CHAPTER 5:

Students' engagement with information and communications technologies

Chapter highlights

Students were experienced users of information and communications technology (ICT).

- Slightly fewer than half of the students in grade 8 had been using computers for five or more years.
- Computer experience was associated with students' computer and information literacy. (Table 5.1)

Students frequently used ICT for general purposes.

- Seven out of 10 grade 8 students used ICT on a daily basis outside school for general purposes but only one in five students reported ICT use on a daily basis for school-related purposes. (Table 5.2)
- Student use of general applications in ICT was more frequent among those with five or more years of computer experience, those currently studying a computer subject, and those with higher levels of computer literacy. (Table 5.5)
- Most students used ICT at least once each week for leisure activities such as listening to downloaded music or watching videos. (Table 5.10)
- Approximately two thirds of students used ICT to access information about things of personal interest from the internet at least once each week. (Table 5.10)

School-related use of ICT most often involved internet searching and document production.

- The most frequent school-related use of ICT was using the internet to do research. Approximately three students in five did this at least once per week. (Table 5.13)
- About one quarter of the students used ICT on a weekly basis to collaborate with other students or organize their time and work. (Table 5.13)
- One quarter of the students used ICT on a weekly basis to prepare reports and essays. (Table 5.13)
- The ICT tools that students most commonly used in a majority of lessons were computer-based information resources, word processing software, and presentation software. (Table 5.17)

Most students were confident users of ICT and saw benefits of ICT for society.

- Four out of five students were confident about their ability to use ICT to search for information, insert an image into a document, and write or edit text for a school assignment. (Table 5.24)
- There was little difference between male and female students in their confidence in using general ICT applications (Table 5.28) but male students expressed greater confidence regarding their use of specialist ICT applications. (Table 5.29)
- Confidence in using general ICT applications was associated with measured CIL and CT, but confidence in the use of specialist ICT applications was not. (Table 5.36)

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- Most students tended to acknowledge positive outcomes of ICT for society, but around half of the students also agreed that ICT had some negative consequences for society. (Table 5.31)
- Male students had greater expectations than female students of using ICT for work or study in the future. (Table 5.35)

Introduction

The International Computer and Information Literacy Study (ICILS) 2018 investigated students' experience of using information and communication technology (ICT), their frequency of using ICT for a range of different purposes at and outside of school, and their dispositions toward the use of ICT. This builds on the knowledge about variations in the extent and type of ICT use by students established in ICILS 2013. With large representative samples it is possible to report not only on levels and patterns of ICT engagement but on the relationships of ICT engagement with student attributes.

Our examination of students' engagement with ICT was informed by *opportunity to learn*, a construct that has featured in IEA large-scale international assessment studies over a long period of time (Elliott and Bartlett 2016; Scheerens 2017; Schmidt et al. 2013). Opportunity to learn initially referred to the time allocated for students to be taught the concepts being assessed and the curriculum content that was the focus of that time. The construct evolved to take account of the enacted curriculum rather than the intended curriculum (Rowan and Correnti 2009) and whether students were actively engaged during that time (Fisher et al. 1981).

We based our investigation on the in-school and out-of-school time that students engaged with ICT because students learned about and developed skills in using ICT in both environments. Our focus was on the frequency with which students engaged in different types of activities rather than where that engagement took place. We distinguished between ICT engagement for general purposes and ICT engagement for school-related purposes. We also asked students about the content of the ICT learning they had experienced at school and aspects of their attitudes to ICT.

Our concern was to examine the associations between students engagement with ICT and their computer and information literacy (CIL) and computational thinking (CT). This chapter informs Research Question 3: *What are the relationships between students' levels of access to, familiarity with, and self-reported proficiency in using computers and their CIL/CT?* However, we are not solely interested in the relationships of these aspects with achievement in CIL/CT. Another purpose of ICILS 2018 is to investigate the use of computers and other digital devices by students, as well as their attitudes toward the use of computer technologies. These frame the broader context in which computer technologies are used within and outside school.

Forms of engagement with ICT

Following the taxonomy proposed by Fredericks et al. (2004), we use the term "engagement" to encompass behavioral engagement (i.e., how students use ICT and how often they use it) and emotional engagement (i.e., students' attitudes toward and feelings about ICT).

In order to assess behavioral engagement with ICT we investigated students' general use of ICT and engagement with ICT for school-related purposes. Students' general use of ICT encompassed overall frequency of use as well as use for three particular purposes: creating or editing information products, social communication and information exchange, and leisure activities. Student engagement with ICT for school-related purposes encompassed overall use of ICT for school-related purposes and patterns of ICT use for school-related purposes. Patterns of use for school-related purposes included the ICT tools that were used and the variations in ICT use across subject areas.

Knowing about students' experience of learning about ICT in school is an important aspect of discerning the enacted curriculum within educational systems. Some literature has argued that students are "digital natives" who learned to use ICT outside school (Prensky 2001). However, others have contended that there are important aspects of ICT use that are not familiar to students and need to be taught (Selwyn 2009). We asked students about the extent to which they had learned about particular aspects of CIL and CT at school.

In order to assess emotional engagement, we investigated two main aspects of students' perceptions of ICT. The first aspect was students' perceptions of themselves in relation to ICT: ICT self-efficacy. We asked students to indicate how well they felt that they could accomplish various ICT tasks. Based on the results from ICILS 2013 (Fraillon et al. 2014) we formed two constructs from these tasks. The first referred to ICT self-efficacy in relation to general applications (typically embodied in office applications) and the second referred to ICT self-efficacy in relation to specialist or advanced tasks (such as coding, database management, and webpage construction).

Another aspect of students' emotional engagement with ICT was their perceptions of ICT with regard to society in general and their own future engagement with it. We asked about the extent to which they saw ICT as beneficial for society, the extent to which they saw ICT as harmful for society (noting that these are not simply polar opposites), and the extent to which they aspired to engage with ICT in the future.

Data and measures

In ICILS 2018, grade 8 students completed a computer-based questionnaire concerning their use of and attitudes to ICT after they had completed the ICILS assessment of CIL. Students were advised that ICT could refer to a desktop computer, a notebook, or laptop computer, a netbook computer, a tablet device, or a smartphone (except when being used for talk or text). Student responses to questionnaire items indicated either how frequently they engaged with ICT or particular tasks using ICT, or how strongly they agreed with statements about the use of ICT and their attitudes to ICT. We have reported these data in relation to individual items and to sets of items that were used to derive scales.

When reporting frequency data for individual items we have typically combined frequency response categories to create dichotomous categories such as "daily" or "at least weekly." When we report the percentages of students undertaking a particular activity on a daily (or weekly) basis we use the term prevalence. For responses concerned with attitudes, we grouped response categories such as "strongly agree" and "agree" into agreement and refer to "percentage agreement."

We also used scale scores based on sets of items to provide a more parsimonious picture of differences across countries, differences between subgroups (such as female and male students), and measures of association between two constructs. We used the Rasch partial credit model (Masters and Wright 1987) to construct the scales, and standardized the item response theory (IRT) scores to have an ICILS 2018 average score of 50 points and a standard deviation of 10 points. This means that a difference of two scale points represents one fifth of a standard deviation (and is interpreted as a small difference), and a difference of five scale points represents one half of a standard deviation (and is interpreted as a moderate difference). All student scales included in this report are described in item maps (see Appendix F of this report). The maps relate scale scores to expected item responses under the ICILS scaling model (as illustrated by Figure F.1 in Appendix F). Greater detail of the scaling and equating procedures for questionnaire items is provided in the ICILS 2018 technical report (Fraillon et al. 2020).

We evaluated the cross-country validity of item dimensionality and constructs during the field trial and following the main survey of ICILS 2018. We assessed the extent to which measurement models were congruent across participating countries. In the field trial we made extensive use of both confirmatory factor analysis and item response modeling to examine cross-national measurement equivalence before the final selection of main survey questionnaire items was conducted. When the main survey was completed we checked the measurement equivalence and in a few instances modified the measurement models that were used. These analyses are reported in the ICILS 2018 technical report (Fraillon et al. 2020).

The scales that we used in analysis and reporting, based on the student questionnaire, were:

- Students' general engagement with ICT
  - Frequency of use of general ICT applications
  - Frequency of use of specialist ICT applications
  - Frequency of use of ICT for social communication
  - Frequency of use of ICT for exchanging information
  - Frequency of use of ICT for accessing content from the internet
- Student engagement with ICT for school-related purposes
  - Frequency of use of ICT for study purposes
  - Frequency of use of general applications in class
  - Frequency of use of specialist applications in class
- Extent of student learning about ICT at school
  - Extent to which students learned about CIL tasks at school
  - Extent to which students learned about CT tasks at school
- ICT self-efficacy
  - ICT self-efficacy regarding the use of general applications
  - ICT self-efficacy regarding the use of specialist applications
  - Attitudes to ICT futures
- Perceptions of ICT
  - Perceptions of positive effects of ICT on society
  - Perceptions of negative effects of ICT on society
  - Perceptions of personal futures with ICT

Student general engagement with ICT

The past four decades have seen substantial growth in the availability and use of ICT by young people in and outside school (Bulfin et al. 2016). Growth in student use of ICT has been accompanied by a growing interest in how these technologies are being used (Bulfin et al. 2016). The European Commission reported that 80 percent of students in lower-secondary school (ISCED 2) engaged in ICT-based activities more frequently at home than at school (European Commission 2013). The report identified three groups of ICT-based activities at home: "fun" (e.g., streaming or downloading multimedia, music, movies, or videos), "learning" (e.g., online news, information searching, and learning programs), and "games." Students were more confident in their "digital competences when they had high access to/use of ICT at home and at school" (European Commission 2013, p. 15). Scherer et al. (2017) identified two profiles of students' ICT use in Norway: students who had low participation in leisure-related internet activities and students who frequently used ICT for a wide range of activities. These profiles were associated with differences in gender, migration status, and motivations.

ICILS 2013 has also been an important source for understanding and reporting students' general ICT use. Bundsgaard and Gerick (2017) used latent class analysis of ICILS 2013 data to identify three clusters reflecting different types of students' computer use. The largest cluster (72% of the sample) had average frequencies of school-related and recreational computer use. The next cluster (12%) had low frequencies of computer use for communication and study purposes. The third cluster (11%) had high frequencies of use in general and especially for exchanging information.

Multivariate analyses based on ICILS 2013 data showed that, after controlling for the effect of background variables such as gender or socioeconomic status, students' experience of computer use and their frequency of computer use at home were positively associated with CIL scores in most countries (Fraillon et al. 2014). Student access to a home internet connection and the number of computers at home also had statistically significant associations with CIL scores in about half of the participating education systems. Greater interest in and enjoyment of ICT use was associated with higher CIL scores in nine out of 14 countries. There was also evidence of an association between CIL scores and the extent to which students reported having learned about ICT-related tasks at school.

In this section we take a closer look at aspects of students' general use of ICT. We also look at their use of ICT for particular purposes and applications. Students reported on the use of general applications (such as word processing, presentation, and internet search software) and specialist ICT applications (such as those concerned with producing or editing graphics and images, videos, music, computer programs, and webpages). Furthermore, they reported on their use of ICT for information exchange, social communication, and recreation. We focus on the proportions of students using ICT for each of these aspects at least once a week as well as on the distribution of scale scores overall and by subgroups.

Student background: Experience with using ICT

We regarded students' experience of using ICT as an important aspect of student background in relation to their general engagement with ICT, as well as to their development of CIL and CT. Students reported how long (the number of years) they had been using computers, tablet devices, or smartphones (other than the text or talk facilities) (Table 5.1). We asked students to respond separately for each type of device. This approach was different from the one chosen in ICILS 2013 where we asked students to provide an indication of overall use for any of these devices. Therefore these data are not comparable to those from ICILS 2013. However, based on three comparison countries that met sampling requirements in both 2018 and 2013 (Chile, Germany, and Korea), it appears that there was a fall of about 15 percentage points in students with five or more years of computer experience. An explanation for this could be that the use of tablet devices is now more widespread.

Students reported their experience via five response categories ("never or less than one year," "at least one year but less than three years," "at least three years but less than five years," "at least five years but less than seven years," and "seven years or more"). We transformed these categories into dichotomous values reflecting five or more years of experience (experienced users) or less than five years of experience (inexperienced users). We then used these in regression analyses so that we could review the association between this variable and CIL.

On average across the ICILS countries, just under half (46%) of grade 8 students reported having used computers for five or more years, a little less than one third (31%) had used tablet devices for five or more years, and 44 percent had used smartphones for at least this period (Table 5.1). Grade 8 students' experience with computers varied across the ICILS 2018 participating entities. The highest percentages of experienced computer users among participating countries were in Finland (69%) and Portugal (63%) (Table 5.1). There was also a high percentage of experienced computer users in the benchmarking participant of Moscow (Russian Federation) (67%). The lowest percentages of experienced computer users were in Germany (36%), North Rhine-Westphalia (Germany) (36%), Italy (36%), and Kazakhstan (32%). The pattern was similar for tablet devices, with the highest percentages of experienced users being recorded for Denmark (47%) and the lowest percentages being recorded for Korea (14%) and Kazakhstan (19%). Experience with smartphone use was widespread in Finland (73%), but less frequent in France (26%).

Table 5.1: Percentages of students with at least five years' experience with ICT devices and the association of ICT experience with CIL

Country	Percentages of students who reported at least five years' experience with:			Difference in CIL score points per year of experience with:			Explained variance in CIL by years of experience with:		
	Desktop or laptop computers	Tablet devices or e–readers (e.g., iPad, Tablet PC, Kindle)	Smartphones except for using text and calling	Desktop or laptop computers	Tablet devices or e–readers (e.g., iPad, Tablet PC, Kindle)	Smartphones except for using text and calling	Desktop or laptop computers	Tablet devices or e–readers (e.g., iPad, Tablet PC, Kindle)	Smartphones except for using text and calling
Chile	40 (1.3) ▽	29 (1.1)	47 (1.4) △	**9** (0.7)	**2** (0.7)	**4** (0.8)	**8** (1.3)	0 (0.3)	**2** (0.7)
Denmark† 1	58 (1.4) ▲	47 (1.0) ▲	58 (0.9) ▲	**5** (0.6)	**2** (0.7)	**−2** (0.9)	**3** (0.8)	0 (0.3)	0 (0.3)
Finland	69 (1.1) ▲	37 (1.1) △	73 (0.9) ▲	**8** (0.8)	2 (1.0)	**−3** (1.0)	**5** (1.0)	0 (0.3)	0 (0.2)
France	43 (1.1) ▽	34 (1.2) △	26 (1.0) ▼	**3** (0.6)	−1 (0.6)	**−6** (0.6)	**1** (0.4)	0 (0.1)	**3** (0.7)
Germany	36 (1.1) ▼	24 (1.2) ▽	37 (1.4) ▽	**4** (1.2)	**−3** (0.8)	**−5** (2.0)	**2** (0.8)	1 (0.5)	1 (1.3)
Italy²	36 (1.1) ▽	33 (1.0) △	35 (1.1) ▽	**7** (0.6)	**3** (0.7)	−1 (0.8)	**4** (0.8)	**1** (0.5)	0 (0.1)
Kazakhstan¹	32 (1.4) ▼	19 (0.9) ▼	39 (1.3) ▽	**14** (1.2)	**6** (1.2)	**9** (1.0)	**12** (1.7)	**2** (0.8)	**5** (1.0)
Korea, Republic of	50 (1.0) △	14 (0.9) ▼	50 (1.1) △	**10** (0.8)	**4** (0.9)	**4** (0.9)	**8** (1.2)	1 (0.5)	**1** (0.4)
Luxembourg	39 (0.5) ▽	37 (0.5) △	37 (0.6) ▽	**3** (0.4)	**2** (0.5)	**−5** (0.6)	**1** (0.3)	0 (0.2)	**2** (0.5)
Portugal†† 1	63 (1.3) ▲	41 (1.1) ▲	41 (1.0) ▽	**5** (0.6)	**−1** (0.7)	**−3** (0.7)	**3** (0.7)	0 (0.1)	1 (0.4)
Uruguay	43 (1.2) ▽	22 (1.1) ▽	36 (1.1) ▽	**12** (0.9)	**2** (0.9)	**5** (0.9)	**13** (1.6)	0 (0.3)	**2** (0.6)
ICILS 2018 average	46 (0.4)	31 (0.3)	44 (0.3)	**7** (0.2)	**2** (0.3)	0 (0.3)	**5** (0.3)	**1** (0.1)	**2** (0.2)
Not meeting sample participation requirements									
United States	52 (0.9)	49 (0.8)	45 (0.8)	**8** (0.5)	**3** (0.4)	**−2** (0.5)	**7** (0.8)	**1** (0.3)	0 (0.2)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	67 (1.3) ▲	53 (1.0) ▲	63 (1.0) ▲	**4** (0.7)	1 (0.7)	−1 (1.2)	**2** (0.7)	0 (0.1)	0 (0.3)
North Rhine-Westphalia (Germany)	36 (1.6) ▼	23 (0.9) ▽	41 (1.2)	**4** (1.0)	−2 (1.0)	**−5** (1.0)	1 (0.8)	0 (0.3)	**1** (0.6)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Score averages which are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:
- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

There was a significant association between computer experience and CIL in all participating countries (averaging seven points per year of experience) and a smaller but significant association between experience of using tablet devices and CIL in eight of the participating countries that met sample requirements (averaging two points per year of experience) (Table 5.1). There were significant associations between experience of using smartphones and CIL in 10 participating entities, but some were negative and some were positive so that on average there was no statistically significant effect. On average, student experience of using computers accounted for just five percent of the variance in CIL scores.

Frequency of ICT use

We computed the percentages of grade 8 students who reported using computers at least once a day in each of four categories: outside of school for school related purposes, outside of school for non-school related purposes, inside school for school related purposes, and inside school for non-school related purposes.[19] Daily use of ICT for other (i.e., not school-related) purposes outside school was the most frequent use in every country (Table 5.2). On average 70 percent of grade 8 students reported daily use of ICT outside of school for other purposes. Of the participating educational systems the frequency was highest in Germany (83%) and North Rhine-Westphalia (Germany) (85%) and lowest in Kazakhstan (48%). The next most frequent category of daily ICT use was at school for other purposes, which was reported on average by 29 percent of grade 8 students. Among the participating countries, daily use of ICT at school for other purposes was most frequent in Finland (56%) and Denmark (55%) and least frequent in Italy (4%), France (13%), and Germany (16%).

Daily use of ICT for school-related purposes was less common than for other purposes. On average across participating countries, 18 percent of grade 8 students used ICT on a daily basis for school-related purposes at school and 21 percent of these students used ICT on a daily basis for school-related purposes outside of school (Table 5.2). Using ICT on a daily basis for school-related purposes at school was most frequently reported in Denmark (81%) and least frequently (7% or less) in Germany, Korea, Portugal, and Italy. Daily use of ICT for school-related purposes outside of school was most frequent in Denmark (35%) and Moscow (Russian Federation) (40%) and least frequent in North Rhine-Westphalia (Germany) (9%), Portugal (10%), Korea (10%), and Germany (11%).

It is also evident that in Denmark the frequency of daily use of ICT outside school for other purposes (79%) is similar to the frequency of daily use at school for school-related purposes (81%) (Table 5.2). In contrast, there were large differences between the frequency of daily use of ICT outside school for other purposes and the frequency of daily use of ICT at school for school-related purposes in Germany (83% compared to 4%), Italy (77% compared to 7%), and France (76% compared to 8%). These differences possibly reflect the extent to which ICT is part of teaching and learning in school education and may provide an index of the emphasis on ICT in schooling at lower-secondary level.

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[19] In ICILS 2013 we reported frequency of use on a weekly rather than a daily basis, and we did not separate usage for general purposes and school-related purposes. Therefore, the data for ICILS 2018 are not comparable with those reported for ICILS 2013, even for the three countries that met sampling requirements in both studies.

Table 5.2: Percentages of students reporting daily use of ICT in and outside school for school-related and other purposes

Country	Percentages of students who reported daily use of ICT:			
	At school for school-related purposes	At school for other purposes	Outside of school for school-related purposes	Outside of school for other purposes
Chile	12 (0.9) ▽	27 (1.2)	14 (0.9) ▽	62 (1.5) ▽
Denmark[†, 1]	81 (1.2) ▲	55 (1.4) ▲	35 (1.5) ▲	79 (1.0) △
Finland	12 (1.0) ▽	56 (1.4) ▲	15 (0.9) ▽	79 (0.9) △
France	8 (0.7) ▽	13 (1.1) ▼	25 (0.9) △	76 (0.9) △
Germany	4 (0.6) ▼	16 (1.2) ▼	11 (0.8) ▼	83 (0.9) ▲
Italy[2]	7 (0.6) ▼	4 (0.5) ▼	22 (0.9)	77 (1.0) △
Kazakhstan[1]	24 (1.1) △	30 (1.1)	31 (1.2) △	48 (1.4) ▼
Korea, Republic of	5 (0.5) ▼	19 (1.0) ▽	10 (0.7) ▼	68 (1.0) ▽
Luxembourg	18 (0.6)	33 (0.6) △	27 (0.5) △	66 (0.6) ▽
Portugal[††, 1]	7 (0.5) ▼	36 (1.1) △	10 (0.7) ▼	71 (1.3)
Uruguay	15 (0.9) ▽	25 (1.4) ▽	33 (1.4) ▲	66 (1.6) ▽
ICILS 2018 average	18 (0.2)	29 (0.3)	21 (0.3)	70 (0.3)
Not meeting sample participation requirements				
United States	43 (1.6)	28 (1.0)	29 (0.9)	66 (0.9)
Benchmarking participants meeting sample participation requirements				
Moscow (Russian Federation)	22 (0.8) △	43 (1.1) ▲	40 (1.0) ▲	77 (1.3) △
North Rhine-Westphalia (Germany)	3 (0.5) ▼	19 (1.5) ▽	9 (0.8) ▼	85 (0.9) ▲

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:
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- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

Use of ICT to create or edit information products

On average across ICILS 2018 educational systems one third (33%) of grade 8 students used ICT to write or edit documents at least once each week, one fifth (21%) used ICT-based spreadsheets for calculations or graphing, and one fifth (19%) used ICT to develop slideshow presentations (Table 5.3). The prevalence of these uses of ICT on a weekly basis was highest in Denmark (84%, 51%, and 38% respectively). These uses of ICT were less prevalent in Korea, Finland, Germany, and North Rhine-Westphalia (Germany).

Based on the three comparable countries[20] from ICILS 2013 (Fraillon et al. 2014, p. 133), it appears that there may have been a small increase in the weekly use of ICT to write or edit documents (notably in Germany), an increase in the weekly use of spreadsheets (again particularly in Germany), and little change in the weekly use of ICT to develop slideshow presentations.

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[20] The three countries were Chile, Germany, and Korea. Denmark participated in ICILS 2013, but did not satisfy sampling requirements.

