

Chapter 4

Students' Interest and Enjoyment in, and Patterns of Use of ICT



Abstract Two of the groups of potential influences on the development of computer and information literacy (CIL) concern students' affective responses (how they feel and behave in response to those feelings) when interacting with information and computer technologies (ICT) and their opportunities to learn CIL. IEA's International Computer and Information Literacy Study (ICILS) 2013 revealed that female students achieved better CIL test scores than male students in most of the participating countries. The question then arises as to whether gender differences in the CIL performance of students are associated with differences in their affective responses to ICT and/or differences in their levels of ICT usage. These questions were investigated by analyzing data from the ICILS 2013 student assessments and student questionnaires. Male students notably reported significantly higher levels of interest in, and enjoyment of, ICT than their female peers in 13 of 14 ICILS countries, and interest-enjoyment also appeared to have a stronger relationship with achievement in CIL among male students than among female students. While there may be some gendered patterns of use of ICT that reflect different interests, these differences do not uniformly result in advantages or disadvantages for male or female students in terms of CIL achievement.

Keywords Affective beliefs · Computer and information literacy (CIL) · Gender differences · Information and communications technologies (ICT) · International Computer and Information Literacy Study (ICILS) · International large-scale assessments

4.1 Students' Interest and Enjoyment in Computers and Digital Technology

4.1.1 *Affective Responses to ICT*

There is general acceptance that increased interest in and enjoyment of a field will be associated with higher achievement in that field. Large-scale assessment studies, such as PISA, have found that students who report being more interested in a subject, such as science, reading, or mathematics, or who report greater enjoyment of a subject

than their peers, tend to score higher in tests of these subjects. However, the direction of these relationships is often unclear. For example, does engagement with, or greater enjoyment of reading result in higher achievement in reading, or do students with higher achievement in reading become more engaged with reading and thus derive greater enjoyment from reading than their peers (OECD 2002)? Similarly, greater use of ICT may be associated with increased levels of familiarity with computers, and thus CIL achievement may be related to greater opportunity to learn (OTL). However, analyses of cross-sectional data do not help to untangle the direction of such relationships.

In the early stages of the introduction of computer technology in workplaces, there was a focus on computer anxiety as an affective response to ICT. Computer anxiety was one of the subscales of the extensively used *Teachers' attitudes toward computers* questionnaire (Lloyd and Gressard 1984). More recently, a wider range of affective factors, including motivation, have come to be seen as related to the uptake of, and outcomes from the educational use of ICT (Katz 2018). In this chapter, we make use of an ICILS scale that combines interest in and enjoyment of ICT use: interest-enjoyment in ICT.

A large-scale national survey of ICT literacy in Australia investigated the interactions of a very similar construct they described as “interest in and enjoyment of using ICT” with ICT literacy (a similar construct to CIL) in the context of personal characteristics and computer use (ACARA 2015). These interactions formed part of a model designed to explain gender differences in ICT literacy. Among other results, the analyses showed that:

- Male students were more likely than female students to consider computers to be important;
- Male students were more likely to report stronger interest in computers;
- Interest-enjoyment in computers was associated with both ICT self-efficacy and ICT literacy;
- Ratings of the importance of computers were associated with ICT self-efficacy, but not with ICT literacy;
- Male students had higher levels of ICT self-efficacy than female students; and
- Female students performed better than male students on ICT literacy (a similar construct to CIL).

4.1.2 Opportunity to Learn CIL

Since the First International Science Study (FISS; see IEA 2019), IEA studies have reported a consistent relationship between student achievement and OTL, which was interpreted as student exposure to instructional content (Comber and Keeves 1973; Elliott and Bartlett 2016). Schmidt et al. (2015) reported a consistent association between OTL and mathematics literacy across 62 educational systems.

Gender differences in OTL CIL prompt several questions. One of these concerns whether female students use ICT more frequently or more regularly than male students, or for different purposes. A consequential question concerns whether any such differences contribute to females' higher CIL achievement. Alternatively, it could be that students have more experience with specific aspects of computing and thus perform better on tasks related to those aspects. Previous research has certainly noted gender differences in patterns of use of various types of ICT and posited this as an explanation for gender differences in CIL performance and employment in the digital economy (Karakainen et al. 2018; Punter et al. 2017).

4.2 Gender Differences in ICT Interest and Enjoyment

ICILS 2013 found there was a significant difference between male and female students' ratings of interest and enjoyment in ICT in most countries, with male students reporting higher levels of interest and enjoyment, on average, than female students (Table 4.1). The difference was significant in all countries except Thailand and Chile. The magnitude of the differences in the remaining countries ranged from small in Turkey to large in Germany.

