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Intersectionality in Computer Science: A Systematic Literature Review

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***Abstract*—Gender equality, as well as Diversity, Equity, and Inclusion (DEI), in computer science (CS) is primarily limited to binary gender diversity. It is known that women are heavily underrepresented in CS, but substantial parts of the DEI issues are still unexplored. Intersectionality provides a more nuanced perspective of equality as it acknowledges exclusion and discrimination coming from overlapping layers of people's identities, e.g. gender, ethnicity, dis/ability, nationality, socioeconomic status, age, religion, and sexuality, in combination. It is important to address systemic barriers, bias, and stereotypes in CS through the lenses of intersectionality. There is a growing literature on challenges of women and binary gender diversity in CS, but a limitation to many of these investigations is that they look at only one dimension of discrimination rather than the complexity of intersectional challenges. That is why the research objective of this study is to provide information on the relation of intersectionality and CS, using the Systematic Literature Review methodology. The results show that there is still scarce research explicitly connected to the concept of intersectionality in CS, but awareness is increasing. The SLR also reveals various challenges and success factors related to intersectionality, which call for further attention.**

***Index Terms*—Intersectionality, Diversity, Inclusion, Computer Science, Systematic Literature Review**

I. Introduction

Tech companies often join the Diversity, Equity, and Inclusion (DEI) conversation because it is beneficial for their image as an employer, but in general, the conversation usually stops at binary gender diversity [1] [2]. When researching diversity in computer science (CS) (as well as related fields such as software engineering (SE), information and communication technology (ICT), information technology (IT), informatics, computing, etc.), it is important to do so through an intersectional lens, to fully understand the complexities and nuances of the issues and their possible solutions. Intersectionality encompasses how overlapping factors of a person's identity, e.g. ethnicity, nationality, disability, gender expression, sexuality, religion, and socioeconomic background, affect individuals in their daily lives, contributing to discrimination [3]. Overwhelmingly, diversity in CS is understood as gender diversity, within the frames of UN's Sustainable Development Goal (SDG) 5, Gender Equality [4]. Statistics from Europe show that women are still highly underrepresented in CS. In order to reach the 5th SDG – gender equality – within CS, intersectionality must also be a part of the solution [5]. Binary gender is only one dimension of inclusion, whereas intersectionality considers multiple dimensions of a person's identity and the complexities of how these parts intersect leading to exclusion. With an intersectional approach, DEI can lead to greater creativity and success in CS [6]. Furthermore, having diverse developers helps prevent the creation of software that perpetuates harmful stereotypes and/or bias.

The research objective of this paper is to provide knowledge about intersectionality in CS, both at the university and professional levels. Relatively many studies research the inclusion of women and binary gender diversity within the CS field [7] [8], and several acknowledge that a recurring limitation in this research area is staying within the binary and ignoring the concept of intersectionality [9] [10]. Thus, few studies about diversity in CS look beyond one dimension and consider the complexity of challenges linked to and explicitly attributing them to intersectionality. These factors motivated the following research questions (RQs):

- **RQ1:** What recent research exists that explicitly embraces intersectionality within computer science?
- **RQ2:** What are the main intersectional challenges in computer science?
- **RQ3:** What factors are important to overcome these challenges and succeed in computer science?

To address the research questions **RQ1**, **RQ2**, and **RQ3**, a Systematic Literature Review (SLR) was performed to review primary studies within this project scope and to understand intersectionality in CS. The principles by Kitchenham were used to perform the SLR [11].

The structure of this paper is as follows. Section II presents the background, which elaborates on diversity in CS. The research methods are presented in Section III. Section IV

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presents the results from the SLR, and Section V discusses these findings in relation to the research questions, as well as the limitations. Lastly, Section VI concludes the paper by reflecting on the research questions and future works.

II. Background

A. Intersectionality

Intersectionality was a term first introduced by Kimberle Crenshaw [12], to address the intersections between multiple overlapping components of a person's identity, e.g. nationality, ethnicity, dis/ability, gender expression, sexuality, religion, socio-economic background etc., and how the combination of these identity segments affect their everyday lives leading to exclusion [3]. Crenshaw found that some of the challenges Black women in the US faced remained hidden when looking at only race or gender as a source of discrimination. Instead, it was necessary to consider the combination of these identity factors together, which is how the Theory of Intersectionality was born. The overlapping factors, such as religion, gender & sexuality, socio-economic status, ethnicity, indigeneity, nationality, dis/ability, and education, affect one's experiences as a whole. The combination of these factors can account for the individual's unique disadvantages and challenges.

When commenting on SDG 5 and striving for DEI, the UN underlines the importance of intersectionality, in order to leave no one behind and use our resources better [5].

B. Diversity in Computer Science

By the 21st century, technology has become ubiquitous, penetrating people's daily lives. To make software fit a wider range of users, it is essential to have diversity within the development team. Studies show that diversity leads to greater creativity and success[1]. Even more importantly, a team that is not diverse enough is likely to produce software that is based on and maintains bias. One example of this is face recognition algorithms, where females, especially females with darker skin tones, were left out during development, as well as assessment. Multiple face recognition algorithms were reported to work with an accuracy over 90%, which is classified as high accuracy, but this meant only for male subjects with lighter skin tones. As opposed to this, female participants with darker skin tones had up to 34.4% worse accuracy [13]. It is important to have diversity in CS to ensure the product created can be universal and suitable for a wider range of user group. In order to overcome this technical and social problem, an intersectional approach accounting for the overlap of (in this specific case, at least) gender and race would be necessary.

