Women and Gender Disparities in Computer Science: A Case Study at the University of Padua

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ABSTRACT

This research fits into the scenario of gender disparity in STEM disciplines and aims to identify problems, stereotypes, and gender biases, as well as to highlight solutions to promote gender equality within the Bachelor's degree course in Computer Science (CS) at the University of Padua (Italy), considering both the opinions of female and male students. Data collection was carried out through an online questionnaire addressed to students enrolled or previously enrolled in the Bachelor's degree course in CS. The final sample included 167 volunteer participants. The results highlight how girls believe more than boys in the stereotype that women are disadvantaged in the CS field and that their work is not recognized as equal to that of their male colleagues. However, there are encouraging results regarding the decreasing belief that CS is *"a man's thing"*, with a perception of less diffusion among the population. In situations of gender bias, such as feeling devalued and ignored or experiencing sexist comments from fellow students and professors, females report feeling emotionally uncomfortable and not having control of the situation, which could lead them to not react to the discrimination they face. In this scenario, it is important to increase the communicative effectiveness and psychological well-being of female, but also male, students. Finally, several strategies were proposed to promote a peaceful and inclusive university social environment.

CCS CONCEPTS

• **Social and professional topics** → **Women**; • **Applied computing** → **Education**.

KEYWORDS

University education, Women in Computer Science, Gender Gap

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1 INTRODUCTION

This research work stems from the desire to address a current and widespread problem: gender disparity in the field of Computer Science (CS), in universities, as well as in the subsequent work environment [8, 42]. The gender gap in scientific studies is well known globally, and Italy is no exception. Starting from this, the gender gap widens further considering the STEM (Science, Technology, Engineering, and Mathematics) disciplines [14]. According to the latest data by ISTAT (Italian National Statistics Institute) data from 2021, in Italy, 24% of young adults (25-34 years old) with a university degree have obtained a degree in STEM. However, this percentage changes considering gender. It rises to 33.7% among men and drops to 17.6% among women, highlighting an evident gender gap: female graduates in STEM are half of their male counterparts [20]. This scenario is also present on a smaller scale in the context of the University of Padua, one of the most renowned universities in Italy. The percentages speak clearly and without possible interpretations: female students in STEM disciplines, but especially in CS (on which this work focuses), are underrepresented. Only 22% of students enrolled in STEM courses at the University of Padua are females [44]. The percentage of students enrolled in the field of Information and Communication Technology (ICT), including the Bachelor's and Master's degree courses in CS, is even more biased. Only 10% of students enrolled in ICT courses in 2020-21 are female students [46]. Among the 149 enrolled students in the Bachelor's Degree in CS in the academic year 2020/2021, there were only 14 women (9.39% of enrolled students)[45].

In summary, the shortage of women in STEM is a significant and current critical issue, that is reflected in the world of work, considering that this workforce is essential to meet the needs of 21st-century society. The field of CS and its related disciplines are currently in great development and offer promising job opportunities, but they appear "attractive" at the university level mainly to male student populations. This is why numerous international

scientific studies have investigated, and are still investigating, the reasons why women and girls do not "appear" attracted to CS [1].

From the literature, two closely interconnected factors emerge that influence and feed off each other: gender stereotypes and educational history. In the present paper we will focus especially on the first one and its consequences.

Let's start with an example. Imagine a girl in middle school who can't find the correct solution to a math problem. The boy next to her says, "Wow, girls are really bad at math!". However, if the same difficulties were exhibited by a male classmate, the hypothetical exclamation would be, "Wow, you're really bad at math!". Starting from these simple remarks, it becomes clear how the gender stereotype has shaped the classmate's exclamations. In fact, in the first case, there is a generalisation of the difficulties exhibited by a single girl to the entire female gender. This is an example of stereotype. A stereotype (or schema) is a set of characteristics attributed to all members of a specific group or social category [18, 28, 39], and it is shared by the community or culture that applies it as a heuristic. Heuristics, like stereotypes, are mental shortcuts that help to speed up the categorization of external stimuli by simplifying the processing of our complex social world: it is much simpler and more economical, in terms of mental effort, to categorize groups of people as similar and treat them in the same way, rather than elaborate a single category for every different person we encounter. However, these mental shortcuts often lead to thinking errors such as confirmation bias or accepting exclusively the information that confirms the stereotype, and filtering out information that does not fit the schema [7]. One of the major disadvantages of stereotypes is being unaware of using them when we judge others [30]. In addition, these stereotypical judgments have serious social consequences in the long run, such as precluding certain social and work positions to the members of a certain group because it is not already present or is underrepresented. In fact, some theories derive stereotypes from underrepresentation, or from the disparity in the distribution of group members in different social roles [7, 9]. In this scenario, it is certainly included the gender gap in STEM and ICT as a possible cause of the stereotype that CS is *"a man's thing"* [40].