Table 4.1 National averages in ICT interest-enjoyment, by gender

Country	Students' interest in and enjoyment of using computers		
	Males	Females	Difference (males – females)
Germany	51 (0.3)	45 (0.3)	6* (0.4)
Czech Republic	53 (0.3)	47 (0.3)	6* (0.4)
Slovenia	53 (0.4)	47 (0.2)	5* (0.4)
Norway	52 (0.3)	47 (0.2)	5* (0.3)
Republic of Korea	48 (0.3)	43 (0.3)	5* (0.4)
Croatia	56 (0.3)	51 (0.2)	5* (0.3)
Australia	52 (0.3)	47 (0.3)	5* (0.4)
Slovak Republic	50 (0.4)	46 (0.3)	4* (0.5)
Lithuania	51 (0.3)	47 (0.3)	4* (0.4)
Poland	53 (0.3)	49 (0.3)	4* (0.4)
Russian Federation	49 (0.2)	46 (0.2)	3* (0.3)
Turkey	53 (0.4)	51 (0.4)	2* (0.5)
Chile	56 (0.4)	55 (0.3)	1 (0.4)
Thailand	50 (0.4)	50 (0.3)	0 (0.4)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

4.3 Gender Differences in the Associations Between CIL and ICT, and Interest and Enjoyment in Using ICT

A significant moderate positive correlation was found between interest-enjoyment and achievement in CIL for male students in three of the 14 countries: the Slovak Republic, Thailand, and Turkey (Table 4.2). Interestingly, the correlation was weaker for female students in most countries, with effect size approaching moderate only in Turkey.

Thus, in most countries, we found there was support for the general assumption that male students are more interested in computers and enjoy using them to a greater extent than their female peers do, and that this interest and enjoyment has a positive, albeit moderate, influence on the performance of male students in CIL. Interest-enjoyment in ICT appears to have a stronger association with CIL achievement among male students than among female students. The correlations are not large, however, suggesting that other factors may be influencing CIL achievement.

Table 4.2 Correlations between interest-enjoyment in ICT and CIL by gender

Country	Correlation between students' interest in and enjoyment of ICT and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	0.19* (0.03)	0.4	0.11* (0.03)	0.2
Chile	0.15* (0.03)	0.3	-0.03 (0.03)	-0.1
Croatia	0.14* (0.03)	0.3	-0.01 (0.03)	0.0
Czech Republic	0.02 (0.03)	0.0	0.00 (0.04)	0.0
Germany	0.08* (0.04)	0.2	-0.03 (0.05)	-0.1
Republic of Korea	0.19* (0.03)	0.4	0.15* (0.03)	0.3
Lithuania	0.13* (0.03)	0.3	0.07* (0.03)	0.1
Norway	0.11* (0.03)	0.2	0.12* (0.04)	0.2
Poland	0.13* (0.03)	0.3	0.00 (0.03)	0.0
Russian Federation	-0.01 (0.03)	0.0	-0.10* (0.04)	-0.2
Slovak Republic	0.23* (0.03)	0.5	-0.01 (0.04)	0.0
Slovenia	0.14* (0.04)	0.3	0.05 (0.03)	0.1
Thailand	0.28* (0.03)	0.6	0.17* (0.03)	0.3
Turkey	0.29* (0.04)	0.6	0.21* (0.03)	0.4
Average of countries	0.15* (0.01)	0.3	0.05* (0.01)	0.1

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's *d* are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

4.4 Gender Differences in Patterns of Use

Fairlie (2015) examined how differences in the time invested in computer use by male and female students could contribute to the gender gap in academic achievement. The results showed that the male students were less likely to use computers for schoolwork and more likely to use computers to play games than female students. Female students were found to be more likely to use computers for social networking and email communication than male students, an observation that has been noted in other studies (Cussó Calabuig et al. 2017; Punter et al. 2017). Where early research on computer use focused on whether or how frequently male and female students were using computers, and how that related to differences in achievement, the focus is now on how, and for what purposes, male and female students use computer technology.

4.4.1 Use of ICT Productivity Applications

In ICILS 2013, students reported how often they used a computer outside of school for each of the following activities that involved common productivity applications. Response categories ranged between never and every day.

- Creating or editing documents (for example, to write stories or assignments);
- Using a spreadsheet to do calculations, store data, or plot graphs (for example, using [Microsoft EXCEL[®]]);
- Creating a simple “slideshow” presentation (for example, using [Microsoft PowerPoint[®]]);
- Creating a multi-media presentation (with sound, pictures, video);
- Using education software that is designed to help with school study (for example, mathematics or reading software);
- Writing computer programs, macros, or scripts (for example using [Logo, Basic, or HTML]); and
- Using drawing, painting, or graphics software.

In Turkey, the Slovak Republic, the Czech Republic, and Poland, male students reported using these productivity applications more frequently than female students (Table 4.3). In the Russian Federation, Australia, Chile, and the Republic of Korea, female students reported more frequent use of these applications than male students. The differences in all countries were small.

For male students, the correlation between the frequency of using these productivity applications and their CIL achievement was positive, but insubstantial in size, only reaching moderate strength in the Republic of Korea (Table 4.4). For female students, all effect sizes were insubstantial, approaching moderate only in the Republic of Korea and Turkey.