Computer Science is considered to be a homogeneous field, with professionals who are predominantly white, heterosexual, Global Northern, young, middle-class, cis-gendered men [14]. Although historically women and women of color had a great part in computing, as the profession grew more prestigious, it became more and more white and male-centered, pushing others out of the field through the means of discrimination [15] [16] [17]. "Erasure is not merely an issue of representation, but a foundation on which systematic racism, misogyny, and inequity rely" [15].

[1]https://www.diversityintech.co.uk/the-benefits-of-diversity-in-tech

III. Research Method

In order to uncover the relation between intersectionality and exclusion in CS, we chose the methodology of systematic literature review. We decided to explore papers that do research specifically and explicitly on intersectionality in the frames of CS, either within academia or industry. The advantages to using SLR as a research method are that it identifies gaps in current research and suggests areas for future research activities. Moreover, it synthesises existing research in a fair manner; thus, reproducibility of the systematic review is enhanced and bias reduced [11].

A. Identification of Research Questions

The research objective of this paper is to provide knowledge about intersectionality in CS, both at the university and the professional level, as well as to contribute to research that acknowledges the complexity of intersectional challenges beyond the one-dimensional narrative in CS. We were interested to see to what extent CS has embraced the term of intersectionality which has been widely around in other disciplines [12] [18] [19]. Based on this rationale, the authors defined three RQs, presented in Table I.

Table I

Research Question	Motivation
RQ1: What recent research exists that explicitly embraces intersectionality intersectionality in computer science?	To determine how much CS has started to embrace the concept of intersectionality that Social Sciences has widely been using.
RQ2: What are the main intersectional challenges in computer science?	To focus on the experiences of university students and improve retention and sense of belonging.
RQ3: What factors are important to overcome these challenges and succeed in computer science?	To understand how to design protocols including intersectionality in CS careers and education for increased diversity.

B. Data Collection

The authors used Scopus, the largest electronic database of peer-reviewed academic, to search for primary studies because it supports the usage of complex search queries and provides an exhaustive selection of peer-reviewed studies and published books. After four trial searches, the authors identified *intersectionality* as the most essential keyword for the search query to align with the RQs.[2] Table II presents the final search query used in this SLR.

Table II
Search string applied in Scopus database.

Database	Search string applied	Result
Scopus	`TITLE-ABS-KEY( intersectionality ) AND (LIMIT-TO( SUBJAREA, "COMP" ))`	244

[2]We understand that this poses limitations to the search, as papers addressing intersectional challenges without mentioning intersectionality, are left out.

C. Selection of Studies

The search query used in Scopus (see Table II) retrieved 244 studies. The selection process is illustrated by Figure 1.

The authors first filtered the results to only include studies in English that were from 2018 or later since studies from the past five years would provide the most relevant and updated research. This first filtration retrieved 195 possible primary studies. These studies were exported to Endnote, a tool used to manage papers obtained throughout the literature search [11].

After the full texts of the possible primary studies were retrieved in Endnote, the inclusion and exclusion criteria were defined based on [11], to guide the screening of the titles and abstracts, which was performed in parallel by the authors to ensure the reliability of the inclusion decisions and help avoid selection bias.

Inclusion criteria:

1) The paper addresses the RQs.
2) The paper is published in 2018 or later.
3) The paper has intersectionality as a keyword.
4) The paper has subject area computer science.

Exclusion criteria:

1) Papers not in English
2) Papers about computer science or technology that does not discuss intersectionality.
3) Duplicated work presenting a similar result by the same author.

After completing the parallel screening process, a second screening was performed by the authors on any studies that were deemed as relevant only by one of the authors, opening a discussion on which of these potential primary studies should be included further in the selection process as recommended by Kitchenham [11]. This led to the number of papers being limited to 74 following the first and second screening of titles and abstracts.

The next stage of the SLR was to define the quality criteria to further assess the "quality" of the potential primary studies [11]. By looking at the introduction, discussion, conclusion, headings, tables, and figures of the 74 papers, a more thorough screening process could take place. Each paper was given a quality score between 0 and 2 by the authors, where *0* meant the paper was excluded, whilst *2* meant the paper was included. Any paper that got a score *1* by all authors or a score *1* and *2* was discussed further based on the quality criteria after the parallel screening was complete. After the quality assessment process, 16 primary studies remained. The list of the selected studies is in Appendix A.

Given the rigorousness of the selection process in an SLR, it was expected that a large number of papers would be excluded. The final number of primary studies selected for this SLR could further support that there is a gap in research explicitly concerning intersectionality in CS.

D. Data Extraction and Monitoring Progress

After completing the selection process, the SLR resulted in 16 primary studies. The data extraction and monitoring process consisted of filling out a data extraction form to record the information obtained by the authors from the primary studies. Random samples of the studies and their results were cross-checked by the authors to promote quality [11].