Another important social factor related to stereotypes is the *stereotype threat* effect. The theory suggests that people aware of the stereotype they are the subject of tend to confirm it with poor performance in specific tasks. This happens because during the performance they feel under pressure and less effective [35, 36]. Multiple examples of this theory can be found in the literature, precisely in the educational field, where female students perform inadequately if they are aware of the gender stereotype [16, 19, 29, 33]. Also the external influences containing gender stereotypes related to STEM disciplines, if internalized, can affect girls' life choices and long-term goals. This mechanism is well known in social psychology as the *self-fulfilling prophecy*. The theory of the *self-fulfilling prophecy* suggests that a subject's expectations about an event or on another person behaviours can influence the way they behave towards that other person or event. This, in turn, can influence the other person's behavior or the outcome of the event, making the initial expectations self-fulfilling with a domino effect [4]. In other words, social pressure and ideas derived from stereotypes such as *"women are not good at math"* or *"CS is for men"*, known both by those who believe in them and by those who are the subjects of the bias, make women perform worse under stereotypical conditions, such as in scientific and mathematical fields [4, 27, 31]. These biases affect academic performance and the upstream choice of school and university and work path in the computer field for women.

Even in cases where some girls overcome stereotypes and choose to enrol in CS, they may encounter difficulties. Many of them approach the university coming from schools that do not prepare for computer studies, thus starting the university with a lower essential preparation than their male counterparts. This could lead to difficulties in studying and feelings of inferiority compared to male colleagues, negatively affecting their university experience [12]. In this regard, Gürer and Camp (2001) argue that the lack of self-confidence causes many women to leave or even not enter the field of CS [17]. This becomes particularly problematic when considering that potentially lower results of female students could perpetuate gender bias and widen the disparity in the computer field [12].

It is, therefore, a priority to ask how these numerically fewer girls experience the university path in an often male-dominated environment [5] and with potentially lower initial results than their male counterparts due to the lower starting preparation [15, 37]. A recent study found that only 56.9% of female students think they are average or better than their male and female colleagues in computing skills, unlike males who think so of themselves at 82.3% [25].

One of the main reasons for being interested in female students' well-being and study experiences is to realise that their mental health affects their living at university from a social and interpersonal point of view and their performance results. Results that determine their academic and professional future [25, 48].

1.1 Research aims

According to the background reported in the previous section, this research, in collaboration with the Tullio Levi-Civita Department of Mathematics at the University of Padua, aims to investigate how current and past female students are experiencing or have experienced their studies in CS. Furthermore, this study, from an inclusive and gender equality perspective, analysed gender beliefs, stereotypes, and prejudices related to CS, taking into consideration the opinions of female students as well as the male component of the degree program. The final aim of this study is to identify any issues, stereotypes, and gender-related prejudices and highlight solutions to promote gender equality within the undergraduate degree program in CS at the University of Padua, with the hope that the evidence collected from this study may also be helpful to other departments or universities in highlighting the problem and tackling it.

2 METHODS

2.1 Data collection

The data collection took place in October 2022. Students currently or previously enrolled in the CS bachelor's degree were invited to participate in this research voluntarily by disseminating the study on social networks, such as Instagram and Telegram, and advertising the study through professors during some courses. The only inclusion criteria for completion were to be of legal age and to have

studied recently (registered since 2010) or be currently studying CS at the university of Padua. All participants were asked to read and provide informed consent before starting the questionnaire. The experimental procedure was designed in accordance with the Declaration of Helsinki and approved by the ethical committee for psychological research at the University of Padua.

A preliminary interview with 27 students (14 males and 13 females) was conducted to identify the most important topics to include in the questionnaire. Participants were asked to compile and submit a questionnaire through the Google Form platform that lasted about 15 minutes. The questionnaire consisted of three different sections:

(1) personal information;
(2) gender stereotypes within the field of CS;
(3) experienced situations that confirm and increase gender stereotypes.

Some questions were specifically addressed only to female interviewees, while others had different formulations depending on the gender of the interviewee. In particular, with respect to the situations investigated as causes of discomfort within the university environment, female students were asked to report their experience in terms of arousal, valence, and dominance using *Self-Assessment Manikins* (SAM), a graphical tool, very intuitive and easy to understand, widely used in the psychological field [2]. Each graphical element of the SAM is paired with a Likert scale from 1 to 5, which identified the degree of arousal, valence, and dominance of the situation experienced by the responders[1].