Table 4.3 National averages in use of ICT productivity applications, by gender

Country	In and out of school use of ICT productivity applications by students		
	Males	Females	Difference (males – females)
Turkey	53 (0.4)	50 (0.4)	3* (0.5)
Slovak Republic	52 (0.3)	51 (0.3)	1* (0.4)
Czech Republic	50 (0.3)	49 (0.3)	1* (0.3)
Poland	51 (0.3)	50 (0.3)	1* (0.4)
Croatia	48 (0.3)	47 (0.3)	1 (0.4)
Slovenia	51 (0.4)	51 (0.3)	1 (0.5)
Norway	49 (0.3)	49 (0.3)	0 (0.4)
Germany	46 (0.4)	46 (0.4)	0 (0.4)
Thailand	51 (0.4)	51 (0.3)	–1 (0.4)
Lithuania	51 (0.4)	52 (0.3)	–1 (0.4)
Russian Federation	53 (0.4)	54 (0.3)	–1* (0.3)
Australia	52 (0.3)	53 (0.2)	–1* (0.4)
Chile	50 (0.4)	51 (0.2)	–1* (0.4)
Republic of Korea	44 (0.4)	45 (0.3)	–1* (0.5)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

4.4.2 Use of ICT for Social Communication

Students reported the frequency of their use of computers for the following social communication activities, responding between never and every day for each of the activities:

- Communicating with others using messaging or social networks (for example instant messaging or [status updates]);
- Posting comments to online profiles or blogs;
- Uploading images or videos to an [online profile] or [online community] (for example, Facebook or YouTube); and
- Using voice chat (for example, Skype) to chat with friends or family online.

In most countries, female students reported more frequent use of computers for these social communication activities (Table 4.5). The difference was generally small, except for in Chile, where the difference was moderate in size. In Croatia, Slovenia, Norway, Germany, and the Slovak Republic, there were no differences between male and female students' use of ICT for social communication. Turkey was the only country where male students reported using computers for social communication more frequently than female students.

Table 4.4 Correlation between using specific ICT applications and CIL, by gender

Country	Correlation between students' use of ICT applications and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	0.15* (0.03)	0.3	0.08* (0.03)	0.2
Chile	0.08* (0.03)	0.2	0.03 (0.03)	0.1
Croatia	0.18* (0.04)	0.4	0.08* (0.03)	0.2
Czech Republic	0.09* (0.03)	0.2	0.08* (0.03)	0.2
Germany	0.10 (0.07)	0.2	0.11* (0.06)	0.2
Republic of Korea	0.22* (0.03)	0.5	0.20* (0.03)	0.4
Lithuania	0.11* (0.04)	0.2	0.05 (0.04)	0.1
Norway	0.09* (0.04)	0.2	-0.03 (0.05)	-0.1
Poland	0.05 (0.04)	0.1	0.04 (0.03)	0.1
Russian Federation	0.10* (0.03)	0.2	0.05 (0.04)	0.1
Slovak Republic	0.06 (0.04)	0.1	0.05 (0.05)	0.1
Slovenia	0.02 (0.04)	0.0	0.05 (0.03)	0.1
Thailand	-0.01 (0.03)	0.0	0.05 (0.04)	0.1
Turkey	0.14* (0.04)	0.3	0.18* (0.04)	0.4
Average of countries	0.10* (0.01)	0.2	0.07* (0.01)	0.1

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's *d* are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

Table 4.5 National averages in students' use of ICT for social communication, by gender

Country	Students' use of ICT for social communication		
	Males	Females	Difference (males – females)
Turkey	48 (0.4)	45 (0.5)	2* (0.5)
Croatia	52 (0.3)	52 (0.3)	0 (0.4)
Slovenia	50 (0.3)	51 (0.3)	0 (0.4)
Norway	50 (0.2)	50 (0.2)	0 (0.3)
Germany	49 (0.3)	50 (0.3)	-1 (0.4)
Slovak Republic	52 (0.3)	53 (0.3)	-1 (0.5)
Poland	51 (0.3)	52 (0.2)	-1* (0.4)
Czech Republic	51 (0.3)	52 (0.3)	-1* (0.4)
Thailand	45 (0.4)	47 (0.5)	-1* (0.5)
Russian Federation	53 (0.4)	55 (0.3)	-1* (0.4)
Republic of Korea	43 (0.3)	45 (0.3)	-2* (0.4)
Lithuania	51 (0.3)	52 (0.3)	-2* (0.4)
Australia	49 (0.3)	50 (0.2)	-2* (0.4)
Chile	49 (0.3)	52 (0.4)	-3* (0.4)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

Table 4.6 Correlation between use of ICT for social communication and CIL, by gender

Country	Correlation between students' use of ICT for social communications and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	0.06 (0.03)	0.1	0.04 (0.03)	0.1
Chile	0.20* (0.03)	0.4	0.13* (0.04)	0.3
Croatia	0.18* (0.04)	0.4	0.08* (0.04)	0.2
Czech Republic	-0.01 (0.04)	0.0	-0.07* (0.03)	-0.1
Germany	0.06 (0.04)	0.1	-0.07 (0.05)	-0.1
Republic of Korea	0.14* (0.03)	0.3	0.16* (0.03)	0.3
Lithuania	0.14* (0.04)	0.3	0.13* (0.03)	0.3
Norway	0.02 (0.03)	0.0	0.02 (0.04)	0.0
Poland	0.06 (0.03)	0.1	0.08* (0.03)	0.2
Russian Federation	0.16* (0.03)	0.3	0.10* (0.04)	0.2
Slovak Republic	0.10* (0.04)	0.2	0.09* (0.04)	0.2
Slovenia	0.04 (0.03)	0.1	0.04 (0.03)	0.1
Thailand	0.25* (0.03)	0.5	0.31* (0.04)	0.7
Turkey	0.23* (0.04)	0.5	0.26* (0.04)	0.5
Average of countries	0.12* (0.01)	0.2	0.09* (0.01)	0.2

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's *d* are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

The correlation between use of ICT for social communication and CIL was similar in many countries for male and female students (Table 4.6). The correlation was moderate for both males and females in Turkey and Thailand. In Slovenia, Norway, and Germany, where there were no gender differences in use of ICT for social communication, there were also no significant correlations between this type of ICT use and CIL achievement.