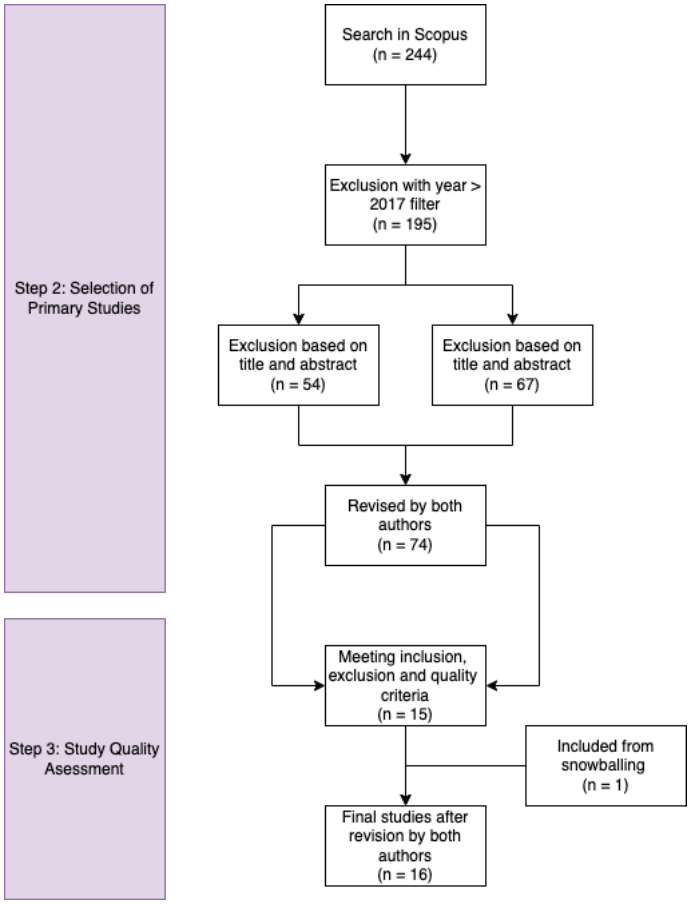

Figure 1. Study selection process

IV. Results

This section presents the results obtained from the 16 primary studies in the SLR, providing new insight into intersectionality in the CS field. The overview of the findings for each RQ is displayed in Appendix B.

A. RQ1: What recent research exists that explicitly embraces intersectionality within computer science?

The search query as defined in Table II was used to investigate what recent research existed explicitly about intersectionality in CS. We identified 16 relevant studies between 2018 and 2022.

The earliest research on intersectionality in CS, according to Scopus, is from 2009. Between then and now, the highest frequency of research contributions to this area was in the period of 2018 and 2022, which justifies our inclusion criterion of focusing on papers published in or after 2018. The recently growing number of papers, as well as the fact that 75% of the papers included in our SLR were published in the

last three years (2020-2022), indicate that the awareness of intersectionality is increasing.

At the same time, when we look at where the data are from, we find a less promising trend. Due to the specificities of cultural contexts, it is relevant to consider intersectional data from a wide range of cultures. 13 of the 16 studies, that is, 81% have gathered their data in the US; that is, only a small portion of the world is represented. The only 3 studies from outside of the US are from Ireland (two studies) and India (one study), which means that the Global South is severely underrepresented.

It is important to note that even if all selected studies focused on intersectionality, it varied what identity segments were actually addressed. Figure 2 visualizes the factors used in the studies when examining intersectionality. Most of the studies have ethnicity and gender as factors in their data generation when looking at intersectionality. The two studies that are placed only within the gender group do have another factor called "minority," which can encompass all of the factors initially presented in Section II-A as it is the participants' subjective choice.

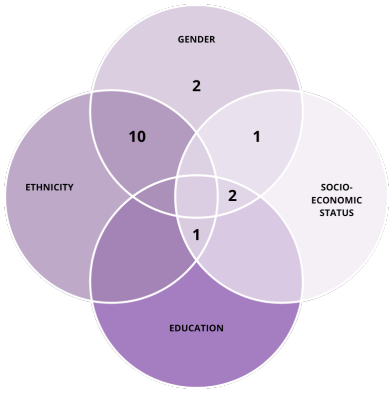

Figure 2. Venn diagram presenting the intersectionality factors in the studies.

Regarding the methodology used to gather data, 56% of the studies in the SLR used a quantitative analysis approach. 6 of the papers applied the method of triangulation, which enhances their validity as two or more data generation methods were used to corroborate their findings. Of these 6 papers, an equal number were mixed, qualitative, and quantitative studies, and 50% used the survey strategy.

B. RQ2: What are the main intersectional challenges in computer science?

Many of the studies revolve around how underrepresented groups face stereotypes, discrimination and bias as challenges they had to overcome in CS. S02, S08, and S10 point out that (within the US context) especially Black women experience the feeling of being the only one [20] [21] [22]. This emphasizes that female CS students face a lower sense of belonging and that Black students face an even lower sense of belonging than White students, as discussed in S09 and S16 [23] [24]. S12 explicitly looks into the difference between being a woman, being Black and the intersection of being both Black and a woman in the US, further emphasizing how intersectional challenges are intertwined [25].

