

Discussing with Students for Better Balance in Informatics^{*}

Elisavet Kozyri¹, Mariel Evelyn Markussen Ellingsen², Ragnhild Abel Grape¹,
and Letizia Jaccheri³

¹ UiT The Arctic University of Norway

² Woid AS

³ Norwegian University of Science and Technology

Abstract. In recent years, there has been considerable effort to promote gender balance in the academic environment of Computer Science (CS). However, there is still a gender gap at all CS academic levels: from students, to PhD candidates, to faculty members. This general trend is followed by the Department of Computer Science at UiT The Arctic University of Norway. To combat this trend within the CS environment at UiT, we embarked on structured discussions with students of our department. After analyzing the data collected from these discussions, we were able to identify action items that could mitigate the existing gender gap at our department. In particular, these discussions elucidated ways to achieve (i) a balanced flow of students into CS undergraduate program, (ii) a balanced CS study environment, and (iii) a balanced flow of graduates into higher levels of the CS academia (e.g., PhD program). This paper presents the results of the discussions and the subsequent recommendations that we made to the administration of the department. We also provide a road-map that other institutions could follow to organize similar events as part of their gender-balance action plan.

Keywords: Gender balance · computer science · diversity · inclusion · student study

1 Introduction

Innovations in Computer Science shape the lives of everyone in our society. To create innovative solutions tailored to everyone, it is important that all groups of society are represented in the creation of these solutions. However, this is still not the case in the field of Computer Science (CS). Having an awareness of the lack of representation and the different barriers people face in CS are fundamental in helping the field target those challenges and becoming more equitable and inclusive [8].

Statistics from Europe show that women are still highly underrepresented in CS. According to Eurostat [4], the percentage of female specialists in Information and Communications Technology has evolved from 17% in 2012 to 19,1% in 2021.

^{*} Mariel's contribution was made while she was a Master's student at UiT.

At university level in STEM, the percentage of female Bachelor, Master, and PhD students is 20%, while the percentage of female professors is 15%.

Specifically for the Department of Computer Science at UiT The Arctic University of Norway, only 13% of students, 14% of PhD candidates and 21% of faculty members are female.

Better Balance in Informatics (BBI), a program led by the CS department at UiT and funded by the Research Council of Norway, aims to rectify this imbalance and create a more diverse learning environment for Computer Science. BBI is connected and builds upon an ecosystem of national and international projects which address gender balance in CS acting on different levels: school ([13], [7]), university ([2], [6] [16]), industry ([17], [3], [5]), and the interplay of these levels ([1]).

BBI aimed to identify some of the reasons that led to the current gender dynamics in our CS department, and then propose measurements that could address those reasons. Hearing directly from the CS students (Bachelor, Master) seemed to be a sensible way for us to identify those reasons. So, BBI organized structured discussion sessions, where we invited CS students (Bachelor, Master) to share their thoughts about:

1. the reasons they picked CS for their studies,
2. their current experience with the CS studies,
3. their intention to pursue an academic career in CS, and
4. ways to make the CS community more diverse and inclusive.

The answers of the students illuminated points of intervention, which could lead to a balanced flow of students into CS undergraduate program, a study environment that embraces diversity, and a balanced flow of students into higher levels of the CS academia.

This paper presents the methodology (§2) we employed to organize the discussion sessions, to collect responses, and to report the results. We then present the specific questions we asked the students and the analysis of their answers (§3). Finally, we list the recommendations (§4) submitted to the CS department for achieving a gender-balanced environment, we discuss related work (§5), and we conclude (§6) with reflections about the discussion sessions.

2 Methodology

The end goal of the discussion sessions was to identify points of interventions that could increase the gender balance among the incoming CS students, the current CS students, and the CS graduates that are interested in entering the CS academia. To identify those points, we were aiming for a high number of participants in the discussion sessions: the more participants, the greater the plurality of experiences, and thus, the higher the chances to find opportunities for improvement. Deciding which questions to ask was crucial to ensure that experiences from different aspects of the CS studies are captured and then analyzed. But, we also had to create a trusting discussion environment for the

students to honestly share those experiences with us. This section describes the methodology we followed to prepare and organize the discussion sessions such that all these targets are met.

2.1 Outreach

Attracting the attention of students and persuading them to participate in the discussion sessions was not trivial. Unless there is an immediate academic or employment gain, motivating students to devote part of their busy schedules to a university-led event is indeed challenging. Our strategy to address this challenge comprised the following steps:

Hiring students as project assistants. We hired two talented and enthusiastic female students as assistants for the project. They were our bridge to the student community in our CS department. And this bridge was functioning in both ways. Their thoughts, insights, and experience informed all aspects of the BBI project, including the questions we asked during the discussions. At the same time, they knew best how to reach their fellow-students and promote the agenda of BBI (e.g., what advertisement means to employ and what to say in these means).

Website. The BBI website (<https://uit.no/project/bbi>) is the main official space where the mission of BBI is communicated to the world. So, we redesigned this website to include a clear and short motivation for the BBI mission, and describe the upcoming BBI events, in particular the discussion sessions.

Advertisement. To reach a wider set of students and persuade them to participate in the BBI discussion sessions, we employed a variety of means. We posted advertisements on the monitors of the Department, the social networks of the Department, on Canvas, the UiT calendar, and the local student organization forum, which is a Discord server that is maintained by the student organization TD. The student assistants also gave 5-minutes talk about BBI and the discussion sessions to courses with high enrollment, they created and distributed flyers, and they organized a stand with coffee and cookies, where students could casually socialize and talk about BBI. In terms of registrations to the BBI discussion sessions, Canvas and TD seemed to have been the most effective, since we observed a high correlation between the time a post about the BBI event was created and the time students were registered.

