

Workplace Values, Knowledge Gaps and Gender: Explaining German Adolescents' Computer Science Career Choices

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Abstract: A persistent gender gap in computer science (CS) study choices and careers remains in Germany and internationally despite long-standing equality initiatives. Late adolescence is a key decision phase for academic and vocational pathways, making it critical to understand what drives young women and men toward or away from CS. This article reports findings from a 2024 survey of more than 800 German adolescents aged 15–20. The study examines gender differences in intentions to pursue CS across three domains: workplace values such as earnings or career prospects, perceptions of CS working conditions and potential structural barriers, and self-assessed knowledge of CS occupations. Findings show that young women and men have very similar expectations of their careers. Contrary to common stereotypes that men prioritise pay while women emphasize work–family balance, most value ratings are statistically similar with job security, career opportunities, and high salary at the top three positions. The exception is job security, which appears even more salient to young women. Comparing value profiles with perceived CS job characteristics indicates that adolescents of both genders rate CS consistently below their ideal job and that perceived female-specific barriers may further deter interest. These patterns are interpreted in the context of Germany's digital transformation—marked by a shortage of skilled CS professionals and the anticipated automation of white-collar work through artificial intelligence. These narratives frame CS as both opportunity-rich and volatile, shaping expectations about job security, career advancement, and work–life balance. The study also documents information asymmetries: young women report significantly lower knowledge of CS careers than young men, which may hinder informed choices and pose an additional barrier beyond differences in interests or values. These insights underscore the importance of targeted interventions that provide accessible, accurate career information, demystify CS work and pathways, and address perceived barriers faced by young women.

Keywords: Career choice, Computer science, Gender differences, Knowledge gaps, Workplace values, Career guidance

1. Introduction

Despite decades of initiatives promoting gender equality in Science, Technology, Engineering and Mathematics (STEM), a pronounced gender gap in computer science (CS) enrolment and career choices persists internationally (DESTATIS, 2025; World Economic Forum, 2025). In Germany, only 2% of women with a tertiary qualification hold a degree in computer science or ICT, compared to 7.1% among men (DESTATIS, 2025). Late adolescence is a crucial period for career decision-making, when young people choose academic or vocational pathways. PISA 2000 and 2022 data show technology remain highly attractive to boys (OECD, 2025): “*ICT professional*” is the most frequently mentioned career expectation among boys, but does not rank among girls’ top ten. Understanding why young people choose or reject CS is key to addressing gender disparities.

The study analyses data from a 2024 large-scale online survey of over 800 German adolescents. It examines gender differences in CS career intentions and investigates workplace values (e.g. earnings, prestige), perceptions of CS job conditions, and subjective knowledge of CS professions. It tests whether traditional value-based stereotypes persist by contrasting adolescents’ values with their assessments of CS jobs, including perceived structural barriers for women.

The paper is structured as follows. Section 2 presents the theoretical background on factors influencing career decisions, especially regarding CS professions. Section 3 introduces the methodology, including the research question, data collection, and analysis. Section 4 presents the results, which are discussed in Section 5. Section 6 concludes with key findings and directions for future research.

2. Career Decision-making Processes Concerning Computer Science and STEM Professions

This section establishes a theoretical foundation and examines factors influencing career decision-making in adolescents, focusing on gender differences and their impact on CS career intentions.

2.1 Understanding Gender Differences in Career Intentions

A substantial body of research has examined the persistent gender gap in CS and other STEM fields over the past decades. Much of this work is grounded in the Expectancy–Value Theory (Eccles and Wigfield, 2020), which provides a useful framework for understanding patterns in students’ career intentions. The theory helps explain why individuals choose certain academic and professional paths based on their perceived competence, interest, and the value they attach to these fields. Regarding career intentions in STEM fields, gender differences emerge as a particularly consistent pattern. For instance, Mahadeo, Hazari and Potvin (2020) investigated how students’ beliefs in their competence, interest in computing, and perceived recognition from others contribute to the formation of a computing identity, which in turn influences their intention to pursue a CS career. Male students demonstrated a significantly higher computing identity compared to female students, confirming gender disparities observed in earlier research.