2.2 Participants

181 volunteers participated into the study, of whom 168 completed or are completing the bachelor's degree course in CS at the University of Padua. 13 subjects were excluded as they did not meet the inclusion criteria for the research purposes. The sample of students considered consists of 168 students, of whom 37 (22.02%) are female, 130 (77.38%) are male, and one student (0.60%) is non-binary. For the purposes of our research, the non-binary participant was excluded, considering that gender identity issues would merit a more in-depth study with a specific approach.

The average age of the 167 final participants was 23.41 years ($SD = 3.17$, *range* $18 - 37$ years). Regarding the year of enrollment in the Bachelor's degree course in CS, it ranges from 2010 to 2021 ($M = 2018$, $SD = 2.43$). As concerning the academic position at the time of the questionnaire, the sample was distributed as reported in Figure 1. As can be seen, a large part of the sample was enrolled in the third year of the bachelor degree course.

2.3 Statistical Analysis Methodology

Data analysis was conducted using JASP and *R* software [22, 34]. Due to the small sample size, especially considering only female students, non-parametric tests were used when data distributions did not meet normality criteria [13].

To evaluate the presence of significant differences between the two genders, the independent sample *t-test* was used. Instead, the one-sample *t-test* was used to verify if the sample mean significantly differed from the known mean value of the investigated variable. For each *t-test*, Cohen's d is reported as a measure of effect size [6]. The Wilcoxon signed rank test (W) was used as non-parametric test inalternative to the *t-test* [13, 23, 24]. The rank-biserial correlation (r) is reported as a non-parametric correlation measure to indicate the strength of the association [6]. The corresponding 95% confidence interval (CI) is also reported [43]. All analysis results are significant with a critical *p-value* set at 0.05.

[1]The complete questionnaire and statistical analyses' results are reported in https://unipd.link/WomenInCS22

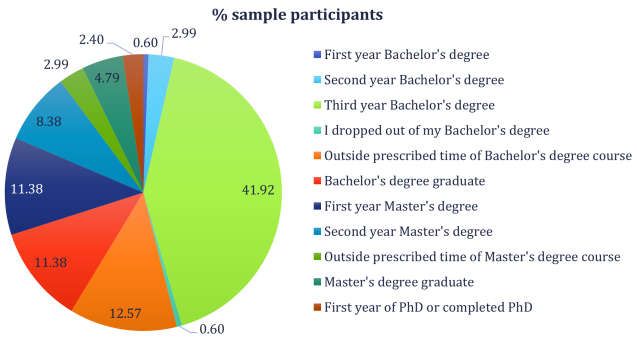

Figure 1: Graph representing the percentage distribution of the sample by academic position at the time of questionnaire administration.

3 RESULTS

3.1 Gender stereotypes within the field of CS

The male and female students who participated in the study had significantly different opinions regarding the belief that women are disadvantaged in the field of CS (*"Do you think girls/women are disadvantaged in CS?"*) ($t_{(165)} = -5.30$, $p < .01$, $d = 0.58$, 95% CI *for Cohen's d* $(-1.37, -0.61)$). In fact, females had an average response of 3.00 ($SD = 1.33$) on a Likert scale from *"1 = No, not at all"* disadvantaged to *"5 = Yes, absolutely"* disadvantaged. Meanwhile, males had an average response of 1.86 ($SD = 1.10$). Therefore, women perceive a higher degree of disadvantage than men's perception of this issue, despite women's responses on the Likert scale indicating an average position.

Regarding the generic stereotype that *"CS is for men"*, participants were asked to answer on a Likert scale from *"1 = No, not at all"* to *"5 = Yes, very much"* how prevalent this bias was among the younger population (15-40 years old) and the older population (> 40 years old), (*"In your opinion, is the idea "CS is for men" present among young people/adults (15-40 years old)?" or "In your opinion, is the idea "CS is for men" present among adults/elderly (+40 years old)?"*). Overall, CS students perceive this bias as more prevalent among the older population ($M = 3.98$, $SD = 1.14$) than the younger population ($M = 3.07$, $SD = 1.10$), ($t_{(166)} = -12.36$, $p < .001$, $d = -0.96$, 95% CI *for Cohen's d* $(-1.14, -0.77)$). Considering males and females separately, female students perceive this stereotype ($M = 4.38$, $SD = 0.95$) more than their male peers ($M = 3.86$, $SD = 1.16$), ($t_{(165)} = -2.48$, $p < .05$, $d = -0.46$, 95% CI *for Cohen's d* $(-0.83, -0.09)$) in the older population.

