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Investigating the Current Gender Gap in ICT among Students (A Comparative Study of Eight Countries)

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ABSTRACT

The study of gender differences in ICT-related factors has been a core topic in education in the last several decades. Given the rapid development and infiltration of ICT, the purpose of this study is to investigate the current extent of the gender differences in seven key areas of ICT: use for entertainment, use for educational purposes, use at school, interest, perceived competence, perceived autonomy, and as a topic in social interaction. This study used data from the 2018 administration of the Programme for International Student Assessment (PISA). A total of 37,892 students from eight countries were analyzed to examine the current gender gap. The findings suggest that, overall, significant gender differences were found in six of the seven key areas of ICT, in favor of boys. In all countries under investigation, boys surpassed girls in ICT entertainment use, perceived competence, autonomy, and ICT as a topic in their social interactions.

Keywords: Gender Gap, ICT, International Student Assessment.

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Introduction

The development of information and communications technology (ICT) has been fast and furious, which has resulted in the deep infiltration of technology use into every aspect of people's daily lives, to the point that people is now heavily dependent on technology to function, and it has become an indispensable part of their daily lives. Education is one of the sectors that the ICT revolution has influenced in the past three decades. The United Nations Educational, Scientific and Cultural Organization (UNESCO) claims that 'ICT adds value to the processes of learning, and in the organization and management of learning institutions' (UNESCO 2002, 9). The implementation of ICT in education has been perceived as one of the most important tools in improving educational outcomes and students' twenty-first century skills (Anderson, 2008; Blackwell, Lauricella, & Wartella, 2014; Kim, Kil, & Shin, 2014; Kubiatko & Haláková, 2009; Meelissen & Drent, 2008; U.S. Department of Education, 2010). For example, Tondeur, Van Braak, and Valcke (2007) indicated that computer use fosters collaborative learning and flexible learning opportunities, independent of time and place. Jonassen (1996) stated that students develop higher-order thinking and problem-solving skills through the use of a computer. Cheung and Slavin (2013) conducted a meta-analysis that explored previous studies on the influence of ICT in education and found that ICT often has a positive impact on students' achievements. One of the benefits of ICT integration in education is its ability to increase opportunities for learning and reduce the gap between socioeconomic factors and education system outcomes (Shank & Cotten, 2014). As mentioned above, previous literature regarding the impact of ICT on educational outcomes is quite extensive; several meta-analyses and experimental and parametric studies have been produced. Therefore, many educational systems around the world have established ICT-related policies and invested significant resources in ICT integration in the educational system (Witte & Rogge, 2014).

In this age of ubiquitous ICT use in education, there has been a concern related to potential gender differences in ICT use. Males and females might have different use patterns of and attitudes toward ICT, creating a 'technological gender gap' (Canada & Brusca, 1991). As stated by Cai, Fan, and Du (2017) 'Over the years, there has been a stereotypical view concerning technology use and gender: relative to men and boys, women and girls might have more negative attitudes towards technology and technology use, and they would be less actively engaged in technology-related activities and behaviors, which could have contributed to the so-called technological gender gap... However, as technology is becoming much more ubiquitous than ever, and technology is becoming an important part of life especially for young people, women's attitudes toward technology use could vary and change across time' (p. 2).

This is an ongoing issue that has been under investigation for more than four decades. The low percentage of females in ICT-related majors, such as computer science and

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computer engineering, in countries across the globe has been noted in many articles and reports (Catalyst, 2019; *Eurostat Database*, 2018; *Science & Engineering Indicators*, 2018). The latest report by the National Science Board of the United States indicated that in 2016, female students represented only 18.7% of those who earned bachelor's degrees in ICT-related majors. In European Union countries, female graduates accounted for only 18.3% of graduates in ICT-related majors in 2016 (*Eurostat Database*, 2018). Vekiri and Chronaki (2008, 1393) stated, 'Having lower confidence in their abilities and lower interest in computers may lead female students to avoid experiences that could help them develop computer competence. This, in turn, might influence negatively their academic choices and limit their future career opportunities in information technology'. There has been a growing interest in investigating females in ICT-related majors as a subject of study. This concern has received considerable attention from many educational researchers as well.

In the early stage of this investigation in the 1980s and the 1990s, many studies conducted on gender-related ICT differences among students showed a clear pattern that male students were likely to have more positive perceptions of their ICT competence and were more attracted to ICT than their female peers (Busch, 1995; Colley, Gale, & Harris, 1994; Hess & Miura, 1985; Nelson & Cooper, 1997; Wilder, Mackie, & Cooper, 1985). However, recent studies in the last two decades showed two different patterns. First, boys hold more positive attitudes toward ICT than girls do (Chou, Wu, & Chen, 2011; Colley & Comber, 2003; Durndell, Haag, & Laithwaite, 2000; Durndell & Haag, 2002; Hasan, 2010; Kay, 2009; Kesici, Sahin, & Akturk, 2009; Li & Kirkup, 2007; Ong & Lai, 2006; Sieverding & Koch, 2009). For example, Kay (2009) examined gender differences in attitudes toward interactive classroom communication systems (ICCSs) among 659 secondary school students in Canada. He concluded that male students had significantly more positive attitudes than female students with respect to student involvement, assessment, and perceived learning with ICCSs.