Research in the context of the Expectancy–Value Theory examined further factors that influence students’ motivation and career intentions in CS. Family members and teachers play a central role by shaping students’ self-beliefs and expectations of success (Hess *et al.*, 2023). Many girls experienced subtle discouragement, such as lower confidence from teachers in their technical abilities. This resulted in them underestimating their own capabilities in STEM subjects. Likewise, the presence—or absence—of relatable role models can strongly affect students’ perceptions of belonging and the value they assign to a CS career (Steffen *et al.*, 2025). The persistent shortage of visible female CS role models therefore constitutes a barrier to increasing girls’ interest and participation in the field.

2.2 Workplace Values and Career Priorities

According to Expectancy–Value Theory, people pursue careers that match their values and expected success (Eccles and Wigfield, 2020). Within this framework, workplace values (or work values), can be understood as the specific expressions of these subjective task values in a career context. These values encompass the goals, rewards, and characteristics people deem important in their profession. A common distinction is intrinsic versus extrinsic values: extrinsic emphasize material or external benefits (e.g., income, prestige), whereas intrinsic denote intangible rewards (e.g., learning opportunities, flexible scheduling) (Busch, 2013). The *Zenjob Study 2024* gives an impression of adolescents’ workplace values (Gleyzer, 2024). It surveyed over 1,000 GenerationZ individuals in Germany (born 1997-2012). Top priorities were good salary and career opportunities. Honesty and open communication came in third, followed by opportunity for further training and professional development. Compared to the 2022 survey, work-life balance and flexibility remained central, and job security gained importance.

When assessing workplace values, gender differences often appear—whether reflecting genuine orientations or socialized stereotypes. Research suggests men more often prioritise extrinsic values, whereas women emphasise intrinsic or relational values (Busch, 2013). These priorities, including any gender differences, are not fixed: they shift with culture, economic conditions, and life stage – narrowing in more gender-equal, economically secure contexts, and widening in more traditional or constrained settings. Traditionally, CS is seen as highly technical and intellectually demanding, involving relatively solitary work (Cheryan, Master and Meltzoff, 2015), and offering strong career prospects and pay (Zhou and Shirazi, 2025). This image fosters a competitive, male-dominated, meritocratic culture that prioritises advancement and earnings over social interaction, creativity, and work–life balance (Thomas and Allen, 2006; Cheryan, Master and Meltzoff, 2015). Consequently, CS careers can appear attractive yet exclusionary, depending on how individuals align their personal values and expectations with these occupational images. Such gendered perceptions are mirrored in schools: in Germany, far more boys than girls choose CS as electives (Gesellschaft für Informatik, 2023).

2.3 Adolescents’ Sources of Information for Career Choices

As adolescents explore future careers, they draw on varied information sources and supports, yet many struggle. A 2022 representative Bertelsmann Stiftung survey of 14–20-year-olds in Germany found that only 25% felt sufficiently informed and confident, while 53% felt overwhelmed (Barlovic *et al.*, 2022). Although 56% indicated that they already had a fairly clear understanding of the occupation they wished to pursue, 9% felt poorly or not at all informed about it, and 7% had not yet considered a career. When seeking career advice, adolescents look to their families. The Bertelsmann Stiftung study found that nearly three quarters relied most on parents for career decisions. Schools and teachers were important for over half. Digital media is another key channel: almost half searched online for career information. In contrast, only about one third used the career counselling services provided by the German Federal Employment Agency (Barlovic *et al.*, 2022). The

OECD Report “The State of Global Teenage Preparation” stresses students’ active engagement in career-related experiences, such as job fairs and workplace visits, and especially gaining first-hand insights through part-time jobs, volunteering, or short-term internships (OECD, 2025).

3. Methodology

3.1 Study Design

This study reports findings from a nationwide study on German young adults’ career decisions, focusing on CS as a potential path. In June 2024, an online questionnaire was distributed to adolescents across all German federal states in cooperation with an established market research firm. This approach was chosen to deal with the differing regulations across states’ education systems. The selection of the market research firm was based on the firm’s existing market panel, which consisted of young adults in all federal states of Germany. Young adults under 18 need their parents’ written consent to join. The panel is ISO 20252 certified and adheres to strict ethical standards set by organizations such as the DGOF, ESOMAR, and ADM. The research was fully funded by the researchers’ higher education institution. The sample was limited to ages 15–20: those under 15 were excluded as they are likely in the early stages of career exploration, those over 20 as they are likely already committed to specific careers or study programmes. Participants completed a mixed-methods questionnaire containing structured and open-ended questions, with an average completion time of approximately 15 minutes. The questionnaire was pretested with adolescents to ensure item clarity and age-appropriateness.