4.4.3 Use of ICT for Exchanging Information

Students reported on their frequency of use of ICT for exchanging information, using response categories ranging from never to every day. The activities included:

- Asking questions on forums or [question and answer] websites;
- Answering other peoples' questions on forums or websites;
- Writing posts for a personal blog; and
- Building or editing a webpage.

Table 4.7 National averages in students' use of ICT for exchanging information, by gender

Country	Students' use of ICT for exchanging information		
	Males	Females	Difference (males – females)
Turkey	53 (0.4)	50 (0.4)	4* (0.5)
Croatia	50 (0.3)	47 (0.3)	3* (0.4)
Czech Republic	49 (0.3)	48 (0.3)	2* (0.4)
Slovak Republic	52 (0.3)	50 (0.3)	1* (0.5)
Germany	46 (0.3)	45 (0.3)	1* (0.4)
Lithuania	53 (0.4)	52 (0.3)	1* (0.5)
Norway	46 (0.3)	45 (0.2)	1* (0.3)
Slovenia	52 (0.3)	51 (0.3)	1 (0.4)
Republic of Korea	49 (0.2)	49 (0.2)	0 (0.3)
Poland	50 (0.3)	51 (0.3)	–1 (0.4)
Thailand	54 (0.4)	54 (0.4)	–1 (0.5)
Chile	49 (0.3)	51 (0.3)	–1* (0.4)
Russian Federation	54 (0.3)	55 (0.3)	–1* (0.3)
Australia	47 (0.2)	48 (0.2)	–1* (0.3)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

The distributions of gender differences were fairly symmetrical across countries: male students reported greater use of ICT for exchanging information in seven countries (Turkey, Croatia, the Czech Republic, the Slovak Republic, Germany, Lithuania, and Norway), and female students reported greater use of ICT for exchanging information in three countries (Chile, the Russian Federation and Australia) (Table 4.7). The differences were significant, but small in size for all those countries, except for Turkey, where the difference was moderate in size.

The correlations between the frequency of use of ICT for exchanging information and CIL did not show a clear pattern across countries (Table 4.8). While the correlations in some countries were statistically significant, an examination of effect sizes revealed that all correlations, other than a very small positive correlation for females in Thailand, were insubstantial.

Table 4.8 Correlation between use of ICT for exchanging information and CIL, by gender

Country	Correlation between students' use of ICT for exchanging information and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	-0.09* (0.03)	-0.2	-0.11* (0.03)	-0.2
Chile	-0.02 (0.03)	0.0	-0.07 (0.04)	-0.1
Croatia	0.07* (0.03)	0.1	-0.05 (0.03)	-0.1
Czech Republic	-0.10* (0.03)	-0.2	-0.10* (0.03)	-0.2
Germany	-0.09* (0.05)	-0.2	-0.08* (0.04)	-0.2
Republic of Korea	0.08* (0.03)	0.2	0.06* (0.03)	0.1
Lithuania	0.01 (0.03)	0.0	-0.04 (0.03)	-0.1
Norway	-0.08* (0.03)	-0.2	-0.07 (0.04)	-0.1
Poland	-0.03 (0.03)	-0.1	-0.06 (0.03)	-0.1
Russian Federation	0.03 (0.03)	0.1	-0.03 (0.03)	-0.1
Slovak Republic	-0.05 (0.04)	-0.1	-0.09* (0.04)	-0.2
Slovenia	-0.05 (0.03)	-0.1	-0.03 (0.04)	-0.1
Thailand	0.10* (0.04)	0.2	0.16* (0.04)	0.3
Turkey	0.03 (0.04)	0.1	0.05 (0.04)	0.1
Average	-0.02 (0.01)	0.0	-0.03* (0.01)	-0.1

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's d are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

4.4.4 Use of Computers for Recreation

Students reported on their frequency of use of the internet for recreation. The response categories ranged from never to every day. The activities included:

- Accessing the internet to find out about places to go to or activities to do;
- Reading reviews on the internet of things they might want to buy;
- Playing games;
- Listening to music;
- Watching downloaded or streamed video (for example, movies, TV shows, or clips); and
- Using the internet to get news about things they were interested in.

Male students reported higher use of the internet for recreation than female students in six of the countries: Turkey, Poland, Norway, the Czech Republic, Slovenia, and Germany (Table 4.9). In Chile, Thailand, and the Republic of Korea the opposite pattern was observed, and female students reported greater use of ICT for recreation than male students. All differences were small in size.

