledge sharing, and overall learning. This has made hackathons popular in an educational context. As a hackathon event often implies software design, the introduction of hackathon practices would be especially beneficial for Software Engineering education. The question is how to attract a diverse student audience to enroll in these hackathon events and hackathon enhanced courses. Historically, hackathons attract fewer females than males and show gender balance issues. Even though there are positive examples of female-inclusive events, there is a risk that by focusing on women's interests, the hackathon designers could end up discouraging the male audience. It was found that men e.g., tend to reject feminine products and occupations as they experience social pressure regarding what is acceptable for them. Thus, it would be reasonable to focus on the hackathon's gender-neutrality rather than on female inclusivity. This research provides practices to implement hackathon courses gender-neutrally. We also discuss pros and cons of different approaches.

CCS CONCEPTS

• Social and professional topics -> User characteristics -> Gender • Applied computing Education

KEYWORDS

Hackathon, code camp, time pressure, gender-neutral, stereotype, project-based, education, intensive event, female



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GE@ICSE'22, May 20, 2022, Pittsburgh, PA, USA

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ACM ISBN 978-1-4503-9294-5/22/05.

<https://doi.org/10.1145/3524501.3527603>

1 Introduction

Our work focused on studying different ways to produce gender-neutral intensive educational project-based events, currently named hackathons, and previously known as code camps. Hackathons are becoming increasingly popular educative [30], business model development [29], sustainability boosting [31,56] and innovation seeds [29] developmental events [52]. They were originally created as project-oriented computer science competitions [52]. Hackathons have a great learning potential [25,47,48,64], as they help to build and test skills in a short timeframe [20] and can be local, hybrid, or online by nature [30]. Moreover, competitive environments stimulate learning by encouraging creative thinking [44] and team working [28]. Thus, it is quite a natural thing that they are gaining popularity in educational institutions as part of both formal and informal learning [25,44,52]. However, there are still questions on how to make these events attractive for students of all genders, as year-to-year hackathons show low female and non-binary individuals' participation [48,53]. The number of literature sources focusing on non-binary participants of hackathons is scarce at best [53]. Therefore, this study is mainly based on male and female participation in general. However, according to the study of Prado et al. [53], which was investigating the trans-inclusiveness of hackathons, trans people and women face similar problems regarding hackathon participation.

Historically, there was an impression that code camps have been sleepless 24/7 coding events [51], while hackathons were perceived to be white male-dominant events [11]. There has been some work already done to make the events more inclusive for women [54]. However, there is still room for improvements, as overall, the gender diversity at hackathons remains low [48]. In the meantime, researchers support diversity as a tool to improve and achieve the best results in an exchange of knowledge and the creation of innovations [5,9,12,22]. To achieve this diversity, hackathon organizers are forced to implement special measures, fighting with stereotypes, experimenting with event focus, etc., to reduce factors that stop people from participating in hackathons [11].

From a gender equality point of view, it is important to remember that both men and women alike are subjected to the pressures of stereotypes and their effects [16,32]. It was noticed that because of stereotypical thinking or societal pressure, men are less likely to choose female-oriented products [24], respectively, they may also refuse to participate in a female-focused event, even if it is open to everyone. Thus, for example, if an event organizer is highly focused on attracting a female audience, they may lose male participants, if the approach is not properly gender-neutral. Therefore, our research is devoted to studying how to make hackathons more gender-neutral, thereby increasing the possibility of reaching higher diversity and total number of event participants. Moreover, other diversities, like cultural diversity also has a positive effect on project outcomes [67]. Thus, fighting stereotypes should be aimed not only at achieving gender balance, but also at eliminating cultural discrimination [45] which could be considered in further research.

This article reviews the literature on gender-neutral measures practiced in multiple different fields and will then utilize the findings to give recommendations for future research directions on how to make hackathons more gender-neutral and what sort of activities to study and build talents in practice.