In the second pattern, boys exhibited more negative attitudes toward ICT than girls (Chen & Tsai, 2005; Johnson, 2011; Price, 2006; Tsai & Lin, 2004). Chen and Tsai (2005), for example, collected data from 940 males and 926 females at a Taiwanese university to explore gender differences in attitudes toward Web-based learning. They found that females displayed more favorable attitudes than males regarding Web-based learning. Moreover, other studies could not find a significant difference between boys and girls in attitudes toward ICT (Imhof, Vollmeyer, & Beierlein, 2007; North & Noyes, 2002). Despite this debate through the last several decades, ICT use seems to remain a heavily gendered space that needs more exploration, especially with the rapid development.

Previous educational studies have also investigated gender differences in a variety of ICT-related constructs, such as self-efficacy in using ICT (Sáinz & Eccles, 2012), ICT literacy and skills (Aesaert & Van Braak, 2015; Baek et al., 2010; Hohlfeld, Ritzhaupt, & Barron, 2013; Kim et al., 2014; Siddiq, Gochyyev, & Wilson, 2017), attitudes toward ICT (Ardies, De Maeyer, Gijbels, & van Keulen, 2015; Cai et al.,

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العدد (96) أكتوبر 2023

2017; Hoffmann, 2002; Mawson, 2010; Pamuk & Peker, 2009; Potvin & Hasni, 2014; Teo, Milutinović, & Zhou, 2016), and ICT use in general (Vekiri & Chronaki, 2008; Volman, Van Eck, Heemskerk, & Kuiper, 2005).

Notten, Peter, Kraaykamp, and Valkenburg (2009), for example, conducted a multilevel analysis across 30 countries using data from the Programme for International Student Assessment (PISA) 2003 to investigate inequalities in digital access and use patterns. They found that girls have 20% lower odds of having Internet access at home than boys, 34% lower odds of using the Internet for informational purposes than boys, and 78% lower odds of playing games on a computer than boys. Moreover, a recent meta-analysis on attitude toward ICT confirms this result by revealing that there is a significant positive effect toward males, which indicates that males have higher ICT self-efficacy and hold more favorable attitudes toward ICT than females (Cai et al., 2017). Vekiri and Chronaki (2008) found that boys use ICT for entertainment more than girls; however, there were no significant differences between them concerning ICT use for schoolwork.

Drabowicz (2014) investigated how gender influences contemporary adolescents with respect to their use of ICT. The analysis included 39 countries in the framework of the 2006 wave of the PISA study. Regarding ICT use for educational purposes, he found that in 35 of the 39 countries under study, being a girl significantly decreased the respondent's score on this index (including Chile and Uruguay at the 0.001 level). He also found that girls use ICT more often than boys for communication purposes in 17 of the 39 countries (including Chile at the 0.01 level), there was no significant difference between boys and girls in 10 countries (including Uruguay), and boys use ICT more often than girls for communicational purposes in eight countries. Regarding ICT use for entertainment, in all countries under study, boys reported using ICT for entertainment more often than girls (including Chile and Uruguay at the 0.001 level).

Over the past several years, the world has witnessed exponential growth in ICT. Technology like smartphones, iPads, and 5G Internet has become 'more relevant and prominent in all aspects of the society and people's daily lives, concomitant changes might have occurred, and the gender differences related to technology use could have been narrowing' (Cai, Fan, and Du 2017, p. 2). Given this rapid development and infiltration of ICT and the length of time after the last international assessment for ICT literacy by PISA, in 2015, this study's purpose is to provide an up-to-date investigation on the technological gender gap.

This paper addresses the following question: Do the gender-related differences in ICT persist to the present day? It contributes to the literature by elaborating on the current state of the gender gap related to ICT usage and attitude across eight countries using the latest PISA cycle (PISA 2018). The following research hypotheses are examined to answer the research question:

1. Boys use ICT and the Internet for entertainment purposes more often than girls.
2. Boys use ICT and the Internet for educational purposes more often than girls.
3. Boys use ICT and the Internet at school more often than girls.
4. Boys are more interested in ICT than girls.

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5. Boys' perceived ICT competence is greater than girls'.
6. Boys' perceived autonomy related to ICT use is greater than girls'.
7. ICT is a greater part of daily social life for boys than for girls.