Table 5.3: Percentages of students using ICT on a weekly basis, in or outside school, to create or edit information products

Country	Percentages of students who reported at least weekly use of ICT to:							
	Write or edit documents	Use a spreadsheet to do calculations, store data, or plot graphs (e.g., using [Microsoft Excel ®])	Create a simple "slideshow" presentation (e.g., using [Microsoft PowerPoint ®])	Record or edit videos	Write computer programs, scripts, or apps (e.g., using [Logo, LUA, or Scratch])	Use drawing, painting, or graphics software or [apps]	Produce or edit music	Build or edit a webpage
Chile	33 (1.6)	20 (1.3)	26 (1.5) △	29 (1.2)	13 (1.0)	22 (1.3)	38 (1.7) ▲	8 (1.2)
Denmark† 1	84 (1.0) ▲	51 (1.6) ▲	38 (1.3) ▲	22 (1.2) ▽	10 (0.9)	11 (0.9) ▽	7 (0.7) ▼	4 (0.6) ▽
Finland	22 (1.1) ▼	6 (0.6) ▼	5 (0.6) ▼	21 (0.9) ▽	4 (0.5) ▽	9 (0.6) ▼	4 (0.4) ▼	1 (0.3) ▽
France	28 (1.0) ▽	13 (0.7) ▽	10 (0.7) ▽	27 (1.1)	10 (0.6) ▽	15 (0.8) ▽	19 (1.0)	9 (0.6)
Germany	22 (1.0) ▼	8 (0.8) ▼	5 (0.5) ▼	34 (1.0) △	12 (0.8)	19 (1.1)	13 (0.7) ▽	4 (0.5) ▽
Italy²	21 (1.0) ▼	23 (0.8)	14 (0.7) ▽	23 (0.7) ▽	8 (0.6) ▽	19 (0.9)	14 (0.7) ▽	9 (0.7)
Kazakhstan¹	34 (1.3)	41 (1.5) ▲	41 (1.4) ▲	37 (1.2) △	19 (1.2) △	40 (1.1) ▲	39 (1.3) ▲	24 (1.1) ▲
Korea, Republic of	14 (0.9) ▼	8 (0.7) ▼	8 (0.7) ▼	12 (0.7) ▼	9 (1.2) ▽	13 (0.7) ▽	7 (0.6) ▼	3 (0.4) ▽
Luxembourg	32 (0.5)	17 (0.5) ▽	15 (0.4) ▽	37 (0.6) △	13 (0.4) △	23 (0.7) △	20 (0.4)	10 (0.4) △
Portugal†† 1	33 (1.2)	16 (0.9) ▽	21 (1.0)	29 (0.8) △	12 (0.7)	17 (1.1) ▽	27 (1.1) △	8 (0.6)
Uruguay	39 (1.2) △	33 (1.4) ▲	27 (1.1) △	33 (1.4) △	17 (1.3) △	27 (1.5) △	34 (1.3) ▲	11 (0.9) △
ICILS 2018 average	33 (0.3)	21 (0.3)	19 (0.3)	28 (0.3)	12 (0.3)	20 (0.3)	20 (0.3)	8 (0.2)
Not meeting sample participation requirements								
United States	49 (1.5)	20 (0.8)	17 (0.8)	30 (0.7)	12 (0.6)	29 (0.8)	15 (0.5)	6 (0.5)
Benchmarking participants meeting sample participation requirements								
Moscow (Russian Federation)	34 (1.7)	15 (1.2) ▽	19 (1.1)	31 (1.0) △	14 (1.0) △	25 (0.8) △	19 (0.9)	11 (1.0) △
North Rhine-Westphalia (Germany)	19 (1.1) ▼	7 (0.7) ▼	4 (0.5) ▼	33 (1.0) △	12 (1.0)	18 (1.0) ▽	14 (0.9) ▽	5 (0.7) ▽

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:
- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

On average across all countries, the specialist applications used at least weekly by the highest percentages of students were: recording or editing videos (28%), using drawing and painting software (20%), and producing or editing music (20%). Activities reported to be conducted on at least a weekly basis by smaller percentages of students were: writing computer programs or scripts (12%), and building or editing a webpage (8%). The prevalence of weekly use of music applications varied greatly from nearly two-fifths in Chile (38%) and Kazakhstan (39%) to less than one in 14 in Finland (4%), Denmark (7%), and Korea (7%). It is of interest that in Denmark, although there were high proportions of students reporting weekly use of general applications, there was only a low percentage of students indicating weekly use of ICT for music production or editing/building webpages.

Between 2013 and 2018 there appeared to have been increases in the weekly use of drawing, painting, and graphics software in Chile, Germany, and Korea. There were only small increases in the weekly writing of computer programs in these countries.

The items were used to derive two IRT scales reflecting *students' use of general applications for activities* and *students' use of specialist applications for activities*, where higher scale scores reflected higher frequency of use. Both scales had satisfactory reliabilities with average Cronbach's alpha coefficients across countries of 0.70 and 0.73, respectively (the item maps describing these scales are included in Figures F.2 and F.3 in Appendix F).

We used these scale scores (set to metrics with a mean of 50 and a standard deviation of 10 for equally weighted participating countries) to investigate differences among countries in students' use of general applications and specialist applications (Table 5.4). It was evident that the scale scores reflecting reported use of general applications were highest in Denmark and Kazakhstan and lowest in Korea, Finland, and North Rhine-Westphalia (Germany). We recorded the highest scale score of reported use of specialist applications in Kazakhstan and the lowest score in Finland.

We also reviewed the associations between the scale scores representing the use of ICT applications and several aspects of students' experience of, and expertise in, using computers. We compared, for each country, the mean scale scores for the frequency of using general ICT applications (including productivity software) for:[21]

- Students with less than five years of computer experience with those who had five or more years of computer experience;
- Students who studied computer subjects (e.g., computing, computer science, information technology, informatics, or similar) in the current school year with those who did not study computer subjects; and
- Students with CIL scores below Level 2 with students whose CIL scores were at Level 2 or above.

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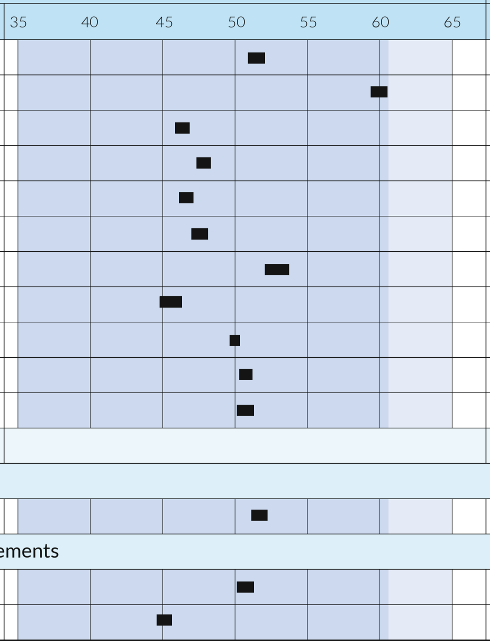
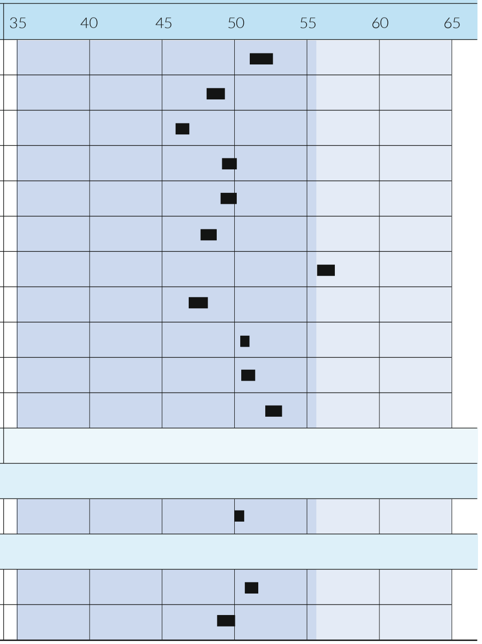
[21] The percentages of students in each subgroup are reported in Appendix E.

Table 5.4: National averages for students' use of general applications and students' use of specialist applications for activities

Country	Scale scores for students' use of general applications for activities			Scale scores for students' use of specialist applications for activities		
	Average scale scores			Average scale scores		
Chile	51	(0.3)	△	52	(0.4)	△
Denmark† [1]	60	(0.3)	▲	49	(0.3)	▽
Finland	46	(0.2)	▼	46	(0.2)	▼
France	48	(0.2)	▽	50	(0.2)	▽
Germany	47	(0.2)	▼	49	(0.2)	▽
Italy[2]	47	(0.3)	▽	48	(0.2)	▽
Kazakhstan[1]	53	(0.4)	▲	56	(0.3)	▲
Korea, Republic of	45	(0.4)	▼	47	(0.3)	▽
Luxembourg	50	(0.1)		51	(0.1)	△
Portugal†† [1]	51	(0.2)	△	51	(0.2)	△
Uruguay	51	(0.2)	△	53	(0.3)	△
ICILS 2018 average	50	(0.1)		50	(0.1)	
Not meeting sample participation requirements						
United States	52	(0.3)		50	(0.2)	
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	50	(0.3)		51	(0.2)	△
North Rhine-Westphalia (Germany)	45	(0.3)	▼	49	(0.2)	▽





National ICILS 2018 results are:
- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

■ Average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

🟦	Less than once a week
▢	At least once a week

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.5: National average scale scores indicating students' use of general applications for activities by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers			Scale score average by study of ICT-related subject			Scale score average by level of CIL		
	Less than five years	12 8 4 0 4 8 12	Five years or more	Not studying ICT-related subject	12 8 4 0 4 8 12	Studying ICT-related subject	CIL below Level 2	12 8 4 0 4 8 12	CIL at or above Level 2
Chile	50 (0.3)	🟩	**53** (0.4)	49 (0.5)	🟩	**52** (0.3)	51 (0.4)	☐	52 (0.3)
Denmark† [1]	60 (0.4)	☐	60 (0.3)	60 (0.3)	☐	61 (0.6)	59 (0.7)	☐	60 (0.2)
Finland	45 (0.4)	🟩	**47** (0.2)	46 (0.3)	🟩	**48** (0.4)	43 (0.5)	🟩	**48** (0.2)
France	48 (0.3)	🟩	**48** (0.3)	47 (0.4)	🟩	**48** (0.2)	47 (0.3)	🟩	**48** (0.2)
Germany	46 (0.3)	🟩	**48** (0.3)	46 (0.2)	🟩	**48** (0.3)	45 (0.4)	🟩	**47** (0.2)
Italy[2]	46 (0.3)	🟩	**49** (0.4)	46 (0.7)	🟩	**48** (0.3)	46 (0.3)	🟩	**49** (0.4)
Kazakhstan[1]	52 (0.4)	🟩	**55** (0.5)	50 (0.8)	🟩	**53** (0.4)	53 (0.4)	☐	54 (0.7)
Korea, Republic of	44 (0.5)	🟩	**47** (0.5)	45 (0.4)	☐	46 (0.8)	42 (0.6)	🟩	**47** (0.4)
Luxembourg	49 (0.1)	🟩	**51** (0.2)	50 (0.1)	🟩	**51** (0.2)	49 (0.2)	🟩	**51** (0.1)
Portugal†† [1]	50 (0.3)	🟩	**51** (0.3)	48 (0.6)	🟩	**51** (0.2)	51 (0.4)	☐	51 (0.2)
Uruguay	50 (0.3)	🟩	**52** (0.3)	44 (2.4)	🟩	**51** (0.2)	50 (0.4)	🟩	**52** (0.4)
ICILS 2018 average	49 (0.1)	🟩	**51** (0.1)	48 (0.3)	🟩	**51** (0.1)	49 (0.1)	🟩	**51** (0.1)
Not meeting sample participation requirements									
United States	50 (0.3)	🟩	**53** (0.3)	51 (0.3)	🟩	**53** (0.3)	50 (0.4)	🟩	**52** (0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	49 (0.4)	🟩	**51** (0.3)	43 (1.4)	🟩	**50** (0.3)	49 (0.6)	🟩	**51** (0.3)
North Rhine-Westphalia (Germany)	44 (0.3)	🟩	**46** (0.4)	44 (0.3)	🟩	**47** (0.5)	43 (0.5)	🟩	**45** (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Scale scores for frequency of use of general applications for activities were higher for experienced than inexperienced computer users (Table 5.5). The difference between these groups was significant in all ICILS 2018 countries except Denmark (where scale score was very high). On average across countries, the difference between experienced and inexperienced computer users was two scale points.

We also found that there was more frequent use of general applications for activities among students who studied computing subjects in the current year than by those who did not. This difference in scale scores was significant in all but two countries (Denmark and Korea) and was three scale points on average across participating countries. The difference was particularly large (seven points) in Uruguay and also in the benchmarking participant Moscow (Russian Federation) (also seven points).

There was more frequent use of general applications for activities reported by those with CIL scores at or above Level 2 than by those with CIL scores below Level 2. The difference in scale scores averaged two scale points across countries and was significant in all countries except Chile, Kazakhstan, and Portugal. The difference was largest in Korea (six points) and Finland (four points). Of course we cannot identify the direction of causation but the association may hold important ramifications for the development of skills.

We conducted similar analyses of the association between the frequency of use of specialist ICT applications for activities and student attributes (Table 5.6). The mean scale scores for the frequency of using specialist applications for activities of students with five or more years of computer experience were significantly greater than for other students in 10 of the 13 countries that met sampling requirements, and averaged two scale points.

In eight of 13 countries students who studied computer subjects in the current school year reported more frequent use of specialist applications for activities than those who did not, with an average difference of two scale points. This difference was largest in Moscow (Russian Federation) (six points), Denmark (four points), and Finland (four points). Surprisingly, we found in 10 of the 13 countries that students with CIL scores below Level 2 used specialist ICT applications more frequently than students whose CIL scores at Level 2 or above. On average across countries, the difference was about two scale points. In Finland and Korea, the reverse was true. Students with high CIL scores used these applications more frequently than students with low CIL scores.

Use of ICT for social communication and exchange of information

ICILS 2013 reported that students made extensive use of ICT for social communication and accessing information (Fraillon et al. 2014). Because a number of the items changed between ICILS 2013 and ICILS 2018 direct comparisons over time are not possible. In ICILS 2018 we asked students to indicate the frequency with which they were using ICT for a variety of communication and information exchange activities. The response categories were "never," "less than once a month," "at least once a month but not every week," "at least once a week but not every day," and "every day." The 10 activities listed in the questionnaire included seven related to communication and three concerned with information exchange. The responses to the questionnaire confirmed that there were two clusters of items that provided the basis for two scales: social communication and information exchange (Table 5.7).

Table 5.6: National average scale scores indicating students' use of specialist applications for activities by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers			Scale score average by study of ICT-related subject			Scale score average by level of CIL		
	Less than five years	12 8 4 0 4 8 12	Five years or more	Not studying ICT-related subject	12 8 4 0 4 8 12	Studying ICT-related subject	CIL below Level 2	12 8 4 0 4 8 12	CIL at or above Level 2
Chile	51 (0.4)	🟩	**53** (0.5)	51 (0.8)	☐	52 (0.4)	**52** (0.4)	🟥	51 (0.5)
Denmark† 1	48 (0.4)	☐	49 (0.3)	48 (0.3)	🟩	**52** (0.7)	**51** (0.9)	🟥	48 (0.3)
Finland	44 (0.4)	🟩	**47** (0.2)	45 (0.3)	🟩	**49** (0.4)	45 (0.5)	🟩	**47** (0.2)
France	49 (0.3)	🟩	**50** (0.3)	49 (0.5)	☐	50 (0.3)	**51** (0.4)	🟥	49 (0.3)
Germany	49 (0.2)	🟩	**51** (0.4)	49 (0.3)	🟩	**51** (0.4)	**50** (0.6)	🟥	49 (0.2)
Italy2	47 (0.3)	🟩	**49** (0.4)	48 (0.8)	☐	48 (0.3)	**49** (0.3)	🟥	47 (0.4)
Kazakhstan1	56 (0.3)	☐	57 (0.5)	54 (0.7)	🟩	**56** (0.3)	**57** (0.3)	🟥	54 (0.5)
Korea, Republic of	46 (0.4)	🟩	**48** (0.4)	46 (0.3)	🟩	**49** (0.6)	45 (0.5)	🟩	**48** (0.3)
Luxembourg	50 (0.2)	🟩	**52** (0.2)	50 (0.2)	🟩	**51** (0.2)	**51** (0.2)	🟥	50 (0.2)
Portugal†† 1	50 (0.4)	🟩	**51** (0.3)	50 (0.8)	☐	51 (0.2)	**53** (0.4)	🟥	50 (0.3)
Uruguay	52 (0.4)	☐	53 (0.4)	52 (4.3)	☐	53 (0.3)	**54** (0.5)	🟥	51 (0.3)
ICILS 2018 average	49 (0.1)	🟩	**51** (0.1)	49 (0.4)	🟩	**51** (0.1)	**51** (0.1)	🟥	49 (0.1)
Not meeting sample participation requirements									
United States	50 (0.2)	🟩	**51** (0.2)	49 (0.2)	🟩	**52** (0.2)	**51** (0.3)	🟥	50 (0.2)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	50 (0.3)	🟩	**52** (0.2)	45 (2.3)	🟩	**51** (0.2)	52 (0.7)	☐	51 (0.3)
North Rhine-Westphalia (Germany)	49 (0.3)	🟩	**51** (0.4)	49 (0.3)	🟩	**52** (0.4)	50 (0.4)	☐	49 (0.3)

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$
☐ Difference between comparison groups not statistically significant at $p < 0.05$

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

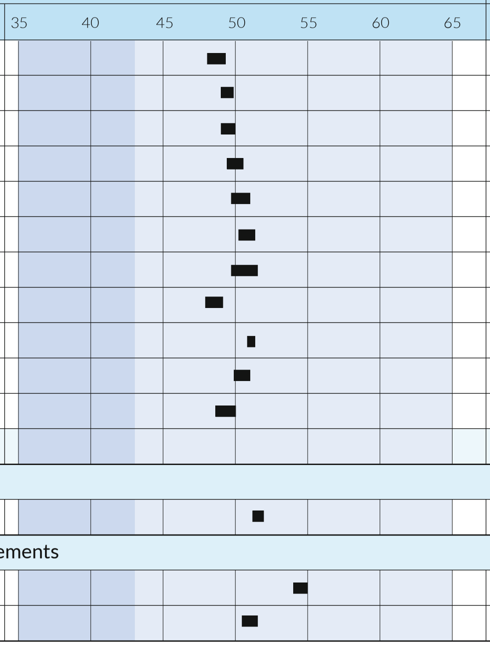
†† Nearly met guidelines for sampling participation rates after replacement schools were included.

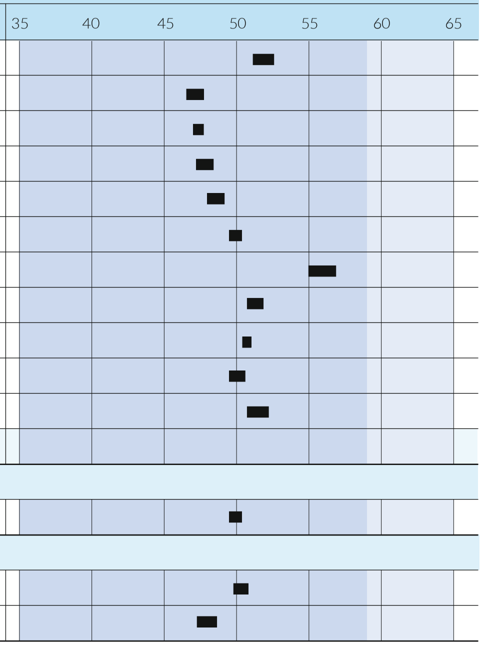
[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.7: National averages for students' use of ICT for social communication and students' use of ICT for exchanging information

Country	Scale scores for students' use of ICT for social communication			Scale scores for students' use of ICT for exchanging information		
	Average scale scores			Average scale scores		
Chile	49	(0.3)	▽	52	(0.3)	△
Denmark[†] [1]	50	(0.2)	▽	47	(0.2)	▼
Finland	50	(0.2)		47	(0.2)	▽
France	50	(0.3)		48	(0.2)	▽
Germany	51	(0.3)		49	(0.3)	▽
Italy[2]	51	(0.2)	△	50	(0.2)	
Kazakhstan[1]	51	(0.4)		56	(0.4)	▲
Korea, Republic of	49	(0.2)	▽	51	(0.3)	△
Luxembourg	51	(0.1)	△	51	(0.2)	△
Portugal[††] [1]	51	(0.2)	△	50	(0.2)	
Uruguay	49	(0.4)		51	(0.3)	△
ICILS 2018 average	50	(0.1)		50	(0.1)	
Not meeting sample participation requirements						
United States	52	(0.2)		50	(0.2)	
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	54	(0.2)	▲	50	(0.2)	△
North Rhine-Westphalia (Germany)	50	(0.3)		48	(0.3)	△





National ICILS 2018 results are:
- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

- ■ Average score +/− confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

- ▨ Less than once a week
- ▢ At least once a week

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

The social communication items were:

- Share news about current events on social media;
- Communicate with friends, family, or other people using instant messaging, voice, or video chat (e.g., Skype, WhatsApp, or Viber);
- Send texts or instant messages to friends, family, or other people;
- Write posts and updates about what happens in your life on social media;
- Post images or video in social networks or online communities (e.g., Facebook, Instagram, or YouTube);
- Watch videos or images that other people have posted online; and
- Send or forward information about events or activities to other people.

The information exchange items were the following:

- Ask questions on forums or Q&A (question and answer) websites;
- Answer other people's questions on forums or Q&A websites; and
- Write posts for your own blog (e.g., using WordPress, Tumblr, or Blogger).

The items were used to derive two IRT scales reflecting *students' use of ICT for social communication* and *students' use of ICT for exchanging information*, where higher scale scores reflected higher frequency of use. Both scales had satisfactory reliabilities with average Cronbach's alpha coefficients across countries of 0.77 and 0.75 respectively (the item maps describing these scales are included in Figures F.4 and F.5, Appendix F).

An inspection of national mean scale scores for the frequency of social communication and for information exchange indicated small differences among countries on the social communication scale but larger differences among countries on the information exchange scale (Table 5.7). Scale scores reflecting the use of ICT for information exchange were relatively high in Kazakhstan and Chile and relatively low in Denmark and Finland.

The average scale scores for the use of ICT for social communication were significantly higher for students who were experienced computer users than other students in all countries except Denmark, and the average difference between the two comparison groups was three scale points (Table 5.8).

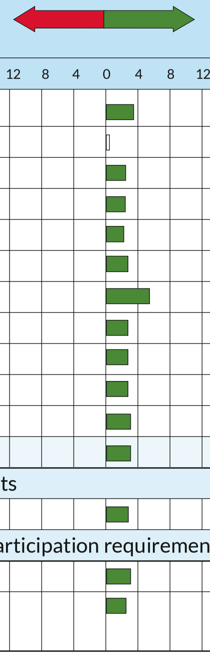
In only two countries (Kazakhstan and Portugal) did students who were currently studying computing subjects have higher scores on the ICT for social communication scale than those who were not studying ICT (Table 5.8). In Finland, students who were currently studying computer subjects had lower scores on the ICT for social communication scale than other students. In most countries there was no significant difference between the two groups of students.