Open to everyone. The invitation to participate in the BBI discussion sessions was open to all students of the CS department, independently of their gender (female, male, non-binary). This is because the gender imbalance is a problem that owes to concern everyone—not only a part of the community. And because any further actions that the Department will take to address the problem might effect every student, there needs to be a wider understanding that these actions are worthwhile. Leaving specific groups of students outside the discussion, would not have increased this understanding.

2.2 Discussion Sessions

The discussion sessions were held at Árdna, UiT. Árdna is an iconic place in the university, ideal for secluded discussions. Its central fire place and the surrounding wooden benches invites people to open up and discuss honestly.

In the BBI discussion sessions participated around 20 participants.⁴ Comparing to events organized in the past by BBI, this number of participants was a very welcoming surprise. From those participants, around 50% were female or non-binary students, and around 50% were male students. The vast majority of the students participated physically, but there were some that participated remotely. There were around three participants per discussion session. Each discussion session was moderated by two BBI members: one member was asking the questions, and the other member was typing the answers (we used no video or sound recording). At least one of the moderators was always one of the BBI student assistants; having participants talking to their peers led to frank discussions. To preserve anonymity, each participant was assigned a number, so the recorded answers were associated with these numbers—not with the identity of the student. For the discussion sessions, we gave the option to the student to select either Norwegian or English as the speaking language. All participants, apart from those that participated remotely, were offered a full meal.

2.3 Selection of Questions

The selection of questions was inspired by questionnaires developed by other gender-balance projects, such as EUGAIN [1], Prestige in UiT [2], and Balanse-Hub [6]. However, the questions were tailored for the needs of the CS department in UiT. And, in particular, the questions were intended to cover a wide range of students' experience: from the point they considered applying for CS, to their current studies and their future plans.

2.4 Reporting of Results

For most of the questions asked during the BBI discussion sessions, we compiled the answers into graphs. Each graph depicts how answers are correlated with different genders. This information help us guide our selection of action items for improving the gender balance. We protect the anonymity of the participants, so we do not give specific numbers at graphs. Also, we do not have a separate category for non-binary participants, because the number of non-binary participants was not high enough to protect their anonymity. Instead, we group female and non-binary participants together, and we explore the dynamics between majority (males) and minorities (female, non-binary).

⁴ We do not give specific numbers to preserve the anonymity of the participants.

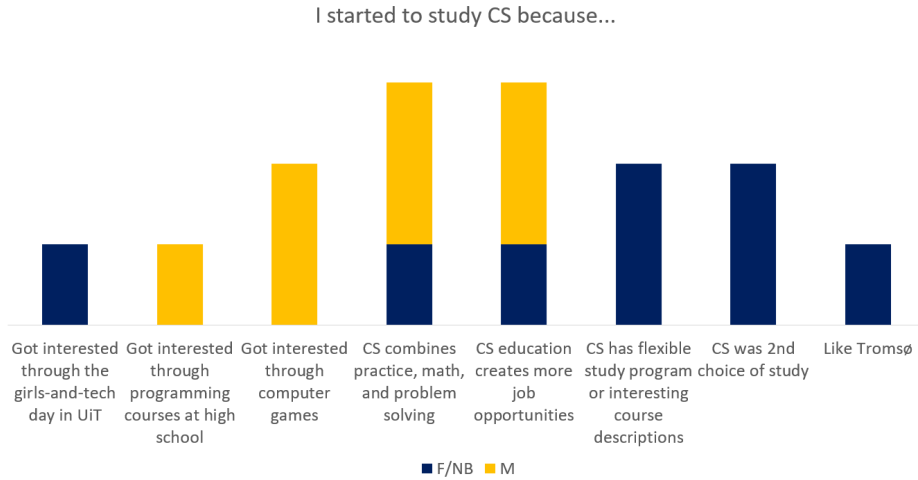


Fig. 1. Reasons for choosing to study CS. Each column corresponds to a different reason. The height of a column represents the number of participants that submitted the corresponding reason. Dark blue represents female or non-binary participants (F/NB); yellow represents male participants (M).

3 Results

This section presents the questions we asked the participants and their answers concerning:

1. the reasons they picked CS for their studies,
2. their current experience with the CS studies,
3. their intention to pursue an academic career in CS, and
4. ways to make the CS community more diverse and inclusive.

Correlating their answers with their gender, we identified action items that could lead to a balanced flow of students into CS undergraduate program, a study environment that embraces diversity, and a balanced flow of students into higher levels of the CS academia.

3.1 Intention to Study CS

To increase the balance in Computer Science, one first needs to increase the balance in the new-coming students. So, when advertising CS to younger students, one could also include aspects that attract minorities. We tried to identify those aspects by asking the participants the reason they decided to study CS in the first place. Figure 1 shows the different answers we received. The higher the column, the more students gave that answer. The graph also shows how the answers are split between the minority (F/NB) and majority (M). There is a correlation between the gender and the reason for selecting CS studies.

Action Items. Observing Figure 1, we can identify the reasons the minority chose CS studies: the problem solving aspect of CS, the flexibility of the CS studies, the job opportunities that CS graduates enjoy. To increase the diversity of incoming students, we can then emphasize those reasons when advertising CS. Also, as a possible means of advertisement Figure 1 indicates the UiT girls-and-tech day.

