

It's not all about gender: A Multi-dimensional Course Perspective on Diversity and Inclusion in Software Engineering Education

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ABSTRACT

Diversity and inclusion (D&I) are topics that are increasingly being recognized as important in CS education. There are a few guidelines on approaching D&I in CS education courses. When narrowing down to Software Engineering (SE), the literature on approaching D&I in SE education is scarce. There has been recent growth in the SE field in the literature covering this topic, mostly around software teams. Still, most publications are not focused on education and are typically centered around gender. However, there are other important dimensions of diversity that remain underexplored, such as race/ethnicity, disability, neurodivergence, and age. This experience report details how we approached those diversity dimensions in a graduate school course – attended by both MSc and PhD students – on Diversity and Inclusion in Software Engineering. We explored two perspectives: users and teams, which relate to the subdomains of Software Requirements and Human Aspects of Software Engineering, respectively. In this course, classes were held remotely, using Google Meet, Discord, and Google Classroom as communication tools, and took place twice a week, with each meeting lasting 2 hours. Assessments were conducted using a formative approach, observing student participation and engagement throughout the semester. According to student feedback, creating a safe space was important for creating a sense of belonging and an ambiance for learning and sharing their experiences. We provide details on how we structured and conducted this course. In addition, we share lessons learned throughout this process.

CCS CONCEPTS

• **Social and professional topics** → **Software engineering education**.

KEYWORDS

Diversity, Inclusion, Safe space, CS education

1 INTRODUCTION

Diversity refers to various personal characteristics and cultural differences between people [43] while inclusion is the notion of individuals feeling a sense of belonging and feeling valued for such unique attributes [48]. In recent years, there was a significant increase in the awareness that diversity and inclusion can increase team performance and innovation [22]. Also, there is a growing notion of the importance of diversity and inclusion (D&I) in the tech companies as something that can lead to better practices in software engineering, software design, and requirements engineering [55].

D&I are often perceived as orthogonal topics that could be dealt with in various domains of CS education and are key for fostering

a comprehensive and inclusive learning environment [56]. Despite their growing importance, there is a noticeable lack of established guidelines on effectively integrating D&I into CS education courses, particularly within Software Engineering (SE). The SE discipline has recently seen an increase in the literature addressing that topic [42]. Yet, the focus predominantly remains on gender-related issues, leaving other critical dimensions of diversity, such as race/ethnicity, disability, neurodivergence, and age, underexplored. Even the scarce literature about teaching D&I in Software Engineering is gender-centric [10, 25].

To the best of our knowledge, the closest evidence of a Software Engineering course focused on D&I was Mei Nagappan's CS846 "Diversity in Software Engineering", which was limited to software teams [34]. As researchers on D&I in SE, we decided to structure a graduate course on "Diversity and Inclusion in Software Engineering", targeting Master's and Doctoral students. It was designed to delve into different diversity dimensions (race/ethnicity, disability, neurodivergence, age, and gender/sexuality) under two key perspectives: users and teams, corresponding to the subdomains of Software Requirements and Human Aspects of Software Engineering, respectively. These perspectives helped provide a holistic view of D&I in the SE context, addressing the development process and the end users' diverse needs. The course structure, content, and delivery methods were carefully crafted to ensure that these diverse dimensions of diversity were discussed, deeply understood, and appreciated by the students.

As a key contribution, this experience report is the first to provide a detailed description of a course covering Diversity and Inclusion in Software Engineering. We aim to help fill the literature gap by detailing our approach. As tangible outcomes, there was a significant increase in students' understanding of less explored diversity dimensions, particularly in areas like disability, neurodivergence, and age. This underscores the importance of broadening the scope of D&I topics beyond the commonly discussed gender issues. The participation of students from underrepresented groups enriched the learning experience for everyone, thus aligning with literature findings about students underrepresented by race/ethnicity being more likely to report interest in social, cultural, and political impacts of technology [6]. Creating a 'safe space' was key, fostering a sense of belonging and facilitating student exchange of experiences and ideas. Such an atmosphere is essential for effective learning and sharing, especially when dealing with sensitive topics.

We understand that D&I have many facets that can not be oversimplified and is also context dependent (e.g., a white Brazilian is a Latinx in the USA; a black software developer is not a minority

in Angola). However, simplifications such as merging certain dimension (race + ethnicity and gender + sexuality) were deemed necessary in our context of broad perspective in many dimensions.

This paper was written carefully following what is expected in an experience report, being organized as follows: the current section brought motivation and objectives; section 2 discusses prior and related work about D&I to contextualize the experience in SE education and introduces the concept of safe spaces; section 3 covers the course design aiming at its replication by other lecturers; section 4 gives additional detail discussing on the course conduction/implementation; section 5 brings rich evidence of course outcomes and student feedback; section 6 brings lessons learned on what worked and what did not work, followed by positionality of authors; and finally, section 7 which concludes the paper.

2 BACKGROUND

2.1 D&I and Computer Science Education

There are studies emphasizing the importance of incorporating diversity and inclusion topics into computer science education to foster a more inclusive and equitable environment for students, although they do not detail any semester course dedicated to that. Wilde [56] showcases efforts that have made a positive impact on the inclusion and support of women and LGBTQ+ individuals in science, engineering and technology, and how these practices could be infused in CS curriculum. Pournaghshband and Medel [39] discuss about intersectionality – the interrelationship that may exist between social identity elements (e.g., gender, race) – and how is directly relevant to diversity and inclusion in computer science education. They underscore the importance of recognizing the diverse and overlapping social identities of students, which can influence their experiences and success in CS fields. Zeitz and Anewalt [58] developed a repository of assignments aimed at raising awareness about diversity, inclusion, and accessibility in computer science courses, highlighting the need for repeated exposure to these issues throughout the curriculum to maximize impact on students' awareness and attitudes. Seyam and Abu-Elkheir [47] presented a course design that incorporated diversity conference attendance into computer science education, emphasizing the benefits of combining theoretical concepts with hands-on experiences to enhance students' engagement and understanding of diversity issues.

