

GENDER PERCEPTIONS AND ATTITUDES IN ICT: A COMPARATIVE STUDY AMONG UNIVERSITY STUDENTS*

Tatiana Pethö¹, Miroslava Bozogáňová², & Monika Magdová²

¹*Institute of Social Sciences, Centre of Social and Psychological Sciences SAS (Slovakia)*

²*Institute of Pedagogy, Andragogy and Psychology, Faculty of Humanities and Natural Sciences,
University of Presov (Slovakia)*

Abstract

Research has consistently shown that stereotypes about computer science exist among students, particularly in relation to gender. Ghorayeb, Comber and Gooberman- Hill (2021) and Sáinz et al. (2016) found that students hold stereotypical beliefs about ICT professionals, with a masculine portrayal being prevalent. However, these stereotypes are not always negative, and both boys and girls can hold counter-stereotypical beliefs. Cheryan et al. (2015) further emphasizes the role of cultural stereotypes in steering girls away from computer science and engineering, suggesting that diversifying these stereotypes can increase girls' interest in these fields. Funk and Parker (2018) add to this by highlighting the differences in perceptions of computer science between male and female students, with men focusing more on technical aspects and women being attracted to creativity and communication. The aim of this paper is to compare genders; information and communication technologies (ICT) and non-ICT students in terms of their attitudes toward people from ICT field, gender discrimination, and gender inequality. The research sample consisted of 225 university students from Slovakia (64.44% females) aged 18-26 years ($M=22.82$; $SD=1.23$). 24.44% of the students were studying within the ICT major. Attitudes toward people from ICT field were measured by four items on a 5-point scale, where 1 = strongly disagree - 7 = strongly agree with the statement. The same was true when measuring attitudes towards gender discrimination (McDonald's $\omega = .721$) (Beyer et al., 2005). Gender inequality was measured by The Separate Spheres Ideology Scale (Miller & Borgida, 2016) consisted of 15 items (McDonald's $\omega = .811$). The differences between men and women (Welch's t-test) showed a strong effect within gender inequality (Cohens $d = -.653$), where men perceived it at a higher rate than women. Further, differences with medium effect size (Cohens $d = -.347$) were demonstrated between ICT and non-ICT students under gender discrimination (There is gender discrimination in the study of Computer Science.) where non-ICT students agreed with the statement to a higher extent than ICT students. The results of the pilot study can help understand how gender perceptions differ between ICT and non-ICT students and women and men. Understanding this is important for developing more inclusive educational environments in ICT disciplines.

Keywords: *University students, information and communication technologies, gender inequality, gender discrimination.*

1. Introduction

Gender stereotypes play a crucial role in shaping individuals' perceptions of various professions. Researchers have extensively examined these stereotypes, particularly among young people, to understand how they influence career choices. Most of the existing literature (e.g., Eccles, 1994; Cejka & Eagly, 1999; Levy et al., 2000; Cheryan et al., 2013) about stereotypical beliefs about occupation has been conducted in North America.

Holland (1985) states that adolescents tend to choose a career in relation to their personality. Recent studies in US (Moss & Frieze, 1993; Cheryan et al., 2013) revealed that stereotypes about people working in ICT field often depict professionals as highly intelligent and technology- oriented.

* *Acknowledgment:* VEGA 2/0146/22 Psychological constructs and contextual frameworks determining the intention of girls and women to study ICT fields.

However, negative traits as lacking social skills or having unattractive physical features, persist. These stereotypes may discourage young women from pursuing ICT careers.