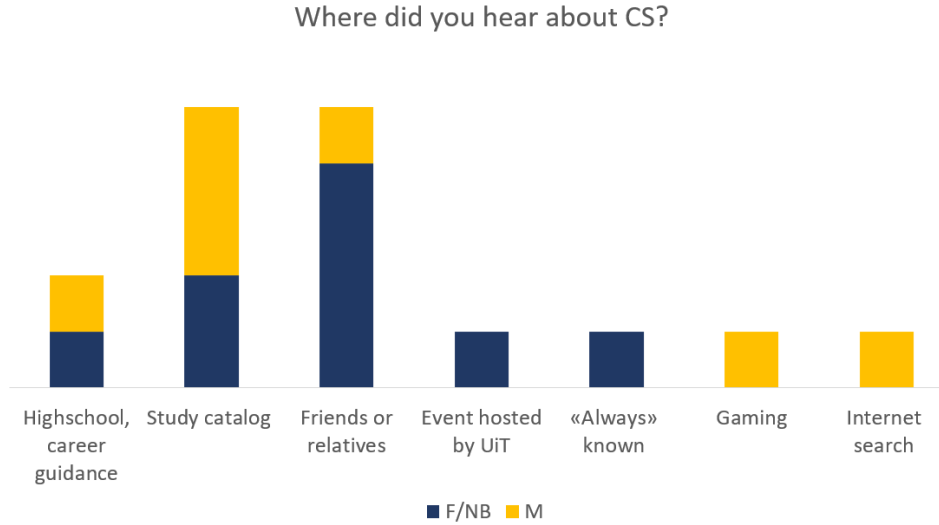


Fig. 2. Ways for becoming familiar with CS.

Apart from the UiT girls-and-tech day, we wanted to understand what would be other effective means of advertisement for attracting minorities to CS studies. So, we asked the participants where did they hear about CS. Figure 2 plots the answers, which are again correlated with the gender.

Action Items. Figure 2 indicates that one could use the highschool and the university’s study catalog to better promote CS to minorities. Interestingly, friends and relatives have a high impact on the decision of minorities to study CS. So, one can make tech employees ambassadors of CS to young female and non-binary members of their families.

In general, the vast majority of the participants, independently of their gender, would have liked CS to have been introduced differently to them, as Figure 3 indicates. Participants indicated that CS should be introduced as something that everyone can do and something that offers a plausible path to a regular job.

Action Item. When advertising to high-school students, we need to break stereotypes on who can study CS.

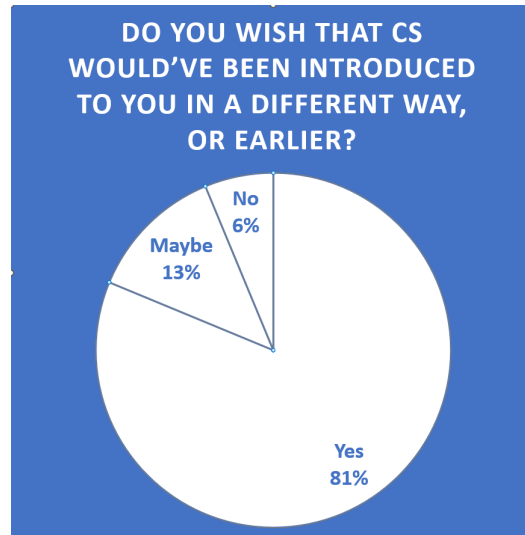


Fig. 3. Independent of their gender, 81% of the participants said that they would have liked to be introduced to CS in a different way.

3.2 Your Experience in the Current CS Environment

At the very least, we want to sustain the diversity among the incoming students, while these students progress to more senior years; we aim to decrease the number of drop-outs, with an emphasis on the minority group. To achieve this, we need to assess the student's experience within the CS department and identify aspects that can be improved to accommodate gender diversity.

We start by asking the participants whether the CS studies met their initial expectations. Their answers are depicted in Figure 4. Almost all minority participants gave a negative answer: they found their studies either more difficult or more practical than expected. In particular, they found the learning curve of programming to be particularly steep, something that might drive some of the minority students to drop-out. We believe addressing this concern is important for maintaining a diverse environment in the department.

Action Item. We propose the adoption of a smoother introduction to programming, which will be appropriate for students with no prior programming experience.

Returning to Figure 4, one also notices that, for most of the male participants, their experience in the CS studies met or even exceeded their initial expectations. So, this question highlights a striking difference between the minorities and the male students in terms of how they view their studies. This difference might be a cause of the current gender imbalance in the department.

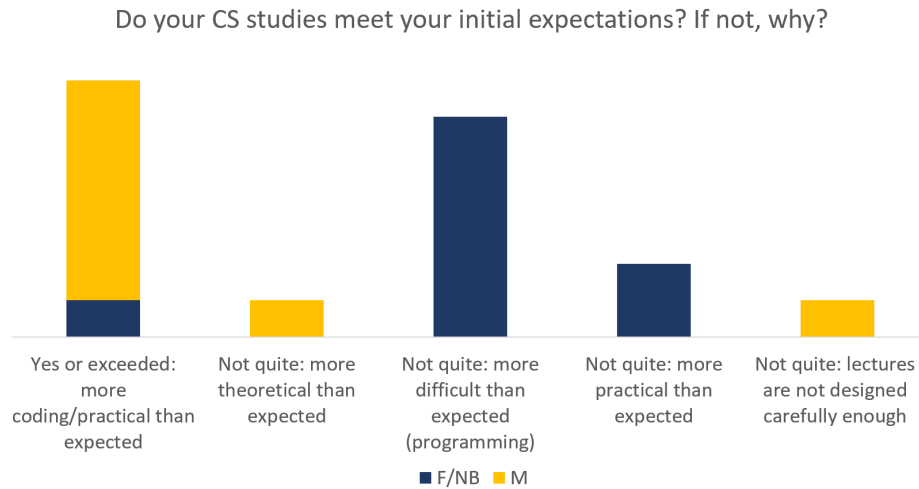


Fig. 4. The first column corresponds to the answer that the CS studies met or exceeded the expectations of the participant. The remaining four columns correspond to the answer that the CS studies did not quite meet the expectations of the participant, and they also represent different reasons why. The height of a column represents the number of participants that submitted the corresponding answer. Dark blue represents female or non-binary participants (F/NB); yellow represents male participants (M).

All the participants agreed, though, that the social environment built around their studies exceeded their initial expectations. This is a great achievement of the department that needs to be preserved for the future, too.