C. RQ3: What factors are important to overcome these challenges and succeed in computer science?

The results related to RQ can be categorized into two main groups. According to the studies, the primary means of overcoming intersectional challenges are a sense of belonging and mentoring. Some other success factors were also mentioned that do not fall into the above two groups. More specifically, 12 out of the 16 papers discuss solutions related to a sense of belonging, as an important factor for overcoming challenges that arise from intersectional differences; 6 studies were related to mentorship; and 6 suggested other solutions as tools to overcome such challenges, also helping to increase diversity in CS.

V. Discussion

A. Principal Findings

There is a dearth of research about intersectionality in CS (synthesised from [20] [26] [22] [16] [27] [25] [28]). When comparing this to the research on intersectionality in general, there is a clear and steady increase in papers being published on the topic between 2018 and 2022. In this timeframe, research on intersectionality has doubled, while research on intersectionality in CS has quadrupled. It must be noted, though, that most of the studies found in the SLR were from the US and that most studies about intersectionality in CS, overall, are from the US. The increased interest to research intersectionality in these years can be tied to the broader social context and specifically events like the #MeToo movement and the Black Lives Matter movement.

The #MeToo movement had an important impact on the tech industry as well, as it highlighted the misogynistic work culture in Silicon Valley high-tech firms. This disproved that CS was a meritocracy [22] [16], and uncovered how the companies had extensive knowledge about and were enabling sexual harassment in the workplace [29] [30] [31]. These issues were also highlighted in the SLR. S10 and S11 state that upholding the false notion that CS is a colorblind meritocracy is dismissive of intersectional experiences and enables an inequitable workplace [22] [16]. S08 and S13 also state that many tech companies continue to perpetuate this misogynistic culture in CS throughout the hiring process and at the workplace (e.g. by only using male computer scientists and engineers in the hiring process), thus not improving the recruitment and retention of underrepresented people [21] [27].

2020 was also an important year for intersectionality. This year marked the beginning of the COVID-19 pandemic and the resurgence of the Black Lives Matter movement. Both of these events opened a new conversation concerning inclusion and intersectionality. S05, S07, and S09 support that the pandemic was an important factor that decreased the sense of belonging in CS, but also highlighted how marginalised people

continuously have had a lesser sense of belonging in CS from being students and into their professional careers [32] [33] [23]. Furthermore, S07, S02, and S03 state that the resurgence of the Black Lives Matter movement placed intersectionality on the agenda through a call to action from the CS community to be an active leader of change for equity, which further proved that oppression and ignorance had enabled CS to hide behind the false narrative of being a meritocracy [33] [20] [26].

Even if the issue has been put on the agenda more in the past years, it has been the case mainly in the US. In addition, most studies (9 out of 16) address only the intersection of gender and ethnicity. In fact, when comparing the intersectionality framework (see subsection II-A) with the primary studies, only half of the intersectionality factors were discussed in all of the papers combined. This supports that there is a clear gap in research regarding intersectionality in CS.

All 16 studies in the SLR addressed intersectional challenges in CS.

S11, S08, S10, S02, and S05 found that people of underrepresented identities in CS were more likely to be talked down to, have their qualifications questioned, and experience imposter syndrome as a result of low expectations either in the workplace or in their studies [16] [21] [22] [20] [32]. Moreover, a lack of diversity in the workplace is considered to lead to blatant discrimination and a lost sense of belonging. It is indicated that marginalised people are more likely to miss out on opportunities of advancement, due to promotional practices built on informal networks [16] [22].

Female students face a lower sense of belonging, as discussed in S09, and studies from the US found that Black students face an even lower sense of belonging than White students, especially when they are both Black and women [23] [21] [22] [27] [20] [24]. According to the study, women who self-identified as a minority experienced a lower sense of belonging in CS education [23]. In an industry context, S01 also discusses this explaining how Indian women face more constraints as CS professionals due to societal expectations and traditional gender roles [34] than Indian men. One interviewee in S11 recounted an experience of receiving a harmful stereotypical comment from a male colleague; “I love having you on my team because if we have a problem, I can ask you to handle it because they’ll be afraid of an angry Black woman” [16]. This shows that harmful stereotypes that exist in CS further decrease a person’s sense of belonging through objectification and dehumanization. Being underrepresented not only means isolation but a lack of having role models and a support system that understands the complexities arising from intersectionality.

15 of the 16 studies identified factors that can help overcome intersectional challenges in CS. These success factors were grouped into three different categories: a sense of belonging, mentorship, and other means.

Having a sense of belonging was found as a success factor in most of the studies analysed in this SLR. The importance of having a network of support was discussed in S13, as being around other people of similar intersectional backgrounds makes one feel less isolated [27]. These networks could be in the form of a peer community since this simultaneously creates a CS network and a social network, presented in S14 [35]. Having a social network in CS was found critical in increasing the probability of choosing CS in higher education [35] [33] [25] [26]. Moreover, the academic/professional CS network was essential in building career confidence and technical skills [35] [21] [16] [36] [27] [32]; further supporting retention in CS. Thus, the network that a person is involved in can help increase their sense of belonging since they can identify with or have empathy for different intersectional experiences while also contributing to a richer, more inclusive environment in CS.