3.2 Sample Composition

The research captured data from 822 young adults across Germany. This final sample size was established after implementing rigorous quality analysis procedures to ensure data integrity and validity. The gender distribution revealed a higher representation of female participants (506 individuals, constituting 61.6% of the sample) compared to male participants (315 individuals, representing 38.3%). Additionally, one participant (0.1%) identified as non-binary. Table 1 shows the participants’ demographic profile.

Table 1: Sample characteristics

Age	Female N (%)	Male N (%)	Non-binary N (%)	Total N (%)
15	37 (7.3%)	44 (14.0%)	0	81 (9.9%)
16	60 (11.9%)	53 (16.8%)	0	113 (13.8%)
17	84 (16.6 %)	58 (18.4%)	0	142 (17.3%)
18	133 (26.3%)	75 (23.8%)	0	208 (25.3%)
19	99 (19.6%)	37 (11.7%)	1 (100%)	136 (16.6%)
20	93 (18.4%)	48 (15.2%)	0	141 (17.2%)
Total	506 (100%)	315 (100%)	1 (100%)	822

The survey asked whether participants had chosen a career path and, if so, whether it was in CS. About 62.7% had decided. Among them, 32.8% planned to study CS. Undecided respondents rated their likelihood of considering CS: 37.7% said they could imagine a CS career. Overall, 43.9% of all respondents expressed interest in CS.

3.3 Research Questions and Approach Towards Data Analysis

To guide the study, the following overarching research question was defined and translated into an analytical approach (Figure 1) that is further elaborated through specific hypotheses below.

Research Question: How do adolescents’ workplace values, perceptions, and knowledge about CS-related professions differ by gender?

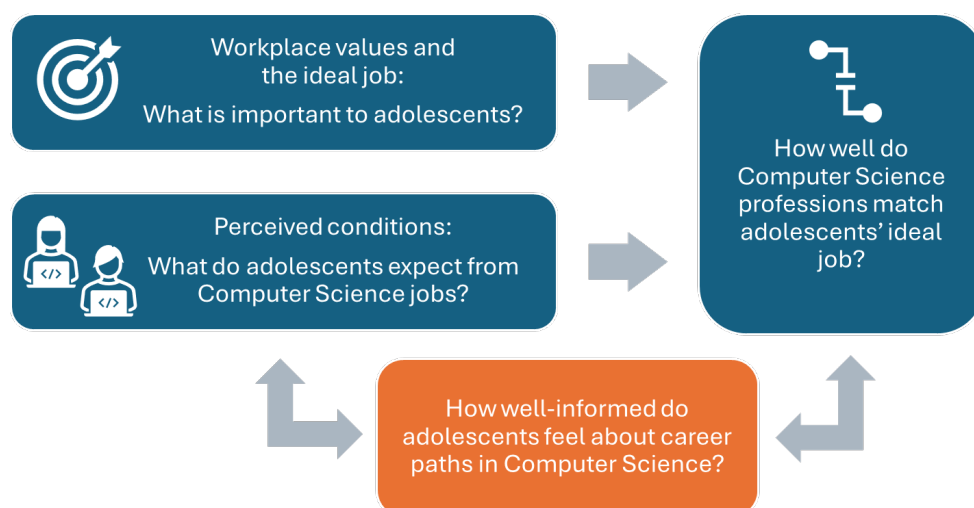


Figure 1: Approach towards data analysis

Step 1: Baseline comparison of workplace values. Participants' general workplace values are examined to identify adolescents' career priorities and contextualize perceptions of CS careers. As discussed in Section 2.2, the Zenjob Study 2024 surveyed GenZ job preferences. The adolescents in the present study are also GenZ (born 2004-2009). Since both studies were conducted in Germany in May/June 2024, similar priorities are expected for job security, salary, and career opportunities. Traditional gender stereotypes inform the following hypotheses:

H1a: Young men assign a higher importance to high salary than young women.

H1b: Young men assign a higher importance to high prestige than young women.

H1c: Young women assign a higher importance to balancing family and career than young men.

Step 2: Perceived CS job conditions. The analysis aims to clarify adolescents' expectations in CS careers. According to Section 2.2, CS careers are expected to be seen as offering strong prospects and high economic rewards. The analysis was systematically differentiated by gender, leading to the following hypothesis:

H2: Young men and young women differ in their perceptions of CS job conditions.