2.2 D&I in Software Engineering Education

Some gaps – typically gender-centric – related to this topic are observed in software engineering. Studies indicate that women represent less than half of the population in the technology field [13]. On the other hand, research shows that diverse teams can develop technologies that better understand society's needs [55]. At US universities, for instance, more than 50% of students in computer science courses tend to be male [12]. An educational environment with this composition can result in problems related to prejudice and bias, such as the experience of a young woman who did not feel taken seriously by classmates in her CS undergraduate class [13], which is a challenge also affecting LGBTQIA+ students [51].

When looking for a course syllabus focused specifically on D&I in Software Engineering, we could only find one course focused on team diversity, taught by Mei Naggapan [34], who researches about

D&I in SE. The course goals included developing the ability to read, comprehend, and summarize academic papers, identifying diversity-related issues in the papers (e.g., biases and barriers), applying critical thinking to devise mitigation strategies, and collaborating in a team for a research project related to class discussions.

Although not exclusively focusing on diversity and inclusion in the SE context, Murphy et al. [32] detailed their experience integrating some readings on D&I into a traditional software engineering course, aiming to increase students' understanding of the importance of diversity in the tech industry and inspire them to create more inclusive environments. In a similar direction, another significant measure is raising teachers' awareness about aspects of D&I [25]. Student-led activities such as blogs and seminars can spark the interest of other students from underrepresented groups in technology courses [27]. Creating a safe environment is also an action to be considered.

2.3 Safe spaces

A “safe space” is a space in which individuals feel comfortable expressing themselves and participating without fear of facing attacks or having their experiences denied. Safe spaces aim to combat discrimination, harassment, and threats. This type of environment is important for minoritized groups because it supports these students [3, 8, 21]. For instance, in an environment not deemed “safe”, a racial minority student sharing a personal experience related to prejudice might be inhibited. They could feel vulnerable to negative judgments, discrimination, or reprisals from peers or even teachers.

Safe spaces are intended to support minority students, minimizing the feeling of isolation and providing an environment that helps these students integrate into predominantly white university contexts. [21]. Safe spaces within a university can be constructed in two ways: (i) self-segregated refuges, which are specific areas within the institution that offer protection to a specific group, and (ii) institution-wide security, which involves transforming the culture of the institution to eliminate vulnerability for all groups [8]. To create both types of safe spaces, it is important to understand the needs of different groups and open communication. These actions can contribute to a diverse and inclusive environment.

An alternative to safe spaces is “brave spaces” [3]. This concept emphasizes the need for participants to authentically engage with each other in challenging conversations about power, privilege, and oppression. In this case, it is necessary to establish some common rules. For example: (i) agree to disagree in dialogues about diversity and social justice; (ii) encourage participants not to take things personally; (iii) encourage participants to push themselves to explore content that pushes them outside of their comfort zones; (iv) emphasize the importance of respect in creating courageous spaces for dialogue around diversity and social justice; (v) encourages participants to engage impartially and allows exploration of social justice issues without fear of attack [3].

3 COURSE DESIGN

This section describes the planning and structure used in the course, which was conducted in the second semester of 2023 at the Informatics Center of the Federal University of Pernambuco (CIn/UFPE). The main aspects related to the course's design and organization

are covered. This includes the course goals, duration and structure, teaching methodology, teaching material, technologies and tools, external collaborations, and assessment and feedback.

3.1 Overview

This elective course aimed to study various dimensions of diversity (gender, race, age, disability, and neurodiversity) in Software Engineering. The course lasted a total of 60 hours. It was structured to address the dimensions of diversity from two perspectives: software requirements, exploring how diversity can influence the requirements definition process, and software development teams, examining how diversity can impact team dynamics. Also, guest lectures were held with experts to enrich the understanding of intersections between D&I and Software Engineering.

Since this is an elective course, it was advertised to students by an email sent by the teacher to the mailing list of the graduate school. The message detailed course goals and the topics to be explored.

3.2 Teaching methods

Since the pandemic, all graduate school classes can be remote, although this is no longer mandatory. We chose that remote option and used the following tools:

- Google Meet: Classes, guest lectures, and discussions on papers and videos were conducted on Google Meet sessions.
- Discord: Activities and discussions involving student groups during classes were conducted on Discord voice channels.
- Google Classroom: Paper and video assignments and supplementary material were provided in Google Classroom.

Classes had a 2-hour duration and took place twice a week. The first half of the semester focused on the requirements perspective, while the other half focused on software teams. Usually, one diversity dimension was studied under one perspective at a time, using the following format each week:

- One class focused on a scholarly *article* discussion assigned on the previous week.
- The other class focused on a *video* or a *guest lecture*. In the case of videos, the same format of an article assignment was used, while guest lectures consisted of discussions with the guest lecturer during/after the talk.

Because of the social impact of this topic, we encouraged a lot of critical thinking through active participation. Both the teacher and teaching assistant (TA) are researchers in that domain and attempted to follow a dialogical approach to education advocated by Freire [16], where teacher and student engage in a mutual learning process and the traditional hierarchy in the classroom is challenged. His concept of critical pedagogy emphasizes the importance of education as a practice of freedom rather than domination.