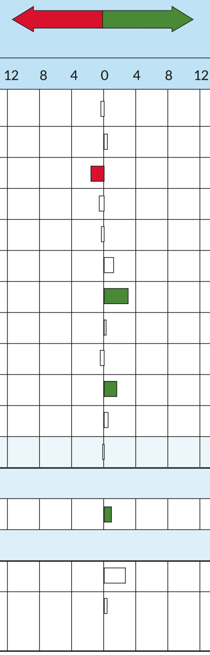
In four ICILS 2018 countries, students whose CIL scores were at Level 2 or above used ICT for social communication more frequently than students with CIL scores below Level 2. On average across educational systems the difference was just one scale point. The opposite was true for North Rhine-Westphalia (Germany).

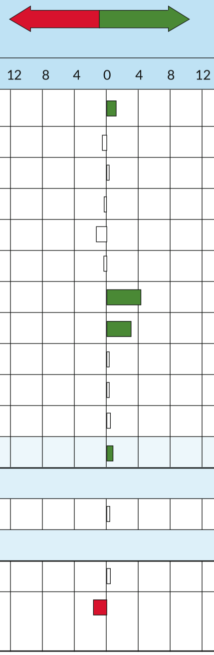
The scale score reflecting frequency of use of ICT for exchanging information was significantly higher for students who were experienced computer users than for other students in nine of the ICILS countries, but the average difference was only one scale point (Table 5.9). In just four of the countries, students who were currently studying computing subjects had higher scores on the use of ICT for exchanging information scale than those who were not. In 11 of the ICILS countries, students with CIL scores below Level 2 had higher scale scores for ICT use to exchange information than students whose CIL scores were at Level 2 or above. On average across countries the difference was three scale points. The largest differences were evident in Denmark (five points), Germany (four points), and Luxembourg (four points).

Table 5.8: National average scale scores indicating students' use of ICT for social communication by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers		Scale score average by study of ICT-related subject		Scale score average by level of CIL	
	Less than five years	Five years or more	Not studying ICT-related subject	Studying ICT-related subject	CIL below Level 2	CIL at or above Level 2
Chile	47 (0.4)	**51** (0.3)	49 (0.9)	49 (0.3)	48 (0.4)	**50** (0.4)
Denmark† [1]	50 (0.3)	50 (0.2)	49 (0.2)	50 (0.5)	50 (0.6)	49 (0.2)
Finland	48 (0.3)	**50** (0.2)	**50** (0.2)	49 (0.3)	49 (0.5)	50 (0.2)
France	49 (0.3)	**52** (0.3)	51 (0.6)	50 (0.3)	50 (0.5)	50 (0.3)
Germany	50 (0.4)	**52** (0.3)	51 (0.3)	51 (0.4)	51 (0.7)	50 (0.3)
Italy[2]	50 (0.2)	**53** (0.4)	50 (0.7)	51 (0.2)	51 (0.3)	51 (0.3)
Kazakhstan[1]	49 (0.5)	**54** (0.5)	48 (0.9)	**51** (0.4)	50 (0.5)	**55** (0.5)
Korea, Republic of	47 (0.3)	**50** (0.3)	49 (0.3)	49 (0.4)	46 (0.5)	**49** (0.3)
Luxembourg	50 (0.2)	**53** (0.2)	51 (0.2)	51 (0.2)	51 (0.2)	51 (0.2)
Portugal†† [1]	49 (0.3)	**52** (0.3)	49 (0.7)	**51** (0.3)	50 (0.4)	51 (0.3)
Uruguay	48 (0.4)	**51** (0.5)	49 (3.0)	50 (0.4)	49 (0.5)	50 (0.4)
ICILS 2018 average	49 (0.1)	**52** (0.1)	50 (0.3)	50 (0.1)	50 (0.1)	**51** (0.1)
Not meeting sample participation requirements						
United States	50 (0.2)	**53** (0.2)	51 (0.2)	**52** (0.2)	51 (0.3)	52 (0.2)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	52 (0.3)	**55** (0.2)	51 (1.8)	54 (0.2)	53 (0.5)	54 (0.2)
North Rhine-Westphalia (Germany)	50 (0.3)	**52** (0.5)	51 (0.3)	51 (0.4)	**51** (0.5)	50 (0.3)







Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Table 5.9: National average scale scores indicating students' use of ICT for exchanging information by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers		Scale score average by study of ICT-related subject		Scale score average by level of CIL	
	Less than five years	Five years or more	Not studying ICT-related subject	Studying ICT-related subject	CIL below Level 2	CIL at or above Level 2
Chile	51 (0.4)	52 (0.4)	51 (0.8)	52 (0.3)	52 (0.5)	51 (0.4)
Denmark[†] [1]	47 (0.3)	47 (0.2)	46 (0.2)	**50** (0.7)	**51** (0.8)	46 (0.2)
Finland	47 (0.3)	47 (0.2)	47 (0.2)	**48** (0.3)	**48** (0.4)	47 (0.2)
France	47 (0.3)	**48** (0.3)	48 (0.5)	48 (0.2)	**49** (0.4)	47 (0.2)
Germany	48 (0.3)	**49** (0.5)	49 (0.3)	49 (0.4)	**51** (0.6)	47 (0.2)
Italy[2]	49 (0.2)	**51** (0.4)	50 (0.7)	50 (0.2)	**51** (0.3)	48 (0.3)
Kazakhstan[1]	55 (0.4)	**57** (0.6)	53 (0.8)	**56** (0.4)	56 (0.5)	55 (0.6)
Korea, Republic of	50 (0.3)	**52** (0.3)	51 (0.3)	52 (0.5)	51 (0.5)	51 (0.3)
Luxembourg	50 (0.2)	**52** (0.3)	50 (0.2)	51 (0.3)	**53** (0.3)	49 (0.2)
Portugal[††] [1]	49 (0.4)	**50** (0.3)	48 (0.7)	**50** (0.2)	**52** (0.5)	49 (0.3)
Uruguay	51 (0.4)	51 (0.5)	49 (1.8)	51 (0.4)	**53** (0.5)	50 (0.4)
ICILS 2018 average	50 (0.1)	**51** (0.1)	49 (0.2)	**50** (0.1)	**52** (0.2)	49 (0.1)
Not meeting sample participation requirements						
United States	50 (0.2)	**51** (0.2)	49 (0.2)	**51** (0.3)	**52** (0.4)	49 (0.2)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	50 (0.4)	**51** (0.3)	51 (2.3)	50 (0.2)	51 (0.6)	50 (0.3)
North Rhine-Westphalia (Germany)	48 (0.3)	**49** (0.5)	48 (0.4)	49 (0.5)	**51** (0.7)	47 (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Use of ICT for leisure activities

Prior research has shown that students tend to use ICT frequently for leisure activities (Tobias et al. 2011) and this was confirmed in ICILS 2013 (Fraillon et al. 2014, p. 143). ICILS 2018 included leisure activities that involved accessing content from the internet (but not necessarily for study or school) as well as recreational activities such as playing games, listening to downloaded music, or watching downloaded or streamed TV or movies. The ICILS 2018 student questionnaire asked students to indicate how often they used computers for leisure activities. For reporting purposes, we categorized these as the percentages who reported doing these activities at least once each week (Table 5.10).

There was a high prevalence of using ICT for recreation on a weekly basis (Table 5.10). On average across ICILS 2018 countries, 83 percent of students used ICT to listen to downloaded or streamed music at least once each week, 71 percent used ICT to play single-player games at least once each week, and 68 percent used ICT to watch downloaded or streamed TV shows or movies on a weekly basis. Using ICT to watch downloaded or streamed TV shows or movies on a weekly basis was most common in Denmark (81%) and Moscow (Russian Federation) (83%), and least common in Korea (57%).

In the three comparable countries from ICILS 2013 (Chile, Germany, and Korea) there appeared to have been an increase in the use of ICT to access "the internet to find out about places to go or activities to do," "read reviews on the internet of things you might want to buy," and "watch downloaded or streamed TV shows or movies" (see Fraillon et al. 2014, p. 142). Other items had been altered from ICILS 2013 so that it is not possible to make other comparisons.

The activities that involved accessing content from the internet were (in decreasing order of average percentages):

- Search for online information about things you are interested in (69%);
- Use websites, forums, or online videos to find out how to do something (50%);
- Read news stories on the internet (50%);
- Read reviews on the internet of things you might want to buy (39%); and
- Search the internet to find information about places to go or activities to do (36%).

The activities that involved accessing content from the internet formed a reliable scale (average Cronbach's alpha across countries = 0.75) representing the frequency with which students accessed content from the internet (see the corresponding item map in Figure F.6 in Appendix F). Students from Kazakhstan scored highest on this scale and those from Germany scored lowest (Table 5.11). In Denmark, Finland, Germany, and Portugal male students scored higher than female students (i.e., use the internet more often to access content), but in Korea and Kazakhstan the reverse was the case. On average across countries, there was no significant difference between female and male students.

On the basis of results from this scale we concluded that, on average across countries, weekly ICT use for accessing content from the internet was higher (by two scale points) for experienced computer users than for inexperienced computer users, and higher for those with high levels of home computer resources than for those who had low levels of home computer resources (by two scale points) (Table 5.12). The difference associated with computer experience was significant in all but one of the ICILS 2018 countries (Denmark). The difference associated with home computer resources was significant in all but two of the ICILS 2018 countries (Denmark and Germany).

Table 5.10: Percentages of students using ICT on a weekly basis for specified leisure activities

Country	Percentages of students who reported at least weekly use of ICT to:							
	Search the internet to find information about places to go or activities to do	Read reviews on the internet of things you might want to buy	Read news stories on the internet	Search for online information about things you are interested in	Use websites, forums, or online videos to find out how to do something	Play single-player games	Listen to downloaded or or streamed music	Watch downloaded or streamed TV shows or movies
Chile	36 (1.2)	36 (1.4) ▽	39 (1.4) ▼	65 (1.4) ▽	49 (1.6)	72 (1.1)	83 (1.1)	71 (1.3) △
Denmark† ¹	28 (0.9) ▽	37 (1.1)	55 (1.6) △	69 (1.3)	39 (1.1) ▼	73 (1.1) △	87 (0.7) △	81 (0.8) ▲
Finland	27 (1.1) ▽	37 (1.2)	50 (1.2)	69 (1.3)	45 (1.3) ▽	65 (1.0) ▽	83 (0.8)	68 (1.1)
France	40 (1.1) △	39 (1.1)	50 (1.1)	66 (1.1) ▽	54 (1.1) △	74 (1.1) △	82 (0.8)	70 (1.2)
Germany	17 (0.9) ▼	24 (1.1) ▼	49 (1.2)	61 (1.1) ▽	45 (1.2) ▽	69 (1.3)	84 (1.0)	59 (1.1) ▽
Italy²	45 (1.1) △	44 (1.1) △	45 (1.1) ▽	80 (0.7) ▲	53 (1.0) △	79 (0.8) △	85 (0.9) △	67 (1.1)
Kazakhstan¹	47 (1.3) ▲	50 (1.4) ▲	70 (1.4) ▲	79 (1.4) △	59 (1.5) △	64 (1.3) ▽	78 (1.1) ▽	65 (1.3) ▽
Korea, Republic of	54 (1.2) ▲	53 (1.0) ▲	42 (1.2) ▽	70 (1.0)	57 (1.1) △	73 (1.1) △	79 (0.7) ▽	57 (1.0) ▼
Luxembourg	32 (0.6) ▽	33 (0.7) ▽	56 (0.7) △	66 (0.7) ▽	51 (0.6)	69 (0.6) ▽	82 (0.4) ▽	69 (0.5)
Portugal†† ¹	31 (1.2) ▽	39 (1.2)	43 (1.2) ▽	75 (1.0) △	50 (1.1)	71 (0.9)	89 (0.7) △	70 (1.0) △
Uruguay	42 (1.3) △	35 (1.6) ▽	49 (1.5)	64 (1.3) ▽	52 (1.2)	68 (1.5)	85 (1.0)	70 (1.0) △
ICILS 2018 average	36 (0.3)	39 (0.4)	50 (0.4)	69 (0.3)	50 (0.4)	71 (0.3)	83 (0.3)	68 (0.3)
Not meeting sample participation requirements								
United States	50 (0.8)	41 (0.7)	43 (0.8)	67 (0.7)	57 (0.8)	80 (0.6)	87 (0.5)	74 (0.6)
Benchmarking participants meeting sample participation requirements								
Moscow (Russian Federation)	46 (1.7) ▲	41 (1.1) △	70 (0.9) ▲	90 (0.7) ▲	66 (1.0) ▲	61 (0.8) ▽	93 (0.6) △	83 (0.8) ▲
North Rhine-Westphalia (Germany)	17 (1.0) ▼	25 (1.1) ▼	47 (1.3) ▽	58 (1.3) ▼	45 (1.2) ▽	71 (1.1)	84 (1.0)	59 (1.5) ▽

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

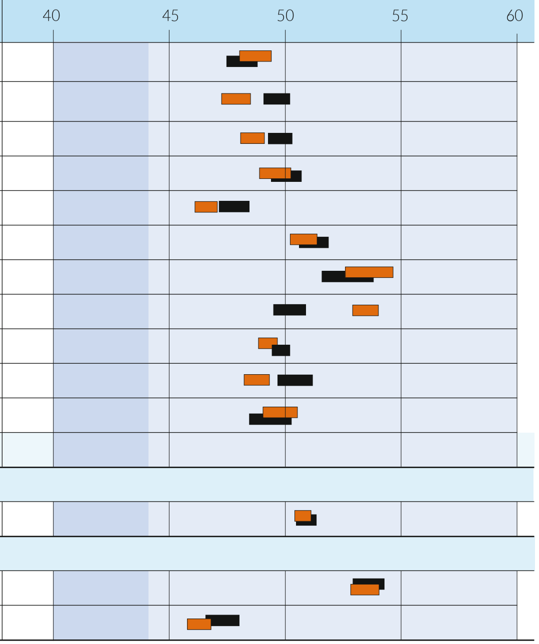
[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:
- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

Table 5.11: National average scale scores indicating students' use of ICT for accessing content from the internet by gender group

Country	All students			Females		Males		Differences (females – males)	
Chile	49	(0.3)	▽	49	(0.3)	48	(0.3)	0.8	(0.4)
Denmark† 1	49	(0.2)	▽	48	(0.3)	50	(0.3)	**–1.6**	(0.4)
Finland	49	(0.2)	▽	49	(0.2)	50	(0.3)	**–1.0**	(0.4)
France	50	(0.3)		50	(0.3)	50	(0.4)	–0.4	(0.4)
Germany	47	(0.3)	▽	47	(0.2)	48	(0.4)	**–1.0**	(0.3)
Italy²	51	(0.2)	△	51	(0.3)	51	(0.3)	–0.4	(0.4)
Kazakhstan¹	53	(0.5)	▲	54	(0.5)	53	(0.6)	**1.1**	(0.5)
Korea, Republic of	52	(0.2)	△	54	(0.3)	50	(0.4)	**3.5**	(0.5)
Luxembourg	50	(0.1)	▽	50	(0.2)	50	(0.2)	–0.3	(0.3)
Portugal†† 1	50	(0.2)		49	(0.2)	51	(0.3)	**–1.6**	(0.4)
Uruguay	50	(0.3)		50	(0.4)	49	(0.4)	0.8	(0.4)
ICILS 2018 average	50	(0.1)		50	(0.1)	50	(0.1)	0.0	(0.1)
Not meeting sample participation requirements									
United States	51	(0.2)		51	(0.2)	51	(0.2)	0.1	(0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	54	(0.3)	▲	54	(0.3)	54	(0.4)	0.0	(0.4)
North Rhine-Westphalia (Germany)	47	(0.2)	▼	46	(0.3)	47	(0.3)	–0.9	(0.5)



🟧 Female average score +/– confidence interval

⬛ Male average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Less than once a week
▨	At least once a week

National ICILS 2018 results are:

- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

Notes: Standard errors appear in parentheses. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Statistically significant differences (p < 0.05) between subgroups are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.12: National average scale scores indicating students' use of ICT for accessing content from the internet by experience with computers, computer resources at home, and level of CIL

Country	Scale score by students' experience with computers			Scale score average by computer resources at home			Scale score average by level of CIL		
	Less than five years		Five years or more	Fewer than two computers		Two computers or more	CIL below Level 2		CIL at or above Level 2
		12 8 4 0 4 8 12			12 8 4 0 4 8 12			12 8 4 0 4 8 12	
Chile	47 (0.4)	🟩	**50** (0.4)	47 (0.5)	🟩	**50** (0.3)	48 (0.4)	🟩	**49** (0.3)
Denmark[†] [1]	48 (0.3)	☐	49 (0.3)	49 (0.9)	☐	49 (0.2)	49 (0.6)	☐	49 (0.2)
Finland	47 (0.3)	🟩	**50** (0.2)	48 (0.4)	🟩	**50** (0.2)	48 (0.4)	🟩	**50** (0.2)
France	49 (0.3)	🟩	**51** (0.4)	49 (0.4)	🟩	**50** (0.3)	50 (0.5)	☐	50 (0.3)
Germany	47 (0.3)	🟩	**49** (0.4)	46 (0.7)	☐	48 (0.2)	47 (0.6)	☐	47 (0.2)
Italy[2]	50 (0.2)	🟩	**53** (0.4)	50 (0.3)	🟩	**52** (0.3)	51 (0.3)	☐	51 (0.4)
Kazakhstan[1]	52 (0.5)	🟩	**56** (0.5)	52 (0.5)	🟩	**56** (0.5)	53 (0.5)	🟩	**55** (0.6)
Korea, Republic of	50 (0.3)	🟩	**54** (0.3)	50 (0.4)	🟩	**53** (0.3)	49 (0.5)	🟩	**53** (0.3)
Luxembourg	49 (0.2)	🟩	**51** (0.2)	48 (0.4)	🟩	**50** (0.1)	**50** (0.2)	🟥	49 (0.2)
Portugal[††] [1]	48 (0.3)	🟩	**51** (0.3)	48 (0.4)	🟩	**50** (0.3)	50 (0.5)	☐	50 (0.2)
Uruguay	49 (0.4)	🟩	**51** (0.5)	48 (0.6)	🟩	**51** (0.4)	50 (0.5)	☐	49 (0.4)
ICILS 2018 average	49 (0.1)	🟩	**51** (0.1)	49 (0.2)	🟩	**51** (0.1)	50 (0.1)	🟩	**50** (0.1)
Not meeting sample participation requirements									
United States	49 (0.2)	🟩	**52** (0.2)	50 (0.3)	🟩	**52** (0.2)	51 (0.3)	☐	51 (0.2)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	52 (0.3)	🟩	**55** (0.3)	53 (0.5)	🟩	**54** (0.3)	53 (0.5)	☐	54 (0.3)
North Rhine-Westphalia (Germany)	46 (0.2)	🟩	**48** (0.4)	46 (0.4)	☐	47 (0.3)	47 (0.5)	☐	47 (0.3)

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

There were small differences on the scale representing the frequency with which students accessed content from the internet between students with CIL scores at or above Level 2 and those with CIL scores below Level 2 (differences in scale scores averaged one scale point). In Korea and Kazakhstan, the differences were a little larger (by four and three scale points).

Inferences

Grade 8 students were highly engaged with ICT, but much more engaged outside school than at school. Seven out of 10 grade 8 students used ICT on a daily basis outside school for general purposes but only one student in five used ICT on a daily basis outside school for school-related purposes. In contrast, fewer than one student in five used ICT at school for school-related purposes and three students in 10 used ICT at school for general purposes. The mismatch between ICT engagement out-of-school and ICT engagement in school is wider in some countries than others. This difference possibly provides an indication of the extent to which ICT has become incorporated in pedagogy.

Students' general use of ICT most commonly involved writing and editing documents, listening to downloaded music or videos, accessing information from the internet, and playing games. Most students used ICT at least once each week for leisure activities such as listening to downloaded music or watching videos. Approximately two thirds of students used ICT to access information about things of personal interest from the internet at least once each week. Students' general use of ICT may provide opportunities for them to develop and refine their ICT skills but there remains a question of the extent to which this experience is linked to systemic teaching in schools.

Student engagement with ICT for school-related purposes

The ICILS 2018 student questionnaire asked students about a number of aspects of ICT use for school-related purposes. It asked students about the extent of ICT use for school-related purposes, the use of ICT across subject areas, the ICT tools used in class, and the extent to which they learned about CIL at school.

ICILS 2013 reported that there were greater cross-national differences in student participation in ICT-based activities at school than in ICT-based activities outside of school (Fraillon et al. 2014). Similarly, more than half of the grade 8 students surveyed in TIMSS 2015 used the internet to access information and resources, and more than two thirds used the internet to collaborate with other students (Martin et al. 2016). However, TIMSS 2015 also found that only one fifth of grade 8 students reported working with computers as part of their mathematics lessons at least once a month (Martin et al. 2016; Mullis et al. 2016).