Ghorayeb, Comber and Gooberman-Hill (2021) and Sáinz et al. (2016) found that students hold stereotypical beliefs about ICT professionals, with a masculine portrayal being prevalent. However, these stereotypes are not always negative, and both boys and girls can hold counter-stereotypical beliefs. Cheryan et al. (2015) further emphasizes the role of cultural stereotypes in steering girls away from computer science and engineering, suggesting that diversifying these stereotypes can increase girls' interest in these fields. Funk and Parker (2018) add to this by highlighting the differences in perceptions of computer science between male and female students, with men focusing more on technical aspects and women being attracted to creativity and communication. Research conducted by Cheryan et al. (2013) points to perception of ICT as a masculine field persists, impacting women's participation. Stereotypes often associate ICT field with traditionally masculine traits, such as programming focus and social awkwardness. These biases can discourage women from pursuing careers in ICT. Challenging these stereotypes is crucial for creating a more inclusive environment in ICT. Stereotypes and attitudes in the field of ICT are phenomenon that has been studied for a long time, and therefore this contribution is based on a complex problem on the issue of the application of girls and women in the field of ICT.

2. Objectives

The aim of this paper is to compare genders; information and communication technologies (ICT) and non-ICT students in terms of their attitudes toward people from ICT field, gender discrimination, and gender inequality.

3. Methods

3.1. Research sample

The research sample consisted of 225 university students from Slovakia (64.44% females) aged 18-26 years ($M=22.82$; $SD=1.23$). Regarding regional distribution, the sample included individuals from eight different regions of Slovakia, with the highest representation from the Bratislavský region ($n = 36$, 16.00%) and the lowest from the Žilinský region ($n = 21$, 9.333%). In terms of their field of study, most of the participants reported an economic focus ($n = 206$, 91.556%), followed by those with a humanistic focus ($n = 12$, 5.333%). Participants were also asked about their involvement in ICT programs or specializations. A minority of the participants ($n = 55$, 24.444%) confirmed studying in the relevant ICT programs, whereas a majority ($n = 170$, 75.556%) did not pursue any ICT-related program or specialization.

3.2. Methodology

Attitudes toward people from ICT field were measured by four items (I think I should work in ICT.; My close family thinks I should work in ICT., My closest friends think I should work in ICT., People who are important to me think I should work in ICT.) on a 5-point scale, where 1 = strongly disagree - 5 = strongly agree with the statement.

Attitudes towards gender discrimination (ATGD) was measured by 8 items from "Stereotypes of CS" scale designed by Beyer et al. (2005), which is based on the Role Conflict Scale (Cuny et al., 2003). Stereotypes of CS scale measures stereotypical perception of ICT students and people working in the field of ICT. A score was calculated and divided by the number of items (McDonald's $\omega = .721$).

Gender inequality was measured by The Separate Spheres Ideology Scale (SSIS; Miller & Borgida, 2016) consisted of 15 items, which measured attitude toward gender roles especially technical skills, marriage roles and parenting and family structure in the context of gender. A score was calculated and divided by the number of items (McDonald's $\omega = .811$). JASP 0.18.3.0 (JASP, 2024) was used for analysis of the data.

4. Results

First, descriptive statistics for individual beliefs and social perceptions regarding employment in the ICT sector, as well as attitudes towards gender discrimination and inequality within this field is reported. The results, summarized in the following table, include means, confidence intervals for means, and distribution measures for each variable.

Table 1. Descriptive statistics.

	95% Confidence Interval Mean				SD	Skewness	Kurtosis	Min	Max
	M	Upper	Lower						
I think I should work in ICT.	2.671	2.842	2.500	1.302	0.116	-1.219	1	5	
My close family thinks I should work in ICT.	2.342	2.508	2.176	1.265	0.466	-0.939	1	5	
My closest friends think I should work in ICT.	2.240	2.403	2.077	1.241	0.468	-1.001	1	5	
People who are important to me think I should work in ICT.	2.307	2.469	2.144	1.239	0.422	-0.942	1	5	
Attitudes towards gender discrimination (ATGD)	4.108	4.218	3.998	0.836	-0.266	-0.111	1.5	6.625	
Gender inequality (SSIS)	3.526	3.632	3.419	0.810	0.032	0.321	1.133	6.2	

In addition, we made a comparison between men and women on all variables. The analysis was done using Welch's t-test. This is shown in Table 2.

