CHAPTER 6:

School Environments for Teaching and Learning Computer and Information Literacy

Introduction

Using information and communication technology (ICT) for teaching and learning has become an increasingly common practice in educational settings, especially given that ability to use ICT is a requisite skill in today's digital age (Ananiadou & Claro, 2009; European Commission, 2013). Research suggests that schools must have certain conditions in place if they are to support effective pedagogical use of ICT in their classrooms. These conditions include not only sufficient ICT infrastructure and a positive and collaborative atmosphere where teachers receive training in how to best use ICT but also a minimum or preferably none of the obstacles that can limit teachers' ability to use ICT in their teaching (Law, Pelgrum, & Plomp, 2008).

Several surveys have reported crossnational comparisons of the ICT-related resources available in schools for teaching and learning purposes. The Second Information Technology in Education Study (SITES-M1), conducted by the International Association for the Evaluation of Educational Achievement (IEA), noted a large increase in the uptake of ICT in schools in comparison to earlier such data. However, the study also identified large differences in infrastructure across countries (Pelgrum & Anderson, 2001). A follow-up study found a similar rate of increase in infrastructure development and crosscountry discrepancies (Law et al., 2008). Neither study, however, found an association between schools' ICT resources and the proportions of teachers at these schools using ICT for teaching and learning activities.

A recent study, funded by the European Commission, on the state of ICT use in European schools noted the increase in ICT-capabilities of schools but stated urgency in remedying the fact that some of these countries were lagging behind others in this regard (European Commission, 2013). The study also found no relationships between high levels of ICT provision in schools and teachers' confidence in, use of, and attitudes toward using ICT. Despite these findings, teachers considered insufficient ICT equipment to be an obstacle to effective use of ICT in teaching and learning activities. They also highlighted a lack of technical and pedagogical support as a major obstacle to their use of ICT in classroom teaching. The study's authors concluded that providing teachers with support and appropriate pedagogical development is as important as ensuring ICT provision and support (European Commission, 2013, p. 156).

Our focus in this chapter is on describing the school contexts for CIL learning based on data from the ICILS teacher, ICT-coordinator, and principal questionnaires. The data that we present here pertain to three considerations set down in ICILS Research Question 2: *“What aspects of schools and education systems are related to student achievement in computer and information literacy with respect to (b) school and teaching practices regarding the use of technologies in computer and information literacy, (d) access*

to ICT in schools, and (e) teacher professional development and within-school delivery of computer and information literacy programs?”

We begin the chapter by reporting on the types of ICT resources evident in the schools that participated in ICILS. We then explore the different policies and practices identified across the ICILS countries and discuss the survey respondents’ perceptions of school ICT learning environments. In the final section of the chapter, we describe the ICT-related professional development activities undertaken by teachers, as reported by principals and teachers.

Schools’ access to ICT resources

Previous comparative crossnational surveys show that the provision of ICT resources in schools varies widely across countries (see, for example, Anderson & Ainley, 2010; Pelgrum & Doornekamp, 2009). The ICILS research team therefore considered collecting data on the following to be an important facet of the study: the availability of computing devices at school, the location of these devices within the school, students’ access to them, and schools’ connectivity to internet.

The ICT-coordinator questionnaire included a question about the availability of technology resources for teaching and/or learning. Table 6.1 shows the percentages of Grade 8 students (Grade 8 being the ICILS target grade) at schools where, according to the ICT-coordinators, each of the technology resources listed was available in their respective schools. We established these student percentages by using the sampling weights of the students in each sampled school. These allowed us to estimate the proportion of students in each country enrolled at schools providing each of the featured resources.

According to these results, almost every student (99% on average) participating in ICILS was studying at a school with access to the World Wide Web. The national averages ranged from 96 percent to 100 percent across the 14 countries that met sampling requirements. Crossnationally, large majorities of the Grade 8 students also had access to computer-based information resources. On average, these resources were available to 96 percent of students. In many countries, 100 percent of students had this access. The lowest national percentage was found in Turkey, with 71 percent.