Step 3: Comparison of workplace values and perceived conditions in CS-related professions. Participants' workplace values (step 1) – their "ideal job" – were contrasted with their assessments of CS job conditions (step 2). This allows to show gaps or mismatches.

H3a: There is no difference in perception of adolescents' high salary for an ideal job than what they believe CS careers offer.

H3b: There is no difference in perception of adolescents' career opportunities for an ideal job than what they believe CS careers offer.

Step 4: Evaluation of Knowledge Gaps. The final step examines adolescents' self-assessed knowledge of CS professions. As many adolescents struggle with learning about career paths (Section 2.3), the same is expected for CS. Limited knowledge or a tendency to think in stereotypes increases the chance of inaccurate perceptions, so value–perception comparisons may reflect misconceptions rather than real incompatibilities. As discussed in Section 2, lower participation of young women in school CS electives restricts exposure. Hence, the following hypothesis is proposed:

H4: Young women report lower levels of subjective knowledge about CS careers compared to young men.

3.4 Limitations

The study has several limitations. First, age distribution differed by gender: among young women, those aged 15-16 were somewhat underrepresented; among young men, those aged 19-20 were slightly underrepresented. Second, the sole non-binary participant was excluded from gender-specific analyses. Third, despite coverage across all federal states, the sample cannot be considered fully representative of German students, so findings should be interpreted with caution. Furthermore, the workplace values assessed are

limited, omitting factors such as creativity, social impact, or teamwork. The analysis does not account for contextual factors, including variations in CS curricula, exposure to role models, or socioeconomic background, which may shape adolescents' workplace values and perceptions of CS jobs. Finally, the study does not compare adolescents' views of CS careers with other occupations.

4. Data Analysis

The steps of data analysis described above are now discussed in the next sections.

4.1 Adolescents' Workplace Values

Workplace values were measured using scales by Esch and Grosche (2011), Schreiner and Sjøberg (2019), and Thomas and Allen (2006). A 5-point Likert scale was used [1-strongly disagree; 5-strongly agree]. An independent samples *t*-test was used to analyse for gender differences. Figure 2 shows both groups rated all values highly, with means around 4 on a 5-point scale. Both genders put similar priorities: job security, career opportunities, and high salary are the top three positions, only the order differs, with young women ranking career opportunities higher than salary. These results align with the Zenjob Study 2024 (Gleyzer, 2024).