Table 4.9 National averages in use of computers for recreation, by gender

Country	Students' use of computers for recreation		
	Males	Females	Difference (males – females)
Turkey	48 (0.4)	47 (0.5)	1* (0.5)
Poland	54 (0.3)	52 (0.3)	1* (0.5)
Norway	52 (0.2)	50 (0.3)	1* (0.3)
Czech Republic	52 (0.3)	51 (0.2)	1* (0.3)
Slovenia	50 (0.3)	49 (0.1)	1* (0.3)
Germany	47 (0.2)	46 (0.2)	1* (0.3)
Croatia	52 (0.4)	51 (0.2)	1 (0.4)
Russian Federation	55 (0.4)	54 (0.3)	1 (0.4)
Slovak Republic	52 (0.3)	52 (0.3)	0 (0.4)
Australia	50 (0.3)	50 (0.2)	0 (0.4)
Lithuania	48 (0.3)	49 (0.3)	–1 (0.4)
Chile	48 (0.4)	49 (0.3)	–1* (0.4)
Thailand	47 (0.3)	48 (0.4)	–1* (0.4)
Republic of Korea	47 (0.3)	48 (0.3)	–1* (0.4)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

The correlation between use of computers for recreation and CIL was positive but the strength of the relationship was insubstantial in most countries (Table 4.10). In Thailand and Turkey, the correlations were of moderate size for females but smaller for males.

4.4.5 Use of ICT for Study Purposes

Students reported on their frequency of use of ICT for study purposes. The response categories ranged from never to every day. The activities included:

- Preparing reports or essays;
- Preparing presentations;
- Working with other students from the school;
- Working with other students from other schools;
- Completing [worksheets] or exercises;
- Organizing personal time and work;
- Writing about personal learning; and
- Completing tests.

Table 4.10 Correlation between use of computers for recreation and CIL, by gender

Country	Correlation between students' use of computers for recreation and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	0.09* (0.03)	0.2	0.11* (0.03)	0.2
Chile	0.13* (0.03)	0.3	0.15* (0.03)	0.3
Croatia	0.17* (0.03)	0.3	0.08* (0.03)	0.2
Czech Republic	0.03 (0.03)	0.1	0.04 (0.03)	0.1
Germany	0.09* (0.03)	0.2	0.07 (0.04)	0.1
Republic of Korea	0.13* (0.03)	0.3	0.15* (0.03)	0.3
Lithuania	0.08* (0.03)	0.2	0.10* (0.03)	0.2
Norway	0.06 (0.03)	0.1	0.10* (0.03)	0.2
Poland	0.11* (0.03)	0.2	0.17* (0.03)	0.3
Russian Federation	0.12* (0.03)	0.2	0.11* (0.04)	0.2
Slovak Republic	0.11* (0.04)	0.2	0.10* (0.04)	0.2
Slovenia	0.07* (0.03)	0.1	0.06 (0.03)	0.1
Thailand	0.17* (0.03)	0.3	0.25* (0.04)	0.5
Turkey	0.20* (0.03)	0.4	0.31* (0.03)	0.7
Average of countries	0.11 (0.01)	0.2	0.13 (0.01)	0.3

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's *d* are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

Female students reported using ICT for study purposes significantly more frequently than male students in eight out of 14 countries (Table 4.11). These differences were generally small or negligible (>1.0).

Correlations between use of ICT for study purposes and CIL were generally not significant, or insubstantial where significant (Table 4.12).

4.5 Combined Effect of Interest and Enjoyment and Patterns of Use on CIL Achievement, by Gender

We applied a multiple regression analysis to estimate the net effect of interest-enjoyment, and assess differences in patterns of use on CIL achievement by gender. The averages of independent variables were fixed to zero within each country for these analyses (Tables 4.13 and 4.14).

For male students, the net positive effect of interest-enjoyment on CIL was significant and small (>1) in five out of 14 countries. In other countries where it was statistically significant, the strength of the relationship was negligible. For female students, the effect was statistically significant and meaningful only in two out of 14 countries. While the bivariate correlations (Table 4.2) suggested a somewhat

Table 4.11 National averages in use of ICT for study purposes, by gender

Country	Students' use of ICT for study purposes		
	Males	Females	Difference (males – females)
Turkey	53 (0.4)	53 (0.4)	0 (0.5)
Norway	53 (0.3)	53 (0.3)	0 (0.2)
Poland	49 (0.3)	49 (0.2)	0 (0.3)
Lithuania	47 (0.5)	47 (0.3)	0 (0.4)
Republic of Korea	44 (0.4)	44 (0.4)	-1 (0.5)
Chile	52 (0.3)	52 (0.2)	-1 (0.3)
Germany	46 (0.3)	47 (0.2)	-1* (0.4)
Czech Republic	48 (0.3)	49 (0.3)	-1* (0.3)
Slovak Republic	50 (0.3)	51 (0.3)	-1* (0.3)
Croatia	45 (0.3)	47 (0.2)	-1* (0.3)
Slovenia	48 (0.3)	49 (0.2)	-1* (0.3)
Australia	54 (0.4)	55 (0.3)	-1* (0.4)
Thailand	54 (0.3)	56 (0.3)	-1* (0.4)
Russian Federation	53 (0.4)	54 (0.2)	-2* (0.3)

Notes Standard errors in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent. *Differences were significant ($p < 0.05$)

Source Fraillon et al. (2014)