2 Methods

Our research was initiated by the practical need, as Hackathon organizers, to popularize hackathons among female students to achieve more gender-balanced events. The lack of female participants in Hackathons was both, described in the literature and observed by authors in multiple events organized by different institutions from different countries.

To provide improvement recommendations, on how to design gender-neutral events, it is needed to understand what the reasons for low female participation are and have a look at the “male side view” as well. The first issue we faced during our research was a lack of Hackathon-related literature, shown in a previous literature review [30], and an even lower amount of literature focusing on Hackathons’ gender imbalance. Therefore, we expanded the literature search into a broader perspective focusing on women’s participation in Hackathons and Software Engineering, Computer science, and STEM in general. We also appealed to the sources from social science and psychology to build a broader understanding of gender discrimination issues. For the literature gathering, we took the snowballing approach. According to Jalali and Wohlin [35], it shares the efficiency with the systematic literature review approach and leads to similar conclusions. The data was collected from academic literature, starting from the year 2000 and focusing on major academic databases, including IEEE, Scopus, ACM, Web of Science, and Science direct.

We found that the concepts described in the literature were very close to each other, however, we wanted to broaden the understanding of the issue. To perform this task, we have

applied an abductive reasoning approach. By its nature, abductive reasoning is close to induction and deduction-based reasoning, combining both methods’ advantages, and at the same time trying to stay away from the challenges posed by either one. Its purpose is to create an abductive explanation based on observations and background theory [23]. The abduction reasoning implies offering a hypothesis that may be refuted with additional information [2]. By implementing abductive reasoning agents may take a broader view, which allows not only change underlying logical consequence relation but also to create and/or modify concepts [63]. The authors took the role of agents as they have diverse and relevant backgrounds: experienced hackathon organizer and Software Engineering professor, female practitioner and professor in Computer Science, and female Software Engineering doctoral student who is the target audience of these events. In multiple discussions, we were evaluating the existing hypothesis and looking for new potential ones, trying to find the best explanation of female imbalance in hackathons. To understand if the new hypothesis is sufficient, we made another round of literature analysis. The overall process could be illustrated as an infinite cycle presented in Figure 1.

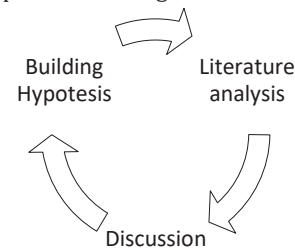


Figure 1. Research process

The presented findings with their interpretations could be influenced by authors’ cultural backgrounds. This could be seen as a limitation of the study. The interpretation of cultural phenomena occurs within a limited set of societal contexts and may not translate well beyond those contexts. The reader needs to consider these aspects and apply our findings judiciously, with proper cultural considerations.

3 Background building and supportive literature

Nowadays hackathons are used as an instrument to improve the educational experience through “learning by doing concept” [25]. Informal activities, case championships, etc. stimulate learning and allow students to apply the knowledge gained in the classroom to practice [44].

Even though hackathons traditionally last several days, there are few examples of the hackathon approach implementation in standard classroom hours (120-150 minutes) [57,58]. Hackathons as a part of the educational process could be separate project-based intensive courses, practical parts of the traditional course, and even exam replacement [25]. Teachers

can use the hackathon experience to adjust and improve their courses by having the opportunity to observe students' performance, to identify their interests and struggles [14]. In educational institutions, it is even more important for these hackathon-based courses to be inclusive, to provide the same learning opportunities for all student groups.

3.1 Gender neutrality

Hackathon introduction to an educational process implies a need to reflect the diversity of students enrolled in a related program. For project-based courses, to be interesting to all genders, educators should pay attention to gender-neutrality. Literature reflects a diverse understanding of gender neutrality. Overall, we defined three main directions of understanding gender neutrality that are presented in Table 1: there are no gender assumptions, attention is equally paid to all genders, it is something acceptable for both men and women.

Table 1 – Approaches towards gender-neutrality.