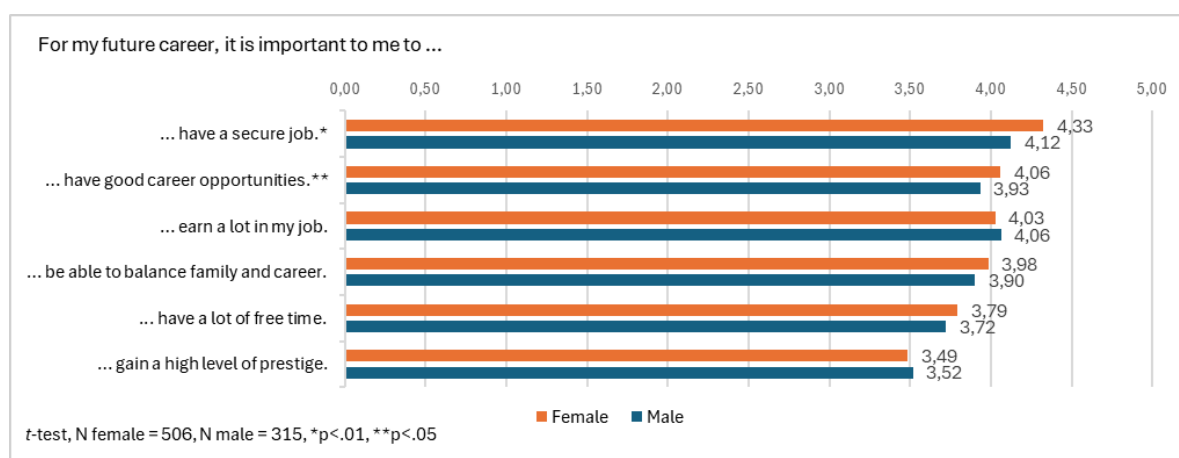


Figure 2: Mean workplace values

Regarding hypotheses H1a and H1b, young men rated high earnings ($M_m=4.06$, $SD_m=0.922$) and prestige ($M_m=3.52$, $SD_m=1.045$) slightly higher than young women did ($M_f=4.03$, $SD_f=0.954$ for high earnings, $M_f=3.49$, $SD_f=0.969$ for prestige). However, these differences were not statistically significant at $p<.05$. Therefore, H1a and H1b were rejected. The same applies to H1c: While young women considered the balance between family and career ($M_f=3.98$, $SD_f=1.019$) more important than men ($M_m=3.90$, $SD_m=0.997$) did, this difference was not statistically significant at $p<.05$. Although both genders gave the highest values to job security, young women ($M_f=4.33$, $SD_f=0.839$) rated job security significantly higher than young men ($M_m=4.12$, $SD_m=0.968$). This disparity is statistically significant ($t(595)=3.062$, $p=.002$) with a small effect size (Cohen's $d=0.227$), suggesting that women consider employment stability a slightly more important factor in their career aspirations. Moreover, young women valued career opportunities slightly higher than young men ($M_f=4.06$, $SD_f=0.898$; $M_m=3.93$, $SD_m=1.012$) with $t(606)=1,781$, $p=.038$ and a small effect size ($d=0.131$).

4.2 Adolescents' Perception of Occupational Conditions in Computer Science-related Professions

After analysing general workplace values, perceptions of CS careers are examined. Respondents rated the same characteristics as asked for in the part of the survey on workplace values. Again, a 5-point Likert scale was used. Additionally, potential difficulties for women in CS were assessed. Independent-samples *t*-tests were performed to analyse the differences. Figure 3 presents the mean ratings. Overall, young women and men rated most aspects positively (means>3), indicating moderately favourable views of CS careers. A closer look at the individual items reveals three main patterns.

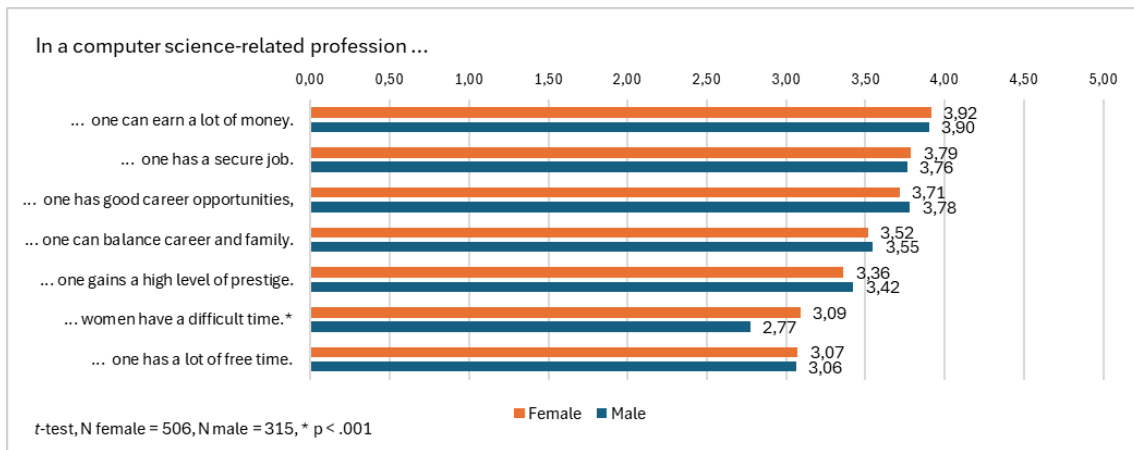


Figure 3: Mean perception of occupational conditions in CS professions by gender

First, both young women and men view career prospects in CS positively, agreeing that CS-related professions offer secure employment, good pay, and career opportunities. Mean values for these items ranged between 3.7 and 3.9 for both genders. Gender differences were not statistically significant at $p < .05$. Second, perceptions of prestige and work–life balance in CS careers were moderately positive (around 3.4 to 3.5), slightly lower than for the professional prospects. This suggests that, while adolescents see CS as a stable, respectable and financially attractive career path, they may perceive somewhat greater challenges in achieving an ideal work–life balance compared to other aspects of the job. Differences between genders were not significant at $p < .05$. Finally, agreement was lowest for the following statements. On average, respondents were neutral on whether CS jobs offer much free time, suggesting that they view these professions as demanding and time-intensive. The statement “women have a difficult time in CS professions” revealed the only significant gender difference: young women ($M_f = 3.09$, $SD_f = 1.141$) agreed more strongly than young men ($M_m = 2.77$, $SD_m = 1.096$), and ($t(819) = 3.921$, $p < .001$) with a small effect size ($d = 0.281$). This indicates a slightly greater awareness among female respondents of gender-related challenges in the field. Overall, H2 which postulated a gender difference is rejected.