School use of ICT appears to have mainly focused on general applications (productivity and internet access software) (Fraillon et al. 2014). Students in the European Commission (2013) study rarely reported using specialist applications (e.g., data-logging tools and computer simulations) that might be considered particularly well suited to ICT use. In contrast, a third of the students said they used digital textbooks and multimedia resources on at least a weekly basis. There was a positive association between amount of student-centered learning and frequency of ICT use for classroom activities. A review of a number of studies by Fu (2013) also concluded that greater ICT use was associated with the amount of student-centered learning even though the direction of causation was not clear. Even though ICT has been propounded as having the potential to impact on pedagogy (Aparicio et al. 2016) the extent of this impact is less than envisaged and dependent on teacher characteristics (Comi et al. 2016; Vrasidas 2015). It appears that classroom ICT use in secondary schools is influenced by the availability of appropriate software, teacher expertise and self-efficacy, and the extent of collaboration among teachers (Gil-Flores et al. 2017). Technological, pedagogical, and content knowledge appears to influence the implementation of ICT in classrooms (Willermark 2017). Gerick et al. (2017) identified the influence of school

Table 5.13: Percentages of students using ICT on a weekly basis for specified school-related purposes

Country	Percentages of students who reported at least weekly use of ICT to:									
	Prepare reports or essays	Prepare presentations	Work online with other students	Complete [worksheets] or exercises	Organize your time and work	Take tests	Use software or applications to learn skills or a subject	Use the internet to do research	Use coding software to to complete assignments (e.g., [Scratch])	Make video or audio productions
Chile	29 (1.1) △	30 (1.3) △	18 (1.2) ▽	24 (0.9) ▽	30 (1.1)	23 (1.1) △	24 (1.4)	67 (1.5) △	20 (1.0) △	23 (1.0) △
Denmark† 1	61 (1.3) ▲	45 (1.5) ▲	86 (1.0) ▲	60 (1.1) ▲	48 (1.4) ▲	25 (1.3) △	44 (1.2) ▲	91 (0.7) ▲	15 (0.9)	8 (0.7) ▽
Finland	7 (0.7) ▼	7 (0.8) ▼	9 (0.6) ▼	6 (0.5) ▼	10 (0.7) ▼	7 (0.6) ▼	12 (0.7) ▼	17 (0.8) ▼	3 (0.4) ▼	3 (0.3) ▼
France	25 (0.9)	16 (0.9) ▽	21 (0.9) ▽	32 (1.1) △	32 (0.9) △	16 (1.0) ▽	17 (0.9) ▽	73 (1.0) ▲	13 (0.8)	13 (0.6) ▽
Germany	15 (0.8) ▼	13 (0.8) ▽	12 (0.8) ▼	22 (0.9) ▽	14 (0.8) ▼	9 (0.8) ▼	13 (0.8) ▼	49 (1.5) ▼	7 (0.7) ▽	9 (0.9) ▽
Italy²	20 (0.9) ▽	14 (0.8) ▽	15 (0.7) ▼	18 (0.9) ▼	24 (1.0) ▽	14 (0.6) ▽	22 (0.8) ▽	62 (1.2) △	13 (0.7)	22 (1.0) △
Kazakhstan¹	48 (1.4) ▲	39 (1.5) ▲	42 (1.4) ▲	56 (1.4) ▲	47 (1.5) ▲	44 (1.4) ▲	51 (1.4) ▲	54 (1.6) ▽	27 (1.4) ▲	40 (1.3) ▲
Korea, Republic of	14 (1.1) ▼	15 (1.2) ▽	10 (0.9) ▼	19 (0.9) ▼	16 (0.9) ▼	13 (0.7) ▽	15 (0.8) ▽	36 (1.4) ▼	9 (1.1) ▽	9 (0.6) ▽
Luxembourg	26 (0.7)	22 (0.6)	23 (0.6) ▽	27 (0.6) ▽	26 (0.7) ▽	27 (0.6) △	21 (0.7) ▽	61 (0.6) △	14 (0.5)	15 (0.6) ▽
Portugal†† 1	23 (1.1) ▽	20 (1.2) ▽	20 (1.0) ▽	33 (1.2) △	37 (1.5) △	29 (1.5) △	27 (1.1) △	73 (1.0) ▲	16 (0.9) △	24 (1.1) △
Uruguay	21 (1.0) ▽	26 (1.2) △	22 (1.0) ▽	31 (1.4)	28 (0.8)	19 (1.1)	23 (1.1)	71 (1.2) ▲	19 (1.1) △	30 (1.3) ▲
ICILS 2018 average	26 (0.3)	22 (0.3)	25 (0.3)	30 (0.3)	28 (0.3)	20 (0.3)	24 (0.3)	59 (0.4)	14 (0.3)	18 (0.3)
Not meeting sample participation requirements										
United States	41 (1.3)	30 (1.0)	30 (0.9)	56 (1.1)	40 (0.9)	43 (1.0)	33 (0.9)	72 (0.9)	15 (0.8)	13 (0.4)
Benchmarking participants meeting sample participation requirements										
Moscow (Russian Federation)	24 (1.0)	19 (1.1) ▽	19 (0.8) ▽	41 (1.4) ▲	33 (1.2) △	29 (1.1) △	35 (1.2) ▲	31 (1.2) ▼	12 (0.8) ▽	21 (0.8) △
North Rhine-Westphalia (Germany)	14 (1.0) ▼	12 (1.0) ▼	13 (0.9) ▼	18 (1.0) ▼	12 (0.9) ▼	7 (0.6) ▼	12 (1.1) ▼	44 (1.5) ▼	7 (1.0) ▽	8 (0.8) ▽

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:
- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

factors (especially the confidence of teachers in using ICT) on the use of ICT by students but noted that the strength of these influences was different in different countries. Data from ICILS 2013 showed that computer and internet access at school vary across and within countries, and are associated with student background and school contexts (Fraillon et al. 2014).

Extent of student engagement with ICT for school-related purposes

We asked students to report how often they used ICT for particular school-related purposes that ranged from the conventional to less conventional. These included the following:

- Prepare reports or essays;
- Prepare presentations;
- Work online with other students;
- Complete worksheets or exercises;
- Organize your time and work;
- Take tests;
- Use software or applications to learn skills or a subject (e.g., mathematics tutoring software, language learning software);
- Use the internet to do research;
- Use coding software to complete assignments (e.g., *Scratch*); and
- Make video or audio productions.

Although students could respond to the question using a set of categories (from "never" to "every school day") we reported the percentages who reported using ICT for a specified school-related purpose at least once each week[22] (Table 5.13). Among the school-related purposes, by far the most frequently recorded use of ICT was to "use the internet to do research." On average across countries this was reported as at least a weekly occurrence by three fifths (59%) of students. In Denmark this was reported as a weekly occurrence by nine tenths (91%) of students. It was also reported by seven out of 10 students in Portugal (73%) and Uruguay (71%). In some countries relatively few students reported using the internet to do research. In Finland only 17 percent of students reported using the internet for research on a weekly basis, and in Korea only 36 percent said that they used the internet to do research on a weekly basis.

Two of the forms of use of ICT for school-related purposes concerned how students did their work. One of these was organizing their own time and work (in the sense of self-regulation) and the other was working online with other students (collaboration). On average across countries one quarter of students (25% for self-regulation and 28% for collaboration) reported using ICT for these purposes on a weekly basis. The most common of these uses of ICT on a weekly basis were in Denmark (48% for self-regulation and 86% for collaboration) and Kazakhstan (47% for self-regulation and 42% for collaboration). The least common weekly use of ICT for self-regulation was in Germany (9%), followed by Finland (10%) and Korea (14%). The least common weekly use of ICT for collaboration was in Finland (9%), followed by Korea (10%) and Germany (12%).

There was a group of purposes listed that could be considered conventional school activities: completing worksheets or exercises (averaging 30%), preparing reports (averaging 26%), preparing presentations (averaging 22%), and taking tests (averaging 20%). Denmark recorded the highest level of weekly use of ICT for three of these conventional purposes (61% for preparing reports, 60% for completing worksheets or exercises, and 45% for preparing presentations). The lowest

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[22] In ICILS 2013 we reported use of ICT for each purpose at least once per month. Therefore the two sets of data are not comparable.

levels of weekly use of ICT for preparing reports were in Finland (7%) and Korea (14%). The least widespread weekly use of ICT for completing worksheets were in Finland (6%), Italy (18%), and Korea (19%). The lowest prevalence of ICT use for preparing presentations was in Finland (7%). Taking tests using ICT on a weekly basis was most common in Kazakhstan (44%) and least common in Finland (7%).

Use of ICT-based software or applications to learn skills or subject content on a weekly basis was most common in Denmark (44%) and Kazakhstan (51%) and least common in Finland (12%). On average across countries, 24 percent of students reported using these forms of ICT-based instructional software on a weekly basis.

The weekly use of ICT for the two listed specialist purposes was reported by fewer than one in five students. Using ICT on a weekly basis for making video or audio productions was reported by 18 percent of students on average and the weekly use of coding software such as *Scratch* to complete assignments was reported by 14 percent of students on average across countries. High levels of use of ICT for these purposes were reported for Kazakhstan (40% and 27%), and very low levels of use were reported for Finland (3% for each form of use).

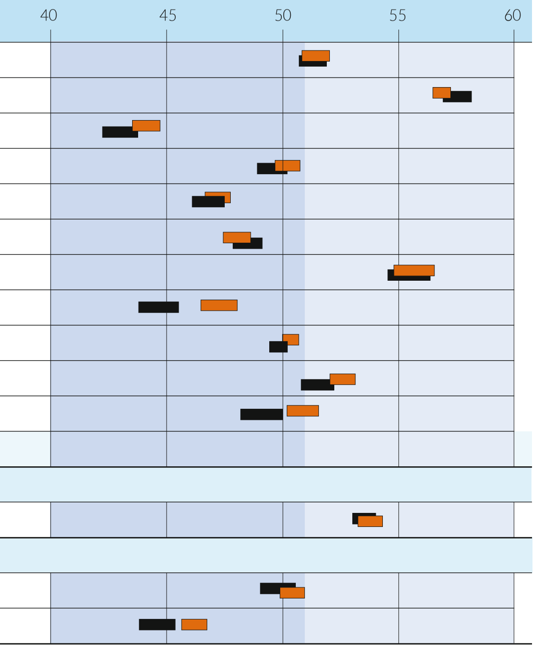
We constructed a scale that represented the use of ICT applications as a whole for school-related purposes with an average reliability across participating countries of 0.83 (please see the corresponding item map in Figure F.7 in Appendix F), where higher scale scores indicated more frequent use. We observed that the use of ICT for school-related purposes was, on average across countries, slightly greater (by just one scale point) for female than male students (Table 5.14). ICT use for school-related purposes was notably higher than the ICILS 2018 average in Denmark (57 points) and Kazakhstan (56 points), and notably lower in Korea (46 points) and Finland (43 points) (Table 5.14).

We also observed that the use of ICT for school-related purposes was a little higher on average for students who were experienced computer users than for other students (by two scale points) and a little higher on average for students who were currently studying a computer-related subject than for students who were not (by two scale points) (Table 5.15). The differences associated with computer experience were significant in seven of the ICILS 2018 countries, and was greatest in Finland (three scale points). The differences in the use of ICT for school-related purposes between those who currently studied a computer subject and other students were significant in seven ICILS 2018 countries and greatest in Portugal and Kazakhstan. The difference was also large in Moscow (Russian Federation).

On average across countries, there was no significant difference in the use of ICT for school-related purposes between those students who had CIL scores at or above Level 2 and students who had CIL scores below Level 2 (Table 5.15). However, there were significant differences between these two groups of students in Finland and Korea (in each case by four scale points) in favor of those with higher CIL levels. In five ICILS 2018 countries the direction of difference was in favor of those with lower CIL levels, and in four countries there was no significant difference.

Table 5.14: National average scale scores indicating students' use of ICT for school-related purposes by gender group

Country	All students			Females		Males		Differences (females – males)	
Chile	51	(0.2)	△	52	(0.3)	51	(0.3)	0.6	(0.4)
Denmark[†] [1]	57	(0.2)	▲	57	(0.2)	58	(0.3)	–0.5	(0.3)
Finland	43	(0.3)	▼	44	(0.3)	42	(0.4)	**1.7**	(0.4)
France	50	(0.2)		50	(0.2)	49	(0.3)	**0.9**	(0.3)
Germany	47	(0.3)	▼	47	(0.3)	46	(0.4)	**0.8**	(0.4)
Italy[2]	48	(0.2)	▽	48	(0.3)	48	(0.3)	0.0	(0.3)
Kazakhstan[1]	56	(0.4)	▲	56	(0.4)	55	(0.5)	0.5	(0.4)
Korea, Republic of	46	(0.3)	▼	47	(0.4)	44	(0.4)	**3.1**	(0.5)
Luxembourg	50	(0.1)		50	(0.2)	50	(0.2)	**0.7**	(0.3)
Portugal[††] [1]	52	(0.3)	△	53	(0.2)	51	(0.3)	**1.2**	(0.3)
Uruguay	50	(0.3)		51	(0.3)	49	(0.4)	**2.2**	(0.5)
ICILS 2018 average	50	(0.1)		50	(0.1)	49	(0.1)	**1.0**	(0.1)
Not meeting sample participation requirements									
United States	54	(0.2)		54	(0.2)	54	(0.3)	0.5	(0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	50	(0.3)		51	(0.3)	50	(0.4)	**0.8**	(0.4)
North Rhine-Westphalia (Germany)	46	(0.2)	▼	47	(0.3)	45	(0.4)	**2.0**	(0.5)



National ICILS 2018 results are:

- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

🟧 Female average score +/– confidence interval

■ Male average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Less than once a week
▨	At least once a week

Notes: Standard errors appear in parentheses. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Statistically significant differences ($p < 0.05$) between subgroups are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.15: National average scale scores indicating students' use of ICT for school-related purposes by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers			Scale score average by study of ICT-related subject			Scale score average by level of CIL		
	Less than five years	12 8 4 0 4 8 12	Five years or more	Not studying ICT-related subject	12 8 4 0 4 8 12	Studying ICT-related subject	CIL below Level 2	12 8 4 0 4 8 12	CIL at or above Level 2
Chile	51 (0.3)	🟩	**52** (0.2)	51 (0.7)	☐	51 (0.2)	**52** (0.3)	🟥	51 (0.3)
Denmark† 1	57 (0.3)	☐	58 (0.2)	57 (0.2)	🟩	**59** (0.6)	**59** (0.7)	🟥	57 (0.2)
Finland	41 (0.5)	🟩	**44** (0.3)	43 (0.3)	🟩	**44** (0.4)	40 (0.6)	🟩	**44** (0.2)
France	50 (0.2)	☐	50 (0.3)	50 (0.5)	☐	50 (0.2)	**50** (0.4)	🟥	49 (0.2)
Germany	46 (0.3)	☐	47 (0.4)	46 (0.3)	🟩	**48** (0.5)	47 (0.7)	☐	47 (0.3)
Italy2	47 (0.2)	🟩	**49** (0.3)	46 (0.8)	🟩	**48** (0.2)	48 (0.3)	☐	48 (0.3)
Kazakhstan1	55 (0.4)	🟩	**57** (0.6)	53 (0.7)	🟩	**56** (0.4)	56 (0.5)	☐	55 (0.5)
Korea, Republic of	45 (0.4)	🟩	**46** (0.4)	45 (0.3)	🟩	**47** (0.8)	43 (0.6)	🟩	**47** (0.4)
Luxembourg	50 (0.1)	🟩	**51** (0.3)	50 (0.2)	🟩	**50** (0.2)	**51** (0.2)	🟥	50 (0.1)
Portugal†† 1	52 (0.3)	🟩	**52** (0.3)	49 (0.7)	🟩	**52** (0.3)	**53** (0.4)	🟥	52 (0.3)
Uruguay	50 (0.3)	☐	50 (0.4)	49 (2.0)	☐	50 (0.3)	50 (0.4)	☐	50 (0.3)
ICILS 2018 average	49 (0.1)	🟩	**51** (0.1)	49 (0.2)	🟩	**51** (0.1)	50 (0.1)	☐	50 (0.1)
Not meeting sample participation requirements									
United States	53 (0.2)	🟩	**55** (0.3)	53 (0.3)	🟩	**55** (0.3)	54 (0.4)	☐	54 (0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	49 (0.4)	🟩	**51** (0.3)	47 (1.3)	🟩	**50** (0.3)	50 (0.6)	☐	50 (0.3)
North Rhine-Westphalia (Germany)	46 (0.3)	☐	46 (0.4)	45 (0.3)	🟩	**47** (0.6)	45 (0.6)	☐	46 (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Use of ICT across subject areas

Research literature over a number of years has suggested that there are differences among subject areas in the extent of use of ICT (Fraillon et al. 2014; Howard et al. 2014). In ICILS 2018 we asked students how often they used computers during lessons in designated subjects or subject areas ("never," "in some lessons," "in most lessons," "in every or almost every lesson," and "I don't study this subject/these subjects"). Student responses in the last category were treated as missing responses. The list of subjects or subject areas that students had to consider was based on a list developed for the OECD Teaching and Learning International Study (TALIS) (OECD 2014):

- Language arts: survey language;
- Language arts: foreign or other national languages;
- Mathematics;
- Sciences (general science and/or physics, chemistry, biology, geology, earth sciences);
- Human sciences or humanities (history, geography, civics, law, economics, etc.);
- Creative arts (visual arts, music, dance, drama, etc.);
- Information technology, computer studies, or similar;
- Practical or vocational studies; and
- Other.

We recorded the extent of use of computers during lessons in specified subject areas as the percentage of students who reported having used computers in most lessons, or in every or almost every lesson, in that subject area. We found that, on average across countries, the subject area with the greatest use of computers was information technology (49%) (Table 5.16). Across the subject areas of language arts (27%), sciences (27%), foreign languages (26%), and mathematics (25%) there was little variation. The use of computers was a little less in the creative arts (23%).

The subject areas with the lowest percentages of students who reported using computers in most lessons were practical or vocational (19%) and "other" subjects (e.g., moral/ethics, physical education, personal and social development) that could not be classified in the eight listed subject areas (17%).

In the core subject areas of language arts, mathematics, sciences, and human sciences, as well as in foreign languages, use of computers in most lessons was reported by an overwhelming majority of students in Denmark (69% to 85%). High levels of computer use in these subject areas were also reported in Kazakhstan (36% to 45%). In Germany the use of computers in most lessons in these subject areas was reported by around one tenth of the students (8% to 11%). Similar levels of computer usage were reported in North Rhine-Westphalia (Germany) (6% to 11%). Low levels of computer use in these subject areas were also reported in Luxembourg (16% to 20%) and Finland (13% to 18%).

High levels of computer use in the creative arts were reported in Kazakhstan (29%) and Denmark (27%). Low levels of computer use in the creative arts were reported in Germany (13%) and North Rhine-Westphalia (Germany) (16%). There were relatively high levels of computer use in practical or vocational studies in Kazakhstan (34%) but very low levels in Germany (11%), Finland (11%), and North Rhine-Westphalia (Germany) (9%).

On average across countries, approximately half the students (49%) reported using computers in most lessons for information technology, computer studies, or similar. National percentages for this indicator were high in Denmark (75%), Portugal (67%), and Uruguay (69%), but low in France (18%) and Italy (26%).

Table 5.16: Percentages of students using computers during most lessons in specified subject areas

Country	Percentages of students who reported to have used computers in most lessons in the following subject areas:								
	Language arts: test language	Language arts: foreign or other national languages	Mathematics	Sciences (general science and/or physics, chemistry, biology, geology, earth sciences)	Human sciences, humanities, or social studies (history, geography, civics, law, economics, etc.)	Creative arts ([visual] arts, music, dance, drama, etc.)	Information technology, computer studies, or similar	Practical or vocational	Other (e.g., moral/ ethics, physical education, personal and social development)
Chile	19 (1.1) ▽	19 (1.2) ▽	21 (1.3) ▽	21 (1.4) ▽	20 (1.1) ▽	22 (1.0)	45 (1.7) ▽	—	18 (1.6)
Denmark[†][1]	85 (1.5) ▲	72 (1.9) ▲	70 (2.2) ▲	69 (2.1) ▲	74 (1.9) ▲	27 (2.3) △	75 (2.6) ▲	24 (2.7) △	27 (1.7) ▲
Finland	18 (1.3) ▽	18 (1.2) ▽	13 (1.1) ▼	17 (1.4) ▽	14 (1.6) ▼	20 (1.2) ▽	58 (2.1) △	11 (0.9) ▽	10 (0.8) ▽
France	22 (0.9) ▽	20 (0.9) ▽	14 (1.0) ▼	22 (1.1) ▽	25 (1.2)	21 (1.1)	18 (0.9) ▼	21 (0.9) △	15 (0.7) ▽
Germany	8 (0.8) ▼	9 (0.7) ▼	9 (0.9) ▼	11 (0.7) ▼	11 (0.7) ▼	13 (1.0) ▽	44 (2.4) ▽	11 (1.5) ▽	8 (0.6) ▽
Italy[2]	24 (1.1) ▽	29 (1.2) △	27 (1.3) △	22 (1.1) ▽	26 (1.2)	26 (1.2) △	26 (1.6) ▼	15 (1.0) ▽	13 (0.9) ▽
Kazakhstan[1]	41 (1.5) ▲	37 (1.4) ▲	41 (1.3) ▲	45 (1.4) ▲	36 (1.4) ▲	29 (1.3) △	52 (1.6)	34 (1.6) ▲	32 (1.3) ▲
Korea, Republic of	20 (1.1) ▽	31 (1.1) △	18 (1.0) ▽	26 (1.1)	22 (1.2) ▽	23 (1.0)	38 (2.5) ▼	23 (1.2) △	17 (1.1)
Luxembourg	20 (0.6) ▽	16 (0.5) ▼	20 (0.5) ▽	16 (0.5) ▼	16 (0.5) ▼	20 (0.5) ▽	49 (0.9)	16 (0.8) ▽	15 (0.6) ▽
Portugal[††][1]	18 (1.0) ▽	17 (0.8) ▽	16 (0.9) ▽	26 (1.0)	21 (1.0) ▽	21 (1.2)	67 (1.4) ▲	12 (0.9) ▽	15 (0.9) ▽
Uruguay	21 (1.1) ▽	23 (1.1) ▽	22 (1.1) ▽	22 (0.9) ▽	22 (1.2) ▽	27 (1.3) △	69 (1.5) ▲	21 (1.6)	16 (1.1)
ICILS 2018 average	27 (0.3)	26 (0.3)	25 (0.4)	27 (0.4)	26 (0.4)	23 (0.4)	49 (0.6)	19 (0.4)	17 (0.3)
Not meeting sample participation requirements									
United States	44 (1.6)	32 (1.7)	41 (1.5)	48 (1.4)	45 (1.4)	26 (0.9)	61 (1.3)	29 (1.4)	23 (1.0)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	16 (0.8) ▼	23 (1.0) ▽	22 (1.2) ▽	25 (1.1) ▽	21 (1.1) ▽	20 (1.4) ▽	53 (1.7) △	20 (1.5)	12 (0.7) ▽
North Rhine-Westphalia (Germany)	6 (0.7) ▼	7 (0.5) ▼	7 (0.9) ▼	11 (1.0) ▼	11 (1.1) ▼	16 (1.4) ▽	40 (2.5) ▽	9 (1.6) ▼	7 (0.8) ▼

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

— No data available.

National ICILS 2018 results are:

▲ More than 10 percentage points above average

△ Significantly above average

▽ Significantly below average

▼ More than 10 percentage points below average

Use of ICT during lessons

In ICILS 2018 we asked students how often they used each of 11 listed ICT tools during lessons. Students responded using the options: "never," "in some lessons," "in most lessons," or "in every or almost every lesson." We recorded the use of each tool in terms of the percentage of students who used it in "most" or in "every or almost every lesson" (Table 5.17). In the text we refer to this as use in the majority of lessons.

On average across countries, the most used ICT tools were computer-based information resources (e.g., websites, wikis, and encyclopedias) (29%), word processing software (28%), and presentation software (26%). Use of computer-based information resources in the majority of lessons was prevalent in Denmark (59%) and Finland (41%) but not in Germany (11%), North Rhine-Westphalia (Germany) (12%), and Korea (15%). Use of word processing and presentation software in the majority of lessons was notably high in Denmark (82% and 50% respectively) and Kazakhstan (39% and 38%) but low in Italy (14% and 15%). Use of word processing software on a weekly basis was also notably low in Korea (11%). Of productivity tools, spreadsheet use in the majority of lessons was only reported by 16 percent of students on average across ICILS 2018 countries.

Although computer-based information resources were widely used on the majority of lessons, interactive digital learning resources were not. On average across countries, only 15 percent of students used these in a majority of lessons, and there was little variation among countries. Similarly, there was low usage of specialist tools even though there was high use of common productivity software. An average of only 14 percent of students used graphing or drawing software in a majority of lessons and only 11 percent of students used multimedia production tools (e.g., media capture and editing, web production) in a majority of lessons.