Table 2. Comparison of men and women (Welch's t-test).

	Gender	N	Mean	SD	t	df	p	Cohen's d
I think I should work in ICT.	women	145	2.531	1.270	-2.162	156.769	0.032	-0.303
	men	80	2.925	1.329				
My close family thinks I should work in ICT.	women	145	2.159	1.188	-2.881	147.356	0.005	-0.408
	men	80	2.675	1.339				
My closest friends think I should work in ICT.	women	145	2.048	1.151	-3.053	144.38	0.003	-0.434
	men	80	2.587	1.328				
People who are important to me think I should work in ICT.	women	145	2.186	1.219	-1.961	159.27	0.052	-0.274
	men	80	2.525	1.253				
Attitudes towards gender discrimination (ATGD)	women	145	4.066	0.791	-0.972	144.296	0.333	-0.138
	men	80	4.184	0.914				
Gender inequality (SSIS)	women	145	3.345	0.767	-4.674	159.273	< .001	-0.653
	men	80	3.853	0.788				

Note. Welch's t-test.

A Welch's t-test revealed a significant difference between genders on the belief "I think I should work in ICT," with women ($M = 2.531$, $SD = 1.270$) scoring lower than men ($M = 2.925$, $SD = 1.329$), $t(156.769) = -2.162$, $p = .032$, Cohen's $d = -0.303$. When it came to family beliefs about them working in ICT, there was also a significant difference, with women ($M = 2.159$, $SD = 1.188$) scoring lower than men ($M = 2.675$, $SD = 1.339$), $t(147.356) = -2.881$, $p = .005$, Cohen's $d = -0.408$. Regarding friends' beliefs, women ($M = 2.048$, $SD = 1.151$) scored significantly lower than men ($M = 2.587$, $SD = 1.328$), $t(144.38) = -3.053$, $p = .003$, Cohen's $d = -0.434$. For the importance of opinions from significant others on working in ICT, women ($M = 2.186$, $SD = 1.129$) scored lower than men ($M = 2.525$, $SD = 1.253$), but this difference did not reach significance, $t(159.27) = -1.961$, $p = .052$, Cohen's $d = -0.274$.

In terms of attitudes towards gender discrimination (ATGD), there was no significant difference between women and men ($t(144.296) = -0.972$, $p = .333$, Cohen's $d = -0.138$). However, there was a significant difference in perceived gender inequality (SSIS), with women ($M = 3.345$, $SD = 0.767$) scoring lower than men ($M = 3.853$, $SD = 0.788$), $t(159.273) = -4.674$, $p < .001$, Cohen's $d = -0.653$.

We also compared ICT students with those not studying ICT. The results are shown in Table 3.

Table 3. Comparison of non/students of ICT (Welch's t-test).

	Do you study ICT?	N	Mean	SD	t	df	p	Cohen's d
I think I should work in ICT.	Yes	55	3.800	0.931	9.622	116.037	< .001	1.397
	No	170	2.306	1.192				
My close family thinks I should work in ICT.	Yes	55	3.345	1.04	7.996	100.869	< .001	1.206
	No	170	2.018	1.159				
My closest friends think I should work in ICT.	Yes	55	3.255	1.075	7.989	93.97	< .001	1.230
	No	170	1.912	1.109				
People who are important to me think I should work in ICT.	Yes	55	3.345	1.126	7.952	88.392	< .001	1.247
	No	170	1.971	1.079				
Attitudes towards gender discrimination (ATGD)	Yes	55	3.884	0.908	-2.167	82.989	0.033	-0.347
	No	170	4.181	0.801				
Gender inequality (SSIS)	Yes	55	3.541	0.908	0.143	81.284	0.887	0.023
	No	170	3.521	0.779				

Note. Welch's t-test.