4.3 Comparing Ideal Workplace Values and Perception of Computer Science

Now the results from steps 1 and 2 are compared to assess gaps between adolescents’ ideal job and their perception of CS jobs. Figure 5 shows the comparison with both genders consistently rating conditions in CS jobs lower than their ideal workplace. Paired-samples t -tests were conducted to analyse the differences.

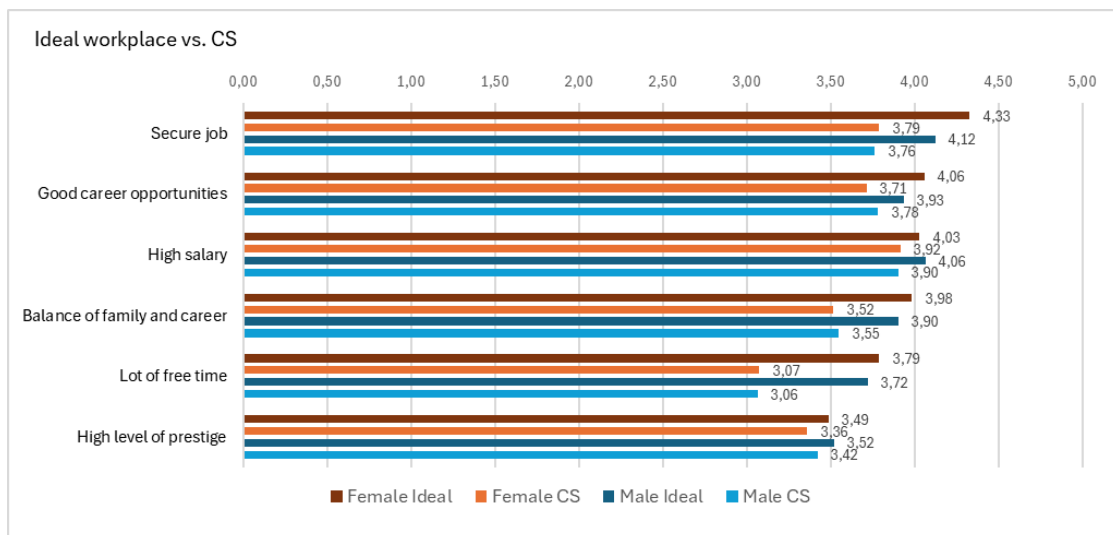


Figure 4: Gaps between ideal workplace and perceived CS job conditions

Both genders rated job security highly but saw CS as less secure. For young women, CS scored 0.54 points below their ideal; for young men the difference was 0.36 points. Both differences were significant ($p < .001$) and showed small to medium effect sizes ($d_f = 0.493$; $d_m = 0.341$). The gap is larger for young women, suggesting less

confidence that CS provides the stability they seek. Moreover, young women rated career opportunities in CS jobs 0.34 points below ideal, while young men perceived them as 0.15 points lower. For young women, this difference is statistically significant ($p=.000$) with a small to medium effect size ($d=0.308$). For young men, the difference is also significant ($p=.014$) with a small effect size ($d=0.139$). Therefore, hypothesis H3b (no difference in perceived opportunities) is rejected. Although CS is viewed as offering reasonably good career prospects, it falls short of adolescents' ideal.

For young women, the gap between their ideal job and CS jobs regarding salary was the smallest across all measured values, at 0.11 points. However, this difference remains significant ($p=0.024$) with a small effect size ($d=0.100$). For young men, the perceived gap is slightly larger, at 0.16 points and significant ($p=.004$) with a small effect size ($d=0.163$), too. Therefore, hypothesis H3a, which predicts no difference in these perceptions, is rejected. Furthermore, both young women and men perceive CS jobs as offering less family-career balance than their ideal. For young women, the CS rating is 0.47 points lower, a significant difference ($p=.000$) with a medium effect size ($d=0.401$). For young men, the gap is 0.36 points, likewise significant ($p=.000$) with a small to medium effect size ($d=0.319$). The larger gap for young women suggests they are less convinced that CS careers offer the desired work-family balance.