There were several tools listed that could be categorized as learning tools. The most frequently used of these were tutorial software or practice programs. On average across ICILS 2018 countries, 13 percent of students used these tools in a majority of lessons. Just nine percent of students reported using concept mapping software, and eight percent reported using simulations and modeling software, in a majority of lessons. Tools for digitally capturing real-world data were used in a majority of lessons by only 10 percent of students on average.

From the responses to these items we developed two scales (Table 5.18). One of these scales represented the extent to which general applications (productivity, word processing, and presentation software and computer-based information resources) were used in class (average Cronbach's alpha across countries was 0.72). The other represented the extent to which specialist applications (multimedia production, concept mapping, real-world data capture, simulations and modeling software, computer-based information resources, interactive digital learning resources, and graphing or drawing software) were used during lessons (average Cronbach's alpha across countries was 0.84). Tutorial software and spreadsheets were not included in either scale. (Figures F.8 and F.9 in Appendix F contain the two item maps for these two scales.)

We found that general applications were used in class to a greater extent in Denmark and Kazakhstan than the international average and to a smaller extent in Germany, North Rhine-Westphalia (Germany), Italy, and Korea (Table 5.18). The difference between the countries with the highest and lowest scale scores was quite large, being about 15 scale points.

Table 5.17: Percentages of students using general and specialist ICT applications during most or all lessons

Country	Percentages of students who reported at least weekly use of ICT										
	Tutorial software or [practice programs]	Word processing software (e.g.,[Microsoft Word ®])	Presentation software (e.g., [Microsoft PowerPoint ®]	Spreadsheets (e.g., [Microsoft Excel®])	Multimedia production tools (e.g., media capture and editing, web production)	Concept mapping software (e.g., [Inspiration ®], [Webspiration ®])	Tools that capture real-world data (e.g., speed, temperature) digitally for analysis	Simulations and modeling software	Computer-based information resources (e.g., websites, wikis, encyclopedia)	Interactive digital learning resources (e.g., learning games or applications)	Graphing or drawing software
Chile	11 (0.8) ▽	23 (1.3) ▽	31 (1.5) △	13 (0.8) ▽	14 (0.7) △	12 (0.8) △	11 (0.7) △	9 (0.9)	32 (1.3) △	19 (1.4) △	16 (0.9) △
Denmark† ¹	27 (1.2) ▲	82 (1.1) ▲	50 (1.4) ▲	35 (1.5) ▲	8 (0.7) ▽	7 (0.6) ▽	8 (0.7)	7 (0.6) ▽	59 (1.2) ▲	14 (0.9)	13 (0.9)
Finland	10 (0.7) ▽	26 (1.4)	25 (1.4)	4 (0.5) ▼	4 (0.4) ▽	2 (0.3) ▽	4 (0.4) ▽	3 (0.4) ▽	41 (1.5) ▲	9 (0.8) ▽	5 (0.5) ▽
France	8 (0.5) ▽	25 (1.0) ▽	21 (0.9) ▽	11 (0.7) ▽	7 (0.5) ▽	6 (0.5) ▽	5 (0.5) ▽	8 (0.6)	19 (0.9) ▽	9 (0.6) ▽	9 (0.7) ▽
Germany	4 (0.4) ▽	16 (1.2) ▼	15 (0.8) ▼	10 (0.7) ▽	4 (0.5) ▽	3 (0.4) ▽	4 (0.6) ▽	3 (0.5) ▽	11 (0.7) ▼	6 (0.7) ▽	8 (0.7) ▽
Italy²	8 (0.6) ▽	14 (0.7) ▼	15 (0.7) ▼	10 (0.6) ▽	12 (0.8)	15 (0.8) △	10 (0.6)	8 (0.6)	29 (1.1)	14 (0.7)	14 (0.7)
Kazakhstan¹	33 (1.7) ▲	39 (1.8) ▲	38 (1.9) ▲	35 (1.5) ▲	30 (1.4) ▲	19 (1.3) ▲	27 (1.4) ▲	21 (1.3) ▲	34 (1.7) △	32 (1.4) ▲	34 (1.6) ▲
Korea, Republic of	9 (0.6) ▽	11 (0.8) ▼	17 (0.9) ▽	8 (0.6) ▽	9 (0.6) ▽	5 (0.4) ▽	6 (0.5) ▽	5 (0.5) ▽	15 (0.9) ▼	11 (0.8) ▽	9 (0.7) ▽
Luxembourg	8 (0.4) ▽	21 (0.5) ▽	23 (0.6) ▽	10 (0.5) ▽	9 (0.3) ▽	7 (0.4) ▽	8 (0.3) ▽	7 (0.3) ▽	21 (0.7) ▽	11 (0.4) ▽	11 (0.5) ▽
Portugal†† ¹	11 (0.6) ▽	25 (1.2) ▽	31 (1.2) △	13 (1.0) ▽	12 (0.9)	6 (0.5) ▽	9 (0.7)	9 (0.7)	25 (1.0) ▽	15 (0.9)	12 (0.9) ▽
Uruguay	16 (1.1) △	28 (1.3)	24 (1.3) ▽	30 (1.7) ▲	16 (1.0) △	12 (1.1) △	12 (0.8) △	13 (1.0) △	31 (1.4) △	25 (1.2) △	22 (1.2) △
ICILS 2018 average	13 (0.3)	28 (0.4)	26 (0.4)	16 (0.3)	11 (0.2)	9 (0.2)	10 (0.2)	8 (0.2)	29 (0.4)	15 (0.3)	14 (0.3)
Not meeting sample participation requirements											
United States	18 (0.6)	37 (1.1)	35 (0.9)	16 (0.8)	16 (0.7)	10 (0.6)	18 (0.6)	13 (0.6)	44 (1.0)	26 (0.8)	19 (0.7)
Benchmarking participants meeting sample participation requirements											
Moscow (Russian Federation)	20 (1.1) △	28 (1.6)	26 (1.4)	16 (1.3)	11 (0.7)	5 (0.5) ▽	10 (0.6)	9 (0.6)	35 (1.2) △	17 (0.9) △	14 (0.8)
North Rhine-Westphalia (Germany)	3 (0.6) ▼	12 (1.1) ▼	12 (1.1) ▼	9 (1.0) ▽	3 (0.3) ▽	2 (0.6) ▽	3 (0.6) ▽	3 (0.4) ▽	12 (0.9) ▼	4 (0.5) ▼	8 (1.1) ▽

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

¹ National defined population covers 90% to 95% of the national target population.

² Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:

▲ More than 10 percentage points above average

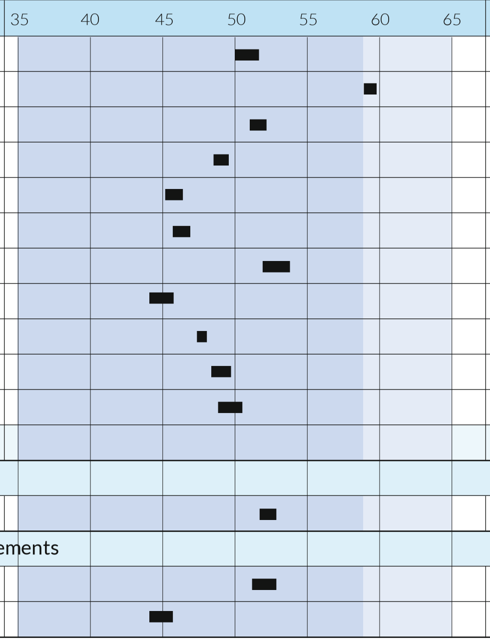
△ Significantly above average

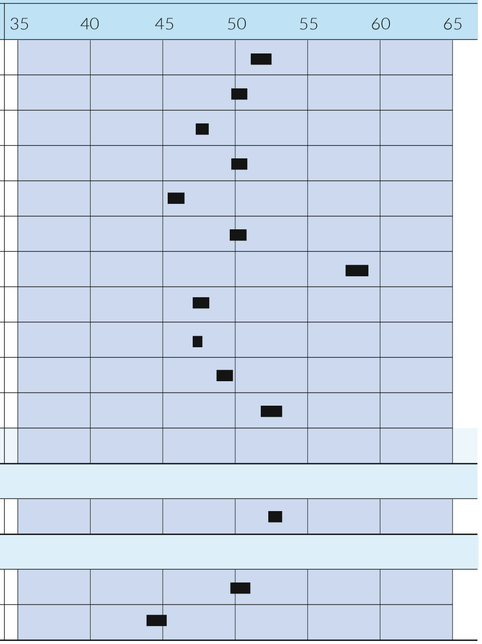
▽ Significantly below average

▼ More than 10 percentage points below average

Table 5.18: National averages for scales reflecting the extent of students' use of general and specialist ICT applications in class

Country	Scale scores for students' use of general applications for activities			Scale scores for students' use of specialist applications for activities		
	Average scale scores			Average scale scores		
Chile	51	(0.3)	△	52	(0.3)	△
Denmark[†] [1]	60	(0.2)	▲	50	(0.3)	
Finland	52	(0.2)	△	47	(0.2)	▽
France	49	(0.2)	▽	50	(0.2)	
Germany	46	(0.3)	▼	46	(0.2)	▼
Italy[2]	46	(0.3)	▼	50	(0.3)	
Kazakhstan[1]	53	(0.4)	▲	58	(0.4)	▲
Korea, Republic of	45	(0.3)	▼	47	(0.3)	▽
Luxembourg	48	(0.1)	▽	47	(0.1)	▽
Portugal[††] [1]	49	(0.3)	▽	49	(0.3)	▽
Uruguay	50	(0.4)		53	(0.3)	△
ICILS 2018 average	50	(0.1)		50	(0.1)	
Not meeting sample participation requirements						
United States	53	(0.2)		53	(0.2)	
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	52	(0.3)	△	51	(0.3)	
North Rhine-Westphalia (Germany)	45	(0.4)	▼	45	(0.3)	





National ICILS 2018 results are:

- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

■ Average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

🟦	Never or only in some lessons
▭	In most or all lessons

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

The use of general applications in class was slightly more frequently reported by female than male students, a difference which was statistically significant overall as well as in several individual countries (Table 5.19). In Germany, male students reported greater use of general applications in class than did female students. Using general applications in class was more frequently reported by students who were currently studying ICT than by students who were not. On average the difference was three scale points and the difference was four or more scale points in Chile, Kazakhstan, and Portugal. The difference was also large in the benchmarking participants: Moscow (Russian Federation) and North Rhine-Westphalia (Germany).

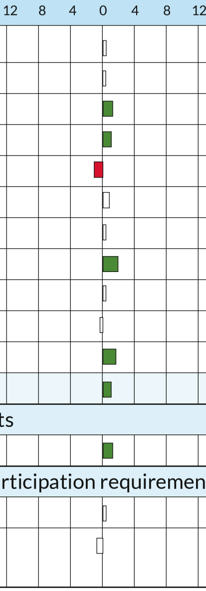
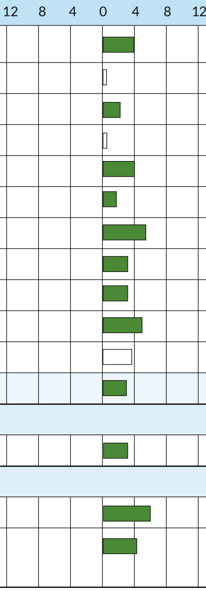
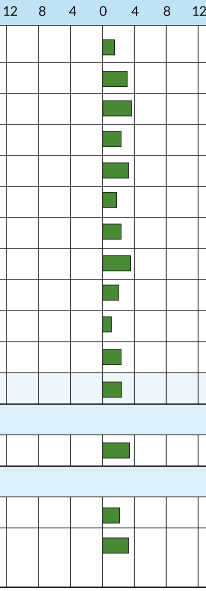
Use of specialist applications in class was more frequently reported by male students than by female students overall (by an average of two scale points), and the difference was significant in eight of the 11 ICILS 2018 countries (Table 5.20). In the remaining five ICILS 2018 countries the differences were not significant. However, the use of specialist applications in class was more frequently reported by students who were studying ICT than by those who were not (by an average of three scale points) in all except two ICILS 2018 countries. Surprisingly, the use of specialist applications in class was more frequently reported by students whose CIL score was below Level 2 than by students whose CIL scores were at or above Level 2. This unexpected result deserves further investigation, including the possibility that it might reflect differences in the types of subjects studied by low and high achieving students.

Inferences

ICT use for school-related purposes varies according to context. It appears to depend on the extent to which ICT is embedded in national curricula and pedagogy. The extent to which students use ICT for school-related purposes was higher than the ICILS 2018 average in Denmark and Kazakhstan and lower in Korea and Finland. ICT use for school-related pruposes also varied across subject areas: the greatest use occurred in foreign languages and the sciences and the lowest use of computers occurred in practical or vocational studies. ICT use for school-related purposes was also associated with student attributes. It was a little higher on average for students who were experienced computer users than those who were less-experienced computer users and was higher for students who were currently studying a computer-related subject than for students who were not.

ICT use for school-related purposes predominantly involved general applications. The most frequent reported school-related use of ICT among grade 8 students was for doing research on the internet. Approximately three students in five reported doing this at least once per week using computer-based information resources. About one quarter of the students used ICT in class on a weekly basis to create and edit documents (i.e., prepare reports and essays) using word processing and presentation software. Lower percentages of students indicating the use of applications using the potential of ICT to transform pedagogy (such as concept mapping software, simulations and modeling software, or digitally capturing real-world data). These findings may suggest that there remains a challenge to make use of the full potential of ICT in schools.

Table 5.19: National average scale scores indicating students' use of general ICT applications in class by gender group, study of ICT-related subject, and level of CIL

Country	Scale score average by gender group			Scale score average by ICT-related subject			Scale score average by level of CIL		
	Males		Females	Not studying ICT-related subject		Studying ICT-related subject	CIL below Level 2		CIL at or above Level 2
		12 8 4 0 4 8 12 			12 8 4 0 4 8 12 			12 8 4 0 4 8 12 	
Chile	51 (0.4)		51 (0.4)	48 (0.8)		**52** (0.3)	51 (0.4)		**52** (0.3)
Denmark† 1	60 (0.3)		60 (0.3)	60 (0.2)		60 (0.6)	57 (0.6)		**60** (0.2)
Finland	51 (0.3)		**52** (0.3)	51 (0.3)		**53** (0.3)	49 (0.4)		**53** (0.3)
France	49 (0.3)		**50** (0.2)	49 (0.5)		49 (0.3)	48 (0.4)		**50** (0.2)
Germany	**46** (0.4)		45 (0.3)	45 (0.3)		**48** (0.4)	44 (0.5)		**47** (0.3)
Italy²	46 (0.3)		47 (0.4)	45 (0.7)		**47** (0.3)	46 (0.4)		**47** (0.4)
Kazakhstan¹	53 (0.5)		53 (0.4)	49 (0.6)		**54** (0.4)	53 (0.4)		**55** (0.8)
Korea, Republic of	44 (0.4)		**46** (0.4)	44 (0.3)		**47** (0.5)	43 (0.5)		**45** (0.4)
Luxembourg	48 (0.1)		48 (0.2)	47 (0.2)		**49** (0.1)	47 (0.2)		**49** (0.2)
Portugal†† 1	49 (0.4)		49 (0.4)	45 (1.0)		**50** (0.3)	49 (0.5)		**50** (0.3)
Uruguay	49 (0.4)		**50** (0.5)	46 (2.7)		50 (0.4)	49 (0.5)		**51** (0.4)
ICILS 2018 average	50 (0.1)		**50** (0.1)	48 (0.3)		**51** (0.1)	49 (0.1)		**51** (0.1)
Not meeting sample participation requirements									
United States	52 (0.3)		**53** (0.3)	51 (0.3)		**54** (0.3)	51 (0.4)		**54** (0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	51 (0.3)		52 (0.4)	46 (1.4)		**52** (0.3)	50 (0.5)		**52** (0.3)
North Rhine-Westphalia (Germany)	45 (0.4)		44 (0.5)	43 (0.4)		**47** (0.7)	42 (0.6)		**46** (0.4)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.20: National average scale scores indicating students' use of specialist ICT applications in class by gender group, study of ICT-related subject, and level of CIL

Country	Scale score average by gender group			Scale score average by study of ICT-related subject			Scale score average by level of CIL		
	Males	12 8 4 0 4 8 12	Females	Not studying ICT-related subject	12 8 4 0 4 8 12	Studying ICT-related subject	CIL below Level 2	12 8 4 0 4 8 12	CIL at or above Level 2
Chile	52 (0.4)	☐	51 (0.4)	48 (0.6)	🟩	**52** (0.3)	**53** (0.4)	🟥	50 (0.3)
Denmark† 1	**51** (0.4)	🟥	49 (0.3)	50 (0.3)	🟩	**54** (0.8)	**54** (0.9)	🟥	49 (0.2)
Finland	**48** (0.3)	🟥	46 (0.2)	46 (0.2)	🟩	**50** (0.3)	47 (0.5)	☐	48 (0.2)
France	**51** (0.3)	🟥	49 (0.2)	49 (0.4)	🟩	**50** (0.2)	**52** (0.3)	🟥	49 (0.3)
Germany	**47** (0.4)	🟥	45 (0.2)	45 (0.2)	🟩	**48** (0.5)	**47** (0.6)	🟥	45 (0.2)
Italy²	51 (0.3)	☐	50 (0.3)	49 (0.7)	☐	50 (0.3)	**51** (0.4)	🟥	49 (0.3)
Kazakhstan¹	59 (0.5)	☐	58 (0.4)	55 (0.5)	🟩	**59** (0.4)	**59** (0.4)	🟥	56 (0.6)
Korea, Republic of	47 (0.4)	☐	47 (0.4)	46 (0.3)	🟩	**50** (0.5)	**49** (0.5)	🟥	47 (0.3)
Luxembourg	**48** (0.2)	🟥	46 (0.2)	46 (0.2)	🟩	**48** (0.2)	**50** (0.2)	🟥	45 (0.2)
Portugal†† 1	**50** (0.4)	🟥	48 (0.3)	46 (0.9)	🟩	**50** (0.3)	**52** (0.5)	🟥	48 (0.3)
Uruguay	53 (0.4)	☐	52 (0.4)	53 (4.3)	☐	52 (0.3)	**55** (0.4)	🟥	50 (0.5)
ICILS 2018 average	**51** (0.1)	🟥	49 (0.1)	48 (0.4)	🟩	**51** (0.1)	**52** (0.1)	🟥	49 (0.1)
Not meeting sample participation requirements									
United States	**53** (0.3)	🟥	52 (0.2)	51 (0.2)	🟩	**55** (0.3)	**55** (0.4)	🟥	52 (0.2)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	**51** (0.4)	🟥	50 (0.3)	47 (2.1)	☐	51 (0.3)	**53** (0.6)	🟥	50 (0.3)
North Rhine-Westphalia (Germany)	**46** (0.4)	🟥	44 (0.3)	43 (0.3)	🟩	**47** (0.6)	**46** (0.5)	🟥	44 (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Learning about ICT at school

At the beginning of this chapter, we noted that opportunity to learn referred to the time allocated for students to be taught the concepts being assessed and the curriculum content that was the focus of that time (Scheerens 2017). In ICILS 2018 the concepts being assessed were CIL and CT. Although it was not possible to measure the time allocated to teaching CIL and CT, because they were sometimes taught in several curriculum areas, it was possible to ask students to indicate the emphasis placed on learning about these two dimensions of ICT. In the student questionnaire we asked students to indicate the extent to which they had learned ("to a large extent," "to a moderate extent," "to a small extent," "not at all") how to do various ICT tasks.

Learning about CIL at school

The ICT tasks that we took as being concerned with CIL were:

- Provide references to internet sources;
- Search for information using ICT;
- Present information for a given audience or purpose using ICT;
- Work out whether to trust information from the internet;
- Decide what information obtained from the internet is relevant to include in school work;
- Organize information obtained from internet sources;
- Decide where to look for information on the internet about an unfamiliar topic; and
- Use ICT to collaborate with others.

We examined the percentages recording that they learned about CIL tasks to a large or moderate extent (Table 5.21). These data indicated small variations across the various tasks, ranging from 60 percent for "use ICT to collaborate with others" to 74 percent for "search for information using ICT." Overall, the results suggested that students learn about constituent components of CIL at school. The percentage of students was notably high in Denmark (for all tasks except "organize information obtained from internet sources"), Kazakhstan, Portugal, and Moscow (Russian Federation). The percentages were generally low in France, Luxembourg, and Germany.

In order to explore differences among groups of students in countries, in students' reported learning of CIL tasks, we derived a scale based on student responses to the eight aspects of CIL shown above. The scale had a reliability of 0.88 (Cronbach's alpha) on average across ICILS countries (the item map for this scale is shown in Figure F.10 in Appendix F). Higher scores on the scale indicate greater attribution to school-based CIL learning. The scale scores confirmed what we had observed in the frequency distributions for items. Students in Denmark, Kazakhstan, Portugal, and Moscow (Russian Federation), recorded notably high average scores on this scale. France, Germany, Luxembourg, and North Rhine-Westphalia (Germany) recorded notably low scores on this scale (Table 5.22). Differences between female and male students in the extent to which they attributed their CIL learning to school instruction were very small, being only one scale point in favor of female students, on average across countries, and being statistically significant (but less than two scale points) in five of the ICILS 2018 countries. In Chile and Finland, female students scored higher (by just under two scale points) than male students.