Individuals currently studying ICT reported higher levels of personal, family, and friends' belief that they should work in ICT compared to those not studying ICT. Specifically, individuals studying ICT believed they should work in ICT ($M = 3.800$, $SD = 0.931$) more than those not studying ICT ($M = 2.306$, $SD = 1.192$), $t(116.037) = 9.622$, $p < .001$, Cohen's $d = 1.397$. Similarly, participants reported that their close family members ($M = 3.345$, $SD = 1.040$ for ICT students vs. $M = 2.018$, $SD = 1.159$ for non-ICT students), $t(100.869) = 7.996$, $p < .001$, Cohen's $d = 1.206$, and their closest friends ($M = 3.255$, $SD = 1.075$ for ICT students vs. $M = 1.912$, $SD = 1.109$ for non-ICT students), $t(93.97) = 7.989$, $p < .001$, Cohen's $d = 1.230$, were more likely to think they should work in ICT. This trend was also seen in the views of important people to the participants, with those studying ICT reporting higher agreement ($M = 3.345$, $SD = 1.126$) compared to their non-ICT counterparts ($M = 1.971$, $SD = 1.079$), $t(88.392) = 7.952$, $p < .001$, Cohen's $d = 1.247$.

Regarding attitudes toward gender discrimination, individuals not studying ICT reported slightly higher agreement with attitudes towards gender discrimination (ATGD) ($M = 4.181$, $SD = 0.801$) compared to those studying ICT ($M = 3.884$, $SD = 0.908$), $t(82.989) = -2.167$, $p = .033$, Cohen's $d = -0.347$. However, there was no significant difference in perceptions of gender inequality, as measured by the Gender Inequality (SSIS), between those studying ICT ($M = 3.541$, $SD = 0.908$) and those not ($M = 3.521$, $SD = 0.779$), $t(81.284) = 0.143$, $p = .887$, Cohen's $d = 0.023$.

5. Discussion and conclusion

The research results between men and women showed significant gender differences in the level of individual beliefs and social perceptions regarding employment in the ICT sector, where men perceived it at a higher rate than women. Our findings are consistent with previous researches (Vekiri & Chronaki, 2008; Volman, van Eck, Heemskerk, & Kuiper, 2005). Researchers found small, but significant positive effect favoring boys. In other words, boys held more favorable attitudes toward technology and considered themselves more competent than girls did (Cai et al., 2017).

Individuals currently studying ICT reported higher levels of personal, family, and friends' belief that they should work in ICT compared to those not studying ICT. Specifically, individuals studying ICT believed they should work in ICT more than those not studying ICT. Regarding attitudes toward gender discrimination, individuals not studying ICT reported slightly higher agreement with attitudes towards gender discrimination compared to those studying ICT. Non-ICT students, due to not being immersed in the ICT environment, may hold stronger gender stereotypes about the field. This could contribute to their belief that gender discrimination is more prevalent. On the other hand, ICT students might be more immune to stereotype threat due to their direct involvement in the discipline. Students studying ICT may have a more nuanced understanding of the dynamics within the field. It's possible that ICT students, being directly involved in CS, are more aware of efforts to address gender discrimination within the discipline.

They may also have a more personal and positive experience, leading to a lower perception of discrimination. The results of the pilot study can help understand how gender perceptions differ between ICT and non-ICT students and women and men.

Limitation of our research lies in the use of masculine generics by participants, which may inadvertently exclude gender-neutral language. Future efforts should emphasize inclusive language to ensure that all individuals, regardless of gender, feel represented and encouraged in their career aspirations. On the other hand, results of the pilot study can help understand how gender perceptions differ between ICT and non-ICT students and males and females. Understanding this is important for developing more inclusive educational environments in ICT disciplines. Young people suffer from lack of comprehensive information about the labor market and specific occupations, targeted interventions are essential. These interventions should be actively challenging stereotypical beliefs associated with various professions. By providing individuals who haven't committed to a specific academic path with authentic role models in the field of ICT, we can broaden their perspective and encourage diverse career choices.