3.2 Experiences that confirm and increase gender stereotypes

In the third session of the questionnaire, participants provided their responses regarding the frequency with which they have experienced and/or observed discriminatory situations during their CS university program. Overall, various situations have occurred at least once according to the participants (e.g., offensive jokes and inappropriate comments about women by male students; positive gender bias by male students and professors towards female students (preferred/advantaged)). Female students report discriminatory incidents more frequently than their male colleagues in the following cases: offensive jokes and inappropriate comments about women by male students; discrimination, bullying, and negative gender bias (discriminated/disadvantaged) towards female students by male students; offensive jokes and inappropriate comments about women by professors; discrimination and negative gender bias by professors towards female students (discriminated/disadvantaged) (see Table 1).

Further analysis has been conducted on the specific question regarding group work planned in the CS bachelor's degree path. The results of the items in which female students provide significantly different responses from male colleagues are graphically presented in Figure 2. Female students report significantly lower scores than male students on the item regarding good working environment ($t_{(155)} = 3.14$, $p < .01$, $d = 0.60$, 95% CI for Cohen's $d(0.22, 0.98)$, see Figure 2.a). However, for items such as being ignored/ignoring ($W = 1319.00$, $p < .001$, $r = -0.38$, 95% CI for Rank-Biserial Correlation $(-0.55, -0.18)$, see Figure 2.b), being underestimated/underestimating ($W = 1450.00$, $p < .001$, $r = -0.32$, 95% CI for Rank-Biserial Correlation $(-0.50, -0.11)$, see Figure 2.c), feeling uncomfortable/making someone uncomfortable ($W = 1478.50$, $p < .001$, $r = -0.31$, 95% CI for Rank-Biserial Correlation $(-0.88, -0.12)$, see Figure 2.d), female students report higher frequency. Girls also report more frequently than boys that female students have to raise their voices to be heard by male colleagues ($W = 1385.50$, $p < .001$, $r = -0.351$, 95% CI for Rank-Biserial Correlation $(-0.53, -0.15)$, see Figure 2.e). The same frequency results are found for being chosen by others in the group formation ($t_{(155)} = -2.61$, $p < .05$, $d = -0.50$, 95% CI for Cohen's $d(0.22, 0.98)$, see Figure 2.f).

Following these differences, the attention focused on the questionnaire's specific sections for female CS students. In response to the question *"Does being a woman in CS or in a predominantly male field intimidate you?"* their average response was 2.32 ($SD = 1.27$, $Mdn = 2$) on a Likert scale from *"1 = No, not at all"* to *"5 = Yes, very much"*, indicating that they feel somewhat less intimidated ($W = 61.50$, $p < 0.01$, $r = -0.83$, 95% CI for Rank-Biserial Correlation $(-0.91, -0.67)$). However, in response to the question *"Do you think your professional and academic achievements are appreciated and evaluated in the same way as a male colleague's?"* female students had an average response of 3.32 ($SD = 1.18$, $Mdn = 3$) on a Likert scale from *"1 = No, not at all"* to *"5 = Yes, definitely"*, indicating a lack of equal recognition of merit between males and females ($W = 252.00$, $p = 0.12$, $r = -0.28$, 95% CI for Rank-Biserial Correlation $(-0.58, 0.08)$). Subsequently, female students were asked how frequently they experienced discomfort in the university environment. The percentage results are presented in Figure 3. Observing the graph, the three most frequent situations experienced by female students during their university studies are feeling undervalued from a professional point of view, feeling misunderstood, and feeling alone in a predominantly male university environment. Regarding the same situations, the female students were asked then to report their experiences in terms of arousal, valence, and dominance using the SAM (*Self-Assessment Manikin*) paired with a Likert scale from 1 to 5 that identified the increasing degree of arousal (from *"1 = no arousal"* to *"5 = maximum arousal"*), the valence of emotion felt (from *"1 = sadness/unpleasant feeling"* to *"5= happiness/pleasant feeling"*), and the dominance (from *"1 = no dominance"* to *"5 = maximum dominance"*) of the situation experienced. The results are shown in Table 2. As concerns the arousal, statistical analyses showed that female students are, on average arousal, activated in all situations. Also, regarding valence, all situations are perceived as significantly unpleasant for female students. Instead, in the question regarding their dominance of the situation at the time these circumstances occurred, in most cases, they felt low control, an indication of perceiving that their actions could not change the circumstances (i.e. when they felt ignored during breaks between lessons or during group formation, felt abandoned, and devalued in a predominantly male environment, or heard sexist jokes or comments from students and professors).

4 DISCUSSIONS

Gender disparity in CS is relevant globally and locally, and the University of Padua is an exemplary case. Despite significant efforts to increase the presence of women in STEM fields, particularly in CS, only a low number of girls still choose to pursue a career in this field. To combat this gender disparity, it is essential to understand how female students experience their university and work life and to create an inclusive and respectful environment of gender differences. Nowadays, this is being pursued through a range of initiatives, including promoting mentoring programs and summer camps for high school girls [26], creating informative spaces for women in STEM, facilitating conferences and workshops on gender issues in CS, and developing curricula that encourage gender balance [11, 32, 49].