Grading was based on formative assessment. We observed participation and engagement during the semester, shaping learning as it happened. We gave the group feedback on their progress and understanding, allowing them to improve and develop their skills and knowledge throughout the course.

3.3 Code of conduct & safe space

This course had a code of conduct¹ based on ACM's policy against harassment [4]. It emphasizes a safe, inclusive environment for open idea exchange and applies to all activities, including classes and discussions. Participants are asked to respect others, avoid discriminatory or harassing behavior, and be mindful of their surroundings. Unacceptable behaviors (e.g., abuse, discriminatory harassment, sexual harassment) lead to consequences like removal from activities or course suspension. The message conveyed by the code of conduct is that of establishing a safe space to foster an open and respectful learning environment. The classroom is a place for learning where everyone can make mistakes without judgment and where hate speech has no place.

4 COURSE IMPLEMENTATION

4.1 Classes

This section provides a general perspective on how the course was conducted, but first, we carefully describe the introductory class, which was a key moment to align expectations and concepts, as well as establishing the agreements and the code of conduct. During that class, we explained the notion of safe space and started a gradual relationship of transparency and trust with students. For other lecturers aiming to offer a similar course, we believe such a concept is key to working with this type of content.

4.1.1 Introductory class. The main goals of this first class were: (1) the teacher and TA presenting themselves; (2) explaining the code of conduct and safe space; (3) presenting the learning goals; (4) sharing and building an initial common vocabulary; and (5) getting students acquainted with each other.

Besides presenting an overview of the course format, we also shared our positioning and where we stand regarding underrepresented groups in the Software Engineering field. Then, we discussed the code of conduct and the intention to create a safe space for discussing many identity topics that usually are delicate discussion. We also highlighted the importance of respecting each individual's chosen personal pronouns and offered tailored support for neurodivergent students, encouraging them to communicate their needs privately if needed. We acknowledged that the course would naturally involve discussions with political overtones, aiming to maintain a non-partisan approach. As educators, we expressed our commitment to ongoing knowledge development and openness to feedback regarding the use of inappropriate terms, reinforcing a dynamic of mutual learning and respect in the classroom.

After presenting the learning goals, we used an online questionnaire tool to livestream their responses (Figure 1) of a warm-up exercise to help sharing and building a common vocabulary:

- What is your understanding of Diversity and Inclusion?
- Which of these words you do not know the meaning: *Ableism, Ageism, Ally, Cisgender, Decoloniality, Equity, Heteronormativity, Historical Reparation, Intersectionality, Microaggression, Representation, Sisterhood, Standpoint, Tokenism*

¹<https://figshare.com/s/c76b1964a750788e8fae>

Table 1: Glossary of terms related to D&I based on multiple sources [1] [2] [5] [9] [19] [53] [54]

| Term | Definition |
|-------------------------|--|
| Ableism | Beliefs or practices rest on the assumption that being able-bodied is “normal” while other states of being must be “fixed” or altered. This can result in devaluing or discriminating against people with physical, intellectual, or psychiatric disabilities [1]. |
| Ageism | Refers to unfairly treating a person based on their age [19]. |
| Ally | A person who is not a marginalized or disadvantaged group member but expresses or supports that group [1]. |
| Cisgender | A person whose gender identity corresponds with the sex the person had or was identified as having at birth [1]. |
| Decoloniality | It is about undoing unfair situations and creating fair situations [2]. |
| Equity | Treat everything fairly, seeking to identify and eliminate inequalities and obstacles [1]. |
| Heteronormativity | Refers to the idea that "only heterosexual relationships are normal or correct and that men and women have naturally different roles" [9]. |
| Historical Reparation | Reparation refers to the "payment for harm or damage" [9]. This concept emphasizes repairing the damage caused by crime or conflict, placing decisions in the hands of those most affected [53]. |
| Intersectionality | The complex and cumulative way in which the effects of multiple forms of discrimination (such as racism, sexism, and classism) combine, overlap, or intersect, and their various impacts on the same individuals or groups [1]. |
| Microaggression | A comment or action that unconsciously or unintentionally expresses or reveals a prejudiced attitude toward a marginalized group member, such as a racial minority [1]. |
| Representation | Refers to increased mechanisms for marginalized voices to be heard. [5]. |
| Sisterhood | Refers to friendship and support between women involved in actions to improve women’s rights [9]. |
| Standpoint ² | a set of beliefs and ideas from which opinions and decisions are formed [38]. |
| Tokenism | Performative presence without significant participation [54]. Making an effort to include one or a few people from minority groups to appear diverse. |

² Standpoint is the closest English translation of what gave origin to *Lugar de fala*, which is the actual term discussed in the classroom

The second question above consisted of a non-exhaustive list of typical terms that appear in D&I texts. Among the 17 students participating in that class, the top unknown terms and the respective count of students were Tokenism (9), Decoloniality (5), Intersectionality (5), and Microaggression (4), as illustrated in Figure 1. Table 1 provides a quick glossary of the terms used in that activity, that we believe being useful for other lecturers interested in offering a similar course. Such collective understanding is important to level the comprehension of terms and establish common ground among participants.