The differences in the CIL learning scale scores between students with five or more years of computer experience and those with less than five years of computer experience were significant and positive in six countries but were small (Table 5.23). The largest difference was three scale points for Korea. In Uruguay the direction of the difference was in the reverse direction. On average across countries, there was no difference associated with computer experience. Not surprisingly, the CIL learning scale scores were higher for students currently studying ICT subjects than for those who were not. This difference was significant and positive in eight ICILS 2018

Table 5.21: Percentages of students who reported having learned to a large or moderate extent about CIL at school

Country	Percentages of students who reported having learned at school to a large or moderate extent to:							
	Provide references to internet sources	Search for information using ICT	Present information for a given audience or purpose using ICT	Work out whether to trust information from the internet	Decide what information obtained from the internet is relevant to include in school work	Organize information obtained from internet sources	Decide where to look for information on the internet about an unfamiliar topic	Use ICT to collaborate with others
Chile	61 (1.5) ▽	74 (1.3)	64 (1.3) ▽	67 (1.2)	74 (1.1) △	72 (1.0) △	73 (1.1) △	60 (1.3)
Denmark† 1	85 (0.9) ▲	93 (0.5) ▲	86 (0.8) ▲	86 (0.9) ▲	87 (0.7) ▲	73 (1.1) △	79 (0.9) ▲	89 (0.9) ▲
Finland	64 (1.3) ▽	71 (1.2) ▽	64 (1.4)	72 (1.1) △	75 (1.0) △	66 (1.3)	71 (1.2) △	57 (1.3) ▽
France	50 (1.3) ▼	64 (1.1) ▼	47 (1.0) ▼	47 (1.2) ▼	48 (1.1) ▼	55 (1.1) ▼	57 (1.1) ▼	40 (1.1) ▼
Germany	56 (1.3) ▼	66 (1.3) ▽	63 (1.2) ▽	39 (1.2) ▼	46 (1.3) ▼	60 (1.3) ▽	46 (1.3) ▼	39 (1.4) ▼
Italy2	58 (1.3) ▽	70 (1.4) ▽	51 (1.2) ▼	64 (1.2)	66 (1.1)	66 (1.1) ▽	67 (1.0)	58 (1.3) ▽
Kazakhstan1	86 (0.8) ▲	88 (0.8) ▲	79 (1.0) ▲	81 (1.0) ▲	81 (1.1) ▲	80 (1.0) ▲	82 (0.8) ▲	80 (1.0) ▲
Korea, Republic of	78 (1.0) △	72 (1.1) ▽	66 (1.1)	70 (1.0) △	71 (1.1) △	71 (1.0) △	63 (1.2) ▽	52 (1.3) ▽
Luxembourg	58 (0.7) ▼	63 (0.7) ▼	61 (0.8) ▽	50 (0.7) ▼	50 (0.7) ▼	58 (0.6) ▼	58 (0.5) ▽	49 (0.7) ▼
Portugal†† 1	80 (0.9) ▲	87 (1.0) ▲	81 (1.1) ▲	79 (1.4) ▲	84 (1.0) ▲	83 (0.9) ▲	80 (1.0) ▲	79 (1.1) ▲
Uruguay	71 (1.3) △	70 (1.2) ▽	66 (1.2)	62 (1.2) ▽	66 (1.1) ▽	66 (1.1)	63 (1.5) ▽	61 (1.5)
ICILS 2018 average	68 (0.3)	74 (0.3)	66 (0.3)	65 (0.3)	68 (0.3)	68 (0.3)	67 (0.3)	60 (0.4)
Not meeting sample participation requirements								
United States	73 (0.8)	74 (0.8)	67 (1.0)	71 (0.8)	74 (0.8)	72 (0.7)	71 (0.7)	57 (1.1)
Benchmarking participants meeting sample participation requirements								
Moscow (Russian Federation)	72 (1.0) △	76 (1.0) △	71 (0.8) △	74 (1.0) △	77 (1.0) △	75 (1.0) △	76 (0.8) △	71 (1.3) ▲
North Rhine-Westphalia (Germany)	49 (1.4) ▼	62 (1.6) ▼	59 (1.8) ▽	38 (1.3) ▼	42 (1.3) ▼	56 (1.3) ▼	45 (1.4) ▼	38 (1.6) ▼

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

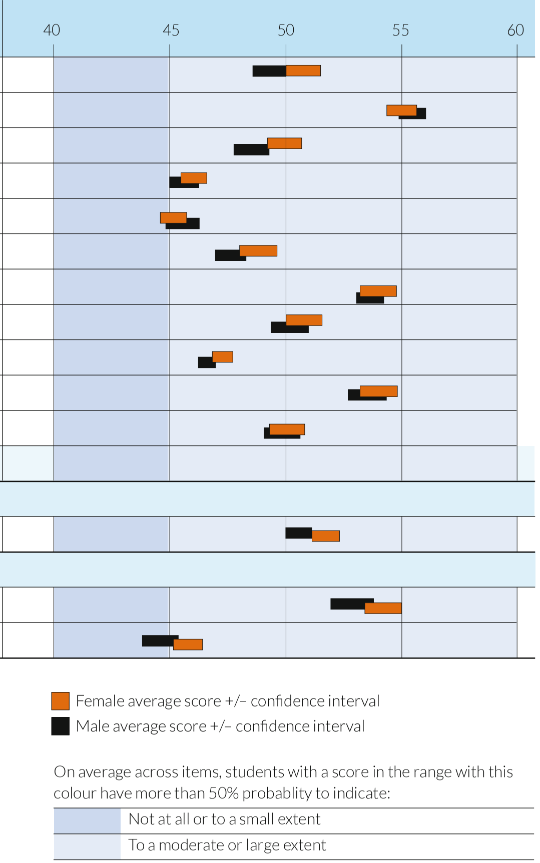
[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:

▲ More than 10 percentage points above average
△ Significantly above average
▽ Significantly below average
▼ More than 10 percentage points below average

Table 5.22: National average scale scores indicating students' learning of CIL tasks at school by country and gender group

Country	All students			Females		Males		Differences (females – males)	
Chile	50	(0.3)		51	(0.3)	49	(0.4)	**1.9**	(0.4)
Denmark[†] [1]	55	(0.2)	▲	55	(0.3)	55	(0.3)	–0.2	(0.3)
Finland	49	(0.2)	▽	50	(0.3)	48	(0.4)	**1.8**	(0.5)
France	46	(0.2)	▼	46	(0.2)	46	(0.3)	**0.9**	(0.3)
Germany	46	(0.3)	▼	46	(0.3)	45	(0.4)	0.3	(0.4)
Italy[2]	48	(0.2)	▽	49	(0.3)	47	(0.3)	**1.6**	(0.4)
Kazakhstan[1]	54	(0.3)	▲	54	(0.4)	53	(0.3)	0.7	(0.4)
Korea, Republic of	50	(0.3)		51	(0.4)	50	(0.4)	**1.3**	(0.5)
Luxembourg	47	(0.1)	▼	47	(0.2)	46	(0.2)	**1.1**	(0.3)
Portugal[††] [1]	54	(0.3)	▲	54	(0.4)	53	(0.4)	0.7	(0.5)
Uruguay	50	(0.3)		50	(0.4)	50	(0.4)	0.6	(0.5)
ICILS 2018 average	50	(0.1)		50	(0.1)	49	(0.1)	**1.0**	(0.1)
Not meeting sample participation requirements									
United States	51	(0.2)		52	(0.3)	51	(0.3)	**1.2**	(0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	54	(0.3)	▲	54	(0.4)	53	(0.5)	0.9	(0.7)
North Rhine-Westphalia (Germany)	45	(0.3)	▼	45	(0.4)	45	(0.4)	**0.9**	(0.4)



🟧 Female average score +/– confidence interval
■ Male average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Not at all or to a small extent
▨	To a moderate or large extent

National ICILS 2018 results are:
- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

Notes: Standard errors appear in parentheses. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Statistically significant differences ($p < 0.05$) between subgroups are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

countries and averaged two scale points overall. The difference was large in Portugal (six points) and Uruguay (six points). In Denmark the difference was in the opposite direction.

CIL learning at school scale scores were significantly higher for students with CIL scores at or above Level 2 than for students with CIL scores below Level 2 overall in eight ICILS 2018 countries as well as Moscow (Russian Federation) (Table 5.23). On average across ICILS 2018 countries the difference was two scale points and in Denmark the difference was four scale points. In Uruguay there was a small difference in the reverse direction.

Learning about CT at school

In the student questionnaire we asked students to indicate the extent to which they had learned how to do various CT-related tasks at school. The tasks were:

- Display information in different ways;
- Break a complex process into smaller parts;
- Understand diagrams that describe or show real-world problems;
- Plan tasks by setting out the steps needed to complete them;
- Use tools to make diagrams that help to solve problems;
- Use simulations to help understand or solve real-world problems;
- Make flow diagrams to show the different parts of a process;
- Record and evaluate data to understand and solve a problem; and
- Use real-world data to solve and revise solutions to problems.

We examined the percentages of students who reported having learned aspects of CT to a large or moderate extent (Table 5.24). These data indicated variations across the aspects of CT ranging from 45 percent for "make flow diagrams to show the different parts of a process" to 76 percent for "display information in different ways." Overall, the results suggested that students had learned about aspects of CT at school. However, there appeared to be larger differences among countries for learning about CT than had been the case for learning about CIL. The percentages of students were notably higher on average in Kazakhstan, Chile, and Uruguay as well as in Denmark on some aspects of CT. The percentages of students were also high in Moscow (Russian Federation). The percentages were generally low across these eight tasks in Luxembourg, Germany, North Rhine-Westphalia (Germany), as well as in France and Portugal on some aspects of CT.

In order to explore differences in countries and among groups of students in countries, in students' reported learning of CT-related tasks, we derived a scale based on student reports of learning about aspects of CT with an average Cronbach's alpha across countries of 0.90 (Figure F.11 in Appendix F shows the corresponding item map for this scale). Higher scores on the scale indicate greater attribution to school for learning about CT. The scale scores confirmed what we had observed in the frequency distributions for items. Students in Kazakhstan, Chile, and Uruguay, as well as Moscow (Russian Federation), recorded high average scores on this scale but Germany and Luxembourg recorded low scores on this scale (Table 5.25).

Table 5.23: National average scale scores indicating students' learning of CIL tasks at school by experience with computers, study of ICT-related subject, and level of CIL

Country	Scale score by students' experience with computers		Scale score average by study of ICT-related subject		Scale score average by level of CIL	
	Less than five years	Five years or more	Not studying ICT-related subject	Studying ICT-related subject	CIL below Level 2	CIL at or above Level 2
Chile	49 (0.3)	**51** (0.4)	48 (0.5)	**50** (0.3)	49 (0.3)	**51** (0.3)
Denmark† 1	55 (0.2)	**56** (0.3)	**56** (0.2)	54 (0.5)	52 (0.6)	**56** (0.2)
Finland	49 (0.4)	50 (0.3)	49 (0.3)	50 (0.4)	47 (0.5)	**50** (0.3)
France	46 (0.3)	**47** (0.3)	45 (0.4)	**46** (0.2)	45 (0.3)	**47** (0.3)
Germany	45 (0.4)	46 (0.4)	45 (0.3)	**46** (0.4)	45 (0.5)	46 (0.3)
Italy²	48 (0.3)	**49** (0.3)	45 (0.8)	**49** (0.2)	47 (0.3)	**49** (0.4)
Kazakhstan¹	53 (0.3)	**55** (0.5)	51 (0.6)	**54** (0.3)	53 (0.3)	**56** (0.6)
Korea, Republic of	49 (0.3)	**52** (0.4)	50 (0.3)	51 (0.5)	48 (0.4)	**51** (0.3)
Luxembourg	47 (0.2)	47 (0.3)	46 (0.2)	**48** (0.2)	46 (0.2)	**47** (0.2)
Portugal†† 1	54 (0.3)	54 (0.3)	48 (1.0)	**54** (0.3)	54 (0.4)	54 (0.3)
Uruguay	**51** (0.4)	49 (0.4)	44 (2.4)	**50** (0.3)	50 (0.5)	49 (0.4)
ICILS 2018 average	50 (0.1)	**50** (0.1)	48 (0.3)	**50** (0.1)	49 (0.1)	**51** (0.1)
Not meeting sample participation requirements						
United States	50 (0.2)	**53** (0.3)	51 (0.3)	**52** (0.3)	47 (0.3)	**53** (0.2)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	53 (0.5)	54 (0.3)	52 (2.3)	54 (0.3)	52 (0.7)	**54** (0.3)
North Rhine-Westphalia (Germany)	45 (0.4)	45 (0.5)	45 (0.4)	**46** (0.4)	45 (0.6)	45 (0.4)

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.24: Percentages of students reporting having learned to a large or moderate extent about aspects of CT at school

Country	Percentages of students who reported having learned to a large or moderate extent how:								
	To display information in different ways	To break a complex process into smaller parts	To understand diagrams that describe or show real-world problems	To plan tasks by setting out the steps needed to complete them	To use tools to make diagrams that help solve problems	To use simulations to help understand or solve real-world problems	To make flow diagrams to show the different parts of a process	To record and evaluate data to understand and solve a problem	To use real-world data to review and revise solutions to problems
Chile	82 (1.3) △	71 (1.2) ▲	73 (1.2) △	82 (1.1) ▲	67 (1.3) △	58 (1.3) ▲	57 (1.4) ▲	71 (1.4) ▲	72 (1.2) ▲
Denmark[†][1]	90 (0.7) ▼	63 (1.3) △	87 (0.8) ▲	79 (1.0) ▲	81 (1.0) ▲	47 (1.0)	39 (1.1) ▽	58 (1.2)	72 (1.2) ▲
Finland	84 (1.0) △	59 (1.3)	59 (1.4) ▽	61 (1.4) ▽	51 (1.5) ▽	35 (1.4) ▼	31 (1.4) ▼	55 (1.5) ▽	57 (1.2)
France	67 (1.1) ▽	39 (1.2) ▼	53 (1.1) ▼	52 (1.3) ▼	49 (1.3) ▽	44 (1.1) ▽	39 (1.5) ▽	53 (1.1) ▽	49 (1.1) ▽
Germany	70 (1.3) ▽	40 (1.3) ▼	63 (1.1)	46 (1.2) ▼	44 (1.3) ▼	31 (1.3) ▼	33 (1.3) ▼	46 (1.2) ▼	45 (1.5) ▼
Italy[2]	76 (1.1)	62 (1.1) △	65 (1.2)	60 (1.1) ▽	56 (1.2) ▽	52 (1.2) △	44 (1.2)	58 (1.1)	61 (1.2)
Kazakhstan[1]	92 (0.6) ▲	81 (0.9) ▲	83 (0.8) ▲	85 (0.9) ▲	82 (0.9) ▲	76 (1.2) ▲	77 (1.2) ▲	83 (1.0) ▲	82 (1.0) ▲
Korea, Republic of	69 (1.1) ▽	58 (1.3)	56 (1.1) ▽	62 (1.4) ▽	55 (1.2) ▽	44 (1.5) ▽	48 (1.5) △	53 (1.4) ▽	49 (1.3) ▽
Luxembourg	66 (0.8) ▼	48 (0.7) ▽	55 (0.7) ▽	52 (0.7) ▼	46 (0.7) ▼	42 (0.7) ▽	39 (0.7) ▽	48 (0.7) ▼	45 (0.6) ▼
Portugal[††][1]	58 (1.3) ▼	41 (1.2) ▼	45 (1.2) ▼	55 (1.3) ▽	44 (1.2) ▼	41 (1.2) ▽	31 (1.3) ▼	50 (1.4) ▽	49 (1.1) ▽
Uruguay	84 (1.0) △	72 (1.1) ▲	68 (1.6) △	76 (1.0) ▲	70 (1.1) ▲	62 (1.4) ▲	60 (1.7) ▲	71 (1.5) ▲	68 (1.5) △
ICILS 2018 average	76 (0.3)	57 (0.4)	64 (0.3)	64 (0.3)	59 (0.4)	48 (0.4)	45 (0.4)	59 (0.4)	59 (0.4)
Not meeting sample participation requirements									
United States	85 (0.7)	71 (0.6)	77 (0.6)	76 (0.7)	70 (0.7)	61 (0.9)	55 (0.9)	74 (0.7)	71 (0.8)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	85 (1.0) △	72 (1.3) ▲	77 (1.0) ▲	79 (1.0) ▲	73 (1.0) ▲	59 (1.4) ▲	55 (1.5) △	68 (1.5) △	73 (1.1) ▲
North Rhine-Westphalia (Germany)	67 (1.3) ▽	36 (1.2) ▼	63 (1.3)	44 (1.4) ▼	42 (1.6) ▼	31 (1.4) ▼	35 (1.4) ▽	47 (1.5) ▼	43 (1.4) ▼

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

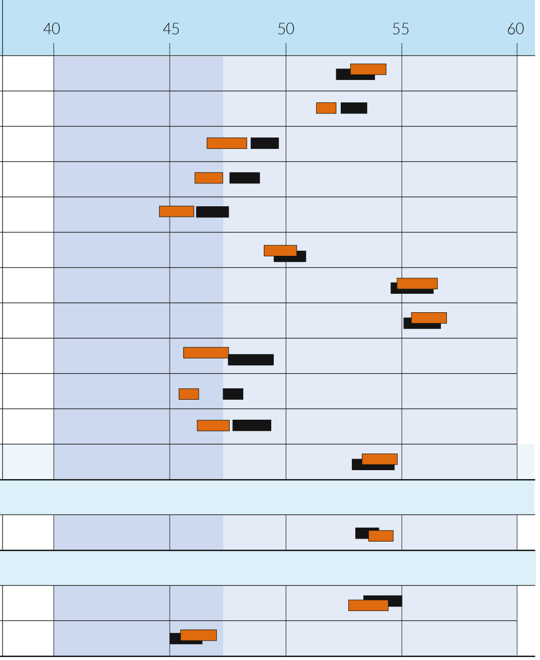
[2] Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:

- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

Table 5.25: National average scale scores indicating students' learning of CT-related tasks at school by country and gender group

Country	All students			Females		Males		Differences (females – males)	
Chile	53	(0.3)	▲	54	(0.4)	53	(0.4)	0.7	(0.5)
Denmark† 1	52	(0.2)	△	52	(0.2)	53	(0.3)	**-0.9**	(0.3)
Finland	48	(0.3)	▽	48	(0.4)	49	(0.3)	**-1.2**	(0.5)
France	48	(0.2)	▽	47	(0.3)	48	(0.3)	**-1.0**	(0.4)
Germany	46	(0.3)	▼	46	(0.4)	47	(0.3)	**-1.0**	(0.4)
Italy[2]	50	(0.3)		50	(0.3)	50	(0.3)	0.2	(0.4)
Kazakhstan[1]	56	(0.3)	▲	56	(0.3)	56	(0.3)	0.4	(0.4)
Korea, Republic of	48	(0.4)	▽	47	(0.4)	48	(0.5)	**-1.4**	(0.6)
Luxembourg	47	(0.1)	▼	46	(0.2)	48	(0.2)	**-1.3**	(0.3)
Portugal†† 1	48	(0.2)	▽	47	(0.3)	48	(0.4)	**-1.2**	(0.5)
Uruguay	54	(0.3)	▼	54	(0.4)	54	(0.4)	0.5	(0.5)
ICILS 2018 average	50	(0.1)		50	(0.1)	50	(0.1)	**-0.6**	(0.1)
Not meeting sample participation requirements									
United States	54	(0.2)		54	(0.2)	53	(0.2)	**0.8**	(0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	54	(0.3)	▲	54	(0.4)	54	(0.4)	-0.6	(0.4)
North Rhine-Westphalia (Germany)	46	(0.3)	▼	46	(0.4)	46	(0.3)	0.4	(0.4)



National ICILS 2018 results are:
- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

🟧 Female average score +/– confidence interval
⬛ Male average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Less than once a week
▨	At least once a week

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Statistically significant differences ($p < 0.05$) between subgroups are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Differences between female and male students in the extent to which they attributed their CT-related learning to school instruction were very small, being less than one scale point in favor of male students, on average across countries, and being statistically significant in seven ICILS 2018 countries (Table 5.25). Although the differences were small, the overall pattern of differences was the converse to that found for students' reports of learning CIL in which female students tended to report more than male students that they had learned about CIL in school (Table 5.22).

Students with five or more years of computer experience had significantly higher scale scores than those with less than five years of experience in just three ICILS 2018 countries (Italy, Kazakhstan, and Denmark). However, in North Rhine-Westphalia (Germany) there was a small difference in a negative direction (Table 5.26). The CT learning scale scores were higher for students currently studying ICT subjects than for those who were not. This difference was significant in all countries except Uruguay and averaged three scale points overall. Among ICILS 2018 countries the difference was largest in Portugal (four scale points); however, in Moscow (Russian Federation) the difference was six scale points.

Student perceptions of ICT

We investigated two main aspects of students' perceptions of ICT as part of the broad field of emotional engagement with ICT. The first aspect was students' perceptions of themselves in relation to ICT: ICT self-efficacy. We asked students to indicate how well they felt that they could accomplish various ICT tasks. Based on the results from ICILS 2013 (Fraillon et al. 2014) we formed two constructs from these tasks. The first referred to ICT self-efficacy in relation to common productivity applications (typically embodied in office applications) and the second referred to ICT self-efficacy in relation to specialist tasks (such as coding, database management, and webpage construction).

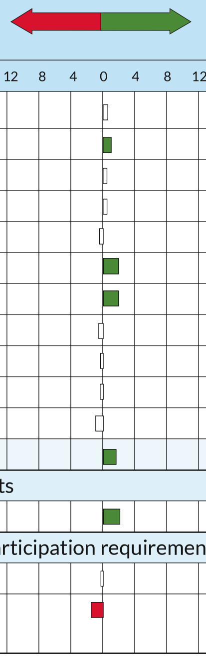
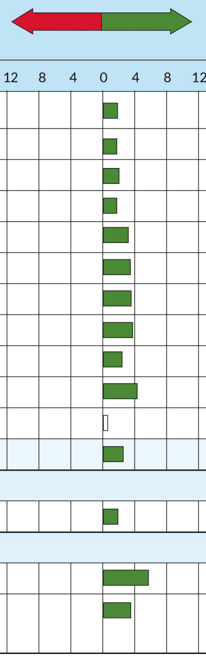
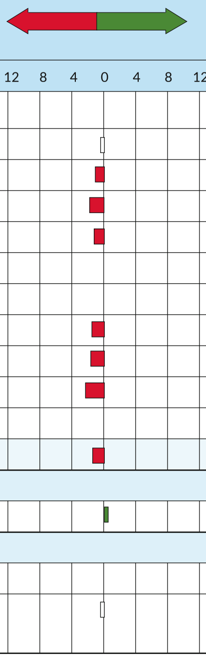
The second aspect of students' emotional engagement with ICT was their attitudes to ICT in their futures. We asked about the extent to which they saw aspects of ICT as beneficial for society, the extent to which they saw aspects of ICT as detrimental for society. Our conception of ICT societal futures envisaged these as separate dimensions rather than as simple polar opposites. According to this conception it was possible to envisage some aspects of ICT as beneficial for society and other aspects as detrimental to society. We also asked students about the extent to which they saw ICT as important for their personal futures.

ICT self-efficacy

The concept of self-efficacy refers to an individual's belief in their capacity to organize and execute a course of action to obtain specific outcomes (Bandura 1997). This, in turn, influences their choices with regard to undertaking tasks, the effort they expend on them, and the extent to which they persevere with a task. In ICILS 2013, we invoked two constructs that referenced ICT self-efficacy: *ICT self-efficacy regarding the use of general applications* and *ICT self-efficacy regarding the use of specialist applications*. In ICILS 2013 we referred to these constructs as *ICT self-efficacy in basic ICT skills* and *ICT self-efficacy in advanced ICT skills*. ICILS 2013 found that ICT self-efficacy in basic ICT skills, which was based on student confidence in undertaking general ICT-based tasks such as creating or editing documents, or searching and finding information on the internet, was positively associated with CIL. However, ICT self-efficacy in advanced ICT skills, which was based on student confidence to carry out tasks such as building or editing a webpage, or creating a computer program or macro, was not associated with CIL (Fraillon et al. 2014; Rohatgi et al. 2016).