Participants were then explicitly asked whether they have thought to drop-out of their study program. As Figure 5 shows, most of the participants answered affirmatively. Notice that this is a concern across all genders, opposing the misconception that the minorities are more likely to have such thoughts. Notice also that even though most of the male students thought to drop-out of the program, they still had an overall positive assessment of their study experience, according to Figure 4.

As reasons for thinking to drop-out, the participants cited the difficulty of some courses, the time-consuming assignments with overlapping deadlines, the demanding task of writing thesis (a task for which they did not feel prepared), and the complications that the COVID-19 pandemic brought. For a student to be thinking to drop-out, it means that the student’s self esteem might be low at that point. Figure 6 validates this claim, showing that most of the participants felt “useless” or “not-deserving” being in the CS program. Again, the answers do not seem to be correlated with the gender. However there is an underlying difference: many of the males had this feeling once, related to a specific assignment or for short period of time, whereas the minority students had this feeling for a long period of time (i.e, months or even years).

Have you ever thought of dropping out of your study program?

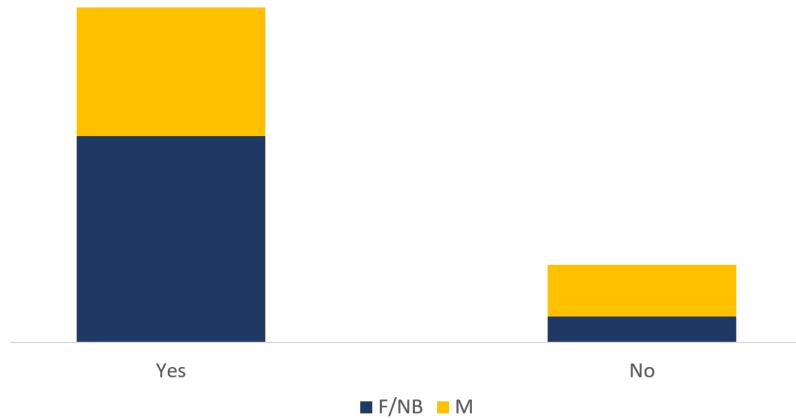


Fig. 5. The majority of the participants replied that they have thought of dropping out of their CS study program.

Have you ever felt “useless” or “not-deserving being here” (i.e., imposter syndrome) during your studies?

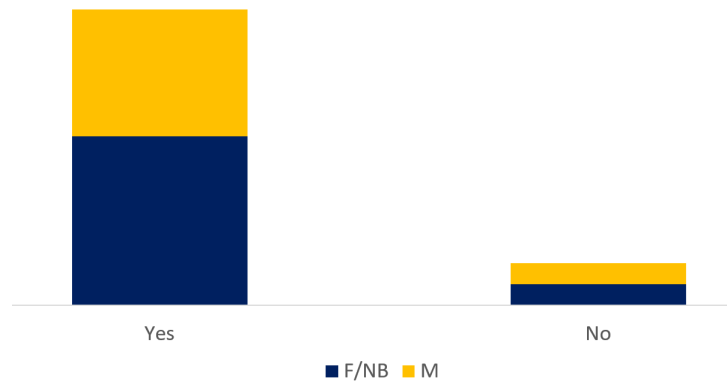


Fig. 6. The majority of the participants replied that they have have felt “useless” or “not-deserving to be here” during their CS study program.

When asked about the reasons they instead decided to stay in the program and not drop out, the participants mentioned:

- the robust social network that they have built within and outside UiT, where they could talk about their struggles,
- the senior student advisor Jan Fuglesteg,

- their self-determination and discipline,
- taking time to relax.

Action Items. Given the stimulating power that the social groups exercised on the students, we should further support actions and groups that promote social networking in the department. Also, we will organize events where senior students can offer tips and tricks from their experiences to the junior students, where the main message will be “if we have made it, so can you”.

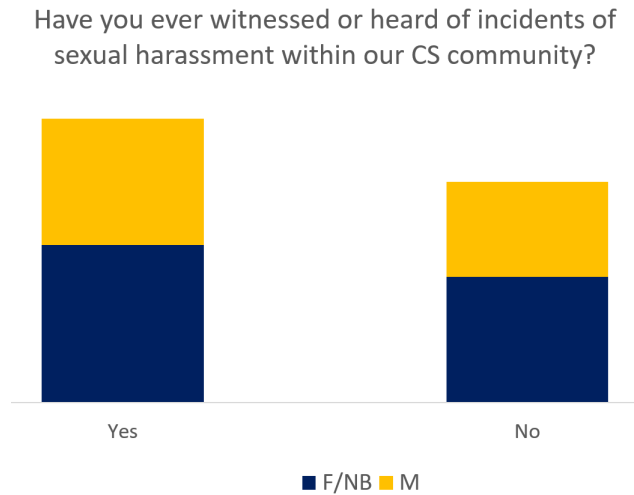


Fig. 7. More than half of the participants said that they have witnessed or heard of sexual harassment incidents within our CS community.

Concentrating on minority students, one of the reasons they might feel uncomfortable in an environment (and ultimately drop-out of the program) is when they have experienced sexual harassment. So, we asked the participants whether they have ever witnessed or heard of sexual harassment incidents within the CS community. Figure 7 depicts their answers. More than half of the participants answered positively.

Action Item. The “Yes” column in Figure 7 should not exist. So, we will propose to the department to devise videos and examples of unacceptable behavior, so the student can recognize and dissociate from these phenomena.

The experience that a student gets from their CS program is a collection of many educational aspects, such as lectures, colloquiums, and assignments. For the CS program to be inclusive and diverse, all these aspects should promote inclusiveness and diversity. We asked the participants if they feel that the educational aspects below promote only a particular way of thinking.

Do you wish to have an academic career in CS?