Compared with their ideal job, young women and men both view CS positions as offering noticeably less free time. Among young women, the CS rating falls 0.72 points below their ideal, a highly significant difference ($p=.000$) with a medium to large effect size ($d=0.616$). For young men, the shortfall is 0.66 points, also highly significant ($p=.000$) with a medium effect size ($d=0.623$). The slightly larger gap for young women suggests they view CS careers as particularly time-demanding. Regarding prestige, young women rate CS roles 0.13 points below their ideal, a difference that reaches statistical significance ($p=.022$) but is accompanied by only a small effect size ($d=0.102$). Among young men, the corresponding gap of 0.10 points is not significant ($p=.144$). Thus, a minor prestige gap appears for young women, whereas no comparable difference emerges among young men.

4.4 Adolescents' Subjective Knowledge of Computer Science Professions

Adolescents' perceived subjective knowledge about CS professions was assessed using the items shown in Figure 5, each measured, as the previous items, on a 5-point Likert scale. To examine gender differences, independent-samples t -tests were conducted.

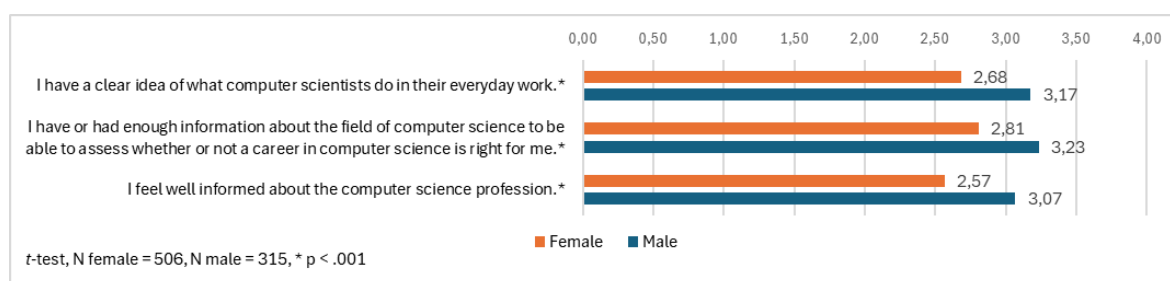


Figure 5: Perceived subjective knowledge of CS professions

Young men reported a significantly clearer idea of what computer scientists do in their everyday work ($M_m=3.17$, $SD_m=1.061$) than young women ($M_f=2.68$, $SD_f=0.943$), $t(819)=-6.907$, $p<.001$, with a medium effect size ($d=-0.50$). With the scale midpoint at 3, young men were around the midpoint, indicating moderate clarity, whereas young women were below it, indicating that they generally do not feel they understand the daily work of computer scientists. Young men also reported having significantly more information to evaluate whether a career in computer science suits them ($M_m=3.23$, $SD_m=1.081$) than young women ($M_f=2.81$, $SD_f=1.061$), $t(819)=-5.45$, $p<.001$, $d=-0.391$. Finally, young men felt significantly better informed about the CS profession overall ($M_m=3.07$, $SD_m=1.081$) than young women ($M_f=2.57$, $SD_f=1.081$), $t(819)=-6.647$, $p<.001$, with a medium effect size ($d=-0.477$). On average, young men were near the midpoint, suggesting a moderate level of perceived information, whereas young women fell clearly below 3, indicating they do not feel well informed. Across all three items, young women reported significantly lower subjective knowledge than young men at $p<.001$, confirming H4 which postulated a gender gap.

5. Discussion

Young women and men reported similar priorities regarding job security, career opportunities, and high earnings, consistent with the Zenjob Study 2024 (Gleyzer, 2024). Job security ranked highest for both groups,

with young women rating it significantly higher. These patterns reflect Germany's economic situation in mid-2024, following the 2022/2023 energy crisis and high inflation. Ongoing global uncertainties, including the war in Ukraine, reinforced concerns about stability, making job security and reliable income particularly salient. Young women's stronger focus on job security may relate to gender inequalities in the German labour market: women earn less on average (World Economic Forum, 2025), work part-time more often (DESTATIS, 2025), and face more career interruptions (e.g., parental leave or caregiving), heightening the importance of stable employment.