Eighty-seven percent of students across ICILS countries were at schools that provided access to an education site or network maintained by an education system. National percentages were highest in Korea (99%), Ontario (99%), Australia (97%), Croatia (97%), and Newfoundland and Labrador (97%), and lowest in Germany (50%). Eighty-four percent of students were attending schools that made interactive digital learning resources available. The national average percentages ranged from 44 percent in Turkey to 98 percent in Australia and the Slovak Republic and 99 percent in Norway.

Most students were studying at schools that had email accounts for teachers (83% on average across countries). The lowest national percentages were evident in Turkey (65%), Chile (67%), and Germany (67%). The highest percentages indicated universal or almost universal such provision. These percentages were observed in Australia and the Canadian province of Newfoundland and Labrador, both 100 percent, as well as Croatia, Norway, and Ontario, all 99 percent. The average percentage for students at schools where the students themselves had email accounts was 59 percent. The lowest national percentages were evident in Turkey (28%), Germany (29%), Chile (34%), and the Czech Republic (42%). These results show considerable variation across countries with regard to email accounts for teachers and, in particular, for their students.

Table 6.1: National percentages of students at schools with available internet-related resources for teaching and/or learning

Country	Computer-Based Information Resources (e.g., Websites, Wikis, Encyclopedias)	Interactive Digital Learning Resources (e.g., Learning Objects)	Access to the World Wide Web	Access to an Education Site or Network Maintained by an Education System	Email Accounts for Teachers	Email Accounts for Students
Australia	100 (0.0) △	98 (0.6) ▲	100 (0.0) △	97 (1.2) △	100 (0.0) ▲	96 (1.4) ▲
Chile	94 (1.8)	94 (2.1) △	97 (1.5)	68 (4.4) ▼	67 (4.2) ▼	34 (4.6) ▼
Croatia	100 (0.0) △	84 (3.2)	100 (0.0) △	97 (1.3) ▲	99 (0.8) ▲	95 (1.9) ▲
Czech Republic	100 (0.0) △	94 (2.4) ▲	100 (0.0) △	78 (3.4) ▽	90 (2.4) △	42 (4.1) ▼
Germany [†]	99 (0.7) △	75 (3.8) ▽	98 (1.2)	50 (4.9) ▼	67 (4.4) ▼	29 (4.0) ▼
Korea, Republic of	99 (0.7) △	67 (4.0) ▼	97 (0.8)	99 (0.0) ▲	80 (3.3)	62 (4.0)
Lithuania	99 (1.0)	91 (2.3) △	99 (0.9)	95 (1.9) △	87 (2.8)	76 (3.6) ▲
Norway (Grade 9) ¹	100 (0.0) △	99 (0.8) ▲	100 (0.0) △	96 (2.0) △	99 (0.8) ▲	49 (5.1)
Poland	100 (0.0) △	78 (4.0)	100 (0.0) △	82 (3.6)	79 (3.7)	61 (4.3)
Russian Federation ²	98 (1.1)	90 (2.0) △	100 (0.5)	95 (1.5) △	87 (1.8) △	60 (3.6)
Slovak Republic	99 (0.9) △	98 (1.1) ▲	99 (0.4)	96 (1.8) △	79 (3.5)	66 (3.6)
Slovenia	98 (1.5)	90 (2.5) △	100 (0.0) △	95 (2.1) △	91 (2.6) △	65 (4.1)
Thailand ²	93 (2.4)	75 (4.2) ▽	97 (2.0)	94 (2.1) △	75 (3.6) ▽	59 (4.7)
Turkey	71 (3.9) ▼	44 (3.9) ▼	96 (1.7)	77 (3.9) ▽	65 (4.4) ▼	28 (4.2) ▼
ICILS 2013 average	96 (0.4)	84 (0.8)	99 (0.3)	87 (0.7)	83 (0.8)	59 (1.0)
Countries not meeting sample requirements						
Denmark	99 (1.0)	98 (1.6)	100 (0.0)	97 (1.7)	98 (1.6)	94 (2.0)
Hong Kong SAR	99 (0.8)	91 (3.1)	100 (0.0)	97 (1.7)	98 (1.1)	89 (3.5)
Netherlands	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	72 (6.6)
Switzerland	100 (0.0)	84 (4.9)	100 (0.0)	77 (6.7)	97 (2.4)	48 (7.6)
Benchmarking participants						
Newfoundland and Labrador, Canada	100 (0.0)	96 (0.2)	100 (0.0)	97 (0.1)	100 (0.0)	42 (0.3)
Ontario, Canada	99 (1.0)	90 (3.5)	100 (0.0)	99 (1.0)	99 (0.0)	58 (4.9)
Benchmarking participant not meeting sample requirements						
City of Buenos Aires, Argentina	89 (6.9)	72 (8.3)	87 (7.4)	61 (10.4)	62 (8.1)	33 (10.2)

