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Shifting perceptions of gender in IT: Analyzing stereotypes and career choices among high school students in Almaty, Kazakhstan

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Abstract

This study examines the perception of IT as a male-dominated field and how gender stereotypes influence career choices among high school students in Almaty, Kazakhstan. A survey of 250 students revealed that gender stereotypes may be diminishing in the next generation, suggesting a shift in attitudes toward IT careers. The findings highlight the need for inclusive educational environments to inspire all students, regardless of gender, to pursue IT professions, thereby promoting diversity and innovation in the sector.

Keywords: Gender inequity; IT; STEM education; High school; Diversity

1. Introduction

The IT sector's growth has heightened interest in diverse talent, yet gender stereotypes persist, discouraging women from pursuing IT careers. According to the Ministry of Education and Science of the Republic of Kazakhstan only 31.6% of female students consider technical subjects, with just 30% entering IT fields, compared to 68% in other areas. This underrepresentation comes from societal norms, educational biases, and hiring practices that favor men. Addressing this gap is crucial for fostering innovation and economic growth. This study explores the factors behind the gender gap in IT career aspirations among high school students, focusing on societal stereotypes, educational experiences, and unconscious bias in hiring. Key research questions include:

- What factors contribute to women's underrepresentation in IT careers?
- Do employers prefer male candidates over equally or more qualified female candidates?
- How does underrepresentation affect women's self-confidence and career aspirations?
- Why is closing the gender gap in IT essential for the industry and society?

2. Theoretical Framework

Gender bias in Central Asia, including Kazakhstan, limits women's access to high-paying careers like IT. According to the World Bank (2023), women in Kazakhstan earn 78% of men's wages, and societal norms often prioritize childcare over careers. Addressing this gap early is critical, as studies show that companies with gender diversity outperform their less diverse counterparts [6] . Bridging this gap allows access to a broader talent pool, essential in a competitive job market. Additionally, starting inclusivity efforts early can lead to more balanced leadership representation, fostering fairness and innovation.

Social, educational, and psychological factors contribute to the underrepresentation of women in IT. Gender stereotypes associating technology with masculinity deter women from entering the field [10]. Media, pop culture, and the lack of

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female role models reinforce these stereotypes [9]. Educational biases and limited access to resources also reduce women's interest in IT [7]. Curriculum and cultural factors play a role, as stereotypical portrayals of IT professionals as males discourage women [4] . The presence of female role models has been shown to improve women's confidence and aspirations in STEM.

Gender biases in IT hiring practices create significant barriers for women. Studies show that female candidates with equal or better qualifications are often overlooked in favor of male candidates [10]. Research by Moss-Racusin et al. [5] found that identical resumes with male names received better evaluations and higher salary offers. These biases perpetuate the gender gap and create hostile work environments. In Kazakhstan, women must submit 180% more job applications than men for traditionally male roles (World Bank, 2023). The persistence of a "glass ceiling" further limits women's advancement in IT[2].

The underrepresentation of women in IT negatively impacts their self-confidence and career aspirations. Social stereotypes and a lack of support in the IT sector lead many women to underestimate their abilities [3]. Research shows this self-doubt begins during school and continues into career decisions, particularly in STEM fields [8]. Studies like UNESCO's report on women in STEM [9] highlight the need for empowerment initiatives to boost women's self-esteem and ambition in IT careers.

3. Methodology

3.1. Data Collection

A mixed-methods approach was used, with an online survey of 250 high school students (grades 9–11) in Almaty. The questionnaire included 13 items to assess gender stereotypes and factors influencing IT career choices. Data was collected via Google Forms and stored in Excel for analysis.

3.2. Data Analysis

Statistical methods (e.g., ANOVA, chi-square tests) and thematic analysis were employed. Key analyses included comparative analysis of career preferences in IT fields, identification of factors discouraging students from pursuing IT, examination of gender stereotypes and their impact on career choices and thematic analysis of open-ended responses to understand biases and attitudes.

Data were processed using Excel and SPSS for statistical and thematic analysis.

4. Results

4.1. Sample of the Survey

The survey included 250 high school students from seven schools, 62.4% female and 37.6% male participants. Students were from grades 9, 10, and 11, with equal representation from grades 9 and 10 (35.2%) and 29.6% from grade 11.

4.2. Consideration of IT as a Future Profession

38.4% of students expressed interest in pursuing IT as a career. Among males, 50% considered IT, while only 31.4% of females showed interest. The most popular career choice was programming (25%), followed by design (17.7%) and game development (12.5%). Reasons for rejecting IT included preference for other fields (85.1%), lack of confidence (7.8%), and fear of difficulty (5.8%).