Approach	Description	Examples
<i>No gender assumptions</i>	To eliminate beliefs that something is acceptable for women and less/not acceptable for men and vice versa [36,45]	No gender-typed toys, names, colors, activities, etc. [55]
<i>Attention is equally paid to all genders</i>	There are beliefs in male and female differences, but their interests are equally satisfied [3,46]	A book presenting both male and female students/scientists etc. [27]
<i>Something acceptable for both men and women</i>	Choose things which both men and women may be interested in/may accept [55]	Green is a gender-neutral color, etc. [17]. A set of blocks is considered a gender-neutral toy [10]

In the ideal visualization of gender-neutrality, there should be no gender-typed objects, activities, and occupations, so the very term of neutrality becomes superfluous [55]. Unfortunately, it is nearly impossible for humans to perform out of the cultural context [34], and, even though many countries are now working on achieving gender equality [4], it will take a long time to eliminate gender beliefs, as they have not only explicit but also implicit nature [6,45]. So even if people have the best intentions to show an unbiased attitude, they might be driven by implicit beliefs [18,45,65]. Moreover, changing personal beliefs is difficult, since when the individuals are confronted with an oppositional opinion, confidence in their beliefs only weakens slightly, whereas meeting with similar beliefs significantly increases confidence in them [6].

Thus, in a hackathon context, we hypothesize that to improve the gender-neutrality in hackathons we need to consider it as a

combination of three approaches: to keep the intention of reducing gender bias; to be respectful for all genders, and pay attention to them equally trying to find something interesting both for men and women and other gender representatives.

3.2 Gender-stereotypes

To mitigate biased behavior, we need to understand existing stereotypes and how they affect individuals' behavior. Stereotypes about gender differences are laid down from early childhood and are continued to be promoted by media and society at a later age. For example, parents often choose gender-typed toys for their children and encourage socially acceptable behavior, even subconsciously [18]. Later, parents choose and introduce gender-typed hobbies for their children, giving preference to creative activities for girls, and sports and technically oriented ones for boys [38].

By general belief, girls are more inclined towards creative tasks. A study in Australia found that preschool educators with biased gender beliefs direct girls to engage in art activities more than boys [7]. "Art for girls" beliefs effect can be seen at hackathons too. Even in Quora discussion chains, females publicly complain that people at hackathons primarily consider women to be teams designers, since it is generally believed that girls are more engaged in creativity than programming [43]. Similar phenomenon is the "boys are better in math" belief [61] which was repeatedly refuted [34], but remains in society [59]. This is one of the beliefs that reduce girls' confidence in their chances to succeed in technology, thereby continuing to maintain the gender gap of women in STEM. It was measured that the anxiety about math abilities differs much higher among genders than their actual abilities [26].

Speaking about gender neutrality, it is very important to remember that men are also subjected to the pressure of stereotypes [16]. For example, when choosing a career for men, it must be considered masculine, since otherwise they risk getting disapproval from society. Men in female-dominant fields face backlashes from both men and women [42]. Even though hackathons themselves are more often a male-dominant environment [21], we believe that too feminine hackathon orientation can also scare off a male audience.

Unfortunately, the literature is lacking recommendations and examples for organizing gender-neutral hackathons. The next sections present measures to achieve gender neutrality which are taken from literature related to different fields, but applicable to the organization of hackathons.

4 Findings and recommendations for gender-neutral hackathons

To run gender-neutral hackathons, it is important to understand how to reach this gender-neutrality. Therefore, this section provides recommendations on how to achieve better gender-neutrality at events, an overview is presented in Figure

2; and then there is a discussion about the pros and cons these types of events might have.

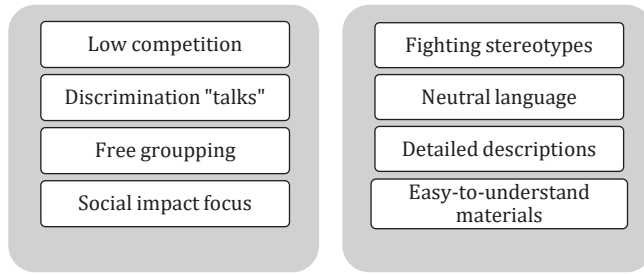


Figure 2. Recommendation's overview.