Data, Measurements, and Methods

Data source

The data used for this study come from the PISA conducted in 2018 (OECD, 2019). The PISA is a cross-national survey that measures 15-year-old students' mathematic, reading, and scientific literacy and is carried out every three years by the Organization for Economic Cooperation and Development (OECD). The PISA was first administered in 2000. In each cycle, there is a major domain for the assessment, which rotates from reading to mathematics to science. Moreover, the PISA uses a two-stage stratified sampling procedure to obtain a sample of 15-year-old students within each country. The sampling procedures involve two stages. The first stage calls for the selection of a representative sample of at least 150 schools in each country randomly, taking into account factors such as location and schools that serve 15-year olds. The second stage requires the selection of a random sample of 40 students who are 15-year-old from each school that has been selected in the first stage (OECD, 2019).

In the last cycle, the PISA assessed students' scientific, reading, and mathematic literacy in more than 79 countries, with reading the major domain. In each cycle, the PISA also makes available several optional questionnaires that gather more information from students, teachers, administrators, and parents. The ICT familiarity questionnaire was one of these optional questionnaires. On it, students provide information on what kinds of ICT they have at home and at school, for what purposes they use them, how often they use them, and what they think about their proficiency and confidence in using them. In 2018, 52 countries participated in the ICT familiarity questionnaire. The eight countries in North and South America that participated in the ICT familiarity questionnaire were included in this study's analysis, namely Brazil, Chile, Costa Rica, the Dominican Republic, Mexico, Panama, the United States, and Uruguay.

Measurement

Nine derived variables were built into the ICT familiarity questionnaire for PISA 2018. These ICT variables encompassed three main categories: (1) availability at school and at home, (2) type of ICT use, and (3) attitudes toward ICT. PISA 2018 measured ICT use with three indexes: (1) ICT use outside of school for schoolwork (HOMESCH), (2) ICT use outside of school for leisure (ENTUSE), (3) ICT use at school in general (USESCH). The questions in the PISA 2018 questionnaire focus on the frequency of using electronic devices. Participants choose one of the following options: never or hardly ever, once or twice a month, once or twice a week, almost every day, or every day.

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The current literature suggests that students' ICT-related attitudinal factors are complex and consist of many constructs (Tsai, Lin, & Tsai, 2001). According to OECD (2019), attitudes toward ICT comprise at least the following constructs: student interest in ICT, perceived ICT competence, perceived autonomy in using ICT, and enjoyment of social interaction around ICT. Thus, the present study investigated the influence of attitudes towards ICT in a more comprehensive way by taking all these four attitudinal constructs into account.

PISA 2018 measured attitudes toward ICT with the following indexes: (1) students' ICT interest (INTICT), (2) students' perceived ICT competence (COMPICT), (3) students' perceived autonomy related to ICT use (AUTICT), and (4) ICT as a topic in students' social interactions (SOIAICT). The corresponding questions in the questionnaire focus on the degree of agreement or disagreement with the selected statements concerning students' interest in ICT. A four-point Likert scale was used to allow students to score each statement, ranging from strongly disagree to strongly agree.

Results

For the purposes of this study, we used data from the eight countries in North and South America that participated in the PISA ICT familiarity questionnaire. The resulting sample consisted of 37,892 students, with nearly equal proportions of girls (50.4%) and boys (49.6%), as shown in Table 1. The first hypothesis states that boys use ICT and the Internet for entertainment purposes more often than girls. Table 2 presents the gender means on the respondents' self-declared frequency of ICT use for entertainment purposes. In all eight countries, being a boy significantly increased the respondent's frequency of ICT use for entertainment purposes at the 0.001 level.

Table 1

Demographic information of participants

Country	Observation	Girls		Boys	
		Count	%	Count	%
Brazil	6620	3396	51.3%	3224	48.7%
Chile	5604	2744	49.0%	2860	51.0%
Costa Rica	6165	3116	50.5%	3049	49.5%
Dominican Republic	3828	1956	51.1%	1872	48.9%
Mexico	5009	2524	50.4%	2485	49.6%
Panama	3095	1476	47.7%	1619	52.3%
Uruguay	3143	1669	53.1%	1474	46.9%
United States	4428	2218	50.1%	2210	49.9%
Total	**37892**	**19099**	**50.4%**	**18793**	**49.6%**

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العدد (96) أكتوبر 2023

The second hypothesis states that boys use ICT and the Internet for educational purposes more often than girls. Table 3 presents the effects that gender exerts on the respondent's score on the index of ICT/Internet educational use. In four of the eight countries under study, being a boy significantly increases the respondent's frequency of ICT use for educational purposes, at the

Table 2

Gender differences in ICT use for entertainment purposes

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	-.077	1.40	.272	1.61	-9.29 (6456)***	.000
Chile	.096	.90	.140	1.06	-9.53 (5535)***	.000
Costa Rica	-.263	1.14	.115	1.45	-11.27 (6097)***	.000
Dominican Republic	-.367	1.39	-.166	1.58	-4.14 (3739)***	.000
Mexico	-.376	1.01	-.049	1.20	-10.39 (4992)***	.000
Panama	-.248	1.14	.024	1.34	-5.98 (3008)***	.000
Uruguay	-.154	.99	.169	1.27	-7.80 (3141)***	.000
United States	-.171	.94	.131	1.09	-9.79 (4403)***	.000

Note. * p < .05, ** p < .01, *** p < .001.