This work discusses gender disparities in CS, highlighting how multiple factors, such as gender stereotypes, educational history, and difficulties in the university environment, cause a low number of women. This study offers a noteworthy scholarly contribution because it is one of the few studies in the literature that directly addresses the opinion of female students attending CS degree courses by integrating psychological well-being aspects applied to situations and experiences concretely reported by them. The interviewed girls believe more than men in gender stereotypes. So they think to be more disadvantaged in CS than male students, laying the foundation for implementing *stereotype threat* theory and subsequent *self-fulfilling prophecy*. Girls are more attentive to this issue as the group subjected to the stereotype, but the mere fact that they believe they could be disadvantaged could possibly lead them to have worse results than males, as discussed previously according to the literature regarding the *self-fulfilling prophecy* theory [4, 27, 31].

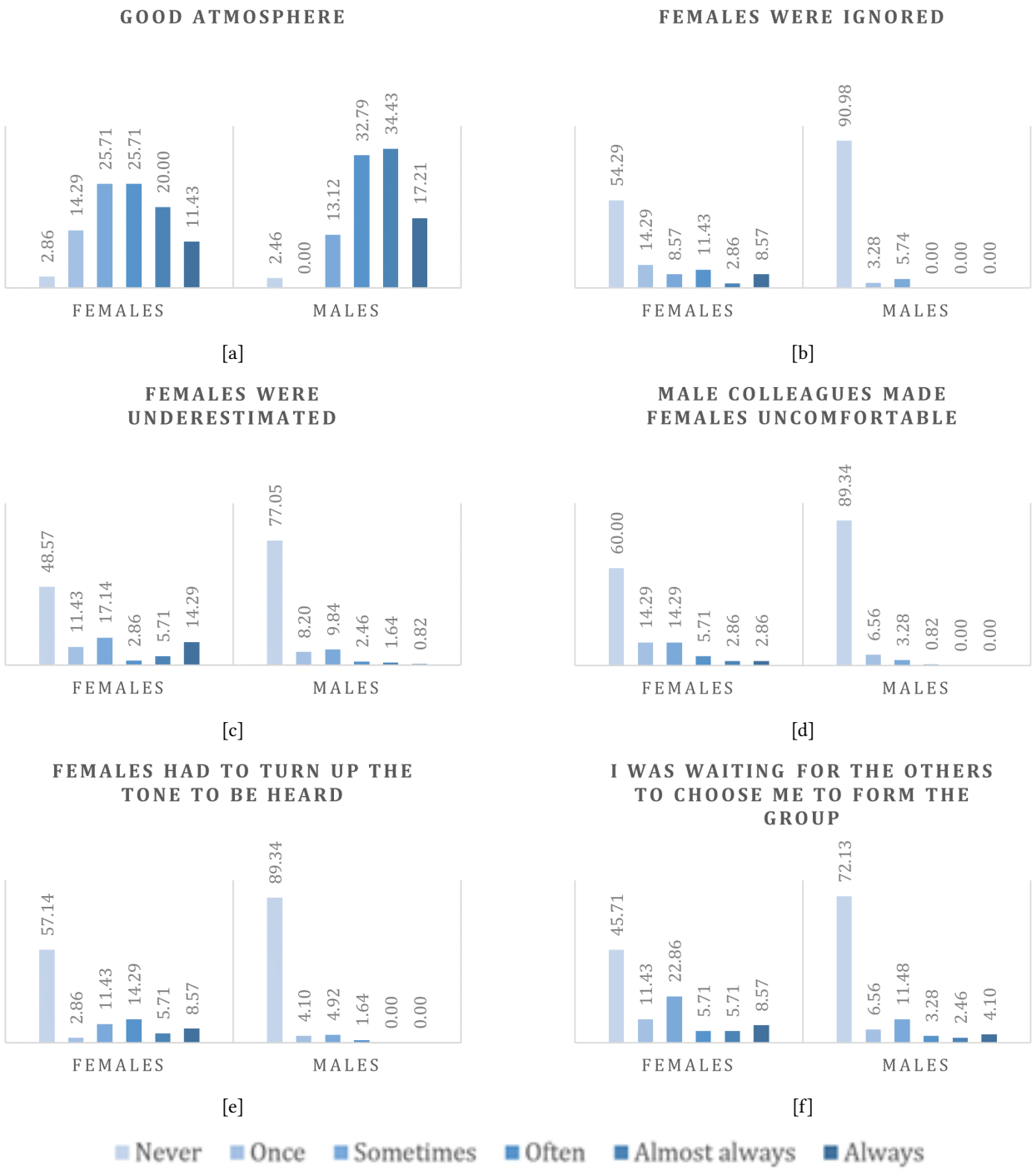

Figure 2: Grouped graphs of responses regarding teamwork, which are significantly different between males and females.