After explaining the unknown terms, students were invited to join voice channels on Discord. They were asked to think of two diversity dimensions they are most interested in and moved to the Discord voice channel named after the 1st one. This was done because these dimensions can significantly influence their perspectives and experiences. The purpose of this task was to encourage the students to share and reflect on the different perspectives they may have from their colleagues. As a practical recommendation for self-organization, if they noticed an imbalance in the number of people in a channel, they should agree to have someone switch to another channel. Once in their groups, participants introduce themselves and quickly discuss within the group: 1) What is each person’s master’s or doctoral thesis topic? 2) Does this course relate to their thesis topic (and how)? After the 1st discussion, they moved to another channel based on their second chosen dimension. Then,

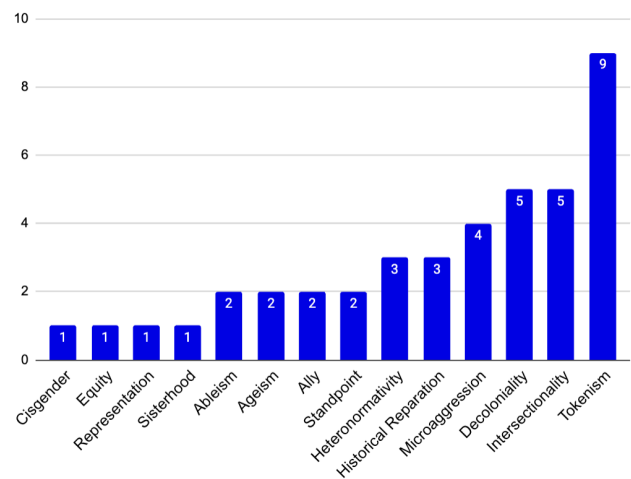


Figure 1: Typical D&I terms unknown to students (n=17)

students were asked to return to the main Google Meet session to share their perspectives on the activity and course expectations.

4.1.2 *Shared understanding of standpoint (“lugar de fala”).* A known term in the context of D&I discussions is that of a *standpoint*, which

was popularized by Harding's feminist standpoint theory [20, 57]. It is one of theoretical foundations for what Brazilian philosopher Djamila Ribeiro called "*lugar de fala*" [41]. This many time leads to what is called "automatic privilege" [57], which refers to the mistaken assumption that individuals who occupy marginalized or oppressed social positions inherently possess superior or more accurate knowledge simply by virtue of their social *locus*. For instance, based on a over-simplistic interpretation of that term, white people would not have (or not have the right to have) a standpoint in regards to racism; nor a cisgender woman would be able to discuss about transphobia.

Pereira [38] reflects on the concept of "*lugar de fala*" reinforcing the perspective that worldviews are presented unequally, based on social conditions that allow or disallow certain groups to access spaces of citizenship and expression. It is not about denying individual experiences but rather recognizing the social locus of each group and reflecting on how these positions impact the possibility of transcendence and social participation. Everyone has this "place of speech" (i.e., standpoint), but it is crucial for individuals from privileged groups to recognize the hierarchies and how their positions impact marginalized groups, thus promoting an ethical and socially committed stance. However, this should not lead to an opposite direction of entitling the privileged in positions of power to claim the right to discuss issues of the underrepresented. For instance, a recent Brazilian News program did a panel with white-only journalists discussing racism and ignored the social locus of black or brown journalists, although that news company had key professionals from that underrepresented group³.

Throughout the initial classes we discussed many times about each one of us having our own standpoint from the different social places we belong to. By reaching such shared understanding, we thus avoided radical common sense such as "you do not have a standpoint here because you do not belong to that underrepresented group". However, we acknowledged that our perspectives are different and based on those places and on our own experiences. For instance, regardless of the level of empathy, the perspective of a man would never be the same as a woman in regards to gender equality.

4.1.3 Discussions of articles and videos. Before starting the course, we selected a subset of the articles contained in Naggapan's course reading list, which was focused software teams [34]. At the same time, for the requirements perspective, we chose articles used as references in previous D&I research we did. For the remaining references, we looked for literature directly linked to the diversity dimensions and prioritized publications of higher quality, favoring works with more citations and from reputable academic journals and events. The construction of the theoretical framework benefited from diverse perspectives from different authors, schools of thought, and cultural contexts.

The videos and articles used in this course are listed on Table 2. The typical assignment was to deliver a text with answers to guiding questions such as the ones below, and discuss collectively in the week after the assignment:

- What are the main findings of the article/video?

³<https://www.terra.com.br/diversao/tv/globonews-volta-a-debater-racismo-so-com-jornalistas-brancos,932370cb99bab8152b13e8cc0f8fe8e21j528sx7.html>

- How could existing applications/software be more inclusive from a [studied dimension] perspective?
- What developments (reflections, recommendations, solutions, etc.) could be brought to research and practice in the field?
- How does this affect my perception when thinking about inclusive applications from a [studied dimension] perspective?

Under the Software Requirements perspective of the course, students examined how race, ethnicity, gender, disability, neurodiversity, and age influence software development. They explored algorithmic biases, particularly in facial recognition, and design biases in conversational agents that overlook the dialects of black communities. Also, gender stereotypes in software, the binary man-woman gender perspective, and the invisibility of LGBTQIA+ groups are important issues. Accessibility challenges for users with disabilities and the specific needs of neurodivergent and elderly users were also explored, highlighting the importance of inclusive design in software to address diverse user requirements and combat biases like AI ageism.

From the perspective of Software Teams, students examined the role of diversity in team dynamics. Students read about gender in agile teams and open-source development and understood gender biases, age stereotypes, and the challenges faced by underrepresented groups in the field (e.g., blind developers, neurodiverse individuals, women making career changes). The aim was to understand how diverse team compositions influence software development and contribute to a more inclusive tech industry.

4.1.4 Guest Lectures and other activities. The videos and guest lectures were complementary regarding topics, dimensions, and perspectives. Table 3 shows the topics of all guest lectures given during the semester. They were delivered by researchers who belonged to the corresponding underrepresented groups and researched those specific domains. To be more specific about the content and representation of guest lectures, we briefly detail them next.