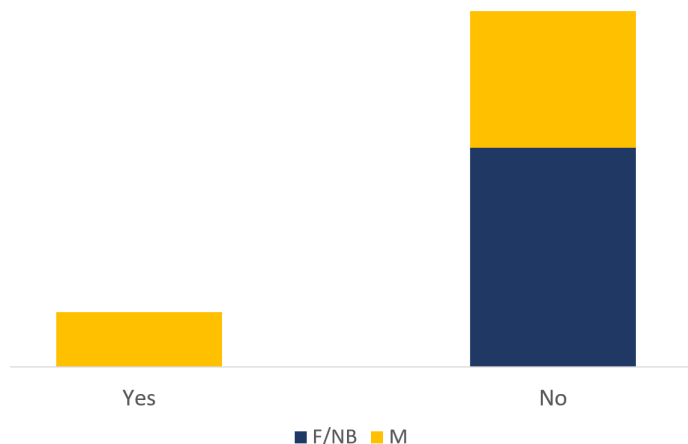


Fig. 8. Almost all of the participants do not wish to have an academic career in CS.

- Lectures: Participants mentioned that examples employed in some lectures are more appealing to male students. These examples usually involve games or cars.
- Colloquiums:⁵ Participants, from all genders, mentioned that a colloquium can quickly get a “boys-club” atmosphere if the TA is not attentive enough. The participants also express the wish for more female TAs.
- Assignments: Some assignment are very focused on gaming or promote competitiveness, which might be uncomfortable for some students.

Action Items. We will advise the faculty members to ensure that lectures and assignments accommodate a variety of interests. The department should organize a seminar for TAs in which they become sensitized on not allowing colloquiums to become “boys-clubs” and accommodating different interests and needs. We also need to brainstorm on how to hire more female TAs.

3.3 Intention to Enter Higher Levels in CS Academia

We are striving to achieve balance at all levels of the CS academia, from students to professors. At this section, we focus our attention to higher levels in CS academia (from PhD candidates and above), and we want to understand the intention of the current students to enter that level. According to Figure 8, the vast majority, and in particular all female and non-binary participants, do not wish to have an academic career in CS. Here are some reasons why:

⁵ A colloquium is associated with a course and it is often led by a TA, who answers student’s questions about the course material and assignments.

- The academic career seems difficult or exhausting.
- No interest in research or writing or teaching.
- Preference for work-life balance offered by the industry (pay, social, use tools, practical).
- The description of an academic career is not clearly communicated.

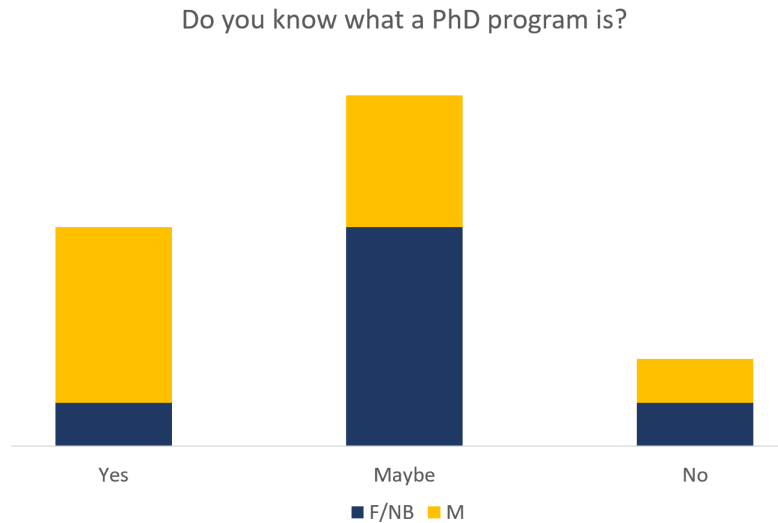


Fig. 9. Most of the participants are either unsure about or do not know what the CS PhD program.

In fact, as indicated by Figure 9, there is uncertainty between the students, and in particular the minority students (i.e., female and non-binary), about what a PhD program is—the first stepping stone towards building an academic career. Given this uncertainty, it is expected that many students will not apply to a PhD program, something that is affirmed by Figure 10. Notice, though, that comparing Figures 8 and 10, the participants are less negative towards pursuing a PhD program than ultimately following an academic career. This is because, after obtaining a PhD degree, there is always the possibility to follow a career in the industry. And some of the participants that replied “no” to the prospective of applying to a PhD program now, they contemplate the possibility of applying after working in the industry.

And if a participant does not want to apply to a PhD program, what are their immediate plans after graduation? Figure 11 answers this question. Notice that participants from the minority group explore a wider variety of options.

Also, for the participants that are not considering to apply to the CS PhD program, Figure 12 gives the main reasons behind this disposition. Figure 12

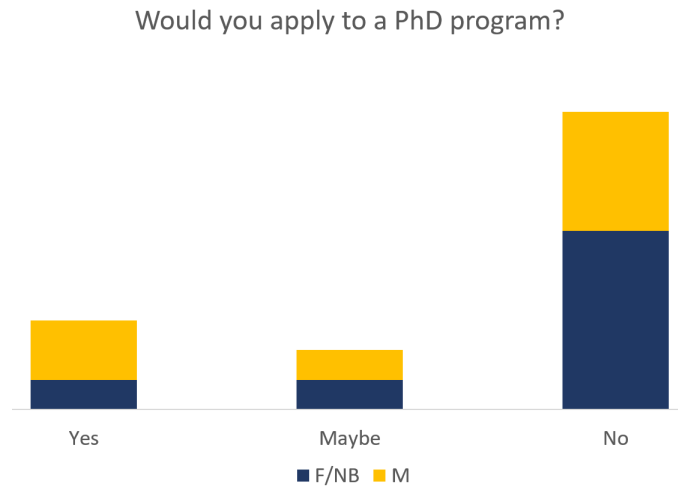


Fig. 10. Most of the participants would not apply to a PhD program.