Table 4.12 Correlation between use of ICT for study purposes and CIL, by gender

Country	Correlation between students' use of ICT for study purposes and CIL skills			
	Males	Cohen's <i>d</i>	Females	Cohen's <i>d</i>
Australia	0.16* (0.03)	0.3	0.10* (0.03)	0.2
Chile	0.03 (0.04)	0.1	0.00 (0.04)	0.0
Croatia	0.11* (0.03)	0.2	0.05 (0.04)	0.1
Czech Republic	-0.08* (0.04)	-0.2	-0.14* (0.04)	-0.3
Germany	0.06 (0.06)	0.1	0.01 (0.03)	0.0
Republic of Korea	0.16* (0.03)	0.3	0.09* (0.03)	0.2
Lithuania	0.03 (0.04)	0.1	-0.01 (0.04)	0.0
Norway	0.08 (0.05)	0.2	-0.01 (0.04)	0.0
Poland	0.00 (0.03)	0.0	-0.01 (0.04)	0.0
Russian Federation	0.03 (0.03)	0.1	0.08* (0.04)	0.2
Slovak Republic	-0.01 (0.04)	0.0	0.00 (0.04)	0.0
Slovenia	-0.04 (0.03)	-0.1	-0.05 (0.04)	-0.1
Thailand	0.04 (0.04)	0.1	0.06 (0.04)	0.1
Turkey	0.05 (0.04)	0.1	0.10* (0.04)	0.2
Average of countries	0.04* (0.01)	0.1	0.02 (0.01)	0.0

Notes Standard errors in parentheses. *Correlations were significant ($p < 0.05$). Effect sizes using Cohen's *d* are regarded as insubstantial if $d = 0.2$, moderate if $d = 0.5$, and strong if $d = 0.8$

Table 4.13 Multiple regression of CIL on interest and enjoyment and patterns of use for male students

Country	Intercept	Interest and enjoyment	Productivity applications	Use of ICT				R ²	
				For social communication	For exchanging information	For recreation	For study purposes		During lessons at school
Australia	528 (2.9)	1.4* (0.2)	0.9* (0.2)	0.6* (0.3)	-2.2* (0.3)	0.1 (0.3)	0.8* (0.2)	0.8* (0.3)	0.11* (0.02)
Chile	481 (3.1)	0.8* (0.3)	0.5 (0.3)	2.5* (0.4)	-2.2* (0.4)	0.6 (0.3)	0.2 (0.4)	-1.3* (0.3)	0.11* (0.02)
Croatia	506 (3.5)	0.7* (0.3)	1.1 (0.3)	1.2 (0.4)	-1.2* (0.3)	0.7* (0.3)	0.4 (0.3)	-0.7* (0.3)	0.08* (0.02)
Czech Republic	549 (2.7)	0.0 (0.2)	1.4* (0.3)	0.4 (0.3)	-1.3* (0.3)	0.4 (0.3)	-0.6* (0.2)	-0.6* (0.3)	0.06* (0.01)
Germany	519 (2.7)	0.5 (0.3)	1.0 (0.5)	0.7 (0.5)	-1.8* (0.4)	0.6 (0.5)	0.4 (0.5)	-0.4 (0.5)	0.05* (0.02)
Republic of Korea	517 (3.4)	1.3* (0.3)	1.4* (0.3)	1.1* (0.4)	-1.8* (0.4)	0.2 (0.3)	0.3 (0.2)	0.4 (0.2)	0.09* (0.02)
Lithuania	491 (3.6)	0.6* (0.3)	1.1* (0.3)	1.6* (0.4)	-1.1* (0.4)	0.1 (0.3)	0.0 (0.3)	-1.0* (0.3)	0.06* (0.02)
Norway	525 (3.1)	0.7* (0.2)	0.7* (0.3)	-0.2 (0.4)	-1.3* (0.3)	0.3 (0.4)	0.5 (0.4)	0.6 (0.4)	0.04* (0.02)
Poland	530 (3.1)	0.9* (0.3)	0.5 (0.3)	0.4 (0.3)	-1.1* (0.4)	0.8* (0.3)	-0.2 (0.3)	-0.5 (0.3)	0.04* (0.01)
Russian Federation	513 (3.4)	-0.6 (0.3)	0.8* (0.3)	1.3* (0.3)	-1.0* (0.3)	0.6* (0.3)	-0.2 (0.3)	-0.3 (0.2)	0.05* (0.01)
Slovak Republic	512 (4.6)	1.6* (0.3)	1.1* (0.4)	1.1* (0.4)	-1.6* (0.3)	0.6 (0.4)	-0.1 (0.4)	-0.4 (0.3)	0.08* (0.02)
Slovenia	496 (2.6)	0.8* (0.3)	0.4 (0.4)	0.5 (0.3)	-1.1* (0.3)	0.6 (0.3)	-0.4 (0.3)	0.1 (0.2)	0.04* (0.01)
Thailand	372 (4.8)	2.0* (0.3)	-0.9* (0.3)	3.3* (0.5)	-1.1* (0.4)	0.7 (0.4)	0.0 (0.4)	-0.7 (0.4)	0.14* (0.02)
Turkey	364 (4.7)	1.8* (0.3)	1.0* (0.3)	2.2* (0.4)	-2.3* (0.3)	1.1* (0.4)	-0.4 (0.4)	-0.5 (0.3)	0.16* (0.02)

Notes: Standard errors in parentheses. *Differences were significant ($p < 0.05$)

Table 4.14 Multiple regression of CIL on interest and enjoyment and patterns of use for female students