Notes:

- () Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.
- [†] Met guidelines for sampling participation rates only after replacement schools were included.
- ¹ National Desired Population does not correspond to International Desired Population.
- ² Country surveyed the same cohort of students but at the beginning of the next school year.
- ▲ More than 10 percentage points above ICILS 2013 average
 △ Significantly above ICILS 2013 average
 ▽ Significantly below ICILS 2013 average
 ▼ More than 10 percentage points below ICILS 2013 average

The ICILS ICT-coordinator questionnaire also collected data on the availability of software resources for teaching and/or learning. Table 6.2 records the national percentages of students studying at schools where the specified learning resources were reported by the ICT-coordinator as available. Almost all students (99% on average) across the ICILS countries were studying at schools where presentation software (e.g., Microsoft PowerPoint®) was available. We observed similar results for the availability of wordprocessing, database, and spreadsheet software (98%). In many countries, all ICT-coordinators said these resources were present in their schools. The lowest percentage recorded was for Turkey (88%).

Large majorities of students were at schools that had the following software available:

- Communication (91% on average, with national percentages ranging from 62% in Germany to 100% in Croatia);
- Tutorial or practice programs (88% on average, with national percentages ranging from 49% in Turkey to 98% in the Czech Republic);
- Multimedia production tools (80% on average, with national percentages ranging from 46% in Turkey to 99% in Australia);
- Data-logging and monitoring tools, such as devices that automatically record data such as temperature over time (54% on average, with national percentages ranging from 15% in the Czech Republic to 86% in Lithuania); and
- Simulation and modeling software (41% on average, with national percentages ranging from 9% in Turkey to 85% in Australia).

As with the internet-related resources, we observed marked differences across countries with respect to these software resources.

ICILS also asked the ICT-coordinators to provide information about the availability of the different computer resources for teaching and/or learning in their schools. Table 6.3 records the national percentages of students enrolled at schools that had each of the different computer resources available. Across all ICILS countries, majorities of students (on average 94%, with national percentages ranging from 84% in Lithuania to 100% in Australia) were studying at schools with access to a local area network (LAN). On average, about two thirds (65%) of students were enrolled at schools with space on a school network for students to store their work. The national percentages ranged from 24 percent in Turkey to 98 percent in Australia.

On average across the ICILS countries, fewer than half (46%) of the students were at schools with internet-based applications for collaborative work (with national percentages ranging from 14% in Germany to 82% in Newfoundland and Labrador), and 37 percent were at schools with a school intranet that provided applications and workspaces for students. The range in national percentages for a school intranet extended from 11 percent in Turkey to 83 percent in Australia. Learning management systems were available at the schools of about one third of students on average. Again, the national percentages ranged widely—from two percent in Turkey to 95 percent in Norway.

We also observed considerable differences with regard to the provision of tablet devices to students. On average, only about every fifth student was enrolled at a school that provided tablet devices. The national percentages ranged from three, four, and six percent respectively in Croatia, Turkey, and the Czech Republic as well as Germany to

Table 6.2: National percentages of students at schools with available software resources for teaching and/or learning