0.001 level in Costa Rica and at the 0.01 level in Brazil, the Dominican Republic, and Panama. In the remaining four countries under study (Chile, Mexico, Uruguay, and the United States), gender does not affect the respondent's self-reported frequency of ICT use for educational

Table 3

Gender differences in ICT use for educational purposes

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	.169	1.19	.263	1.29	-3.03 (6456)**	.002
Chile	.096	.90	.140	1.06	-1.65 (5535)	.100
Costa Rica	.109	.98	.282	1.17	-6.27 (6097)***	.000
Dominican Republic	.241	1.13	.372	1.28	-3.31 (3739)**	.001
Mexico	.374	.94	.421	.99	-1.71 (4992)	.087

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Volume (96) October 2023
العدد (96) أكتوبر 2023

Panama	.277	1.03	.382	1.14	-2.64 (3008)**	.008
Uruguay	.257	.97	.262	1.12	-.143 (3141)	.886
United States	.255	.88	.205	1.09	1.67 (4403)	.096

Note. * p < .05, ** p < .01, *** p < .001.

purposes in a statistically significant way. Therefore, the second hypothesis is accepted for four counties and rejected for the other four.

With respect to ICT use at school, the third hypothesis states that boys use ICT and the Internet at school more often than girls. As Table 4 shows, there were gender differences in the use of ICT at school in three countries at the 0.001 level (Brazil, Costa Rica, and the Dominican Republic) and one country at the 0.05 level (Uruguay). Boys are more engaged in using ICT at school than girls in these countries. However, there were no significant gender differences in using ICT at school in the remining countries (Chile, Mexico, Panama, and the United States). Thus, the third hypothesis is accepted for four counties and rejected for the other four.

Table 4

Gender differences in ICT use at school in general

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	-.411	1.09	-.213	1.27	-6.70 (6456)***	.000
Chile	.064	.85	.106	.98	-1.72 (5535)	.089
Costa Rica	.010	.96	.172	1.10	-6.09 (6097)***	.000
Dominican Republic	-.249	1.11	-.132	1.26	-4.18 (3739)***	.000
Mexico	.062	.94	.105	1.05	-1.55 (4992)	.121
Panama	-.073	.91	-.039	1.09	-.917 (3008)	.359
Uruguay	.121	.91	.194	1.08	-1.99 (3141)*	.047
United States	.426	.79	.411	.91	.563 (4403)	.573

Note. * p < .05, ** p < .01, *** p < .001.

For ICT interest, the fourth hypothesis states that boys are more interested in ICT than girls. Table 5 presents the gender means on the respondents' self-declared interest in ICT. Interestingly, the fourth hypothesis is rejected for all eight countries. There were no significant

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www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

Table 5

Gender differences in ICT Interest

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	.201	1.14	.089	1.15	3.95 (6456)***	.000
Chile	.099	.98	.089	1.03	.366 (5535)	.715
Costa Rica	.158	1.07	.191	1.16	-1.13 (6097)	.256
Dominican Republic	-.107	1.34	-.139	1.26	.81 (3739)	.415
Mexico	-.066	.97	-.117	.99	1.81 (4992)	.068
Panama	-.026	1.09	.009	1.20	-.83 (3008)	.405
Uruguay	-.114	.95	-.112	1.08	-.03 (3141)	.971
United States	.077	.92	.095	1.01	-.629 (4403)	.530

Note. * p < .05, ** p < .01, *** p < .001.

gender differences in seven countries (Chile, Costa Rica, the Dominican Republic, Mexico, Panama, the United States, and Uruguay). In Brazil, girls are more interested in ICT than boys.

The fifth hypothesis states that boys' perceived ICT competence is higher than girls'.

Table 6 presents the effects that gender exerts on perceived ICT competence. In all eight countries, male and female students' perceived ICT competence was significantly different. Male students had significantly more perceived ICT competence in seven countries at the 0.001 level (Brazil, Chile, Costa Rica, the Dominican Republic, Mexico, Panama, and the United States) and in one country at the 0.05 level (Uruguay). Therefore, the fifth hypothesis is accepted for all eight countries.

With respect to perceived autonomy related to ICT use, the sixth hypothesis states that boys' perceived autonomy related to ICT use is greater than girls'. In all eight countries, male

students had more perceived autonomy related to ICT use at the 0.001 level (see Table 7). Therefore, the sixth hypothesis is accepted for all eight countries.