Country	Intercept	Interest and enjoyment	Productivity applications	Use of ICT				R ²	
				For social communication	For exchanging information	For recreation	For study purposes		During lessons at school
Australia	557 (2.6)	0.6* (0.2)	0.2 (0.3)	0.7* (0.2)	-1.6* (0.3)	0.7* (0.2)	0.4 (0.3)	1.1* (0.4)	0.06* (0.01)
Chile	498 (3.7)	-0.5 (0.3)	0.6 (0.4)	1.4* (0.4)	-1.7* (0.4)	1.2* (0.4)	-0.2 (0.5)	-1.1* (0.3)	0.08* (0.01)
Croatia	519 (3.2)	-0.4 (0.3)	0.9 (0.3)	0.8 (0.3)	-1.1* (0.3)	0.5* (0.3)	0.2 (0.4)	-0.4 (0.3)	0.03* (0.01)
Czech Republic	561 (2.1)	0.0 (0.3)	1.4* (0.3)	-0.4 (0.3)	-0.8* (0.2)	0.8* (0.3)	-1.1* (0.2)	-0.4 (0.3)	0.07* (0.01)
Germany	535 (3.1)	-0.6 (0.4)	1.1* (0.6)	-0.6 (0.4)	-0.9* (0.4)	1.3* (0.5)	-0.4 (0.4)	-0.2 (0.4)	0.04* (0.02)
Republic of Korea	556 (3.1)	0.8* (0.3)	1.5* (0.3)	1.3* (0.3)	-1.5* (0.4)	0.4 (0.3)	-0.5* (0.3)	0.5* (0.2)	0.08* (0.02)
Lithuania	504 (4.3)	0.5 (0.3)	0.6 (0.5)	1.5* (0.4)	-1.3* (0.4)	0.7* (0.3)	-0.4 (0.4)	-0.9* (0.3)	0.05* (0.01)
Norway	552 (3.0)	0.8* (0.3)	-0.3 (0.4)	-0.2 (0.5)	-0.9* (0.4)	1.0* (0.4)	0.0 (0.5)	0.4 (0.5)	0.03* (0.01)
Poland	546 (2.9)	-0.4 (0.3)	0.5 (0.3)	0.6 (0.4)	-1.3* (0.4)	1.7* (0.3)	-0.7 (0.4)	0.1 (0.3)	0.05* (0.02)
Russian Federation	521 (2.7)	-1.2* (0.3)	0.1 (0.3)	1.0* (0.3)	-1.2* (0.3)	0.8* (0.3)	0.5* (0.3)	0.2 (0.2)	0.05* (0.01)
Slovak Republic	525 (5.1)	-0.5 (0.4)	1.4* (0.4)	1.3* (0.4)	-1.9* (0.3)	0.9* (0.4)	-0.6 (0.5)	-0.6 (0.4)	0.05* (0.02)
Slovenia	528 (2.8)	0.4 (0.2)	0.6* (0.3)	0.5 (0.3)	-0.7* (0.3)	0.5 (0.3)	-1.0* (0.4)	0.6* (0.3)	0.03* (0.01)
Thailand	379 (4.8)	1.1* (0.4)	-0.6 (0.4)	3.5* (0.6)	-1.9* (0.6)	2.1* (0.6)	-0.4 (0.5)	-0.3 (0.4)	0.14* (0.03)
Turkey	368 (4.2)	0.7* (0.3)	1.3* (0.4)	2.0* (0.4)	-2.7* (0.4)	2.1* (0.4)	-0.8* (0.3)	-0.3 (0.3)	0.16* (0.02)

Notes: Standard errors in parentheses. *Differences were significant ($p < 0.05$)

stronger relationship between interest-enjoyment and CIL than the results of the multiple regression, the pattern of gender differences (with the relationship being positive for male students in a greater number of countries than was the case for female students) held across both sets of analyses.

The use of ICT productivity applications had a statistically significant and small positive effect on CIL in six countries for males and three countries for females.

Use of ICT for social communication had a small positive net effect in about half of the countries for both genders, with a moderate effect recorded in Thailand for both males and females.

While the relationship between use of ICT for exchanging information and CIL was negative in some countries and positive in others, the inclusion of other variables in the multiple regression resulted in ICT use for exchanging information having an almost uniform negative effect on CIL performance. For males, the effect was small to moderate and negative in all countries. For females, the net effect was small and negative in 10 countries.

In contrast, the positive relationship between using ICT for recreation and CIL that was suggested by the bivariate correlations disappeared for many countries once other variables were taken into account. For male students, the net effect was not meaningful in any country except for Turkey (compared to eight countries when referring to the bivariate correlations). For female students, the net effect was small and significant in six countries (compared to 11 countries when examining bivariate correlations).

The net effect of using ICT for study purposes was not meaningful for any group except for females in the Czech Republic, while using ICT during lessons at school was positively related to CIL only in Australia, and negatively related to CIL in Chile and Lithuania.

In total, the set of predictors explained between three and ten percent of the total variation in CIL achievement (Fig. 4.1). The percentage was highest in Thailand (14%) and Turkey (16%). In Australia, Chile, Croatia, and the Slovak Republic, the predictors collectively explained more of the variation in male performance than they did for female performance.

4.6 Summary

Research question RQ3 asked: To what extent do female and male students differ in their patterns of computer use and in their attitudes to computer technology?

As noted previously, male students reported significantly higher levels of interest in and enjoyment of ICT than their female peers in 12 of 14 ICILS countries, although these differences were usually small in magnitude. Interest and enjoyment, as measured in ICILS 2013, also appeared to have a stronger relationship with male student achievement in CIL than female student achievement.