Country	Tutorial Software or [Practice Programs]	Digital Learning Games	Wordprocessing, Databases, Spreadsheets (e.g., [Microsoft® Office Suite])	Multimedia Production Tools (e.g., Media Capture and Editing, Web Production)	Data-Logging and Monitoring Tools	Simulations and Modeling Software	Presentation Software (e.g. [Microsoft PowerPoint®], [Keynote®])	Communication Software (e.g., Email, Chat, Blogs, Other Social Media)	Graphing or Drawing Software
Australia	92 (2.2)	95 (1.7) ▲	100 (0.0) △	99 (0.3) ▲	85 (2.4) ▲	85 (2.8) ▲	100 (0.0) △	98 (1.0) △	99 (0.6) ▲
Chile	90 (2.3)	77 (3.6)	98 (1.1)	60 (4.2) ▼	59 (4.4)	24 (3.7) ▼	97 (1.4)	86 (3.0)	49 (4.6) ▼
Croatia	85 (3.1)	80 (2.9)	100 (0.0) △	74 (3.3)	56 (3.7)	16 (2.7) ▼	99 (0.6)	100 (0.0) △	70 (4.2) ▼
Czech Republic	98 (1.5) △	72 (3.0)	100 (0.0) △	75 (3.6)	15 (3.1) ▼	15 (2.6) ▼	100 (0.0) △	94 (2.3)	96 (1.6) △
Germany [†]	87 (3.2)	62 (4.2) ▼	100 (0.0) △	71 (3.7) ▽	57 (4.7)	41 (4.3)	100 (0.0) △	62 (5.0) ▼	96 (1.3) △
Korea, Republic of	88 (2.5)	78 (3.5)	98 (1.1)	87 (3.0) △	56 (4.4)	38 (4.0)	99 (0.9)	94 (1.9)	89 (2.6)
Lithuania	97 (1.2) △	93 (1.7) ▲	99 (0.5)	85 (3.2)	86 (3.3) ▲	54 (4.4) ▲	100 (0.5)	95 (2.1)	98 (0.9) ▲
Norway (Grade 9) ¹	95 (1.8) △	93 (2.6) ▲	100 (0.0) △	89 (3.0) △	34 (3.4) ▼	56 (4.4) ▲	100 (0.0) △	91 (2.6)	97 (1.7) △
Poland	89 (2.9)	83 (3.3) △	99 (0.5)	92 (2.0) ▲	42 (4.4) ▼	53 (3.9) ▲	99 (0.7)	98 (1.5) △	91 (2.4)
Russian Federation ²	93 (1.7) △	72 (3.2)	100 (0.0) △	78 (2.6)	65 (3.3) ▲	48 (3.2) △	100 (0.0) △	93 (1.4)	96 (1.7) △
Slovak Republic	96 (1.7) △	89 (2.6) ▲	100 (0.0) △	75 (3.6)	58 (4.3)	33 (4.6)	100 (0.0) △	98 (1.0) △	98 (1.2) ▲
Slovenia	97 (1.7) △	93 (2.1) ▲	100 (0.0) △	98 (1.1) ▲	45 (3.7) ▽	50 (3.9) △	100 (0.0) △	99 (0.6) △	97 (1.6) △
Thailand ²	74 (3.8) ▼	51 (4.5) ▼	95 (1.8)	88 (2.9) △	58 (4.7)	46 (5.0)	98 (1.5)	99 (0.9) △	98 (1.0) ▲
Turkey	49 (4.9) ▼	28 (3.8) ▼	88 (2.9) ▼	46 (4.4) ▼	40 (4.6) ▼	9 (2.4) ▼	98 (1.4)	73 (3.9) ▼	48 (4.4) ▼
ICILS 2013 average	88 (0.7)	76 (0.8)	98 (0.3)	80 (0.8)	54 (1.1)	41 (1.0)	99 (0.2)	91 (0.6)	87 (0.7)
Countries not meeting sample requirements									
Denmark	95 (2.1)	94 (3.1)	100 (0.0)	96 (2.1)	60 (5.8)	48 (5.2)	100 (0.0)	98 (1.5)	87 (3.5)
Hong Kong SAR	91 (3.5)	65 (4.9)	100 (0.0)	100 (0.0)	83 (4.1)	63 (5.3)	100 (0.0)	94 (2.8)	98 (1.4)
Netherlands	100 (0.0)	85 (5.0)	100 (0.0)	78 (5.9)	90 (3.7)	79 (5.2)	100 (0.0)	97 (2.1)	86 (4.7)
Switzerland	98 (1.5)	68 (6.7)	100 (0.0)	89 (3.2)	52 (6.8)	30 (6.8)	100 (0.0)	74 (6.9)	99 (0.4)
Benchmarking participants									
Newfoundland and Labrador, Canada	80 (0.2)	97 (0.1)	100 (0.0)	93 (0.1)	63 (0.3)	64 (0.3)	100 (0.0)	86 (0.2)	93 (0.1)
Ontario, Canada	88 (3.5)	96 (1.8)	99 (1.2)	89 (3.1)	73 (4.6)	67 (5.3)	99 (0.8)	97 (1.7)	94 (2.8)
Benchmarking participant not meeting sample requirements									
City of Buenos Aires, Argentina	83 (6.2)	60 (7.6)	100 (0.0)	81 (7.9)	45 (8.9)	39 (9.7)	91 (5.1)	94 (5.9)	81 (7.1)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