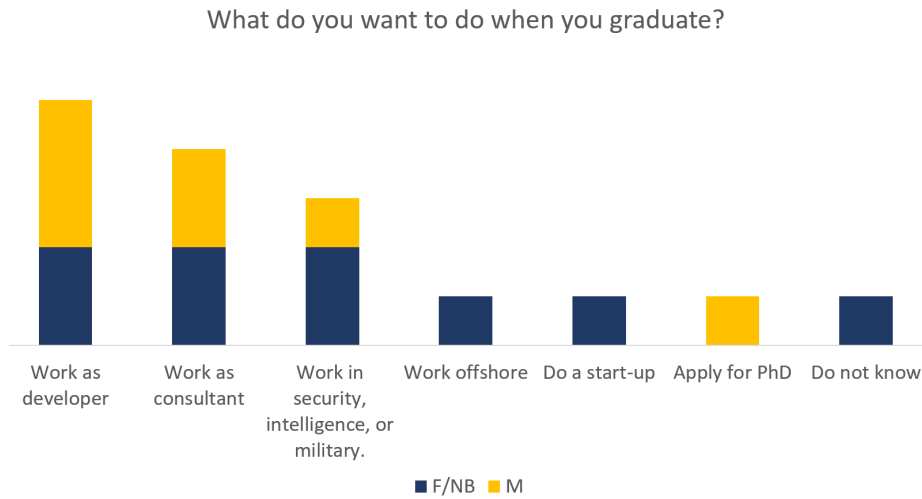


Fig. 11. Columns correspond to different options the participants consider to follow after graduation.

informs how we can intervene and address some of these reasons, possibly leading to more students applying to our PhD program.

Action Items. According to Figure 12, some participants said that the PhD program “sounds too heavy”, and they described PhD students as being “alone” and “depressed”. While this description might portray one aspect of the PhD

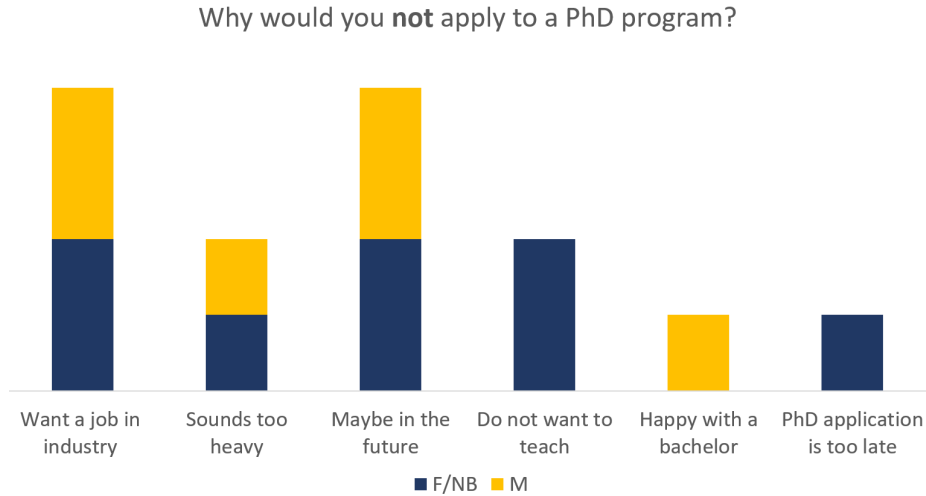


Fig. 12. Columns correspond to different reasons why the participants are not considering to apply to a PhD program.

experience, it is definitely not the entire truth. So, we are going to hold events that clearly describe the characteristics of a PhD program, emphasizing the positive aspects of being a PhD student. These events will also address the uncertainty that was surfaced in Figure 9 about what is a PhD program.

The late deadline for applying to a PhD, which is not synchronized with the job-search period of senior students, is another reason why current students do not select a PhD program. To remedy this, we will advise the faculty members of the CS department to consider moving the PhD application earlier in the academic year (i.e., fall semester).

Finally, given that many participants said that they might consider applying to a PhD program in the future (i.e., after acquiring some experience in the industry), we advocate to advertise new PhD positions explicitly to CS alumni. For some of these alumni, these positions might seem attractive.

3.4 The Gender Gap and Possible Measurements to Close it.

In previous sections, we attempted to understand the reasons why a gender imbalance exists in the CS department, and concluded with action items that could address those reasons. In this section, we explicitly discuss gender balance with the students and record their opinions and proposals on the subject.

To begin with, the vast majority of the participants said that the current gender-imbalance in the department is a problem. They actually see that gender-balance has advantages: promotes innovation, enables plurality of perspectives, and leads to a better study and work environment. Many of the participants said

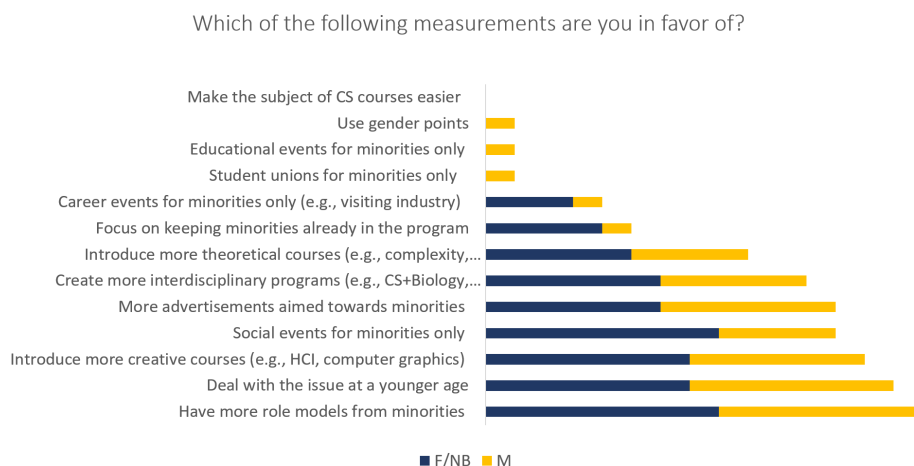


Fig. 13. Each row corresponds to a different measurement for improving gender balance in CS. The length of each row represents the number of participants that agree with the corresponding measurement. Dark blue represents female or non-binary participants (F/NB); yellow represents male participants (M).

that there are no disadvantages with gender balance, although some expressed the concern that gender-balance efforts, such as gender quotas, might “lead to people being hired for the wrong reasons”.