Requirements guest lectures:

- **Race/Ethnicity:** A black researcher who does research on this topic brought a perspective on how structural racism is present in our society. When developing applications and digital solutions for the general public, it is necessary to consider the social and cultural particularities of a population, otherwise technology will reproduce society biases.
- **Disability:** A blind researcher brought a perspective on how artificial intelligence can support disabled people. Voice assistants, screen readers and many support technologies have been developed in the last years and this changed the inclusion landscape. For almost all participants, this was the first time they watched a blind person giving a talk.

Software Teams guest lectures:

- **Gender/Sexuality:** A transgender researcher introduced the notion of gender non-conformity (i.e., do not conform to traditional gender norms) and diverse gender expressions (e.g., transgender, gender-fluid, non-binary). It discussed the traditional binary perspective on gender and also how to ask a participant about their gender in a user input form.

Table 2: Articles and videos list the two perspectives we worked on and the corresponding dimensions: Race (R), Ethnicity (E), Disability (D), Neurodivergence (N), Age (A), Gender (G), Sexuality (S).

| Dim. | Article |
|---|--|
| All | Perceived diversity in software engineering [42] |
| Software Requirements Perspective: | |
| R/E | Resisting racism in tech design [40] |
| D | Accessibility and software engineering processes: A systematic literature review [37] |
| N | Designing emerging technologies for and with neurodiverse users [31] |
| A | Designing user interfaces for the elderly: a SLR [11] |
| | Elderly users and their main challenges usability with mobile applications: a SLR [14] |
| G | Gire: Gender-inclusive requirements engineering [36] |
| Software Teams Perspective: | |
| G | A systematic mapping study of diversity in SE [50] |
| | Gender differences and bias in open source [52] |
| A/G | Age stereotypes in distributed software development [44] |
| | What motivates adult age women to make a career change to the software industry? [24] |
| N | Understanding the challenges faced by neurodiverse software engineering employees [30] |
| D | An exploratory study of blind software developers [28] |
| R/E | On the relationship between the developer's perceptible race and ethnicity and the evaluation of contributions in OSS [33] |
| Dim. | Video |
| Software Requirements Perspective: | |
| G/S,R/E | Requirements of Oppression - Keynote [26] |
| | How to make AI systems more just [15] |
| R/E | <i>Support reading material for discussion:</i> It's Too Easy to Hide Bias in Deep-Learning Systems [23] |
| | Algorithms, platforms, and ethnic bias [49] |
| N | Designing for Neurodiversity [29] |
| Software Teams Perspective: | |
| G | Gender in OSS Development [46] |

- Gender: A woman researching on gender in software engineering presented the importance of women-focused hackathon as safe spaces to welcome women in information technology. These spaces free of gender prejudice can enhance their self-efficacy and reduce the competence-confidence gap that many of them present.
- Disability: An accessibility researcher from industry together with a blind team mate conducted this guest lecture where challenges for people with auditory and visual impairments were discussed. They gave suggestions for inclusive practices like screen reader-compatible tools, reasonable accommodation policies, and sensitivity training.
- Neurodiversity: A researcher with Attention-Deficit Hyperactivity Disorder (ADHD) explained neurodiversity as a perspective that embraces the fact that everyone's brains develop in a unique way. In that direction, developers in the autistic spectrum or with ADHD can bring benefits to software projects, but they face difficulties in the workplace.
- Age: A 60+ researcher who studies ageism in the entrepreneurship context brought a broad perspective on that topic in the information technology market. The talk discussed prejudices and the mindset that prevent companies from hiring 60+ and even 50+ professionals from technical background.

During the semester, students asked for more practical activities about requirements. They were assigned two additional activities: (1) looking for frameworks focusing on design for neurodiversity

and (2) applying the GenderMag [7] framework to our department website.

4.1.5 Assessments. The assessments for this course involved analyzing tasks produced by students. First, we assessed argumentative ability to verify the students' capacity to develop and maintain solid arguments. Furthermore, we evaluated the contextualization of discussions, observing how students inserted their arguments into a broader context. Another evaluation activity involved jointly presenting arguments during discussions. Students were required to present their ideas and collaborate to create a coherent argument. Interaction and the ability to communicate with colleagues were fundamental elements of this process.

In group discussions, students were evaluated based on their ability to communicate their ideas clearly and thoroughly. They had moments to share their assignment results with the class and were assessed on the clarity and depth of their arguments. This evaluation criterion ensured that students could effectively convey their ideas. The assessments in this course focused not only on content but also on the ability to contextualize, argue, and collaborate.

4.2 Feedback data collection

We collected data through an anonymous feedback questionnaire that was advertised at the end of the semester. Ethical considerations, including participant privacy and anonymity, were duly observed. The form was answered by 9 students out of 14 who finished the semester (3 students dropped out after a few classes).