4.3. Influence of Factors on Career Choice

The family had a more decisive impact on female students compared to male students (index = 0.242 and 0.072, respectively). In contrast, self-motivation was the most influential factor for both genders, with a higher impact on male students (index = 0.640) than on female students (index = 0.466). Other factors, such as school, society, social media, and friends, had a relatively low influence on career choices. ANOVA analysis revealed no statistically significant differences in career influence factors between genders ($p = 0.3027$).

Table 1 Factors Chosen by Male and Female Students

Influence factor	male	female
Family	8	57
Society	12	35
School	4	10
Social networks	10	13
Friends	6	11
Self	71	110

Table 2 Anova: Single Factor

ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	1302.083333	1	1302.083333	1.180617472	0.3027268746	4.964602701
Within Groups	11028.83333	10	1102.883333			
Total	12330.91667	11				

4.4. Opinions about Gender Stereotypes in IT

Chi-square analysis showed a significant difference in perceptions of the stereotype "IT is only for men" between male and female students ($p = 0.0036$). 233 students disagreed with this stereotype, emphasizing that success in IT depends on skills, not gender.

Table 3 Chi-square Analysis about Opinions of Students

Groups	Agree with statement	Disagree with statement	Total
Male	12 (6.39) [4.92]	82 (87.61) [0.36]	94
Female	5 (10.61) [2.96]	151 (145.39) [0.22]	156
Total	17	233	250(Grand total)

4.5. Importance of Women in IT

Female students rated the importance of women in IT higher than male students, with a statistically significant difference ($p = 1.6e-10$, $t = -13.53$). This aligns with studies emphasizing the need for gender diversity in STEM fields.

Table 4 Two-sample T-test

	Variable 1 (Male students)	***Variable 2 (Female Students)***
Mean	3.393617021	4.429487179
Variance	1.660603981	0.7756410256
Observations	94	156
Hypothesised Mean Difference	1	
df	145	
t Stat	-13.53101875	
P(T<=t) two-tail	1.60E-10	

4.6. Presence of IT Stereotypes

Society (39.6%) and social media (38%) were the most common sources of IT-related stereotypes. Schools also contributed (23.6%), but 30.8% of respondents reported not encountering any stereotypes. 53% of students agreed to eliminate these stereotypes, while 39.6% remained neutral.

5. Findings and Discussion

The survey shows that 38.4% of students are interested in pursuing IT careers, with male students (50%) showing more interest than females (31.4%). This gender disparity is consistent with broader trends in the IT sector . Programming emerged as the most popular IT career, while fields like robotics and web development were less favored. Most students (85.1%) preferred other fields for not pursuing IT, while many female students expressed self-doubt and fear of difficulty, which are known barriers to women entering male-dominated fields.

Family influence plays a crucial role in shaping career aspirations, especially for female students (influence index = 0.242), who face more pressure regarding career choices [1]. Societal expectations also slightly impact female students more than males, reinforcing traditional gender roles. Although the influence of schools was minimal, social networks had a more significant effect on male students' career choices (influence index = 0.090). Self-esteem was a significant factor, particularly for male students (influence index = 0.640), showing that personal motivation drives their career decisions more than external influences.

ANOVA results indicated no statistically significant differences in career choice factors between genders, suggesting the underrepresentation of women in IT is due to a complex interplay of factors ($p = 0.302727$). Social stereotypes and the lack of female role models continue to impact women's interest in IT careers. Male students were more likely to reject the idea that IT is a male-only field (82 disagreed vs. 12 agreed), while female students showed even stronger opposition (151 disagreed vs. five agreed), reflecting progress in challenging traditional gender biases[4].

Survey findings also revealed that societal norms and media continue to perpetuate IT-related stereotypes, cited by 39.6% and 38% of respondents, respectively. Educational settings also reinforced these biases for 23.6% of students. Encouragingly, 30.8% of students reported not encountering such stereotypes, suggesting a positive shift in perceptions. These findings stress the importance of addressing stereotypes early and fostering inclusive environments to inspire diverse participation in IT.

6. Conclusion

The study proposed the effects of women's underrepresentation in IT, the durability of stereotypes, and the gains of reducing the gender gap in technology. However, there is so much more to discover. Research work in the future could focus on how women's academic performances are related to gender biases in the education sector and the myths that practically push women from looking into the IT sector. Besides self-esteem, their role models and the quality of the taught computer science should be considered as other factors that may push them into IT careers. If we aim for more inclusiveness, Education is the main area that should be researched and reformed to tackle insecurities. We hope our research findings become part of the ongoing movement for reducing gender disparities in computer science programs and bring about positive change in that field.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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