Another prominent success factor found through this SLR was mentorship programs. Mentoring could act as a tool to support diversity in CS and help increase the sense of belonging. In terms of mentoring, intersectional mentorship from S14 was suggested as an extended version of academic and professional mentoring since this supports and acknowledges intersectional issues, and systemic barriers in CS [35]. Awareness and empathy for the background of the mentees are important to have a good mentee-mentor relationship because the mentor understands the mentee’s specific concerns [35], which strengthens the effect of mentoring as well as the mentee’s sense of belonging. Additionally, mentorships were found to be especially important in the early career stages, as mentors could be proactive in sharing imperative information with the mentee about their personal experiences in CS, the work culture, in addition to providing advice and guidance on coping mechanisms or advocate for career advancements [16] [21] [22] [27]. Hence, these factors should be considered when developing and implementing a mentorship program that promotes DEI.

Intersectional mentoring could lessen discriminatory occurrences since this would implicitly increase diverse hiring and use intersectional experiences to define an inclusive and equitable environment. So when creating a mentor program, it is important to reflect on how the mentors and mentees should be matched together. Regarding cross-ethnic and cross-gender, S11 points out that women have greater difficulty with these types of mentor relationships since this could lead to power imbalance in the mentor-mentee relationship [16].

B. Limitations

As discussed earlier, there is a scarcity of research on intersectionality in CS. It must be admitted that the low number in our SLR can also be attributed to the fact that we used Scopus only, which is the largest database but not the only one. In our future works, we will perform a more extended search.

Another reason for the low number of papers can be explained with the fact that we focused on papers explicitly mentioning intersectionality. This also meant that our search did not include papers that address intersectional challenges without mentioning the term itself in their titles, abstracts, or

keywords. While this limitation results in a darker picture, it must also be mentioned that many of the excluded studies (such as [37], [38], [39]) typically address race and gender, only two segments of intersectional challenges, which is in line with our findings.

Most of the studies in our SLR tend to concentrate only on two identity factors of intersectionality, mainly ethnicity and binary gender. There was little to no discussion of dis/-ability, different nationalities, sexuality, or gender expression. Some studies that were left out due to our explicit focus on intersectionality as a term do work with more than two identity segments, such as gender, ethnicity, and culture [40], or on less researched identity segments such as transgender individuals [41]. Therefore, a more extended search would possibly be able to bring more results and a more positive picture of the field.

VI. Conclusion

In this paper, the authors analyzed the literature related to intersectionality in CS. 16 primary studies from the period 2018-2022 have been selected and reviewed.

Even if there are many studies on binary gender diversity in CS by now, there is a clear shortage of research in connection with and explicitly about intersectionality, which would provide a broader and more nuanced perspective of what diversity would mean in CS. Multiple studies in our SLR expressly comment on the scarcity of research done in the field. The earliest research found on intersectionality in CS is from 2009, but the number of papers started to rise mainly in the past couple of years, which motivated the selection of our research period. This shows that the awareness of intersectionality is increasing in CS and that academic attention is most probably influenced by social issues, e.g. #MeToo, the COVID-19 pandemic, and Black Lives Matter.

However, most of the studies found in the SLR were still only from the US, which is a problem, as the issue of intersectionality is complex and context-dependent. Multiple views on the situation should be represented through the literature to fully understand intersectionality in CS since each country has differing views, norms, and intersectional challenges.

The intersection between binary gender and ethnicity was discussed the most in the primary studies. However, none of the studies reflected on the experiences of having more than two intersecting identities. In total, only 4 intersectional factors were discussed in the 16 studies, but, e.g. dis/ability was not researched together with other factors even though it is considered the world's most significant minority. To increase diversity in CS, all factors of intersectionality must be in focus, and there needs to be more awareness of intersectional challenges, such as bias and stereotypes, as well as more research from all parts of the world.

Multiple studies have shown that a lack of diversity leads to discrimination and a lack of sense of belonging among underrepresented identities, which is a concern and a challenge in CS. A lower sense of belonging is also the result of systemic barriers based on stereotypes, bias, and imbalanced power dynamics, e.g, exclusion from informal networks, unrealistic expectations based on traditional gender roles and/or stereotypes, and the lack of role models and support. In general, the CS field still does not acknowledge the power of intersectionality – and/or is less aware of the term itself – exploring how challenges arise differently depending on people's intersecting identities.

In many studies, having a supportive network has been addressed as a solution to the low sense of belonging experienced by individuals in underrepresented groups. Multiple studies suggested mentorship programs as a concrete example of overcoming challenges and succeeding in CS. When a mentee of an intersectional background has a mentor that understands and has empathy for the mentee, the mentee feels more included in the CS environment, especially in the early stages of their career, which can lead to better retention and a more diverse field.

As further studies, we would like to extend our search to include more papers, even if they fail to acknowledge the term, in order to see if the picture gets more complex or less grim. In addition, building on research dealing with intersectionality in CS, we aim to develop a research protocol (including both an interview guide and a questionnaire), to deepen the understanding of the main intersectional challenges, considering three different factors: gender, ethnicity, and socio-economic status. This year, we plan to execute this study in Norway and Brazil, with the hope to extend it even further. Since CS undergraduates in Brazil face significant differences in socio-economic status, this could bring different challenges. We intend to contrast the new results with the findings of this study, contributing to a more robust body of knowledge about intersectionality in CS.