The participants were then presented with different measurements that could be employed to improve the gender balance within the department and asked to say whether they are in favor or not of each presented measurement. Figure 13 depicts their answers. Notice that measurements that blatantly favor minorities in the education or in the career were among the least popular (for both minority and male participants). We aim to focus on the most popular measurements.

Participants also proposed two additional measurements that did not appear in our pre-selected list:

- Share success stories from minorities.
- Have a few preparatory weeks for programming before starting the first semester in CS.

4 BBI recommendations for the near future

Throughout this report we presented a variety of action items for improving gender balance in our CS department. We have motivated these action items using the findings from the discussions with the participants. We now summarize those actions that BBI recommends for the near future. These actions aim to achieve a balanced flow of students into CS studies, a balanced environment within the CS department, and a balanced flow towards CS academia. Figure 14

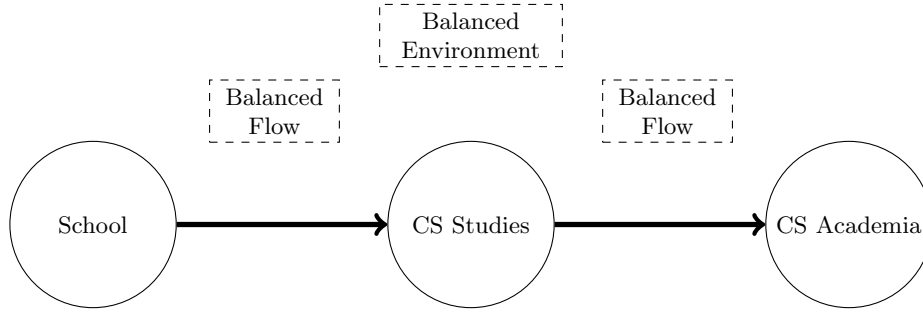


Fig. 14. We propose action items for (i) a gender-balanced flow of students from the school to CS studies, (ii) a gender-balanced student environment in our department, and (iii) a gender-balanced flow of graduates from the CS studies to the CS Phd program, and eventually CS academia.

gives a schematic representation of these three categories of actions, which are listed below.

Action items for a balanced flow of students into CS.

- Student-ambassadors of all genders to present CS to high school and middle high school students.
- Highlight problem solving aspect of CS, flexible and interesting program, job opportunities. CS is something that everyone can do.

Action items for a balanced CS study environment.

- Organize social events where senior students offer tips and share experiences and success stories with junior students.
- Have mandatory videos with examples of unaccepted behaviors (e.g, inappropriate jokes, stalking, etc).
- Advise faculty members to ensure that lectures and assignments accommodate a variety of interests.
- Advise faculty members to ensure that colloquiums are not transformed into boys-clubs.
- Increase the number of female TAs.
- Explore the opportunity to have a few preparatory weeks for programming before starting the first semester in CS.

Action items for a balanced flow of candidates into CS academia.

- Hold events that clearly describe the academic career and the PhD program in CS.
- Advise faculty members to move PhD applications earlier at the academic year.

5 Related Work

The discussion sessions with the students helped us identify action items to achieve (i) a balanced flow of students into CS studies, (ii) a balanced environment within the CS department, and (iii) a balanced flow towards CS academia (i.e., PhD and beyond). This section discusses how prior work tackles these three aspects separately. For an extensive overview of initiatives for improving gender balance in CS, we refer the reader to Jaccheri et al. [14].

Our discussion participants highlighted in Figure 13 that we need to “deal with the issue [of gender balance] at a younger age”. A recent aggregated study [13] collects 22 measures and strategies for CS educators in secondary education to sustain the interest of female students in the CS classes. Our action items for a balanced flow of students into CS are aligned with the proposed measurements in [13] that aim to demolish stereotypes. Our observations are also aligned with a study [9] concluding that: family and friends have high impact to the decision of girls to study CS, courses for CS should be introduced earlier at school, one should highlight the problem-solving aspect of CS and surface female role models. A successful strategy for increasing the percentage of CS female undergraduate students at CMU (close to 50% was the percentage of female students that entered the CS program in 2018) is presented in [12]. Two points of this strategy are that the curriculum does not have to change to become more “female-friendly”, and that it is important to promote cultural changes within the institution (e.g., create entry level courses for students with no prior programming experience, increase the visibility of women, break stereotypes). These points address two main reasons [23] for the low enrollment of female students in CS programs: “bias in early socialization” and “anxiety towards technology”. A more recent paper [22] refines those reasons into three categories: social (e.g., stereotypes), educational (e.g., unattractive CS learning environment), and labor market (e.g., unattractive jobs). Then the authors present ways to address those reasons, by communicating different perspectives of CS and engaging female students to various CS experiences.

Understanding the culture within the study environment of a CS department is a prerequisite for decreasing the gender gap. CMU employed student interviews [11] to inform its strategy for better gender balance. Margolis et al. [18] investigate how the interest of female students about their CS studies might decline and eventually lead to drop-out. Rosenstein et al. [21] report that, within a sample of 200 students, “57% were found to exhibit frequent feelings of the Impostor Phenomenon with a larger fraction of women (71%) experiencing frequent feelings of the Impostor Phenomenon than men (52%)”. Miller et al. [19] focus on students with minoritized identities of sexuality and/or gender (MioSG) in STEM, and concludes that these students are enduring a “dude culture” that fosters hypermasculinity and suppresses discourses related to sexual orientations other than heterosexuality. On the positive side, interviewing STEM students, Rainey et al. [20] conclude that active teaching may improve the sense of belonging for underrepresented students. Finally, Lagesen [15] interviews Malaysian

female students, which form around 50% of the student body, to see how their perception about CS differs from the western culture.