The general assumption in educational research is that higher levels of interest and enjoyment are associated with higher achievement. Yet the findings for female

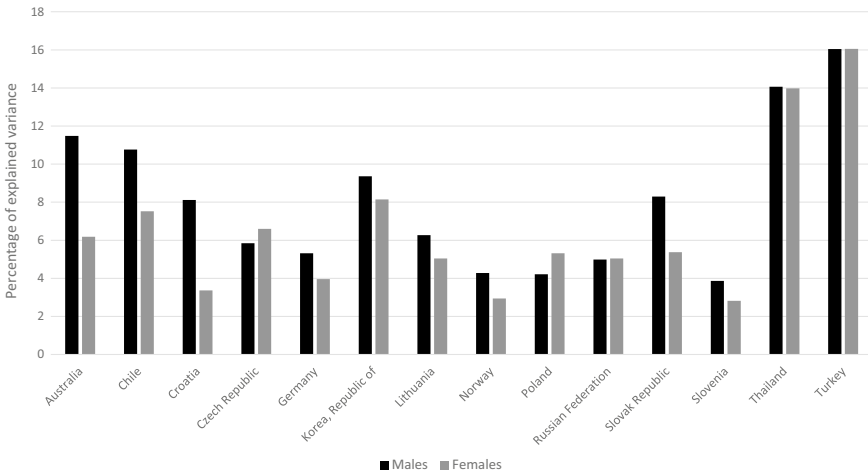


Fig. 4.1 Proportions of explained variance in CIL by interest and enjoyment and patterns of use of ICT

students do not seem to follow this pattern. Although female students outperformed males in CIL, their interest-enjoyment in ICT was lower, on average, than that of male students, and did not appear to be as strongly related to their CIL ability as these factors were for male students. These findings raise some interesting questions. What drives the higher performance of female students if not higher interest and enjoyment of the subject area?

Examination of gender differences in patterns of ICT use did not provide any clear answers to these questions either; while there were gender differences noted across the various types of uses of ICT, there was no pattern of advantage for males or females that would explain the differences in performance.

There were few differences between male and female students in their use of productivity applications. Those that reached significance were small, some in favor of males and some females, indicating no real overall pattern. Correlations between use of these applications and achievement were small but positive, more so for male than female students.

As reported in other studies, female students reported more frequent use of ICT for social communication in many, but not all countries (Fairlie 2015). In some countries (Croatia, Slovenia, Norway, Germany, and the Slovak Republic), there was no difference between male and female students’ use of ICT for social communication, whereas, in Turkey, male students reported more frequent use of social communication channels, such as instant messaging, voice chat, and commenting on images and videos. More frequent use of ICT for social communication may only be a small factor in CIL achievement, with the correlations between frequency of this aspect of ICT use and CIL achievement being positive but significant with moderate strength for both males and females in only six of the

participating countries. There were only limited gender differences in the strength of correlation between use of ICT for social communication and CIL.

For ICT use for exchange of information, there were no clear patterns of difference by gender; in some countries, male students reported greater use than female students, and, in other countries, female students reported greater use than male students. The correlations between use of ICT for exchange of information, such as answering queries or writing blog entries, and CIL achievement were similarly complex; correlations were significant and positive in a few countries and negative in others. In general, these associations were quite small, suggesting that higher participation in tasks such as answering or asking questions in forums or writing blog entries are not activities that contribute greatly to students' performance in formal assessments of CIL.

As reported in other studies (for example, Fairlie 2015), use of ICT for recreation tended to be higher among male students in at least half of the countries that participated in ICILS 2013, with the notable exceptions of Chile, the Republic of Korea, and Thailand, where female students reported higher usage of recreational ICT. It is interesting to note that, while use of ICT for such activities as playing games, listening to music, reading the news, or watching videos would, contrary to expectations, not appear to be associated with CIL, the correlations were actually positive in the majority of countries (with moderate effect sizes in five countries for female students and five countries for male students). In many respects, recreational use of ICT may reflect a greater degree of familiarity with ICT, or may afford these high users incidental opportunities to learn. Alternatively, those who are already proficient in CIL may be more likely to be everyday users of ICT for recreational purposes.

While other research has suggested that female students use ICT for study purposes more frequently than their male peers, there were differences in only five of the 14 countries examined here, and those differences were very small. For the most part, the correlations between use of ICT for study purposes, such as completing assignments and working with other students on shared tasks and taking tests, and performance on the CIL assessment, were not significant.

Use of ICT during school lessons did not show any strong relationship with CIL in the majority of countries, nor did it show any strong gender differences.

The relationships between patterns of use and CIL remained similar in a multivariate model where CIL was predicted by interest and enjoyment together with patterns of use of ICT. There were a few exceptions. Generally, the relationship of CIL with using ICT for exchanging information became more negative when taking the other variables into account and the positive relationship with using ICT for recreation became less positive for male students.

In summary, and to paraphrase another author (Punter et al. 2017), while there may be some gendered patterns of use of ICT that reflect different interests (females using ICT more for social communication and males using ICT more for recreation) these differences do not uniformly result in advantages or disadvantages for male or female students in terms of CIL achievement. For the most part, where correlations

reached significance, they were significant among both male and female students and did not differ in magnitude.

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