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References

[1] S. Shah. (2021) Diversity and inclusion: Moving beyond buzzwords. [Online]. Available: https://www.forbes.com/sites/forbestechcouncil/2021/12/28/diversity-and-inclusion-moving-beyond-buzzwords/

[2] A. Lewin, D. Sathianathan, J. Lenhard, A. O. Britton, E. Warnock, and N. Bavey. (2022) The state of diversity in european tech. [Online]. Available: https://eic.ec.europa.eu/system/files/2022-05/EIC%20report%20presentation.pdf

[3] Gender Innovations. Intersectionality. [Online]. Available: http://genderedinnovations.stanford.edu/terms/intersectionality.html

[4] United Nations. (2022) Goal 5: Achieve gender equality and empower all women and girls. [Online]. Available: https://www.un.org/sustainabledevelopment/gender-equality/

[5] United Nations Entity for Gender Equality and the Empowerment of Women (UN Women). (2021) Intersectionality resource guide and toolkit: An intersectional approach to leave no one behind. [Online]. Available: https://www.unwomen.org/en/digital-library/publications/2022/01/intersectionality-resource-guide-and-toolkit

[6] Y. A. Rankin and N. Han, "Exploring the plurality of black women's gameplay experiences," *Conference on Human Factors in Computing Systems - Proceedings*, 2019.

[7] L. M. Frehill and J. M. Cohoon, *Gender and Computing*. Cham: Springer International Publishing, 2015, pp. 237–272. [Online]. Available: https://doi.org/10.1007/978-3-319-08629-3_8

[8] K. Sharma, J. C. Torrado, J. Gómez, and L. Jaccheri, "Improving girls' perception of computer science as a viable career option through game playing and design: Lessons from a systematic literature review," *Entertainment Computing*, vol. 36, p. 100387, 2021.

[9] K. Albusays, P. Bjorn, L. Dabbish, D. Ford, E. Murphy-Hill, A. Serebrenik, and M.-A. Storey, "The diversity crisis in software development," *IEEE Software*, vol. 38, no. 2, pp. 19–25, 2021.

[10] A. Szlávi and M. Landoni, "Human computer interaction-gender in user experience," in *International Conference on Human-Computer Interaction*. Springer, 2022, pp. 132–137.

[11] B. Kitchenham, "Procedures for performing systematic reviews," Department of Computer Science, Keele University, UK, Keele University. Technical Report TR/SE-0401, 2004.

[12] K. Crenshaw, "Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist policies," *University of Chicago Legal Forum*, vol. 1989, no. 1, pp. 139–167, 1989.

[13] A. Najibi. (2020) Racial discrimination in face recognition technology. [Online]. Available: https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-technology/

[14] S. Stumpf, A. Peters, S. Bardzell, M. Burnett, D. Busse, J. Cauchard, and E. Churchill, "Gender-inclusive HCI research and design: A conceptual review," *Found. Trends Hum.-Comput. Interact.*, vol. 13, no. 1, p. 1–69, 2020.

[15] J. L. Rankin. (2020) Whitewashing tech: Why the erasures of the past matter today. [Online]. Available: https://medium.com/@AINowInstitute/whitewashing-tech-why-the-erasures-of-the-past-matter-today-166d0d5e2789

[16] K. McGee, "The influence of gender, and race/ethnicity on advancement in information technology (IT)," *Information and Organization*, vol. 28, no. 1, p. 1 – 36, 2018.

[17] Women in Tech. (2022) The history of women in tech. [Online]. Available: www.womenintech.co.uk/the-history-of-women-in-tech

[18] B. Robnett, "Race and gender intersections," 2001.

[19] L. J. McCall, "The complexity of intersectionality," *Signs: Journal of Women in Culture and Society*, vol. 30, pp. 1771 – 1800, 2005.

[20] Y. A. Rankin, J. O. Thomas, and S. Erete, "Black women speak: Examining power, privilege, and identity in CS education," *ACM Transactions on Computing Education*, vol. 21, no. 4, 2021.

[21] S. J. Lunn, E. Zerbe, and M. S. Ross, "Need for change: How interview preparation and the hiring process in computing can be made more equitable," *2022 CoNECD - Collaborative Network for Engineering and Computing Diversity*, 2022.

[22] J. O. Thomas, N. Joseph, A. Williams, C. Crum, and J. Burge, "Speaking truth to power: Exploring the intersectional experiences of black women in computing," *2018 Research on Equity and Sustained Participation in Engineering, Computing, and Technology, RESPECT 2018 - Conference Proceedings*, 2018.

[23] C. Mooney and B. A. Becker, "Sense of belonging: The intersectionality of self-identified minority status and gender in undergraduate computer science students," *ACM International Conference Proceeding Series*, p. 24 – 30, 2020.