A more limited number of studies have been devoted to fostering a gender-balanced flow of students towards PhD and beyond. For example, Moreno et al. [10] interview doctoral CS students on the reasons that led them to apply to a PhD program. The authors identified five main reasons: academic career goal, professional development, career change, employment opportunity and personal fulfillment. Personal fulfillment was the most popular reason given.

6 Conclusion

To understand how the gender balance in our CS department can be improved, we organized discussion sessions among CS undergraduate students, who shared their thoughts about: the reasons they picked CS for their studies, their current experience with the CS studies, their intention to pursue an academic career in CS, and ways to make the CS community more diverse and inclusive. From their answers we identified action items for achieving a balanced flow of students into CS undergraduate program, a study environment that embraces diversity, and a balanced flow of students into higher levels of the CS academia. After the completion of the discussion sessions, the students were able to submit their feedback. We were pleased to see that they enjoyed the discussion and thought that the questions we asked were important. The participants also appreciated our effort to use neutral and not-offensive language for the questions and the discussion that they triggered.

Acknowledgements

We would like to thank Lilli Mittner for recommending Árdna for holding the discussion sessions and for giving inspiration for the discussion questions. Lynn Nygaard gave us inspiration for these questions, too. We also thank Melina Duarte for providing network support for BBI within UiT, and Ingeborg Owe- sen for providing network support for BBI within BalanseHub. Finally, we are grateful to the administration of the CS department and the members of BBI for their help in organizing the discussion sessions. This work has been partially supported by the COST Action CA19122, from the European Network for Gender Balance in Informatics, and by the NFR grant 321075 for BBI.

References

1. European network for gender balance in informatics. <https://eugain.eu/>
2. Gender balance in research leadership. <https://uit.no/research/prestige>
3. Google 2022 diversity annual report 2022. <https://about.google/belonging/diversity-annual-report/2022/>
4. ICT specialists in employment. <https://ec.europa.eu/eurostat/>



Fig. 15. A discussion session at Árdna, UiT.

5. Microsoft diversity & inclusion report. <https://www.microsoft.com/en-us/diversity/default.aspx>
6. Network support to promote gender balance in norwegian research. <https://www.forskingsradet.no/utlysninger/2021/balanshub/>
7. Booklet: Best practices from school to university. <https://eugain.eu> (2022)
8. Albusays, K., Bjorn, P., Dabbish, L., Ford, D., Murphy-Hill, E., Serebrenik, A., Storey, M.A.: The diversity crisis in software development. *IEEE Software* **38**(2), 19–25 (2021)
9. Alshahrani, A., Ross, I., Wood, M.I.: Using social cognitive career theory to understand why students choose to study computer science. Association for Computing Machinery, New York, NY, USA (2018)
10. del Carmen Calatrava Moreno, M., Kollanus, S.: On the motivations to enroll in doctoral studies in computer science — a comparison of phd program models. In: 2013 12th International Conference on Information Technology Based Higher Education and Training (ITHET). pp. 1–8 (2013)
11. Fisher, A., Margolis, J., Miller, F.: Undergraduate women in computer science: Experience, motivation and culture. Association for Computing Machinery, New York, NY, USA (1997)
12. Frieze, C., Quesenberry, J.L.: How computer science at CMU is attracting and retaining women **62**(2) (2019)

13. Happe, L., Buhnova, B., Koziolk, A., Wagner, I.: Effective measures to foster girls' interest in secondary computer science education. *Education and Information Technologies* **26**(3) (2021)
14. Jaccheri, L., Pereira, C., Fast, S.: Gender issues in computer science: Lessons learnt and reflections for the future. In: 2020 22nd International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC). pp. 9–16 (2020)
15. Lagesen, V.: A cyberfeminist utopia?: Perceptions of gender and computer science among malaysian women computer science students and faculty. *Science Technology & Human Values* **33**, 5–27 (01 2008)
16. Letizia Jaccheri et. al.: Where are the female professors in STEM? (12 2022)
17. Lewin, A., Sathianathan, D., Lenhard, J., Britton, A.O., Warnock, E., Bavey, N.: The state of diversity in european tech, <https://eic.ec.europa.eu/system/files/2022-05/EIC%20report%20presentation.pdf>
18. Margolis, J., Fisher, A., Miller, F.: The anatomy of interest: Women in undergraduate computer science. *Women's Studies Quarterly* **28**(1/2), 104–127 (2000)
19. Miller, R.A., Vaccaro, A., Kimball, E.W., Forester, R.: "It's dude culture": Students with minoritized identities of sexuality and/or gender navigating stem majors. *Journal of Diversity in Higher Education* **14**, 340–352 (2021)
20. Rainey, K., Dancy, M., Mickelson, R., Stearns, E., Moller, S.: A descriptive study of race and gender differences in how instructional style and perceived professor care influence decisions to major in stem **6**(1) (2019)
21. Rosenstein, A., Raghu, A., Porter, L.: Identifying the prevalence of the impostor phenomenon among computer science students. In: Proceedings of the 51st ACM Technical Symposium on Computer Science Education. p. 30–36. Association for Computing Machinery, New York, NY, USA (2020)
22. Szlávi, A., Bernát, P.: Young women's barriers to choose it and methods to overcome them - a case study from Hungary. *Teaching Mathematics and Computer Science* **19**(1), 77–101 (Oct 2021)
23. Varma, R.: Why so few women enroll in computing? Gender and ethnic differences in students' perception. *Computer Science Education* **20**(4), 301–316 (2010)