Table 1: Average responses of the female students, male students, and total sample to the item *"Indicate how often you observed/experienced the following situations during your Bachelor's studies."* on an answer scale from *"0= Never, 1= Once, 2= Sometimes, 3= Often, 4= Almost always, 5= Always"* regarding discriminant situations experienced/observed. The presence of statistical differences between male and female responses analyzed through t-tests is reported.

Discriminant situations	Females		Males		Total		Sig. Dif.
	M	SD	M	SD	M	SD	
Offensive jokes about women by students	1.95	1.33	0.89	1.18	1.12	1.29	***
Inappropriate comments about women by students	1.92	1.48	0.95	1.23	1.168	1.38	***
Discrimination against female students by male students	1.14	1.48	0.15	0.62	0.37	0.97	***
Bullying of female students by male students	0.60	1.19	0.03	0.21	0.16	0.63	***
Positive gender bias from students towards female students (preferred/advantaged)	1.49	1.50	1.21	1.37	1.27	1.40	
Negative gender bias by students towards female students (discriminated/disadvantaged)	1.38	1.36	0.262	0.73	0.51	1.02	***
Offensive jokes about women by professors	1.00	1.11	0.38	0.73	0.52	0.86	***
Inappropriate comments about women by professors	0.89	1.13	0.36	0.69	0.48	0.84	***
Discrimination against female students by professors	0.38	0.83	0.06	0.27	0.13	0.47	***
Positive gender bias by professors towards female students (preferred/advantaged)	0.67	1.13	0.75	1.18	0.73	0.47	
Negative gender bias by professors towards female students (discriminated/disadvantaged)	0.41	0.99	0.15	0.52	0.21	0.66	*

*Note. *** = p < .001; ** = p < .01; * = p < .05; Sig. Dif. = significant difference between male and female genders*

However, there are encouraging results regarding the belief that CS is *"for men only"*: both males and females have the perception that this stereotype is less prevalent among younger than among older people. However, women appear to be more receptive than male colleagues to the topic they are subjected to, perceiving the stereotype *"CS is for men"* as significantly more prevalent among older adults than male colleagues. Although these gender stereotypes contribute to creating a *"chilly climate"* in which it is expected that women in STEM degree programs will perform poorly (both due to *stereotype threat* and the *self-fulfilling prophecy*), in some cases, these same female students believe more in the possibility of changing and improving their abilities, according to the literature [16, 29]. This perspective could help them - and is currently helping them - to overcome the adverse effects of the stereotype and, in doing so, the stereotype itself.

Regarding situations that increase stereotypes, such as experiencing sexist remarks, offensive comments, negative gender bias, bullying, and discrimination by both students and professors, they are perceived less frequently by males and more significantly by girls. Again, in this case, female students are much more receptive and sensitive to the topic than male colleagues [3, 41]. However, much value should also be attributed to the male perspective regarding this problem. Many girls' experiences could be personal, individual, and simply not perceptible by male colleagues. Many male students from predominantly male classes may have difficulty in relating appropriately and receptively to girls in their degree course [3, 41]. With this reasoning, we do not want to blame male students, but rather try to understand, without justifying intent, why situations perceived as particularly unpleasant by female students occur. Similarly, future research should investigate professor perceptions of gender bias in academic contexts. These data could hold potential for understanding how attentive and sensitive professors are to the topic. Moreover, it could be useful to raise awareness among academic staff to limit the perpetuation of stereotypical situations toward female students.

Despite this, the fact that some male students report the occurrence of such episodes represents a small step forward in the fight against stereotypes; it is no longer only women who perceive the incorrectness of such behaviors, but in some cases both parties. It can be stated that the occurrence of such gender-biased behaviors has a low frequency overall (fortunately). However, a particularly worrying fact is that even professors do not seem exempt from such discriminatory behaviours. On the one hand, this could further reinforce the stereotype, as the behaviours come from authoritative sources in the university environment. On the other hand, it