References

- Beyer, S., DeKeuster, M., Walter, K., Colar, M., & Holcomb, C. (2005). Changes in CS students' attitudes towards CS over time: An examination of gender differences. *SIGCSE Bulletin*, *37*(1), 392-396. <https://doi.org/10.1145/1047124.1047475>
- Cai, Z., Fan, X., & Du, J. (2017). Gender and attitudes toward technology use: A meta-analysis. *Computers & Education*, *105*, 1-13. <https://doi.org/10.1016/j.compedu.2016.11.003>
- Cejka, M. A., & Eagly, A. H. (1999). Gender-stereotypic images of occupations correspond to the sex segregation of employment. *Personality & Social Psychology Bulletin*, *25*(4), 413-423. <https://doi.org/10.1177/0146167299025004002>
- Cheryan, S., Master, A., & Meltzoff, A. N. (2015). Cultural stereotypes as gatekeepers: increasing girls interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology*, *6*. <https://doi.org/10.3389/fpsyg.2015.00049>
- Cheryan, S., Plaut, V. C., Handron, C., & Hudson, L. (2013). The stereotypical computer scientist: Gendered media representations as a barrier to inclusion for women. *Sex Roles*, *69*(1-2), 58-71. <https://doi.org/10.1007/s11199-013-0296-x>
- Cuny, J., Aspray, W., & Cohoon, J. (2003). Factors Concerning Recruitment and Retention of Women Graduate Students in Computer Science and Engineering. *Proceedings of the National Science Foundation's ITWF & ITR/EWF Principal Investigator Conference*, 86-90.
- Eccles, J. S. (1994). Understanding Women's Educational And Occupational Choices: Applying the Eccles et al. Model of Achievement-Related Choices. *Psychology of Women Quarterly*, *18*(4), 585-609. <https://doi.org/10.1111/j.1471-6402.1994.tb01049.x>
- Funk, C. & Parker, K. (2018, January 9). Women and men in STEM often at odds over workplace equity. *Pew Research Center*. Retrieved from <http://pewsocialtrends.org/2018/01/09/women-and-men-in-stem-often-at-odds-over-workplace-equity/>
- Ghorayeb, A., Comber, R., & Goberman-Hill, R. (2021). Older adults' perspectives of smart home technology: Are we developing the technology that older people want? *International Journal of Human-Computer Studies*, *147*, 102571. <https://doi.org/10.1016/j.ijhcs.2020.102571>
- Holland, J. L. (1985). *Making vocational choices. A theory of personalities and workenvironments*. Englewood Cliffs, NJ: Prentice Hall.
- JASP Team (2024). JASP (Version 0.18. 3) [Computer software].
- Levy, G. D., Sadosky, A., & Troseth, G. L. (2000). Aspects of young children's perceptions of gender-typed occupations. *Sex Roles*, *42*, 993-1005. <https://doi.org/10.1023/A:100784516910>
- Miller, A. L., & Borgida, E. (2016). The separate spheres model of gendered inequality. *PloS One*, *11*(1), e0147315. <https://doi.org/10.1371/journal.pone.0147315>
- Moss, M. K., & Frieze, I. H. (1993). Job preferences in the anticipatory socialization phase. A comparison of two matching models. *Journal of Vocational Behavior*, *42*, 282-297.
- Sáinz, M., Meneses, J., López, B.-S., & Fàbregues, S. (2016). Gender stereotypes and attitudes towards information and communication technology professionals in a sample of Spanish secondary students. *Sex Roles*, *74*(3-4), 154-168. <https://doi.org/10.1007/s11199-014-0424-2>
- Vekiri, I. (2008). Chronaki Gender issues in technology use: Perceived social support, computer self-efficacy and value beliefs, and computer use beyond school *Computers & Education*, *51*(3), 1392-1404.
- Volman, M., van Eck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers & Education*, *45*(1), 35-55. <https://doi.org/10.1016/j.compedu.2004.03.001>