Table 3: Average of students answers ($n=9$) rating (1 to 5) how the talks and activities contributed to their learning on the given topic. The corresponding perspective (Requirements or Teams) and dimensions (Race, Ethnicity, Disability, Neurodivergence, Age, Gender, and Sexuality) are depicted.

| Perspective | Diversity Dimension | Topic | Median | Mean (Std) |
|-----------------------------|----------------------------|---|--------|------------|
| Guest lectures/talks | | | | |
| Requirements | Race/Ethnicity | Blackness and Design | 5 | 4.3 (1.1) |
| Requirements | Disability, Race/Ethnicity | Diversity and pro-inclusion artificial intelligence | 4 | 3.9 (1.3) |
| Teams | Gender/Sexuality | Transgender and gender non-conforming developers | 5 | 4.3 (1.0) |
| Teams | Gender | Women in hackathons | 5 | 4.3 (1.1) |
| Teams | Disability | Disability in software development teams | 4 | 3.5 (1.7) |
| Teams | Neurodiversity | Neurodivergent software engineers | 5 | 4.3 (1.1) |
| Teams | Age | Ageism | 4 | 3.8 (1.2) |
| Activities | | | | |
| Requirements | Neurodiversity | Design for Neurodiversity frameworks | 4.5 | 4 (1.2) |
| Requirements | Gender | GenderMag | 3 | 2.9 (1.7) |

The questions consisted of a Likert scale response format about the open space and their perception of learning (Figure 2). There were rating scales (0-5) and open-ended questions about their perception of learning and fields for comments. The instruments and data are available⁴. To be coherent with this article written in English, the questionnaire open-ended responses were translated from Brazilian Portuguese into English using the Google Translate feature/formula in Google Spreadsheets.

Demographics. During classes, many students voluntarily commented about the underrepresented group they belong to. All diversity dimensions of individuals (e.g., gender, neurodivergence, race, sexual orientation) must be self-reported. Consequently, the demographic data was collected through a separate questionnaire to guarantee full anonymity of feedback responses. Only 8 participants answered, thus one feedback data respondent missed it. Table 4 shows all respondents being from underrepresented groups in SE.

| Respondent | Underrepresented groups |
|------------|--|
| R1 | LGBTQIA+, Age |
| R2 | Black or brown |
| R3 | Neurodivergent |
| R4 | Black or brown, LGBTQIA+ |
| R5 | Gender (Women or GNC), Neurodivergent |
| R6 | Gender (Women or GNC), LGBTQIA+ |
| R7 | Black or brown, LGBTQIA+, Neurodivergent |
| R8 | Black or brown |

Table 4: Demographic data questionnaire responses ($n=8$).

5 OUTCOMES AND STUDENT FEEDBACK

5.1 Safe space effectiveness

Likert-scale questions LQ1 to LQ8 (Figure 2) indicate that respondents perceived the creation of a safe space in this course. Question LQ1 shows they did not feel judged, while LQ2 brings evidence of them feeling comfortable sharing their experiences. LQ3 indicates

that most respondents usually do not share such experiences in other courses, with only one person saying that they do. LQ4 and LQ5 both indicate agreement related to the code of conduct and instructions by the pedagogical team.

The open question about safe space was optional and had only three responses. One student commended the teacher for the initiative, saying “it was a great experience”. Another student explained rating safe space creation as “somewhat agree” mostly because of their insecurities rather than the actual lack of safety in the course environment. That student mentioned feeling hesitant to contribute at times, worried about whether their input was well-structured or in line with the discussion, preferring to listen and absorb rather than risk saying something incorrect or biased. The third student believed establishing the safe space contract in the first class was very important, especially because many subsequent classes involved “sensitive topics, and appreciated the opportunity to engage in these discussions without fear of judgment”.

5.2 Perception of learning

Questions LQ9 to LQ14 collected information about student participation and learning. There is slight disagreement about participation in article (LQ9 and LQ10) and video (LQ12 and LQ13) discussions, while LQ11 indicated strong agreement on learning during article discussion. More than half (6) of the respondents agreed that the Discord communication tool helped them feel more comfortable discussing with a smaller audience (LQ14).

More specifically, students were also asked to rate from 1 to 5 how the guest lectures and activities (Table 3) contributed to their learning journey. The highest-rated talks were Blackness and Design, Transgender and gender non-conforming, women in hackathons, and neurodivergent software engineers, while the activity about design for diversity frameworks was the preferred one, while GenderMag mentioned as confusing in an open-ended question about it. Students also rated how they perceived their knowledge of each studied diversity dimension before and after the course (Figure 3). They learned a lot more about the topics they were less familiar with neurodiversity, age, and disability. This outcome was expected, as the course was designed to encourage learning beyond the more common topics of gender and sexuality and, to a lesser extent, race

⁴<https://figshare.com/s/c76b1964a750788e8fae>

and ethnicity. When explicitly asked about the diversity dimension, they learned the most and the least, and respondents answered Neurodivergence (6) and Age (5), respectively. In an open-ended question about their perception of learning, students highlighted the critical role of inclusion in software development, focusing on accessibility and equity for diverse users. They gained new perspectives on gender decolonization, challenges in creating software for gender non-conforming and neurodivergent individuals, and the importance of diverse teams in understanding user needs. The course fostered a deeper understanding of intersectionality in software teams and personal reflection, significantly enhancing their approach to professional and personal interactions.

Four students answered the open-ended question about the main positive aspects. They said the course effectively highlighted fundamental yet often overlooked subjects, fostering a broader perspective on inclusion beyond software development. Students valued the engaging discussions, diverse reading materials, events, and guest contributions, which enhanced their awareness of their societal and professional impact. They believed the course's success was related to establishing a safe learning environment and employing formative assessments, promoting meaningful interactions with underrepresented groups in the software industry. This inclusive approach allowed for personalized learning and shared experiences, enriching the educational experience. This quote from one of the students illustrates an effect influencing their role in software industry and society: *"I am more aware of the products and solutions I develop and how I can minimally try to better drive my team. Also, I believe I am more conscious as a person in my everyday life in society"*.

5.3 Beyond the classroom

As a direct consequence of the experience of offering this course, there were different outcomes that go beyond the classroom.

