

Gendered Views on Computer Science in Secondary Education

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Abstract

The gender imbalance in computer science (CS) has been the subject of research for some time. With its introduction as a mandatory subject in secondary schools in some German federal states, the question of its sufficiency to bridge gender disparities arises. This study explores students' perceptions after one or two years of compulsory CS. The results show that male students express more interest, especially in programming, while female students often find the subject too complex and lacking in practical relevance, citing insufficient real-world applications and teacher support. These differences highlight the importance of considering gender equity in the teaching of CS.

CCS Concepts

• **Social and professional topics** → **Computing education; Gender.**

Keywords

Gender, Computer Science Education

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1 Introduction

CS programs in Germany are becoming increasingly popular, yet women still make up less than 20% of students [3], leading to a persistent gender imbalance that affects both diversity and innovation in the field. This imbalance not only influences women's interest in CS but also limits diversity within the industry, which can hinder creativity and the inclusivity of software [8]. The absence of mandatory computer science education in German schools has long hindered efforts to challenge enduring stereotypes about the discipline. Introducing CS as a mandatory subject is a step toward increasing participation, particularly among women, but the challenge remains in designing a curriculum that engages all students equally. This study explores gender-specific perceptions of mandatory CS education based on data from a pilot project in a German federal state.

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2 Related Work

Previous studies show differences in motivation for studying CS. Men are often drawn to the technical aspects and intellectual challenges of programming, viewing it as a self-driven activity rather than a means to an end [6, 9]. This intrinsic motivation is a key factor in many men's decisions to study and work in CS. Women, on the other hand, tend to focus more on how technical skills can be applied meaningfully and purposefully, often in socially oriented contexts [9]. Research has demonstrated gender differences in experimental behavior from an early age. Boys are more inclined to experiment, whereas girls tend to adhere to rules and emphasize structured learning [4]. This distinction is particularly relevant in CS, where “tinkering” and “trial-and-error” strategies are common. A higher risk aversion among girls and women may contribute to this difference. Self-efficacy [1] plays a crucial role in motivation and confidence. Men frequently rate their technical skills higher, while women tend to underestimate their abilities despite similar competence levels [5]. Many female students report that men have had more and earlier exposure to technology, making them appear more confident in their studies. This gap in perceived competence can lead to frustration and, in some cases, dropping out of CS programs [6].

Master et al. [7] show that stereotypes about boys being more interested in CS than girls already emerge in elementary school and become stronger with age, leading to a decline in girls' interest. Stereotypes also influence how students imagine professionals in different disciplines, with CS often perceived as a male-dominated field. Over time, this perception discourages many girls from engaging with the field.

3 Methodology

The data for this study originate from a pilot project that introduced CS as a mandatory subject in the German federal state of Schleswig-Holstein. In the 2022/23 and 2023/24 school years, 82 schools implemented the subject with two weekly lessons over two years. Participation in the survey was voluntary and conducted outside school hours.

The 2022/23 questionnaire included nine questions, with two open-ended key questions: “How would you describe the subject of computer science?” and “What should be changed for the next cohort?”¹ Based on initial data, a close-ended question was added in the second round, where participants rated nine terms related to CS on a five-point Likert scale. The terms can be found in Table 1.

For qualitative analysis, responses from students identifying as male or female who answered at least one open-ended question were considered. The sample included 436 students (199 male, 237 female) from grades 5 to 9, primarily grades 7 and 8. The quantitative analysis, based on the 2023/24 survey, included 342 students (146

¹It should be noted that all questions, answers and codings were formulated in German and have been translated into English for the purposes of this text.

male, 196 female), mostly from grade 8. Qualitative responses were analyzed using thematic analysis following Braun and Clarke’s methodology [2], while quantitative data was evaluated using the Mann-Whitney U test, applying a significance level of $\alpha = 0.05$ and Bonferroni correction.

4 Results

Nine themes emerged from the qualitative analysis. The first theme, *Subject-related content*, was noted by both genders, with students associating CS with “programming”, “working with computers”, and “applications”. Gender-specific preferences were absent, except in the theme *Interest in Programming*, where 12% of male students expressed a desire for “more real programming” beyond the visual programming language Scratch.

The following two themes are based exclusively on responses from female students. The theme *Subject-related skills* highlights logic and problem-solving, with female students emphasizing “complex programming” and “experimentation.”

The theme *Transferable Skills* focuses on group work and problem-solving. Female students highlighted their positive experiences working with peers and discussed the importance of problem-solving skills in CS. They viewed the skills learned in CS as tools to tackle real-world challenges: “Computer science is exciting, and you learn new approaches to problems and effective methods for solving them.”

Both genders expressed enjoyment for the subject in the theme *Positive Perception*, though female students often linked their interest to its complexity: “It’s interesting, but also exhausting and challenging.” Both genders identified certain aspects as monotonous; however, only female students explicitly reported experiencing stress due to memorization demands and perceiving the content as complex. This is reflected in the theme *Negative Perception*, as one female student put it: “I don’t understand the subject at all. In tests, you basically just have to memorize everything to get the answers right.”

The theme *Practical Relevance* is also exclusively based on responses from female students, who criticized the lack of real-world applications in the curriculum. One female student expressed this concern, saying, “I would like it if we were shown more clearly where we can later apply the things we learn in class.”

Within the theme *Prior Knowledge*, male students highlighted their previous knowledge positively, whereas female students took a more neutral stance regarding the subject’s demands. One male student said, “Additionally, it’s a lot of fun because I have had a computer at home for almost three years, so I’m pretty familiar with it.” Both genders emphasized the need for greater teacher support, with female students specifically advocating for proactive assistance: “More help from the teacher when students are overwhelmed.” This is summarized in the theme *Teacher Reference*.

In the closed-ended section of the survey, significant differences in the evaluation of six out of nine terms between genders were observed, with boys showing higher agreement with positively connoted terms than girls, as presented in Table 1. This ties in well with the qualitative results, especially regarding the themes *Positive / Negative Perception* as well as *Practical Relevance*.

Term	Male	Female	U	p	d
exciting	3.24 (1.19)	2.58 (1.09)	14 177	<.01	.58
logic	3.96 (1.00)	3.65 (1.00)	12 457	.04	.31
useful	3.87 (1.09)	3.30 (1.12)	13 957	<.01	.51
varied	3.26 (1.22)	3.06 (1.16)	12 284	.85	.16
unnecessary	2.13 (1.27)	2.73 (1.32)	7887	<.01	-.46
fun	3.62 (1.11)	2.85 (1.22)	14 552	<.01	.66
trying out	4.09 (1.07)	3.91 (0.93)	12 026	.22	.18
boring	2.59 (1.18)	3.00 (1.24)	8863	.03	-.34
complicated	2.97 (1.21)	3.35 (1.12)	9050	.09	-.32

Table 1: Means (standard deviations), U statistics and p -values and effect size (Cohen’s d) for term evaluations by gender

5 Conclusion

The study reveals gender differences in students’ perceptions of CS education. Male students generally find programming engaging and challenging, while female students often see it as complex and less relevant. Women emphasize the need for practical applications, whereas men focus on technical aspects. Both genders value more content repetition for better understanding, but women express greater frustration with the support they receive. The findings suggest that gender-sensitive teaching approaches are crucial. The study also highlights the importance of teacher training to address these gender-specific differences and promote equity. By fostering interest and equal opportunities, we can help create a more diverse CS field in the future.

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