Both genders generally rated CS job conditions below their ideal workplace. Consistent with Zhou and Shirazi (2025), adolescents perceive CS careers as stable, prestigious, and well paid, yet expect difficulties in achieving work–life balance, echoing Thomas and Allen (2006). Amid Germany's STEM skilled-labour shortage and the IT sector's importance (Germany Trade & Invest, 2025), interested adolescents may be especially open to positive portrayals of CS careers.

At the same time, public debates about AI-driven automation and the future need for programmers may heighten concerns about job security (Nigar *et al.*, 2025). These mixed signals with CS as both a future-oriented field and one undergoing rapid transformation likely shape adolescents' perceptions. Within this context, adolescents tend to see CS careers as time-intensive and less compatible with their preferred lifestyle. Accordingly, free time showed the largest gap, possibly influenced by portrayals of start-up-style tech companies (Cheryan, Master and Meltzoff, 2015) as demanding workplaces with heavy workloads, tight deadlines and constant pressure to innovate.

The survey asked whether participants believe women face difficulties in CS professions. Even moderate perceptions of gender-related challenges may deter interest in CS, as such expectations can become self-reinforcing. If girls anticipate barriers or social discomfort, these perceptions alone, regardless of actual experiences, may discourage them from considering CS as a viable option. This aligns with research on stereotypes in CS and engineering cultures (Cheryan, Master and Meltzoff, 2015). To prevent these perceptions from becoming barriers, career guidance should be gender-sensitive, counter stereotypes, provide realistic information about working conditions, and offer approachable role models (Cheryan *et al.*, 2015; Steffen *et al.*, 2025). This is particularly important given adolescents' limited knowledge of CS careers, especially among young women, confirming earlier findings (Barlovic *et al.*, 2022).

As Barlovic *et al.* (2022) show, parents play a key role in adolescents' career choices. With approximately 1.4 million people employed in CS roles according to the studies consolidated by German Trade & Invest (2025)—a relatively small proportion of the population—many parents likely have limited knowledge of CS professions. Schools offer little support as well: in 2024, only 24 % of lower secondary school students had mandatory CS classes (Gesellschaft für Informatik, 2023), leaving many adolescents without meaningful exposure to CS or its career options. Given these gaps, career guidance should raise general awareness of CS among all adolescents and their parents, not only those already interested. Young women report significantly lower levels of information than young men, reflecting either an actual knowledge gap or lower confidence in assessing their knowledge. They choose CS less frequently as a school subject or extracurricular activity (Gesellschaft für Informatik, 2023), reducing opportunities to acquire CS-related knowledge. At the same time, prior research indicates that women often report lower self-confidence in male-stereotyped domains such as CS (Hess *et al.*, 2023).

6. Conclusion

The study provides large-scale, quantitative evidence from more than 800 German adolescents on their workplace values and their perceptions of CS careers. Overall, adolescents of both genders viewed CS professions as stable and financially attractive, yet also as relatively demanding in terms of workload. Across all groups, perceived conditions in CS jobs consistently fell short of their ideal expectations. The results reveal persistent misconceptions and unequal access to information, particularly among young women, creating systematic barriers to considering CS as a viable career path. Future research should investigate the origins of these gaps to distinguish between perceptions that reflect real conditions in CS jobs and those that arise from missing information or inaccurate communication and stereotypes. Comparing adolescents' perceptions with the experiences of CS professionals would be useful, as would qualitative approaches, such as interviews, to explore how these views develop. Examining how adolescents evaluate CS relative to other appealing careers could also clarify whether the gaps are CS-specific or part of broader patterns. Such insights would support more targeted and effective career guidance in CS.

Ethics Declaration: The study presented received full ethical approval from the institutional ethics committee of the authors' institution. Participation was voluntary and anonymous, and informed consent was obtained from all participants prior to data collection.

AI Declaration: AI tools (ChatGPT-5, DeepL) were used for language editing and improving clarity. The authors confirm that all intellectual content, interpretation, and conclusions were developed by the authors and that AI outputs were reviewed and edited by the authors for accuracy and appropriateness. AI tools (ChatGPT-5, PerplexityAI) were also used to expand literature search terms, suggest related keywords, and identify candidate publications. All searches were validated through academic databases, all inclusion/exclusion decisions were made by the authors. AI was neither used for statistical analysis nor figure/table generation.

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