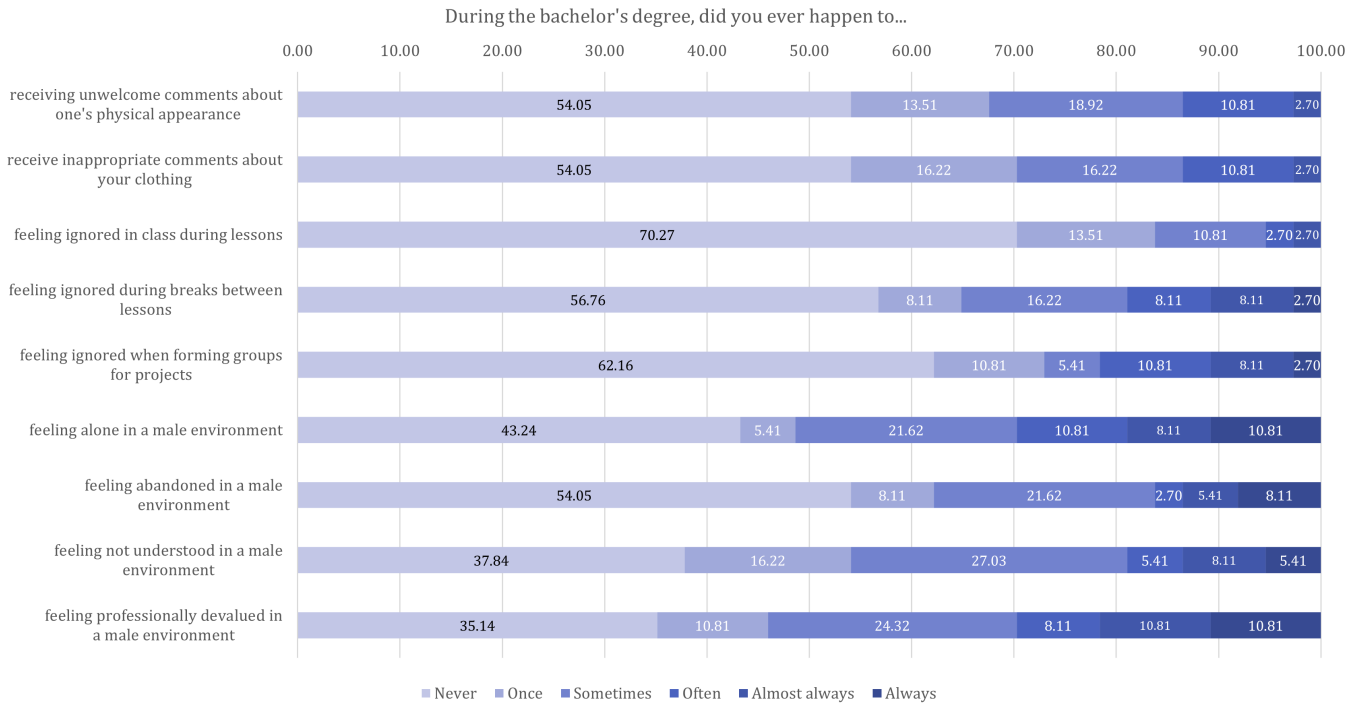

Figure 3: Percentages of frequency of experiences lived by female students in CS Bachelor degree.

supports the perception that bias is still widespread in the adult population.

Specific attention has been placed on group work as a moment of interaction within the CS bachelor's degree course, which could represent a small picture of what their future teamwork might be like in a company. Even in this case, some results show worse experiences for female students than for their male counterparts. Female students perceive a worse group working environment than males, feeling ignored, undervalued, uncomfortable, and forced to raise their voices to be listened to. They also wait more frequently to be chosen by others to form the workgroup. The importance of participating in group work and facilitating only women's work groups is also evidenced by a study of US students enrolled in an introductory CS course [21]. Moreover, parity in teamwork's importance is also testified by the fact that with teams of designers and creators consisting solely of males, the risk of creating tools containing gender bias is strongly present. An outstanding example is the release of the Apple Health App in 2014. This app tracked many physiological parameters for personal well-being but did not monitor the menstrual cycle [10].

Even if female students reported feeling less intimidated in the CS or male-dominated environment, this conflicting result could stem from a possible selection bias in the sample of female students, maybe excluding all those who, intimidated by the CS or male environment, did not enrol in CS. However, female students are not sure their work is equally recognised compared to male colleagues. This belief may negatively affect their self-confidence and determines, with a domino effect, the possibility that girls drop out of school [17]. Furthermore, it is documented in the literature that women really have to work harder to prove their abilities than their male colleagues [38].

In all situations characterised by gender bias that female students were exposed to, they felt emotionally activated unpleasantly with negative emotions, but in most of these episodes, they report not dominating the situation. This latter aspect is very relevant because having little control of the situation in these cases could lead to no reaction to something potentially adverse and discriminatory if experienced first-hand but also as a spectator [47]. This could also lead women not to report unpleasant discriminatory remarks or the most severe bullying events because they become routine [3]. A simple example of this attitude can also be seen in decision-making, where women would not contribute because they are "dominated" by their male colleagues [38]. In particular, the female students included in this study have experienced situations in which they felt devalued from a professional point of view, not understood, and alone in a male-dominated university environment. They experienced moments of low control when they felt ignored, abandoned, and devalued in a predominantly male environment, or they heard sexist jokes or comments from students and professors. In such a scenario, it is vital to increase the sense of efficacy in assertively communicating one's opinions, the psychological well-being experienced, and the possibility of serenely living in the university social environment.