Table 6

Gender differences in Perceived ICT Competence

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	-.083	.93	.072	.98	-6.34 (6456)***	.000

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Volume (96) October 2023
العدد (96) أكتوبر 2023

Chile	.013	.94	.219	1.01	-7.73(5535)***	.000
Costa Rica	-.062	.95	.213	1.04	-10.81 (6097)***	.000
Dominican Republic	-.180	1.02	.004	1.14	-5.07 (3739)***	.000
Mexico	-.019	.98	.139	1.05	-5.39 (4992)***	.000
Panama	-.039	.99	.121	1.10	-3.94 (3008)***	.000
Uruguay	-.019	.96	.073	1.03	-2.51 (3141)*	.012
United States	.009	.87	.234	.98	-8.04 (4403)***	.000

Note. * p < .05, ** p < .01, *** p < .001.

Table 7

Gender differences in Perceived Autonomy related to ICT Use

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	-.144	.95	.135	1.03	-10.98 (6456)***	.000
Chile	-.241	.93	.191	1.04	-16.02 (5535)***	.000
Costa Rica	-.407	.96	.022	1.09	-16.31 (6097)***	.000
Dominican Republic	-.145	1.07	.054	1.19	-5.21 (3739)***	.000
Mexico	-.383	.89	-.078	1.02	-10.84 (4992)***	.000
Panama	-.233	.99	.056	1.09	-6.88 (3008)***	.000
Uruguay	-.303	.89	-.025	1.03	-7.74 (3141)***	.000
United States	-.261	.91	.165	1.01	-14.59 (4403)***	.000

Note. * p < .05, ** p < .01, *** p < .001.

The last hypothesis states that ICT is a part of daily social life for boys more than for girls. Table 8 presents the effects that gender exerts on the respondents' scores on ICT as a topic in social interaction. The analysis reveals that in all eight countries, ICT is a part of the daily social life for boys more than for girls (at the 0.001 level). Thus, the seventh hypothesis is accepted for all eight countries.

Table 8

Gender differences in ICT as a topic in Social Interaction

Country	Female		Male		t(df)	*p* value
	M	SD	*M*	SD		
Brazil	.105	.90	.356	.95	-10.389 (6456)***	.000

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www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

Chile	-.083	.97	.286	.99	-13.60 (5535)***	.000
Costa Rica	-.022	1.01	.44	1.08	-17.13 (6097)***	.000
Dominican Republic	.254	1.02	.438	1.09	-5.04 (3739)***	.000
Mexico	.101	.92	.318	.96	-7.85 (4992)***	.000
Panama	.205	.96	.408	1.07	-4.84 (3008)***	.000
Uruguay	.068	.91	.326	.98	-7.22 (3141)***	.000
United States	-.169	.95	.251	.98	-14.34 (4403)***	.000

Note. * p < .05, ** p < .01, *** p < .001.

Discussion and Conclusion

ICT seems to permeate the everyday lives of the current generation of students. The question asked in this paper concerns the gender-related differences in ICT usage and attitudes across eight countries. This study contributes to the existing literature on the digital divide by elaborating on the current extent of the gender differences in eight countries using the most recent data from PISA 2018. Regarding the gender differences in ICT use for entertainment purposes, the results reveal that there is a great gender gap in all eight countries in favor of boys. Therefore, the first hypothesis, boys use ICT and the Internet for entertainment purposes more often than girls, is accepted for all eight countries. This finding is consistent with previous studies that used PISA 2003 data (Notten et al., 2009) and PISA 2006 data (Drabowicz, 2014). Out of the eight countries included in this study, Chile and Uruguay were the only two countries that participated in the PISA ICT familiarity questionnaire in 2006, and therefore, comparison is possible only for these two countries. Like this study, Drabowicz (2014) found the gender gap related to ICT use for entertainment in Chile and Uruguay to be significant at the 0.001 level.

Concerning ICT use for educational purposes, the second hypothesis, boys use ICT and the Internet for educational purposes more often than girls, is accepted in four countries (Costa Rica, Brazil, the Dominican Republic, and Panama). This finding is in line with that of Notten et al. (2009) and Drabowicz (2014). Drabowicz (2014) found that in 32 of the 39 countries under study, being a boy significantly increased the respondent's score on the index of ICT/Internet educational use (Chile and Uruguay were among these 32 countries). However, contrary to the Drabowicz (2014) result, this study did not find gender differences in Chile and Uruguay in educational use with the PISA 2018 data. This change in results from 2006 and 2018 for Chile and Uruguay indicates a significant change in girls' ICT use for educational purposes. Regarding the third hypothesis, that boys use ICT and the Internet at school more often than girls, the analysis suggests accepting the hypothesis for four countries (Brazil, Costa Rica, the Dominican Republic, and Uruguay) and rejecting it for the other countries, where no significant gender differences were found (Chile, Mexico, Panama, and the United States).

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www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

Regarding the fourth hypothesis, boys are more interested in ICT than girls, it turns out that, contrary to expectations, it should be rejected for all countries under study. There were no significant gender differences in seven countries (Chile, Costa Rica, the Dominican Republic, Mexico, Panama, the United States, and Uruguay), and girls are more interested in ICT than boys in Brazil. This finding with respect to the effect of students' gender on ICT interest is similar to the findings of Ardies et al. (2015), Hoffmann (2002), and Mawson (2010) and contradicts those of Busch (1995), Colley et al. (1994), and Nelson and Cooper (1997).