5.3.1 Society outreach. As a result, this course could reach society in an unusual way. Our university was responsible for providing part of the content in a local technological conference called Rec'N'Play⁵, which is inspired by popular formats such as SXSW and WebSummit. That event hosts discussion panels, talks, and workshops that happen in parallel in the city's technology park for a week. The teacher a discussion panel about Diversity and Inclusion in Software Engineering and invited 3 students to participate as part of the core group. Following a fishbowl panel format, where audience members also join the discussion, this activity had an audience of 20 to 30 people. It allowed teachers and students to share findings and opinions developed in this course.

5.3.2 Research. Because of the research to build the less explored aspect of diversity and inclusion under a user requirement perspective, the teacher proposed a short paper/lightning talk in a workshop at ICSE'24 [17] and started research toward understanding better that problem and looking for potential solutions [18].

6 DISCUSSION

In this section we bring the main reflections on what worked and what did not work. It is followed by our positionality as authors, acknowledging how our background, experiences, and identity

⁵<https://recnplay.pe/>

influence the whole process (class intervention, data collection and analysis) and outcomes. This transparency aims to enhance the credibility and depth of this intervention, offering readers a clearer understanding of our perspectives, especially because it touches equity in the context of education [45].

6.1 Lessons learned

Diverse Perspectives Enhance Learning. The course's focus on various dimensions of diversity provided students with a detailed understanding of how these factors influence both software requirements and team dynamics. This approach highlighted the importance of considering various perspectives in software engineering. Also, students from underrepresented groups were the majority of the class, reinforcing that people from those groups are more likely to express interest in classes involving social, cultural, and political implications of technology [6].

Importance of a Safe Learning Environment. Establishing a code of conduct and creating a safe space was essential for open and respectful discussions, especially when dealing with sensitive topics related to identity and diversity. This approach encouraged students to share their experiences and perspectives without fear of judgment. However, establishing such a space is a gradual process that requires continuous effort and sensitivity to the classroom dynamics. After some classes, we observed students feeling comfortable in sharing their experiences or mentioning their neurodivergent condition or sexual orientation without being asked.

Establishing a common understanding of standpoint ("lugar de fala"). Discussing and aligning this perspective collectively was key to encouraging discussions and respecting each other opinions. Also, acknowledging the different standpoints and the eventual privileges one may have helped reinforce the notion of a safe space.

Fostering Empathy and Allyship. People from privileged groups who actively seek to understand the experiences and perspectives of marginalized or underrepresented groups can play a role in challenging oppressive systems [16]. This requires empathy, openness to learning, and a commitment to allyship and social justice.

Assigning discussion leads. We had slight difficulty grading students who were not very engaged during discussions. Assigning a discussion lead, as in Nagappan's course [34] could help balance participation, but optionally, to avoid anxiety on shy students.

Better planning and integration of guest talks. While guest lectures significantly contributed to learning, there was a need for better scheduling and integration of these talks into the course structure. Assignments related to guest lectures could have deepened the learning experience and ensured consistent student engagement.

Need for Global South lenses. During the initial discussions in the course, some students criticized the fact that articles and videos provided a North American and Euro-centric perspective on D&I. This reflects and reinforces the structure of world economic power. A Global South (GS) perspective⁶ would help in discussing Decoloniality, which is not much explored in the prevalent academic venues that discuss D&I in SE.

⁶Although this literature grounding is mostly from mainstream Global North conferences and journals, this paper somehow moves toward a decolonial perspective – although in a limited way – since it was run in a Global South university, presented in a Global South conference and published in Global South Open Access library.



Figure 2: Answers to questions focusing on the perception of a safe space (LQ1 to LQ8), student participation (LQ9 to LQ14), and course topics’ potential impact on the student activities (LQ15 to LQ18).

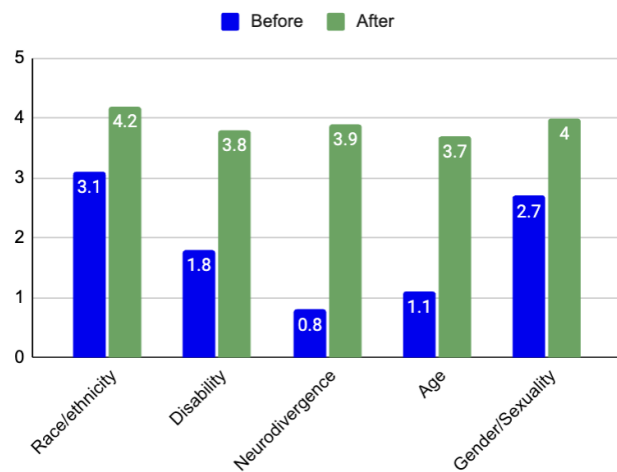


Figure 3: Average of the self-reported familiarity of knowledge about each diversity dimension before and after the course (n=9)

Anticipating student needs. Anticipating student needs is also necessary to provide adequate accessibility resources. These lessons highlight the importance of preparation and attention to different needs that students could have had in the classroom. For instance, we were unprepared for the possibility of having a blind student. **Balancing activities to cover all dimensions.** Although the articles/videos that were assigned to be read/watched covered all

studied dimensions, the activities covered only the Neurodiversity and Gender dimensions, both in the context of Requirements. More balance is needed so the three missing dimensions can be covered. **Avoid general introductory concepts in guest lectures.** Since the course is about D&I, the class had already acquired basic vocabulary and concepts that are present in these talks (e.g., diversity, inclusion, equity). However, most guest lectures spent significant time presenting such concepts. Students complained that it was repetitive and disengaging for them. Also, such time dedicated to the basics could have been used to deepen the discussion on the guest lecture main topic. Briefing guests about that would potentially avoid this issue.