4.1 Hackathon general recommendations

Literature review findings revealed the following recommendations for organizing gender-neutral hackathons:

1. *Low competition* is a step towards gender neutrality. Even though traditionally hackathons are competitive events. In regards to project-based courses, lowering the competition could stimulate friendly collaboration and make the process less stressful for students [64]. Both men and women have noted the low importance of the competition [21]. However, it is worth noting that the competitive element stimulates learning and forces participants to think beyond the usual, to use their resources to the maximum [44]. Learning is an important aspect for the majority of participants [37], thus, organizers can focus participants' attention on learning opportunities, not excluding competitions [54]. It is possible to offer alternative winning places that do not require a certain background. For example, a prize for the best idea, the best teamwork, presentations, etc. [40].

2. *Beginners-friendly environment*. It is common practice that, when a person does not possess certain skills, they feel anxiety when they must partake in an exercise that requires those skills. No technical skill requirements were part of the key features of the hackathon organized by Spotify, which attracted an almost equal number of male and female participants [68]. This approach can reduce fear from beginners in the lack of their knowledge and skills. Although self-doubting is more common among women, it has also been seen among men [64]. It is also possible to provide all the necessary materials in advance or organize introductory pre-events for beginners. There are also opportunities to design different event tracks for people with different experiences to make the hackathon interesting both for beginners and advanced "hackers".

3. *Awareness about discrimination*. The events focused on solving women's infringement problems have shown that increasing men's awareness about female discrimination gives a positive result on the event atmosphere [33]. It should also be considered that all genders are victims of stereotypes, also non-binary people, representatives of different nationalities, social

statuses, etc. To ensure a friendly atmosphere, participants should pay attention to how stereotypes often interfere with organizing healthy interaction. Non-competitive out-of-scope activities can help to increase the friendliness of the atmosphere. It can be sports, games, master classes, or just a reflexive session [37]. Conducting seminars on reducing bias and achieving equality among facilitators or teachers as well as making equity master-classes during the event, has a positive effect on the overall Hackathon mood [13].

4. *Encouraging group participation*. The main motivation of students to participate in the hackathon is to spend time with friends. The ability to create a team in advance will ease the doubts of beginners, both male and female. The fear of novelty is a factor stopping participation for both genders [64]. Studies show that teams with close ties show better results than others and more often take first place [40].

5. *Focus on social impact*. It is advised to focus the hackathon on achieving the Sustainable Development Goals [62]. Studies do show that women are more aware of this issue, but they also note that this topic is interesting to men, and the ability to contribute to different societies is a big motivational driver in general [49]. It is shown that courses and lectures on the topic of sustainable development have a positive effect on students' interest and behavior change [8] and it's also possible to connect hackathons to post-event implementations to enhance local community activity on sustainability too [50].

4.2 Promotion

Promotion is another factor, influencing the level of gender balance. To make the promotion gender-neutral the organizers could use the following recommendations:

1. *Show the intention to fight the stereotypes* is an important aspect of creating an event is the organization of a gender-neutral marketing campaign. Advertising that fights stereotypes about women gives a positive response [1]. The approach used in such advertising can be expanded to combat stereotypes about any gender, nationality, social status, etc.

2. *Use gender-neutral language*. It is necessary to monitor the neutrality of the language used in advertising, as well as event or course materials [11]. A study of reading a book with cross-gender behavior, such as women working as firefighters, showed that people spend more time processing the mention of a character's gender if it was not clear from the very beginning of the description of the person [39]. Observation of parents reading a gender-neutral picture book showed that parents assign gender to characters, depending on the traditional beliefs of male and female behavior [19]. Since our brains are designed in such a way that when we see the usual gender-typed behavior, we automatically attach the "appropriate" image to it [19,39,65], it is necessary to immediately give the reader hints that the described tasks and characteristics may belong to both genders. For example, when

we say that a team needs a leader who must distribute tasks, monitor timing, and solve emerging problems, we cannot control which image the reader will perceive, since due to the lower ratio of women in management, the word “leader” might be associated with men [15]. However, initially stating that “A team needs a leader, he or she must distribute tasks, keep track of time, and solve problems”, eliminates the one-sided representation of the person. Therefore, using “he or she” or singular “they” as a pronoun can make the text more neutral.