Girls' perceived ICT competence and autonomy related to ICT use were significantly lower than boys' in all countries under investigation. Moreover, ICT seems to be a greater part of the boys' social interactions than the girls' in all eight countries. Therefore, the fifth, sixth, and seventh hypotheses are accepted for these countries. These findings are in line with research that shows that male students are likely to have more positive perceptions of their ICT competence (Busch, 1995; Li & Kirkup, 2007; Nelson & Cooper, 1997; Sieverding & Koch, 2009; Vekiri & Chronaki, 2008). However, although girls may have shown lower levels of competence than boys, girls' interest in ICT has changed in the last decades and is now similar to or higher than boys', at least in the countries under investigation.

In brief, seven key areas of ICT were examined for gender differences: use for schoolwork, use for entertainment, use at school, interest, perceived competence, perceived autonomy, and as a topic in social interactions. This study provided evidence that girls still have less perceived competency and autonomy related to ICT in most of the countries under study, despite the rapid development of ICT in the past two decades and despite the finding that girls' interest in ICT has become either equal to or greater than boys' interest. These factors may lead girls to have lower ICT uses than boys, as the result of this study revealed (ICT entertainment usage and educational usage). This, in turn, might negatively impact girls' academic choices and eliminate ICT as a possible field for future career opportunities. These gender differences could be the result of multiple factors, including the common ideas that males are more competent users of ICT and that ICT is a male-dominated arena, and other social and cultural factors. Understanding the gender differences in ICT usage and attitudes should help policymakers develop policies and educational opportunities that can promote girls' usage of, competency with, and autonomy toward ICT.

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Statements on open data and ethics

The data set will be provided upon request.

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Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

Conflict of interest

There are no conflicts of interest.

References

1. Aesaert, K., & Van Braak, J. (2015). Gender and socioeconomic related differences in performance based ICT competences. *Computers and Education*, *84*, 8–25. https://doi.org/10.1016/j.compedu.2014.12.017
2. Anderson, R. E. (2008). Implications of the Information and Knowledge Society for Education. In *International Handbook of Information Technology in Primary and Secondary Education*. Springer. https://doi.org/10.1007/978-0-387-73315-9_1
3. Ardies, J., De Maeyer, S., Gijbels, D., & van Keulen, H. (2015). Students attitudes towards technology. *International Journal of Technology and Design Education*, *25*(1), 43–65. https://doi.org/10.1007/s10798-014-9268-x
4. Baek, S.-G., Lim, C.-I., Kim, H.-S., Yu, Y.-L., Kim, M.-R., & Lee, S.-R. (2010). Analysis of Influential Variables on Performance-based ICT literacy Level for Korean Students. In A. for the A. of C. in Education (Ed.), *E-Learn 2010--World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 1560–1565). Orlando: World Conference on E-Learning in Corporate. Retrieved from https://www.learntechlib.org/p/35773/
5. Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014). Factors influencing digital technology use in early childhood education. *Computers and Education*, *77*, 82–90. https://doi.org/10.1016/j.compedu.2014.04.013
6. Busch, T. (1995). Gender Differences in Self-Efficacy and Attitudes toward Computers. *Journal of Educational Computing Research*, *12*(2), 147–158. https://doi.org/10.2190/h7e1-xmm7-gu9b-3hwr
7. Cai, Z., Fan, X., & Du, J. (2017). Gender and attitudes toward technology use: A meta-analysis. *Computers and Education*, *105*, 1–13. https://doi.org/10.1016/j.compedu.2016.11.003
8. Canada, K., & Brusca, F. (1991). The technological gender gap: Evidence and recommendations for educators and computer-based instruction designers. *Educational Technology Research and Development*, *39*(2), 43–51. https://doi.org/10.1007/BF02298153
9. Catalyst. (2019). *Women in Science, Technology, Engineering, and Mathematics (STEM): Quick Take*. Retrieved from https://www.catalyst.org/research/women-in-science-technology-engineering-and-mathematics-stem/
10. Chen, R. S., & Tsai, C. C. (2005). Gender differences in Taiwan university students' attitudes toward the web-based learning. In *Proc. Int. Conf. on Computers in Education 2005: "Towards Sustainable and Scalable Educational Innovations Informed by the Learning Sciences"- Sharing Research Results and Exemplary Innovations, ICCE* (pp. 625–628). IOS Press Amsterdam. https://doi.org/10.1089/cpb.2007.9974
11. Cheung, A. C. K., & Slavin, R. E. (2013). The Effectiveness of Educational Technology Applications for Enhancing Reading Achievement in K-12 Classrooms : A Meta-Analysis Educator ' s Summary Updated April 2012. *Educational Research Review*, *9*, 88–113.