Need for strategies to attract students from privileged groups. All respondents of our questionnaire belonged to underrepresented groups. There should be a strategy to attract more students from privileged groups (e.g., white middle class heterosexual men) to gain knowledge and a better understanding of the challenged faced by underrepresented groups. This can increase empathy and awareness about D&I. A potential solution is including that topic as part of mandatory courses around informatics in society.

6.2 Positionality statement

The first author was the teacher responsible for this course. He has been conducting research about underrepresented populations (women, LGBTQIA+, black/brown, visually impaired, neurodivergent) in the information technology field, always led by students from those groups. As a middle-class white cisgender heterosexual man and a university teacher, he understands he has position of privilege. The contributions brought from his standpoint are from

an ally in pursuing social justice in higher education toward a more inclusive perspective in the software engineering field. Although being a researcher on that topic, the fact of having the stereotype of the social class that perpetuates the oppression toward minoritized groups made the lecturer hesitate to offer that course. For quite some time, he believed that such a course should be offered by a lecturer with a standpoint of someone from a minoritized group. Coincidentally, just after the decision of offering this course the teacher was diagnosed as neurodivergent – theoretically situating him as part of an underrepresented group. This condition was shared with the class, also helping to build rapport and trust. Regardless of being part of an underrepresented group, teachers can position themselves as allies and as learners, too. As an extra measure of care, during class discussions, one must avoid their position of privilege overshadowing the voices and experiences of students from underrepresented groups, who are the ones who deeply understand the prejudice and social injustice they suffer. Discussion and even divergence of opinions has to be encouraged. A dialogical approach, where teachers and students learn together, in such course can collectively construct knowledge that exercises Freire's critical pedagogy.

The second author was a teaching assistant (TA) in this course. He identifies as brown and gay and is currently committed to investigating diversity within Software Engineering. His research focuses on approaches designed to support underrepresented groups in this sector. His attention is focused on understanding the specific needs of often underrepresented communities, using their identity and position as references to promote a broader and more diverse perspective. Through these actions, the researcher intends to promote a more inclusive environment in his area. Based on his identification, the TA is likely to have a good understanding of the challenges faced by people with similar experiences in Software Engineering. Using his identity and position, he can better relate to students who are also part of underrepresented groups. Additionally, it can help include previously ignored perspectives in the field.

7 LIMITATIONS

This course has some limitations to consider when analyzing the results and conclusions of this report. Firstly, the course was taught over a semester, a limited period, to cover multiple aspects of diversity and inclusion in SE. This time constraint may have led to a need for more in-depth study on specific topics. Another limitation is the number of students enrolled in the course and the number of students who responded to the feedback questionnaire. The course had 17 students participating, of whom 14 finished the semester. This relatively small number of students may have restricted the diversity of perspectives and experiences shared in the discussions. Furthermore, only nine students responded to the feedback questionnaire and eight answered the demographic data questionnaire. Although in an experience report the sample size is not a concern, this small number of respondents limits the discussion. Additionally, a more effective recruitment strategy (e.g., advertising details of the course, a blog or website with course content) for this optional course could increase student enrollment.

Another area for improvement is the practical integration of the concepts studied in the course. Students needed more opportunities

to implement the theories and practices discussed in a natural work environment, which is essential for consolidating learning. The collected answers are limited by social desirability bias. This means that respondents may have been inclined to answer questions in a way that presents themselves in a favorable light rather than providing honest responses [35]. This could impact the accuracy of our data. We ensured that our survey guaranteed respondent anonymity and confidentiality to mitigate this bias.

A key limitation of the course is its scalability. The intensive discussions and personalized support feasible in small classes may be difficult to replicate in larger settings. Dependence on guest speakers and external experts also limits consistency and reach. For instance, not all lecturers replicating such course may have access to researchers in each of those diversity dimensions. To minimize this, a modular design allows educators to adapt content based on needs, audience or lecturer background/expertise. The online classes approach can extend reach while maintaining flexibility.

In general, these limitations underscore the necessity for future replications to tackle these challenges, prolong the course duration, increase participant numbers, and incorporate more robust assessment methods. For a more scalable approach, it is important to have careful planning to ensure quality and student engagement.

8 CONCLUSIONS

As an attempt to fill the gap in teaching Diversity and Inclusion in Software Engineering, this report provides insights into the structuring and conduct of a graduate course that successfully navigates such a multifaceted subject. It highlights the need for a more inclusive approach in SE education that goes beyond traditional topics and engages with a broader spectrum of diversity dimensions, enriching the learning experience and preparing students for a diverse and inclusive professional environment. The course effectively broadened students' understanding of diversity dimensions like disability, neurodivergence, and age, moving beyond the typical focus on gender. The participation of students from underrepresented groups enriched the learning experience, aligning with findings on their interest in technology's societal impacts. A key factor in the course's success was creating a 'safe space,' fostering a sense of belonging and open dialogue, being fundamental for discussing sensitive D&I topics.

Individuals from privileged groups (e.g. middle class white heterosexual men) can develop critical perspectives on power and privilege and can become allies in the pursuit of social justice. However, it is important to recognize that their views are from a different standpoint of those who belong to underrepresented group and experience oppression directly. Incorporating such reflections into SE education and nurturing a collective learning experience in a classroom that recognizes and embraces diverse perspectives can promote critical reflections. This enhances the learning experience, not just in technology aspects but in human aspects of software engineering.

AVAILABILITY OF ARTIFACTS

Artifacts and anonymized data are available at <https://www.doi.org/10.6084/m9.figshare.25040177>

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