5 CONCLUSIONS

In conclusion, it can be affirmed that the sample, although numerically reduced, of female and male students who have attended or are

Table 2: Responses of female students for arousal, valence, and dominance of the situation in different gender bias events experienced during the CS degree.

Situation	Arousal					Valence					Dominance				
	N	M	Mdn	SD	Sig. Dif.	N	M	Mdn	SD	Sig. Dif.	N	M	Mdn	SD	Sig. Dif.
Receiving unwelcome compliments about your physical appearance	18	2.61	2.00	1.09	***	18	1.61	1.00	0.98	***	16	2.69	2.50	1.25	
Receiving inappropriate comments about your clothing	19	2.63	2.00	1.30	***	19	1.63	2.00	0.68	***	18	2.67	2.50	1.28	
Feeling ignored in class during lessons	9	2.33	2.00	1.41	*	11	1.55	1.00	0.69	***	12	2.33	2.00	1.50	
Feeling ignored during breaks between lessons	16	2.56	2.00	1.37	**	17	1.77	2.00	0.75	***	15	1.87	1.00	1.41	*
Feeling ignored when forming project groups	15	3.07	2.00	1.44	**	16	1.44	1.00	1.03	**	17	2.06	2.00	1.35	*
Feeling alone in a male environment	21	2.71	2.00	1.45	***	23	2.00	2.00	1.09	**	21	2.29	2.00	1.45	
Feeling abandoned in a male environment	17	2.77	2.00	1.52	**	18	1.89	2.00	1.02	**	17	2.06	1.00	1.39	*
Hearing you doesn't happen in a male environment	20	2.65	2.00	1.53	***	22	1.73	1.50	0.99	***	20	2.40	2.00	1.50	
Feeling professionally devalued in a male environment	21	3.48	3.00	1.54	***	24	1.75	1.00	1.19	***	22	2.27	1.00	1.61	*
Overhearing a sexist joke/comment from a student	28	3.32	3.00	1.31	***	29	1.76	1.00	1.30	***	27	2.33	2.00	1.44	*
Overhearing a sexist joke/comment from a professor	22	3.545	4.00	1.471	***	23	1.74	1.00	1.39	**	21	1.86	1.00	1.32	**

Note. *** = $p < .001$; ** = $p < .01$; * = $p < .05$; *N= number of answers;*

Sig. Dif.= significant difference from Mdn 1 in arousal e Mdn 3 in valence and dominance

attending the Bachelor's Degree Course in Computer Science at the University of Padua confirms global trends according to which the gender stereotype that CS is *"for men"* is present and that women entering the CS environment at the university may be subject to discriminatory gender biases. Therefore, these female students are experiencing unpleasant situations in a predominantly male environment that is often unreceptive and has not been able to recognise this discomfort. Discrimination and prejudice, including negative comments and discriminatory behaviour towards women, continue to persist and must be strongly addressed to create a more inclusive

and welcoming environment for all CS students. Therefore, it is important to promote actions to increase awareness among students and teachers of this issue and involve them in creating active groups on the subject. For example, student representatives could be important linkage figures between students and professors, who can convey complaints about any unpleasant situations or requests for support. Furthermore, the counseling service could help female students who report and request help for discriminatory situations experienced. Some relevant initiatives already stemmed from the present research, like education orientation in the schools, targeted welcome to new first-year students, and seminars about the current study results to spread support and sensitisation about the gender gap theme among students, professors, and authorities. As concerns future directions, new projects could be implemented at the University of Padua and elsewhere, aimed at verifying the effectiveness of the proposals identified above in increasing gender equality and monitoring the psychological well-being of female students in the field of CS.

However, these initiatives should be part of a global approach to promote diversity, inclusion, and gender equality, recognizing that the gender gap in CS is not just a women's problem at the University of Padua, but a problem that concerns the entire academic environment and the broad community. Men have a fundamental role to play in promoting gender equity in this field. Collaboration between men and women is essential to achieve "healthy" gender equality in the field of CS. In addition, to combat gender stereotypes in this sector, a mindset change in society is needed. It is important to raise public awareness about the challenges women face in the university and workplace and the opportunities that CS and STEM disciplines can offer women. In summary, reducing gender inequality in CS requires joint commitment and collaboration among all actors involved, including women and men, academic institutions, companies, and society.

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