As part of the ICILS 2018 student questionnaire we asked students to indicate how well they thought they could do each of 13 ICT-based tasks. The response categories were "I know how to do this," "I have never done this but I could work out how to do this," and "I do not think I could do this." For the purposes of analyses at the item level, we collapsed the second and third

Table 5.26: National average scale scores indicating students' learning of CT-related tasks at school by experience with computers, study of ICT-related subject, and level of CT

Country	Scale score by students' experience with computers			Scale score average by study of ICT-related subject			Scale score average by level of CT		
	Less than five years		Five years or more	Not studying ICT-related subject		Studying ICT-related subject	CT below ICILS 2018 average (500)		CT at or above ICILS 2018 average (500)
		12 8 4 0 4 8 12			12 8 4 0 4 8 12			12 8 4 0 4 8 12	
Chile	53 (0.4)		53 (0.3)	52 (0.8)		**53** (0.3)	–		–
Denmark† 1	52 (0.2)		**53** (0.2)	52 (0.2)		**54** (0.6)	53 (0.3)		52 (0.2)
Finland	48 (0.4)		49 (0.3)	48 (0.3)		**50** (0.3)	**49** (0.4)		48 (0.3)
France	47 (0.3)		48 (0.3)	46 (0.5)		**48** (0.3)	**49** (0.4)		47 (0.3)
Germany	46 (0.3)		46 (0.5)	45 (0.3)		**48** (0.3)	**47** (0.4)		46 (0.3)
Italy²	49 (0.3)		**51** (0.3)	47 (0.9)		**50** (0.3)	–		–
Kazakhstan¹	55 (0.3)		**57** (0.5)	53 (0.7)		**56** (0.3)	–		–
Korea, Republic of	48 (0.4)		47 (0.5)	47 (0.4)		**50** (0.6)	**49** (0.5)		47 (0.4)
Luxembourg	47 (0.2)		47 (0.2)	46 (0.2)		**48** (0.2)	**47** (0.2)		46 (0.2)
Portugal†† 1	48 (0.3)		48 (0.3)	44 (0.7)		**48** (0.2)	**49** (0.3)		47 (0.3)
Uruguay	54 (0.4)		53 (0.5)	54 (2.8)		54 (0.3)	–		–
ICILS 2018 average	50 (0.1)		**50** (0.1)	48 (0.3)		**51** (0.1)	**49** (0.1)		47 (0.1))
Not meeting sample participation requirements									
United States	53 (0.2)		**55** (0.2)	53 (0.2)		**55** (0.2)	53 (0.2)		**54** (0.2)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	54 (0.4)		54 (0.4)	48 (2.0)		**54** (0.3)	–		–
North Rhine-Westphalia (Germany)	**47** (0.3)		45 (0.5)	45 (0.3)		**48** (0.5)	47 (0.5)		45 (0.4)

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$
☐ Difference between comparison groups not statistically significant at $p < 0.05$

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

categories and gave the first category a score of one and the second a score of zero.

The tasks listed were (in order of increasing difficulty):

- Search for and find relevant information for a school project on the internet;
- Insert an image into a document or message;
- Install a program or app;
- Write or edit text for a school assignment;
- Upload text, images, or video to an online profile;
- Edit digital photographs or other graphic images;
- Judge whether you can trust information you find on the internet;
- Create a multimedia presentation (with sound, pictures, or video);
- Change the settings on your device to improve the way it operates;
- Set up a local area network of computers or other ICT;
- Build or edit a webpage;
- Create a database (e.g., using Microsoft Access®); and
- Create a computer program, macro, or app (e.g., in Basic, Visual Basic).

The percentages of students who reported that they knew how to do these tasks by themselves, which reflect how difficult students perceived each task to be, ranged from 18 percent ("create a computer program or macro") to 88 percent ("search for and find information you need on the internet") (Table 5.27). There were also differences among countries. More than nine out of 10 students in Denmark indicated that they could search for and find relevant information for a school project on the internet (95%), write or edit text for a school assignment (94%), and insert an image into a document or message (94%).

We formed two scales based on these items in order to explore across-country and other differences in students' ICT self-efficacy. One of those scales (based on eight items) reflected *students' ICT self-efficacy regarding the use of general applications* (coefficient alpha = 0.83). The other (based on four items) was related to *students' ICT self-efficacy regarding the use of specialist applications*[23] (coefficient alpha = 0.73). (The corresponding item maps are shown in Figures 6.11 and F.13 in Appendix F.)

There were only small differences among countries on these scales, although the mean score on the ICT self-efficacy (general applications) scale for Kazakhstan was low (45) and for Portugal was high (53) (Table 5.28). Interestingly, the mean score on the ICT self-efficacy (specialist applications) scale for Kazakhstan was high (53) and the mean score for Denmark was low (47).

Statistically significant gender differences in ICT self-efficacy (general applications), favoring female students, emerged in Korea, Chile, and Kazakhstan. However, on average, there was little difference in the ICT self-efficacy (general applications) scores of female and male students (Table 5.29). The scores for female students were, on average, two scale points higher than those for male students. There were significant differences in ICT self-efficacy (general applications) associated with computer experience in every country and overall by three scale points in favor of those who had been using a computer for five or more years compared with those who had less than five years of experience.

There was a substantial difference in ICT self-efficacy (general applications) between those with CIL scores at or above Level 2 and those with CIL scores below Level 2. On average students with high CIL scores had ICT self-efficacy regarding the use of general applications that was five

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[23] One of the items (change the settings on your device to improve the way it operates) was not used in calculating scale scores because it did not fit with either of the ICT self-efficacy scales.

Table 5.27: Percentages of students who indicated that they knew how to use ICT for specified tasks

Country	Percentages of students who indicated they knew how to:												
	Edit digital photographs or other graphic images	Create a database (e.g., using [Microsoft Access ®])	Write or edit text for a school assignment	Search for and find relevant information for a school project on the internet	Build or edit a webpage	Change the settings on your device to improve the way it operates	Create a computer program, macro, or [app] (e.g., in [Basic, Visual Basic])	Set up a local area network of computers or other ICT	Create a multimedia presentation (with sound, pictures, or video)	Upload text, images, or video to an online profile	Insert an image into a document or message	Install a program or [app]	Judge whether you can trust information you find on the internet
Chile	74 (1.2) △	36 (1.6) △	87 (1.0) △	87 (1.0) △	28 (1.8)	62 (1.0) △	16 (1.0) ▽	31 (1.2) ▽	67 (1.4) △	80 (1.3) △	84 (1.1)	83 (1.3)	72 (1.6) △
Denmark† ¹	67 (1.1) ▽	13 (0.7) ▼	94 (0.6) ▲	95 (0.6) ▲	26 (1.4) ▽	52 (1.1) ▽	12 (0.8) ▽	26 (1.1) ▽	57 (1.1) ▽	80 (0.8) △	94 (0.7) ▲	91 (0.7) △	80 (1.2) ▲
Finland	71 (1.0)	17 (0.9) ▽	91 (0.7) △	93 (0.6) △	24 (1.0) ▽	72 (1.0) ▲	10 (0.7) ▽	37 (1.1)	61 (1.1)	73 (1.1) ▽	83 (1.1)	87 (0.8) △	86 (0.9) ▲
France	72 (0.9)	41 (1.0) ▲	86 (0.9) △	85 (0.9) △	29 (0.8)	61 (0.9) △	18 (1.0)	29 (1.0) ▽	56 (1.1) ▽	67 (1.0) ▽	86 (0.9) △	83 (1.0)	65 (1.0) ▽
Germany	77 (1.1) △	14 (1.0) ▼	83 (0.9)	83 (0.8)	23 (1.1) ▽	59 (1.2)	15 (1.0) ▽	41 (1.0) △	51 (1.3) ▽	78 (1.2) △	82 (1.0)	86 (1.1) △	54 (1.2) ▼
Italy²	79 (0.9) △	19 (0.9) ▽	72 (0.9) ▽	82 (0.9)	28 (1.1)	62 (1.0) △	17 (0.9)	38 (1.0) △	67 (1.1) △	72 (0.8) ▽	80 (0.9) ▽	86 (0.8) △	72 (0.9) △
Kazakhstan¹	62 (1.3) ▽	43 (1.3) ▲	67 (1.3) ▼	71 (1.3) ▼	43 (1.0) ▲	54 (1.1) ▽	30 (1.2) ▲	45 (1.2) △	57 (1.4) ▽	65 (1.2) ▼	66 (1.2) ▼	59 (1.4) ▼	57 (1.3) ▼
Korea, Republic of	54 (1.1) ▼	15 (0.8) ▼	72 (1.3) ▽	80 (1.1) ▽	24 (1.1) ▽	51 (1.2) ▽	16 (0.8) ▽	41 (1.1) △	58 (1.3) ▽	77 (1.1)	80 (1.1)	80 (1.2)	62 (1.2) ▽
Luxembourg	71 (0.6)	26 (0.8)	78 (0.6) ▽	79 (0.6) ▽	31 (0.6) △	59 (0.8)	21 (0.6) △	37 (0.6) △	56 (0.6) ▽	71 (0.6) ▽	79 (0.7) ▽	78 (0.7) ▽	59 (0.7) ▽
Portugal†† ¹	82 (1.0) ▲	32 (1.0) △	91 (0.7) △	86 (0.7) △	29 (1.2)	55 (1.2) ▽	16 (0.8) ▽	32 (1.2) ▽	71 (1.2) ▲	82 (1.1) △	89 (0.8) △	86 (0.9) △	73 (1.1) △
Uruguay	80 (1.0) △	28 (1.4)	77 (1.1) ▽	74 (1.2) ▽	41 (1.4) ▲	60 (1.4)	21 (1.0) △	30 (1.4) ▽	70 (1.5) △	80 (1.0) △	82 (1.0)	81 (1.3)	67 (1.3)
ICILS 2018 average	72 (0.3)	26 (0.3)	82 (0.3)	83 (0.3)	30 (0.4)	59 (0.3)	18 (0.3)	35 (0.3)	61 (0.4)	75 (0.3)	82 (0.3)	82 (0.3)	68 (0.3)
Not meeting sample participation requirements													
United States	65 (0.7)	23 (0.9)	86 (0.6)	86 (0.5)	30 (1.1)	76 (0.7)	20 (0.7)	17 (0.6)	66 (0.8)	83 (0.5)	88 (0.5)	83 (0.6)	78 (0.8)
Benchmarking participants meeting sample participation requirements													
Moscow (Russian Federation)	72 (1.0)	26 (1.3)	81 (0.8)	89 (0.7) △	31 (1.0)	65 (1.1) △	20 (0.9) △	39 (1.4) △	62 (1.1)	82 (0.9) △	88 (0.8) △	85 (0.7) △	68 (1.3)
North Rhine-Westphalia (Germany)	73 (1.2) △	15 (1.1) ▼	82 (1.1)	81 (1.2) ▽	22 (1.2) ▽	58 (1.3) ▽	13 (0.8) ▽	40 (1.2) △	45 (1.4) ▼	80 (1.1) △	79 (1.2) ▽	84 (0.9) △	53 (1.4) ▼

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

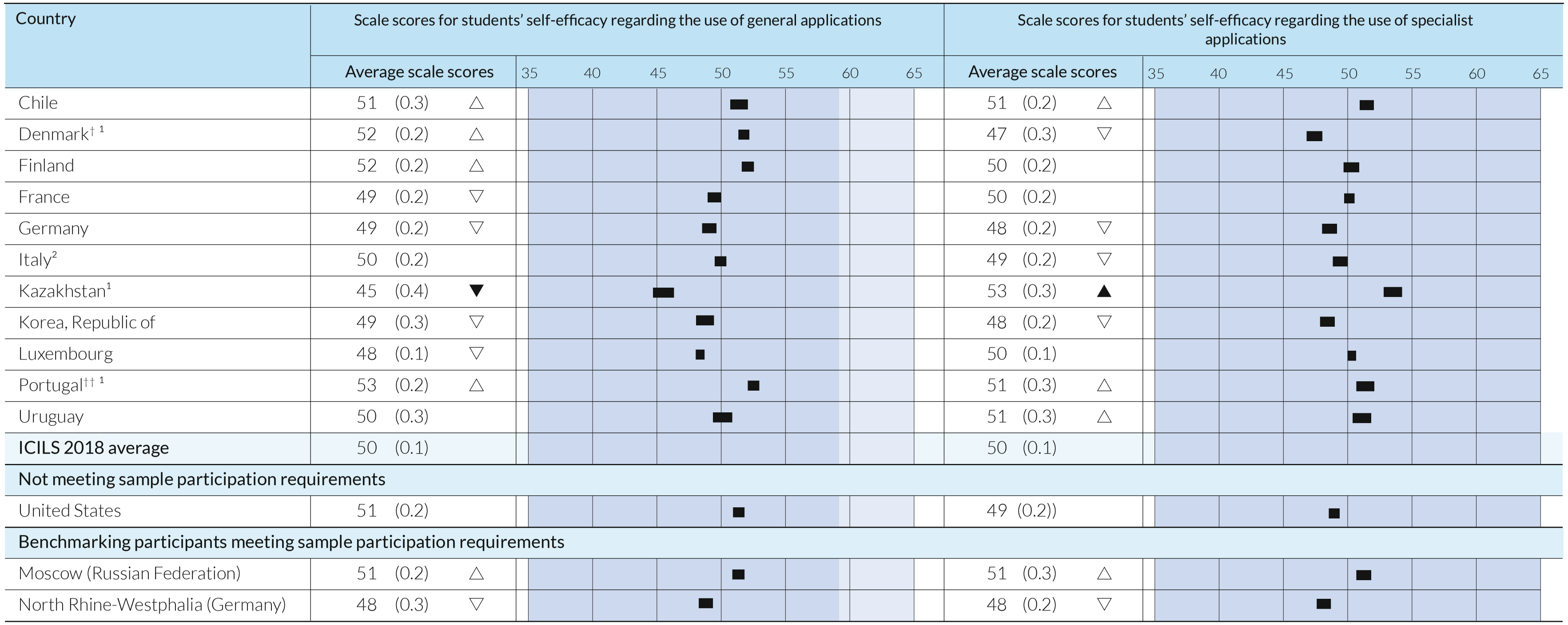
¹ National defined population covers 90% to 95% of the national target population.

² Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:

- ▲ More than 10 percentage points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than 10 percentage points below average

Table 5.28: *National average scale scores for students' ICT self-efficacy regarding the use of general applications and the use of specialist applications*



Country	Scale scores for students' self-efficacy regarding the use of general applications			Scale scores for students' self-efficacy regarding the use of specialist applications		
	Average scale scores			Average scale scores		
Chile	51	(0.3)	△	51	(0.2)	△
Denmark† 1	52	(0.2)	△	47	(0.3)	▽
Finland	52	(0.2)	△	50	(0.2)	
France	49	(0.2)	▽	50	(0.2)	
Germany	49	(0.2)	▽	48	(0.2)	▽
Italy²	50	(0.2)		49	(0.2)	▽
Kazakhstan¹	45	(0.4)	▼	53	(0.3)	▲
Korea, Republic of	49	(0.3)	▽	48	(0.2)	▽
Luxembourg	48	(0.1)	▽	50	(0.1)	
Portugal†† 1	53	(0.2)	△	51	(0.3)	△
Uruguay	50	(0.3)		51	(0.3)	△
ICILS 2018 average	50	(0.1)		50	(0.1)	
Not meeting sample participation requirements						
United States	51	(0.2)		49	(0.2))	
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	51	(0.2)	△	51	(0.3)	△
North Rhine-Westphalia (Germany)	48	(0.3)	▽	48	(0.2)	▽

National ICILS 2018 results are:

- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

■ Average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Never done this
░	Know how to do this

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.29: National average scale scores indicating students' ICT self-efficacy regarding the use of general applications by gender group, experience with computers, and level of CIL

Country	Scale score average by gender group			Scale score by students' experience with computers			Scale score average by level of CIL		
	Males		Females	Less than five years		Five years or more	CIL below Level 2		CIL at or above Level 2
		12 8 4 0 4 8 12			12 8 4 0 4 8 12			12 8 4 0 4 8 12	
Chile	51 (0.4)	🟩	**52** (0.3)	50 (0.4)	🟩	**54** (0.4)	49 (0.4)	🟩	**54** (0.4)
Denmark† 1	52 (0.3)	☐	52 (0.3)	51 (0.3)	🟩	**53** (0.2)	47 (0.6)	🟩	**53** (0.2)
Finland	52 (0.2)	☐	52 (0.3)	50 (0.4)	🟩	**53** (0.3)	48 (0.5)	🟩	**54** (0.2)
France	49 (0.3)	☐	49 (0.3)	49 (0.3)	🟩	**51** (0.3)	47 (0.3)	🟩	**51** (0.3)
Germany	49 (0.4)	☐	49 (0.3)	49 (0.3)	🟩	**50** (0.4)	46 (0.5)	🟩	**50** (0.3)
Males	50 (0.3)	☐	50 (0.3)	49 (0.3)	🟩	**52** (0.3)	48 (0.3)	🟩	**53** (0.3)
Kazakhstan[1]	45 (0.5)	🟩	**46** (0.4)	44 (0.4)	🟩	**49** (0.5)	44 (0.4)	🟩	**52** (0.6)
Korea, Republic of	47 (0.4)	🟩	**51** (0.3)	47 (0.4)	🟩	**51** (0.3)	42 (0.5)	🟩	**51** (0.2)
Luxembourg	48 (0.2)	☐	48 (0.2)	48 (0.2)	🟩	**50** (0.2)	46 (0.2)	🟩	**51** (0.2)
Portugal†† 1	53 (0.3)	☐	52 (0.3)	51 (0.4)	🟩	**54** (0.3)	51 (0.5)	🟩	**54** (0.2)
Uruguay	50 (0.4)	☐	51 (0.4)	49 (0.4)	🟩	**52** (0.4)	48 (0.4)	🟩	**53** (0.3)
ICILS 2018 average	50 (0.1)	🟩	**50** (0.1)	49 (0.1)	🟩	**52** (0.1)	47 (0.1)	🟩	**52** (0.1)
Not meeting sample participation requirements									
United States	51 (0.2)	🟩	**52** (0.2)	50 (0.2)	🟩	**53** (0.2)	47 (0.3)	🟩	**53** (0.1)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	51 (0.3)	☐	51 (0.3)	49 (0.4)	🟩	**52** (0.2)	46 (0.8)	🟩	**52** (0.3)
North Rhine-Westphalia (Germany)	48 (0.4)	☐	48 (0.3)	48 (0.5)	🟩	**50** (0.5)	46 (0.5)	🟩	**50** (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

scale score points higher than among students with low CIL scores (Table 5.29). The difference was nine scale points in Korea.

There were significant gender differences in ICT self-efficacy regarding the use of specialist applications favoring male students in all countries. On average the difference was four scale points (Table 5.30). The gap was large in Denmark (eight points), Germany, and North Rhine-Westphalia (Germany) (both six points).

The differences associated with computer experience were much more closely aligned to what we expected. The ICT self-efficacy (specialist applications) scores of students with five or more years of computer experience were, on average across countries, two points higher than the ICT self-efficacy (specialist applications) scores of students with less than five years of computer experience (Table 5.30). The difference was largest in Germany, North Rhine-Westphalia (Germany), Luxembourg, and Italy (three points).

There was little systematic difference between the ICT self-efficacy (specialist applications) scores of students and their CIL score. Those with CIL scores at or above Level 2 had higher specialist ICT self-efficacy scores than those with CIL scores below Level 2 in two countries, but the reverse was observed in six countries and there was no significant difference in five countries.

Attitudes to ICT in society

We asked students to indicate their attitudes to the value of ICT in society. We presented them with a set of 11 statements that balanced positive and negative views of ICT (Table 5.31). Students responded to these items using four response categories ("strongly agree" to "strongly disagree"). We reported the percentage agreement for each item by combining the percentages who strongly agreed or agreed with the statement.

There were high percentages who expressed agreement with statements referring to positive outcomes of ICT for society such as "ICT helps us to understand the world better" (86%), "advances in ICT usually improve people's living conditions" (85%), "ICT is valuable to society" (84%), and "advances in ICT bring many social benefits" (83%). On the other hand there were moderately high percentages who expressed reservations by recording agreements with statements referring to negative outcomes of ICT for society such as "people spend far too much time using ICT" (80%), "using ICT may be dangerous for people's health" (69%), "using ICT makes people more isolated in society" (66%), and "with more ICT there will be fewer jobs" (52%).

There were also three items that were concerned with expectations of future ICT use for work and study: "learning how to use ICT applications will help me to do the work I am interested in" (68%), "I hope to find a job that involves specialist ICT" (51%), and "I would like to study subjects related to ICT after secondary school" (49%).

We did not observe large differences among countries and constructed three scales representing: perceptions of positive outcomes of ICT for society (average coefficient alpha = 0.75); perceptions of negative outcomes of ICT for society (average coefficient alpha = 0.66); and, to explore differences among countries and subgroups, expectations of future ICT use for work and study (coefficient alpha = 0.80) (see Figures F.14, F.15, and F.17 in Appendix F for corresponding items maps).

We observed stronger support for positive outcomes of ICT for society in Korea, Portugal, and Moscow (Russian Federation) and less strong support for positive outcomes of ICT for society in Luxembourg (Table 5.32). We also observed stronger support for negative outcomes of ICT for society in Chile and Uruguay and less strong support for negative outcomes of ICT for society in Finland, Denmark, and Moscow (Russian Federation).

Stronger support for positive outcomes of ICT for society was expressed by male than by female

Table 5.30: National average scale scores indicating students' ICT self-efficacy regarding the use of specialist applications by gender group, experience with computers, and students' level of CIL

Country	Scale score average by gender group		Scale score by students' experience with computers		Scale score average by level of CIL	
	Males	Females	Less than five years	Five years or more	CIL below Level 2	CIL at or above Level 2
Chile	**52** (0.3)	51 (0.3)	51 (0.3)	**52** (0.4)	52 (0.4)	51 (0.3)
Denmark† ¹	**51** (0.3)	43 (0.4)	46 (0.3)	**48** (0.3)	48 (0.7)	47 (0.3)
Finland	**52** (0.3)	48 (0.3)	49 (0.4)	**51** (0.3)	**51** (0.4)	50 (0.2)
France	**52** (0.2)	48 (0.3)	49 (0.3)	**51** (0.3)	**51** (0.4)	49 (0.3)
Germany	**51** (0.3)	45 (0.3)	47 (0.3)	**50** (0.4)	**50** (0.5)	48 (0.3)
Italy²	**51** (0.3)	48 (0.3)	48 (0.3)	**51** (0.3)	49 (0.3)	49 (0.4)
Kazakhstan¹	**54** (0.3)	53 (0.3)	53 (0.4)	**54** (0.4)	53 (0.3)	**55** (0.6)
Korea, Republic of	**49** (0.4)	47 (0.3)	47 (0.4)	**49** (0.3)	47 (0.5)	**49** (0.3)
Luxembourg	**52** (0.2)	48 (0.2)	49 (0.2)	**52** (0.2)	**51** (0.2)	49 (0.2)
Portugal†† ¹	**53** (0.3)	50 (0.4)	50 (0.4)	**52** (0.3)	**53** (0.5)	50 (0.3)
Uruguay	**52** (0.4)	50 (0.4)	51 (0.3)	51 (0.5)	**52** (0.4)	50 (0.4)
ICILS 2018 average	**52** (0.1)	48 (0.1)	49 (0.1)	**51** (0.1)	**51** (0.1)	50 (0.1)
Not meeting sample participation requirements						
United States	**50** (0.3)	48 (0.2)	48 (0.2)	**50** (0.2)	49 (0.4)	49 (0.2)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	**53** (0.4)	50 (0.3)	50 (0.4)	**52** (0.3)	51 (0.7)	51 (0.3)
North Rhine-Westphalia (Germany)	**51** (0.3)	45 (0.4)	47 (0.3)	**50** (0.4)	49 (0.5)	48 (0.3)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

¹ National defined population covers 90% to 95% of the national target population.

² Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Table 5.31: Percentages of students who strongly agreed or agreed with statements about ICT in society

Country	Percentages of students who strongly agreed or agreed that:										
	Advances in ICT usually improve people's living conditions	ICT helps us to understand the world better	Using ICT makes people more isolated in society	With more ICT there will be fewer jobs	People spend far too much time using ICT	ICT is valuable to society	Advances in ICT bring many social benefits	Using ICT may be dangerous for people's health	I would like to study subjects related to ICT after [secondary school]	I hope to find a job that involves advanced ICT	Learning how to use ICT applications will help me to do the work I am interested in
Chile	87 (0.7) △	84 (1.4)	76 (1.1) ▲	52 (1.2)	89 (0.8) △	82 (1.1) ▽	81 (1.0)	72 (1.1) △	53 (1.7) △	58 (1.3) △	75 (1.0) △
Denmark† 1	78 (1.2) ▽	87 (0.7) △	68 (1.2)	54 (1.2) △	67 (1.0) ▼	87 (1.0) △	78 (1.4) ▽	60 (1.2) ▽	32 (1.2) ▼	29 (1.1) ▼	57 (1.1) ▼
Finland	85 (0.9)	92 (0.7) △	60 (1.2) ▽	43 (1.2) ▽	68 (1.0) ▼	88 (0.9) △	88 (0.9) △	65 (1.0) ▽	41 (1.3) ▽	45 (1.2) ▽	64 (1.1) ▽
France	83 (0.8) ▽	81 (0.9) ▽	66 (1.0)	49 (1.2) ▽	81 (0.9)	82 (0.9) ▽	87 (0.8) △	70 (0.9)	46 (1.1) ▽	39 (1.1) ▼	58 (0.9) ▽
Germany	84 (0.8)	82 (0.9) ▽	65 (1.1)	47 (1.1) ▽	83 (0.9) △	72 (1.2) ▼	74 (1.1) ▽	67 (1.3)	33 (1.2) ▼	56 (1.2) △	49 (1.0) ▼
Italy²	85 (0.8)	85 (0.7)	70 (0.9) △	51 (1.0)	81 (0.7)	82 (0.9)	78 (0.8) ▽	72 (1.0) △	59 (1.1) ▲	62 (1.1) ▲	71 (1.0) △
Kazakhstan¹	86 (0.8)	86 (0.7)	66 (1.0)	53 (1.1)	73 (0.9) ▽	87 (1.0) △	86 (0.8) △	64 (1.0) ▽	66 (1.3) ▲	67 (1.2) ▲	81 (0.9) ▲
Korea, Republic of	95 (0.5) △	95 (0.5) △	56 (1.0) ▽	65 (1.2) ▲	91 (0.7) ▲	94 (0.6) △	90 (0.7) △	88 (0.7) ▲	56 (1.2) △	41 (1.3) ▼	73 (0.9) △
Luxembourg	78 (0.6) ▽	80 (0.6) ▽	66 (0.6)	51 (0.8)	80 (0.7)	73 (0.7) ▼	76 (0.6) ▽	70 (0.7)	44 (0.6) ▽	48 (0.8) ▽	55 (0.8) ▼
Portugal†† 1	94 (0.5) △	91 (0.8) △	64 (1.3)	42 (1.2) ▼	85 (0.8) △	91 (0.6) △	89 (0.6) △	68 (1.2)	52 (1.0) △	55 (1.4) △	88 (0.8) ▲
Uruguay	84 (0.9)	79 (1.1) ▽	66 (1.5)	62 (1.4) △	83 (1.0) △	86 (1.2)	82 (0.9)	67 (1.4) ▽	60 (1.4) ▲	63 (1.4) ▲	75 (1.3) △
ICILS 2018 average	85 (0.2)	86 (0.3)	66 (0.3)	52 (0.3)	80 (0.3)	84 (0.3)	83 (0.3)	69 (0.3)	49 (0.4)	51 (0.4)	68 (0.3)
Not meeting sample participation requirements											
United States	82 (0.6)	86 (0.5)	60 (0.6)	42 (0.7)	71 (0.7)	86 (0.5)	80 (0.6)	62 (0.6)	48 (0.9)	48 (0.8)	72 (0.7)
Benchmarking participants meeting sample participation requirements											
Moscow (Russian Federation)	92 (0.5) △	85 (0.8)	55 (1.0) ▼	60 (1.2) △	70 (1.2) q	90 (1.0) △	90 (0.9) △	64 (1.1) ▽	59 (1.3) ▲	49 (1.3)	82 (0.7) ▲
North Rhine-Westphalia (Germany)	82 (1.1) ▽	78 (1.1) ▽	64 (1.3)	43 (1.4) ▽	81 (1.3)	69 (1.5) ▼	74 (1.3) ▽	65 (1.1) ▽	34 (1.1) ▼	51 (1.2)	46 (1.4) ▼

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

¹ National defined population covers 90% to 95% of the national target population.

² Country surveyed target grade in the first half of the school year.

National ICILS 2018 results are:

▲ More than 10 percentage points above average

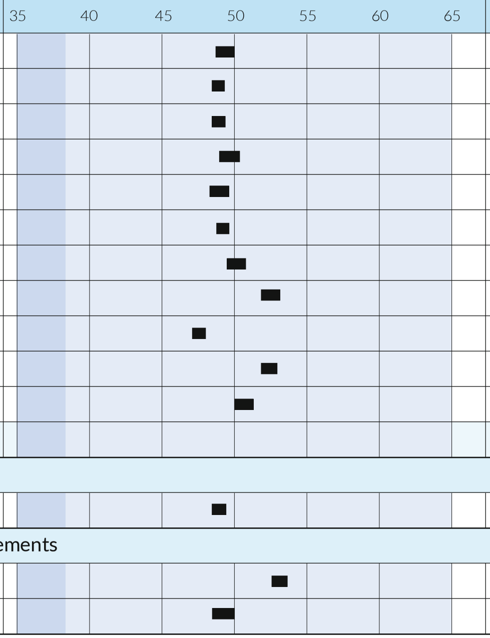
△ Significantly above average

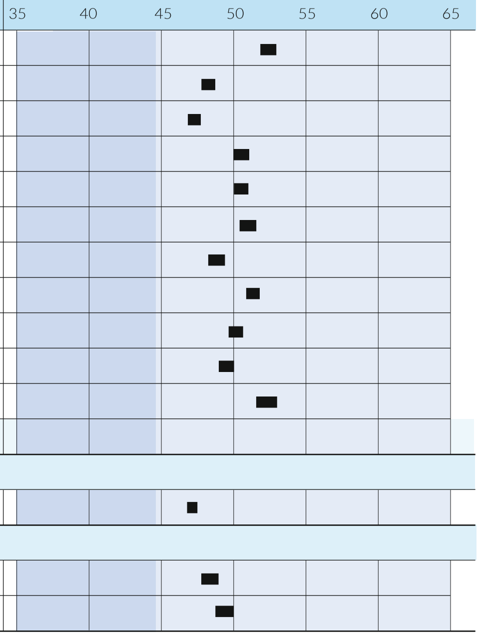
▽ Significantly below average

▼ More than 10 percentage points below average

Table 5.32: National average scale scores for students' perceptions of positive outcomes of ICT for society and students' perceptions of negative outcomes of ICT for society

Country	Scale scores for students' perceptions of positive outcomes of ICT for society			Scale scores for students' perceptions of negative outcomes of ICT for society		
	Average scale scores			Average scale scores		
Chile	49	(0.3)		52	(0.2)	△
Denmark† 1	49	(0.2)	▽	48	(0.2)	▽
Finland	49	(0.2)	▽	47	(0.2)	▽
France	50	(0.3)		50	(0.3)	
Germany	49	(0.3)	▽	50	(0.3)	
Italy²	49	(0.2)	▽	51	(0.2)	△
Kazakhstan¹	50	(0.3)		49	(0.2)	▽
Korea, Republic of	53	(0.3)	△	51	(0.2)	△
Luxembourg	48	(0.1)	▽	50	(0.2)	
Portugal†† 1	53	(0.2)	△	49	(0.2)	▽
Uruguay	51	(0.3)	△	52	(0.3)	△
ICILS 2018 average	50	(0.1)		50	(0.1)	
Not meeting sample participation requirements						
United States	49	(0.2)		47	(0.1)	
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	53	(0.3)	△	48	(0.2)	
North Rhine-Westphalia (Germany)	49	(0.3)		49	(0.3)	





National ICILS 2018 results are:
- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

■ Average score +/– confidence interval

On average across items, students with a score in the range with this colour have more than 50% probablity to indicate:

▨	Disagreement
▭	Agreement

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

students in all countries (Table 5.33). On average across ICILS 2018 countries, the difference was three scale points, but in Germany, North Rhine-Westphalia (Germany), and Denmark the difference was six scale points.

Students with five or more years of computer experience expressed significantly more strongly positive views of ICT for society than students with less than five years of computer experience, in all countries (Table 5.33). On average across countries, the difference was two scale points. More positive views of ICT for society were expressed by students with CIL scores at Level 2 or above in just five ICILS 2018 countries, and the average difference was two scale points.

More strongly negative views of ICT for society were expressed by female students than by male students in eight ICILS 2018 countries (Table 5.34). On average across countries the difference was two scale points. The difference between male and female students was largest in Germany (the difference was three scale points). There was no significant difference in the strength of negative perceptions of ICT for society between male and female students in Chile, Kazakhstan, and Uruguay.

There were few significant differences, and no difference on average across countries, in the strength of negative perceptions of ICT for society associated with computer experience or CIL (Table 5.34). In Chile more experienced computer users expressed negative views of ICT for society more strongly than other students and in Denmark less experienced computer users expressed negative views of ICT for society more strongly than other students.

There was no overall difference in the strength of negative perceptions of ICT for society between students with CIL scores at Level 2 or above and students with CIL scores below Level 2 (Table 5.34). Among ICILS 2018 countries, only in Portugal was there a significant difference with more strongly negative views expressed by students with lower CIL. In Moscow (Russian Federation) students with lower CIL scores were also more likely to have negative perceptions of ICT for society (a scale difference of two points).

The scale scores for student expectations of future ICT use in work and study differed among countries, with students in Uruguay expressing the most positive scores and students in Denmark expressing the least positive scores (Table 5.35). The difference between these two countries was seven scale points. In all countries male students recorded significantly higher expectations of future ICT use than did female students. On average across countries the difference was five scale points (Table 5.35).

Associations of students' ICT self-efficacy with CIL and CT

Students' ICT self-efficacy (general applications) scores were significantly and moderately correlated with CIL in all countries (Table 5.36). On average across countries, the correlation coefficient was 0.32 and it ranged from 0.24 (Portugal) to 0.38 (Italy). In contrast there was little correlation between ICT self-efficacy (specialist applications) scores and CIL. In seven ICILS 2018 countries the correlation coefficient was negative but small, in two countries it was positive but small, and in two countries it was not significant. On average the correlation coefficient was –0.04.

Students' CT was also significantly but moderately correlated with ICT self-efficacy (general applications) scores in all seven participating ICILS 2018 countries. On average across countries the correlation coefficient was 0.26 (Table 5.36). Again there were weak correlations of CT and ICT with ICT self-efficacy (specialist applications) scores. On average across countries, the correlation coefficient was –0.04. The correlation coefficient was always small and was significant and negative in three countries, significant and positive in one country, and not significant in the remaining three countries.

Table 5.33: National average scale scores indicating students' perceptions of positive outcomes of ICT for society by gender group, experience with computers, and level of CIL

Country	Scale score by gender group		Scale score by students' experience with computers		Scale score average by level of CIL	
	Males	Females	Less than five years	Five years or more	CIL below Level 2	CIL at or above Level 2
Chile	**51** (0.4)	48 (0.3)	49 (0.3)	**51** (0.4)	49 (0.4)	50 (0.4)
Denmark† 1	**52** (0.3)	46 (0.3)	48 (0.3)	**50** (0.2)	49 (0.6)	49 (0.2)
Finland	**51** (0.3)	48 (0.3)	48 (0.4)	**50** (0.2)	48 (0.5)	**50** (0.2)
France	**51** (0.4)	48 (0.3)	49 (0.3)	**51** (0.4)	49 (0.4)	50 (0.3)
Germany	**52** (0.4)	46 (0.3)	48 (0.4)	**51** (0.4)	49 (0.7)	49 (0.3)
Italy²	**51** (0.3)	47 (0.3)	49 (0.3)	**51** (0.4)	49 (0.3)	**50** (0.4)
Kazakhstan¹	**51** (0.3)	50 (0.4)	49 (0.3)	**52** (0.5)	49 (0.3)	**54** (0.6)
Korea, Republic of	**52** (0.4)	52 (0.3)	51 (0.3)	**54** (0.4)	50 (0.5)	**54** (0.3)
Luxembourg	**49** (0.2)	46 (0.2)	47 (0.2)	**49** (0.2)	47 (0.2)	**48** (0.2)
Portugal†† 1	**52** (0.3)	51 (0.3)	51 (0.4)	**53** (0.3)	52 (0.5)	**53** (0.3)
Uruguay	**52** (0.4)	50 (0.4)	50 (0.4)	**52** (0.4)	51 (0.5)	50 (0.4)
ICILS 2018 average	**51** (0.1)	48 (0.1)	49 (0.1)	**51** (0.1)	49 (0.1)	**51** (0.1)
Not meeting sample participation requirements						
United States	**50** (0.2)	48 (0.2)	48 (0.2)	**50** (0.2)	47 (0.3)	**50** (0.2)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	**52** (0.3)	51 (0.3)	50 (0.4)	**54** (0.3)	50 (0.6)	**53** (0.3)
North Rhine-Westphalia (Germany)	**51** (0.4)	45 (0.4)	47 (0.5)	**50** (0.5)	49 (0.6)	48 (0.4)

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

¹ National defined population covers 90% to 95% of the national target population.

² Country surveyed target grade in the first half of the school year.

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Table 5.34: National average scale scores indicating students' perceptions of negative outcomes of ICT for society by gender group, experience with computers, and level of CIL

Country	Scale score by gender group		Scale score by students' experience with computers		Scale score average by level of CIL	
	Males	Females	Less than five years	Five years or more	CIL below Level 2	CIL at or above Level 2
Chile	52 (0.4)	53 (0.3)	52 (0.3)	**53** (0.4)	52 (0.4)	53 (0.3)
Denmark† [1]	47 (0.3)	**49** (0.2)	**49** (0.3)	48 (0.3)	48 (0.5)	48 (0.2)
Finland	46 (0.3)	**48** (0.2)	47 (0.4)	47 (0.2)	47 (0.6)	47 (0.2)
France	49 (0.4)	**51** (0.3)	51 (0.3)	50 (0.4)	50 (0.4)	50 (0.3)
Germany	49 (0.4)	**52** (0.4)	51 (0.3)	50 (0.4)	50 (0.4)	50 (0.3)
Italy[2]	50 (0.3)	**52** (0.3)	51 (0.3)	51 (0.4)	51 (0.3)	51 (0.4)
Kazakhstan[1]	49 (0.2)	49 (0.3)	49 (0.2)	49 (0.4)	49 (0.2)	49 (0.5)
Korea, Republic of	51 (0.3)	**52** (0.3)	51 (0.3)	51 (0.2)	51 (0.5)	51 (0.2)
Luxembourg	49 (0.2)	**51** (0.2)	**50** (0.2)	50 (0.3)	50 (0.3)	50 (0.3)
Portugal†† [1]	49 (0.4)	**50** (0.2)	50 (0.4)	49 (0.3)	**50** (0.5)	49 (0.3)
Uruguay	52 (0.4)	53 (0.5)	52 (0.4)	53 (0.4)	53 (0.5)	52 (0.4)
ICILS 2018 average	49 (0.1)	**51** (0.1)	50 (0.1)	50 (0.1)	50 (0.1)	50 (0.1)
Not meeting sample participation requirements						
United States	46 (0.2)	**48** (0.2)	47 (0.2)	47 (0.2)	47 (0.3)	47 (0.1)
Benchmarking participants meeting sample participation requirements						
Moscow (Russian Federation)	48 (0.4)	**49** (0.3)	49 (0.4)	48 (0.3)	**50** (0.7)	48 (0.3)
North Rhine-Westphalia (Germany)	48 (0.4)	**51** (0.3)	**50** (0.3)	48 (0.5)	50 (0.6)	49 (0.4)

🟥🟩 Difference between comparison groups statistically significant at $p < 0.05$

☐ Difference between comparison groups not statistically significant at $p < 0.05$

Notes: Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent. Score averages that are significantly larger ($p < 0.05$) than those in the comparison group are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

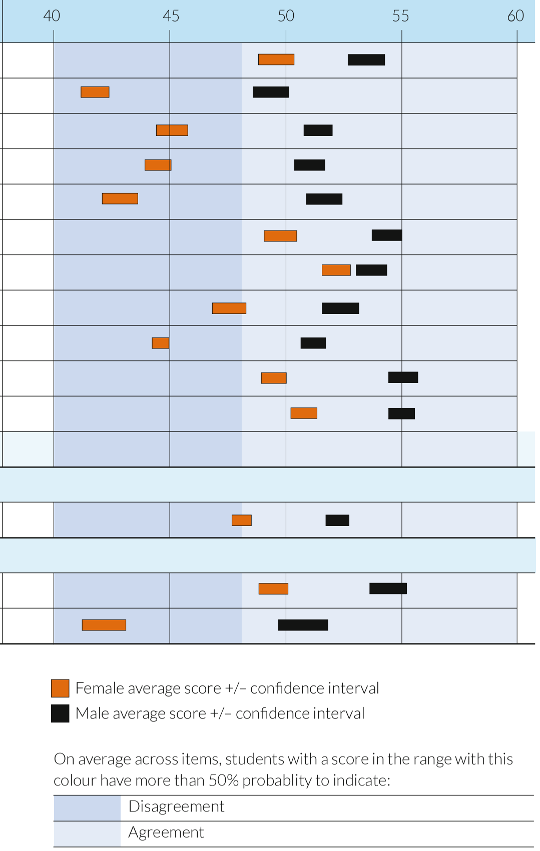
†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.35: National average scale scores indicating students' expectations of future ICT use for work and study by gender group

Country	All students			Females		Males		Differences (females – males)	
Chile	52	(0.3)	△	50	(0.4)	53	(0.4)	**-3.3**	(0.4)
Denmark[†] [1]	46	(0.2)	▼	42	(0.3)	49	(0.4)	**-6.8**	(0.4)
Finland	48	(0.2)	▽	46	(0.3)	51	(0.3)	**-5.7**	(0.4)
France	48	(0.2)	▽	45	(0.3)	51	(0.3)	**-5.9**	(0.4)
Germany	48	(0.3)	▽	43	(0.3)	52	(0.4)	**-8.1**	(0.5)
Italy[2]	52	(0.2)	△	50	(0.3)	54	(0.3)	**-4.2**	(0.4)
Kazakhstan[1]	53	(0.2)	△	52	(0.3)	53	(0.3)	**-1.2**	(0.4)
Korea, Republic of	50	(0.3)		48	(0.3)	52	(0.4)	**-4.3**	(0.5)
Luxembourg	48	(0.2)	▽	45	(0.1)	51	(0.2)	**-5.9**	(0.2)
Portugal[††] [1]	52	(0.2)	△	50	(0.2)	55	(0.3)	**-5.1**	(0.4)
Uruguay	53	(0.2)	▲	52	(0.4)	55	(0.3)	**-3.2**	(0.5)
ICILS 2018 average	50	(0.1)		48	(0.1)	52	(0.1)	**-4.9**	(0.1)
Not meeting sample participation requirements									
United States	50	(0.2)		48	(0.2)	52	(0.2)	**-3.8**	(0.3)
Benchmarking participants meeting sample participation requirements									
Moscow (Russian Federation)	52	(0.3)	△	50	(0.3)	54	(0.4)	**-4.8**	(0.4)
North Rhine-Westphalia (Germany)	47	(0.3)	▼	42	(0.4)	51	(0.5)	**-8.7**	(0.7)



National ICILS 2018 results are:

- ▲ More than three score points above average
- △ Significantly above average
- ▽ Significantly below average
- ▼ More than three score points below average

Notes: Standard errors appear in parentheses. Comparisons with ICILS 2018 only reported for countries or benchmarking participants meeting sample participation requirements. Statistically significant differences ($p < 0.05$) are shown in **bold**.

[†] Met guidelines for sampling participation rates only after replacement schools were included.

[††] Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

Table 5.36: Correlation coefficients of students' ICT self-efficacy for both general applications and specialist applications with CIL and CT

Country	Correlation of CIL with:		Correlation of CT with:	
	Students' ICT self–efficacy regarding the use of general applications	Students' ICT self–efficacy regarding the use of specialist applications	Students' ICT self–efficacy regarding the use of general applications	Students' ICT self–efficacy regarding the use of specialist applications
Chile	**0.33** (0.03)	**–0.06** (0.03)		
Denmark† [1]	**0.33** (0.03)	–0.03 (0.03)	**0.30** (0.02)	0.02 (0.03)
Finland	**0.33** (0.02)	**–0.06** (0.02)	**0.30** (0.02)	–0.03 (0.02)
France	**0.25** (0.02)	**–0.09** (0.02)	**0.19** (0.02)	**–0.11** (0.03)
Germany	**0.26** (0.03)	**–0.07** (0.03)	**0.18** (0.03)	–0.03 (0.03)
Italy[2]	**0.38** (0.02)	0.00 (0.02)		
Kazakhstan[1]	**0.34** (0.03)	**0.12** (0.03)		
Korea, Republic of	**0.48** (0.02)	**0.15** (0.02)	**0.39** (0.02)	**0.10** (0.02)
Luxembourg	**0.28** (0.01)	**–0.10** (0.01)	**0.24** (0.01)	**–0.08** (0.01)
Portugal†† [1]	**0.24** (0.03)	**–0.15** (0.03)	**0.21** (0.03)	**–0.16** (0.03)
Uruguay	**0.34** (0.02)	**–0.11** (0.03)		
ICILS 2018 average	**0.32** (0.01)	**–0.04** (0.01)	**0.26** (0.01)	**–0.04** (0.01)
Not meeting sample participation requirements				
United States	**0.39** (0.01)	0.01 (0.01)	**0.31** (0.01)	–0.01 (0.02)
Benchmarking participants meeting sample participation requirements				
Moscow (Russian Federation)	**0.27** (0.03)	–0.03 (0.03)		
North Rhine–Westphalia (Germany)	**0.26** (0.03)	–0.03 (0.03)	**0.17** (0.03)	–0.01 (0.03)

Notes: Standard errors appear in parentheses. Statistically significant coefficients ($p < 0.05$) are shown in **bold**.

† Met guidelines for sampling participation rates only after replacement schools were included.

†† Nearly met guidelines for sampling participation rates after replacement schools were included.

[1] National defined population covers 90% to 95% of the national target population.

[2] Country surveyed target grade in the first half of the school year.

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