[24] A. Nguyen and C. M. Lewis, "Competitive enrollment policies in computing departments negatively predict first-year students' sense of belonging, self-efficacy, and perception of department," in *Proceedings of the 51st ACM Technical Symposium on Computer Science Education*, ser. SIGCSE '20. New York, NY, USA: Association for Computing Machinery, 2020, p. 685–691.

[25] M. Ross, Z. Hazari, G. Sonnert, and P. Sadler, "The intersection of being black and being a woman," *ACM Transactions on Computing Education*, vol. 20, no. 2, 2020.

[26] S. Lunn, L. Zahedi, M. Ross, and M. Ohland, "Exploration of intersectionality and computer science demographics: Understanding the historical context of shifs in participation," *ACM Transactions on Computing Education*, vol. 21, no. 2, 2021.

[27] Y. A. Rankin and J. O. Thomas, "The intersectional experiences of black women in computing," *SIGCSE 2020 - Proceedings of the 51st ACM Technical Symposium on Computer Science Education*, p. 199 – 205, 2020.

[28] M. A. Jarrell, R. G. Anaraky, B. P. Knijnenburg, and E. M. Ash, "Using intersectional representation and embodied identification in standard video game play to reduce societal biases," *Conference on Human Factors in Computing Systems - Proceedings*, 2021.

[29] J. McGregor. (2018) Uber, google and the long, lingering tail of #metoo. [Online]. Available: https://www.washingtonpost.com/business/2018/10/26/uber-google-long-lingering-tail-metoo/

[30] M. Isaac. (2017) Uber investigating sexual harassment claims by ex-employee. [Online]. Available: https://www.nytimes.com/2017/02/19/business/uber-sexual-harassment-investigation.html

[31] D. Wakabayashi and K. Benner. (2018) How google protected andy rubin, the 'father of android'. [Online]. Available: https://www.nytimes.com/2018/10/25/technology/google-sexual-harassment-andy-rubin.html

[32] K. Kramarczuk, J. Plane, and K. Atchison, "First-generation undergraduate women and intersectional obstacles to pursuing post-baccalaureate computing degrees," *2021 Research on Equity and Sustained Participation in Engineering, Computing, and Technology, RESPECT 2021 - Conference Proceedings*, 2021.

[33] C. Mooney and B. A. Becker, "Investigating the impact of the COVID-19 pandemic on computing students' sense of belonging," *SIGCSE 2021 - Proceedings of the 52nd ACM Technical Symposium on Computer Science Education*, p. 612 – 618, 2021.

[34] S. Dhar-Bhattacharjee and H. Richardson, "A tour of india in one workplace: investigating complex and gendered relations in IT," *Information Technology and People*, vol. 31, no. 2, p. 578 – 594, 2018.

[35] B. Spencer, A. Rorrer, S. Davis, S. H. Moghadam, and C. Grainger, "The role of 'intersectional capital' in undergraduate women's engagement in research-focused computing workshops," *2021 Research on Equity and Sustained Participation in Engineering, Computing, and Technology, RESPECT 2021 - Conference Proceedings*, 2021.

[36] T. Fletcher, A. Green, R. Quintero, and E. Arroyo, "Intersectionality at minority-serving institutions (MSIs): A longitudinal analysis of female student participation within engineering and computing," in *2020 IEEE Frontiers in Education Conference (FIE)*, 2020, pp. 1–8.

[37] K. M. Braswell, J. Johnson, B. Brown, and J. Payton, "Pivoting during a pandemic: Designing a virtual summer camp to increase confidence of black and latina girls," *Proceedings of the 52nd ACM Technical Symposium on Computer Science Education*, 2021.

[38] M. R. Marques, "Software engineering education — does gender matter in project results? — a chilean case study," *2015 IEEE Frontiers in Education Conference (FIE)*, pp. 1–8, 2015.

[39] S. Erete, Y. A. Rankin, and J. O. Thomas, "I can't breathe: Reflections from black women in cscw and hci," *Proc. ACM Hum.-Comput. Interact.*, vol. 4, no. CSCW3, jan 2021. [Online]. Available: https://doi.org/10.1145/3432933

[40] L. Gren, "On gender, ethnicity, and culture in empirical software engineering research," in *2018 IEEE/ACM 11th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)*, 2018, pp. 77–78.

[41] D. Ford, R. Milewicz, and A. Serebrenik, "How remote work can foster a more inclusive environment for transgender developers," in *2019 IEEE/ACM 2nd International Workshop on Gender Equality in Software Engineering (GE)*, 2019, pp. 9–12.

APPENDIX A
STUDIES INCLUDED IN THE SLR

S01 S. Dhar-Bhattacharjee and H. Richardson (2018), "A tour of India in one workplace: Investigating complex and gendered relations in IT"

S02 Y. A. Rankin, J. O. Thomas, and S. Erete (2021), "Black women speak: Examining power, privilege, and identity in CS education"

S03 S. Lunn, L. Zahedi, M. Ross, and M. Ohland (2021), "Exploration of intersectionality and computer science demographics: Understanding the historical context of shifs in participation"

S04 Y. A. Rankin and N. Han (2019), "Exploring the plurality of black women's gameplay experiences"

S05 K. Kramarczuk, J. Plane, and K. Atchison (2021), "First-generation undergraduate women and intersectional obstacles to pursuing post-baccalaureate computing degrees"