DOI: https://doi.org/10.33193/JALHSS.96.2023.920
ISSN online: 2414 - 3383
ISSN print: 2616- 3810
مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع
Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

12. Chou, C., Wu, H. C., & Chen, C. H. (2011). Re-visiting college students' attitudes toward the Internet-based on a 6-T model: Gender and grade level difference. *Computers and Education*, *56*(4), 939–947. https://doi.org/10.1016/j.compedu.2010.11.004
13. Colley, A., & Comber, C. (2003). Age and gender differences in computer use and attitudes among secondary school students: What has changed? *Educational Research*, *45*(2), 155–165. https://doi.org/10.1080/0013188032000103235
14. Colley, A. M., Gale, M. T., & Harris, T. A. (1994). Effects of Gender Role Identity and Experience on Computer Attitude Components. *Journal of Educational Computing Research*, *10*, 129–137. https://doi.org/10.2190/8na7-daey-gm8p-eun5
15. Drabowicz, T. (2014). Gender and digital usage inequality among adolescents: A comparative study of 39 countries. *Computers and Education*. https://doi.org/10.1016/j.compedu.2014.01.016
16. Durndell, A, Haag, Z., & Laithwaite, H. (2000). Computer self efficacy and gender: A cross cultural study of Scotland and Romania. *Personality and Individual Differences*, *28*(6), 1037–1044. https://doi.org/10.1016/S0191-8869(99)00155-5
17. Durndell, Alan, & Haag, Z. (2002). Computer self efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample. *Computers in Human Behavior*, *18*(5), 521–535. https://doi.org/10.1016/S0747-5632(02)00006-7
18. *Eurostat Database*. (2018).
19. Hasan, B. (2010). Exploring gender differences in online shopping attitude. *Computers in Human Behavior*, *26*(4), 597–601. https://doi.org/10.1016/j.chb.2009.12.012
20. Hess, R. D., & Miura, I. T. (1985). Gender differences in enrollment in computer camps and classes. *Sex Roles*, *13*, 193–203. https://doi.org/10.1007/BF00287910
21. Hoffmann, L. (2002). Promoting girls' interest and achievement in physics classes for beginners. *Learning and Instruction*. https://doi.org/10.1016/S0959-4752(01)00010-X
22. Hohlfeld, T. N., Ritzhaupt, A. D., & Barron, A. E. (2013). Are gender differences in perceived and demonstrated technology literacy significant? It depends on the model. *Educational Technology Research and Development*, *61*(4), 639–663. https://doi.org/10.1007/s11423-013-9304-7
23. Imhof, M., Vollmeyer, R., & Beierlein, C. (2007). Computer use and the gender gap: The issue of access, use, motivation, and performance. *Computers in Human Behavior*, *23*(6), 2823–2837. https://doi.org/10.1016/j.chb.2006.05.007
24. Johnson, R. D. (2011). Gender differences in E-learning: Communication, social presence, and learning outcomes. *Journal of Organizational and End User Computing*, *23*(1), 79–94. https://doi.org/10.4018/joeuc.2011010105
25. Jonassen, D. H. (1996). *Computers in the classroom: mindtools for critical thinking*. *N J Prentice Hall*. Upper Saddle River, NJ, USA: Prentice-Hall, Inc.
26. Kay, R. H. (2009). Examining gender differences in attitudes toward interactive classroom communications systems (ICCS). *Computers and Education*, *52*(4), 730–740. https://doi.org/10.1016/j.compedu.2008.11.015
27. Kesici, S., Sahin, I., & Akturk, A. O. (2009). Analysis of cognitive learning strategies and computer attitudes, according to college students' gender and locus of control. *Computers in Human Behavior*, *25*(2), 529–534. https://doi.org/10.1016/j.chb.2008.11.004

DOI: https://doi.org/10.33193/JALHSS.96.2023.920
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Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