3. *Add detailed task description.* To describe the activities of the hackathon, one needs to mention and illustrate different genders and also the various tasks performed by the participants and the characteristics required of them [11]. Due to stereotypes about hackathons, people may also have the wrong participants’ image. A misconception can lead to a low sense of belonging and refusal to participate [66]. Therefore, it is important to convey the correct picture of the participant, to mention not only the technical but also the social aspects of participation [60].

4. *Consider different backgrounds in materials.* It is also important to remember that everyone has different experiences. Using examples that anyone can relate to gives positive results on understanding the learning materials [60].

4.3 Pros and cons of the gender-neutral hackathon

To understand the effects of organizing gender-neutral hackathons, advantages and disadvantages needs to be identified. Literature stating pros and cons gender-neutral hackathons was not found but based on our organizational experience we made the list presented in Table 1.

Table 1 – Gender-neutral hackathon (project-based course) pros and cons

Pros	Inclusivity	Gender-neutral measures in education have proved themselves as a tool to achieve better gender balance in a classroom [38].
	Sustainability goals	The idea of implementing gender-neutral measures in education corresponds to the global sustainability goals [8]. Thus, all educational organizations interested in improving their processes towards a better society should consider gender-neutrality in their performance metrics too.
	A wider diversity of collaborators	Implementation of gender neutrality can attract not only a diverse student audience but also diversity in collaborators.
Cons	Teachers’ challenge	Implementation of gender-neutrality in the course processes could be challengeable for those who are responsible for course design and realization.
	Need for external evaluators	There is a need for an external evaluating view to what extent the course is gender-neutral.

Unwanted focus on gender binarity	Gender-neutrality is criticized for focusing on something acceptable for all. Therefore, it indirectly emphasizes the binary concept of gender [55].
“Not interesting for anyone” effect	There is a risk that a gender-neutral event would be acceptable for everybody but not interesting for anyone.

Therefore, it is important to work carefully on implementing neutrality at hackathons. Even though there are benefits of event-inclusiveness, there are also some gender-sensitive aspects that could be considered to keep audience interest [41].

5 Discussion and conclusion

The goal of the study was to investigate hackathons from an educational perspective to achieve better gender diversity at hackathons and to increase the participation of all student groups. Focus was on gender-neutrality, as one of the most appropriate approaches. Based on findings, educational hackathon can be implemented as a separate course, part of formal learning, and as a replacement for examination. Also, the found and developed recommendations of achieving gender-neutrality are applicable for all found learning approaches.

The literature presents different ways of understanding gender-neutrality: elimination of gender biases, paying equal attention to all genders, and looking for something acceptable for all. We decided not to focus on one understanding, but to look for measures that overall present the combination of different directions of gender-neutrality. Thus, for instance, seminars on gender discrimination can raise students’ awareness of the topic and eliminate bias. Using he or she and singular pronouns in descriptions will help to pay equal attention to all genders. Also, focusing on sustainability goals at the event is something acceptable for both men and women.

Additionally, it is important to understand the pros and cons of the gender-neutral hackathon. An undeniable advantage would be better inclusivity of participants and collaborators. However, achieving gender-neutrality is a challenging task that requires external evaluation. Moreover, there is a risk that something acceptable for everyone would not feel “tasty” to anyone. Thus, gender-neutrality with interest-boosting twists at hackathons should be further researched.

ACKNOWLEDGMENTS

The authors express their gratitude for the CBC-funded AWARE project, LUT University MEC funding and EU’s Erasmus+ initiative WITECH (Entrepreneurship for Women in Tech) project funding support for this research.

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