S06 T. Fletcher, A. Green, R. Quintero, and E. Arroyo (2020), "Intersectionality at minority-serving institutions (MSIs): A longitudinal analysis of female student participation within engineering and computing"

S07 C. Mooney and B. A. Becker (2021), "Investigating the impact of the COVID-19 pandemic on computing students' sense of belonging"

S08 S. J. Lunn, E. Zerbe, and M. S. Ross (2022), "Need for change: How interview preparation and the hiring process in computing can be made more equitable"

S09 C. Mooney and B. A. Becker (2020), "ense of belonging: The intersectionality of self-identified minority status and gender in undergraduate computer science students"

S10 J. O. Thomas, N. Joseph, A. Williams, C. Crum, and J. Burge (2018), "Speaking truth to power: Exploring the intersectional experiences of black women in computing"

S11 K. McGee (2018), "The influence of gender, and race/ethnicity on advancement in information technology (IT)"

S12 M. Ross, Z. Hazari, G. Sonnert, and P. Sadler (2020), "The intersection of being black and being a woman"

S13 Y. A. Rankin and J. O. Thomas (2020), "The intersectional experiences of black women in computing"

S14 B. Spencer, A. Rorrer, S. Davis, S. H. Moghadam, and C. Grainger (2021), "The role of 'intersectional capital' in undergraduate women's engagement in research-focused computing workshops"

S15 M. A. Jarrell, R. G. Anaraky, B. P. Knijnenburg, and E. M. Ash (2021), "Using intersectional representation and embodied identification in standard video game play to reduce societal biases"

S16 A. Nguyen and C. M. Lewis (2020), "Competitive enrollment policies in computing departments negatively predict first-year students' sense of belonging, self-efficacy, and perception of department"

APPENDIX B
MAPPING OF RESULTS FROM THE SLR

ID	Country	RQ1: Research						RQ2: Challenges		RQ3: Success Factors	
		Intersectionality			Method			Internal	External	Internal	External
		Included factors	*Aborted factors*	*Limitations*	*Strategies*	*Data generation*	*Data analysis*				
S01	India, UK	Gender (binary) Socioeconomic Class and caste			Case study	Interviews Observations	Qualitative		Expectations		Paternity leave Equal pay
S02	US	Black women Gender (binary)			Survey	Interviews	Qualitative	Belongingness Expectations	Stereotypes Assumed competency Discrimination Exclusion		
S03	US	Ethnicity Gender (binary) Socioeconomic		Non-binary Dis/ability LGBTQIA+	Survey	Documents	Quantitative		Enrollment rates Retention Lack of literature	Sense of belonging	Mentorship Peer community Role models Intersectional research
S04	US	Black women Gender (binary)		Non-binary	Survey	Interviews Questionnaires	Mixed	Dehumanisation	Stereotypes in games	Sense of belonging	Intersectional approach
S05	US	Women and non-binary Socioeconomic First-generation student	Non-binary Ethnicity		Survey	Questionnaires	Quantitative	Imposter syndrome Belongingness	Sexism Racism Exclusion	Sense of belonging	
S06	US	Ethnicity Gender (binary)			Survey	Documents	Quantitative	Feeling isolated		Sense of belonging	
S07	Ireland	Minority Gender (binary)	Non-binary LGBTQIA+ Ethnicity Dis/ability Nationality Religion Mature student		Survey	Questionnaires	Quantitative	Belongingness		Sense of belonging	
S08	US	Ethnicity Gender (binary)			Survey	Interviews Questionnaires	Qualitative	Belongingness	Sexism Stereotypes Lack of diversity	Sense of belonging Inclusive thinking	Mentorship Diverse leadership
S09	Ireland	Minority Gender (binary)	Non-binary LGBTQIA+ Ethnicity Dis/ability Nationality Religion Mature student		Survey	Questionnaires	Quantitative	Belongingness	Expectations	Sense of belonging	
S10	US	Black women Gender (binary)			Case study	Interviews Observations	Quantitative	Belongingness Expectations	Sexism Racism Discrimination Exclusion		Mentorship Intersectional approach
S11	US	Ethnicity Gender (binary)			Survey	Interviews	Qualitative		Sexism Racism Exclusion Stereotypes Expectations Assumed competency	Sense of belonging	Mentorship Sponsors Diverse leadership
S12	US	Black women Gender (binary)			Survey	Questionnaires	Quantitative			Sense of belonging	
S13	US	Black women Gender (binary)			Survey	Interviews	Mixed		Exclusion	Sense of belonging	Mentorship Intersectional approach
S14	US	Ethnicity Gender (binary) Socioeconomic			Survey	Interviews Questionnaires	Mixed	Belongingness	Enrollment rates Discrimination Stereotypes Sexism	Awareness Sense of belonging Authentic professional identity Competency	Mentorship Peer community Intersectional approach
S15	US	Ethnicity Gender			Design and creation	Observations Questionnaires	Quantitative		Assumed competency Sexism Racism	Awareness	
S16	US, Canada	Ethnicity Gender (binary)	Non-binary LGBTQIA+		Survey	Questionnaires	Quantitative	Belongingness Experience	Exclusion	Sense of belonging	