28. Kim, H. S., Kil, H. J., & Shin, A. (2014). An analysis of variables affecting the ICT literacy level of Korean elementary school students. *Computers and Education*, *77*, 29–38. https://doi.org/10.1016/j.compedu.2014.04.009
29. Kubiatko, M., & Haláková, Z. (2009). Slovak high school students' attitudes to ICT using in biology lesson. *Computers in Human Behavior*, *25*, 743–748. https://doi.org/10.1016/j.chb.2009.02.002
30. Li, N., & Kirkup, G. (2007). Gender and cultural differences in Internet use: A study of China and the UK. *Computers and Education*. https://doi.org/10.1016/j.compedu.2005.01.007
31. Mawson, B. (2010). Children's developing understanding of technology. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-008-9062-8
32. Meelissen, M. R. M., & Drent, M. (2008). Gender differences in computer attitudes: Does the school matter? *Computers in Human Behavior*, *24*(3), 969–985. https://doi.org/10.1016/j.chb.2007.03.001
33. Nelson, L. J., & Cooper, J. (1997). Gender differences in children's reactions to success and failure with computers. *Computers in Human Behavior*, *13*(2), 247–267. https://doi.org/10.1016/S0747-5632(97)00008-3
34. North, A. S., & Noyes, J. M. (2002). Gender influences on children's computer attitudes and cognitions. *Computers in Human Behavior*, *18*(2), 135–150. https://doi.org/10.1016/S0747-5632(01)00043-7
35. Notten, N., Peter, J., Kraaykamp, G., & Valkenburg, P. M. (2009). Research note: Digital divide across bordersa cross-national study of adolescents' use of digital technologies. *European Sociological Review*, *25*(5), 551–560. https://doi.org/10.1093/esr/jcn071
36. OECD. (2019). *PISA 2018 Technical Report*. *OECD Publishing*.
37. Ong, C. S., & Lai, J. Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior*, *22*(5), 816–829. https://doi.org/10.1016/j.chb.2004.03.006
38. Pamuk, S., & Peker, D. (2009). Turkish pre-service science and mathematics teachers' computer related self-efficacies, attitudes, and the relationship between these variables. *Computers and Education*, *53*(2), 454–461. https://doi.org/10.1016/j.compedu.2009.03.004
39. Potvin, P., & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K-12 levels: a systematic review of 12 years of educational research. *Studies in Science Education*, *50*(1), 85–129. https://doi.org/10.1080/03057267.2014.881626
40. Price, L. (2006). Gender differences and similarities in online courses: Challenging stereotypical views of women. *Journal of Computer Assisted Learning*, *22*(5), 349–359. https://doi.org/10.1111/j.1365-2729.2006.00181.x
41. Sáinz, M., & Eccles, J. (2012). Self-concept of computer and math ability: Gender implications across time and within ICT studies. *Journal of Vocational Behavior*, *80*(2), 486–499. https://doi.org/10.1016/j.jvb.2011.08.005
42. *Science & Engineering Indicators*. (2018). Washington, D.C. Retrieved from https://nces.ed.gov/programs/digest/d17/tables/dt17_318.30.asp?current=yes
43. Shank, D. B., & Cotten, S. R. (2014). Does technology empower urban youth? the

DOI: https://doi.org/10.33193/JALHSS.96.2023.920
ISSN online: 2414 - 3383
ISSN print: 2616- 3810
مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع
Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (96) October 2023
العدد (96) أكتوبر 2023

relationship of technology use to self-efficacy. *Computers and Education*, *70*, 184–193. https://doi.org/10.1016/j.compedu.2013.08.018
44. Siddiq, F., Gochyyev, P., & Wilson, M. (2017). Learning in Digital Networks – ICT literacy: A novel assessment of students' 21st century skills. *Computers and Education*, *109*, 11–37. https://doi.org/10.1016/j.compedu.2017.01.014
45. Sieverding, M., & Koch, S. C. (2009). (Self-)Evaluation of computer competence: How gender matters. *Computers and Education*. https://doi.org/10.1016/j.compedu.2008.11.016
46. Teo, T., Milutinović, V., & Zhou, M. (2016). Modelling Serbian pre-service teachers' attitudes towards computer use: A SEM and MIMIC approach. *Computers and Education*, *94*, 77–88. https://doi.org/10.1016/j.compedu.2015.10.022
47. Tondeur, J., Van Braak, J., & Valcke, M. (2007). Curricula and the use of ICT in education: Two worlds apart? *British Journal of Educational Technology*. https://doi.org/10.1111/j.1467-8535.2006.00680.x
48. Tsai, C. C., & Lin, C. C. (2004). Taiwanese adolescents' perceptions and attitudes regarding the internet: Exploring gender differences. *Adolescence*, *39*, 725–734.
49. U.S. Department of Education. (2010). Transforming American education : learning powered by technology : National Education Technology Plan 2010. *Learning*.
50. UNESCO. (2002). *Information and Communication Technology in Education A Curriculum for Schools and Programme of Teacher Development*. *United Nations Educational, Scientific and Cultural Organisation*.
51. Vekiri, I., & Chronaki, A. (2008). Gender issues in technology use: Perceived social support, computer self-efficacy and value beliefs, and computer use beyond school. *Computers and Education*, *51*(3), 1392–1404. https://doi.org/10.1016/j.compedu.2008.01.003
52. 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 and Education*, *45*(1), 35–55. https://doi.org/10.1016/j.compedu.2004.03.001
53. Wilder, G., Mackie, D., & Cooper, J. (1985). Gender and computers: Two surveys of computer-related attitudes. *Sex Roles*, *13*, 193–203. https://doi.org/10.1007/BF00287912
54. Witte, K., & Rogge, N. (2014). Does ICT matter for effectiveness and efficiency in mathematics education? *Computers and Education*, *75*, 173–184. https://doi.org/10.1016/j.compedu.2014.02.012