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

¹ National Desired Population does not correspond to International Desired Population.

² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average
 △ Significantly above ICILS 2013 average
 ▽ Significantly below ICILS 2013 average
 ▼ More than 10 percentage points below ICILS 2013 average

Table 6.3: National percentages of students at schools with computer resources for teaching and/or learning

Country	Access to a Local Area Network (LAN) in the School	Tablet Devices (e.g., iPad) and Similar	Space on a School Network for Students to Store their Work	A School Intranet with Applications and Workspaces for Students to Use (e.g., Moodle)	Internet-Based Applications for Collaborative Work (e.g., Google Docs)	A Learning Management System (e.g., WebCT)
Australia	100 (0.1) △	64 (3.7) ▲	98 (0.9) ▲	83 (2.5) ▲	67 (3.1) ▲	77 (2.8) ▲
Chile	97 (1.3)	14 (3.4)	44 (4.0) ▼	19 (3.5) ▼	49 (4.3)	11 (2.9) ▼
Croatia	95 (1.9)	3 (1.3) ▼	54 (3.7) ▼	16 (3.4) ▼	40 (3.8)	22 (2.5) ▼
Czech Republic	94 (2.1)	6 (2.0) ▼	87 (3.3) ▲	30 (3.4)	33 (3.9) ▼	17 (2.9) ▼
Germany ¹	99 (0.8) △	6 (2.8) ▼	94 (1.9) ▲	54 (3.9) ▲	14 (2.7) ▼	8 (2.2) ▼
Korea, Republic of	93 (2.3)	48 (3.7) ▲	39 (4.1) ▼	69 (3.8) ▲	62 (4.1) ▲	94 (2.0) ▲
Lithuania	84 (3.2) ▼	13 (3.2)	54 (4.4) ▼	24 (4.0) ▼	60 (4.3) ▲	27 (4.1)
Norway (Grade 9) ¹	89 (3.0)	12 (2.5) ▽	89 (3.1) ▲	35 (4.6)	42 (4.6)	95 (1.8) ▲
Poland	96 (1.8)	9 (2.8) ▽	77 (3.8) ▲	25 (3.8) ▼	26 (4.0) ▼	6 (2.1) ▼
Russian Federation ²	89 (2.3) ▽	11 (2.3) ▽	72 (3.0) △	25 (3.3) ▼	39 (3.0) ▽	51 (4.1) ▲
Slovak Republic	87 (3.2) ▽	15 (3.3)	63 (4.2)	13 (2.6) ▼	57 (4.2) ▲	24 (3.8) ▼
Slovenia	98 (0.7) △	11 (2.8) ▽	66 (3.6)	73 (3.7) ▲	78 (2.9) ▲	6 (1.7) ▼
Thailand ²	99 (0.7) △	47 (4.8) ▲	50 (5.3) ▼	40 (4.4)	51 (4.6)	46 (4.4) ▲
Turkey	99 (0.9) △	4 (1.8) ▼	24 (4.0) ▼	11 (2.6) ▼	27 (4.1) ▼	2 (1.2) ▼
ICILS 2013 average	94 (0.5)	19 (0.8)	65 (1.0)	37 (1.0)	46 (1.0)	35 (0.8)
Countries not meeting sample requirements						
Denmark	98 (0.2)	45 (5.5)	96 (2.1)	97 (0.7)	74 (5.1)	90 (3.1)
Hong Kong SAR	99 (0.7)	36 (5.4)	95 (2.3)	90 (3.3)	52 (5.6)	65 (5.3)
Netherlands	98 (1.6)	35 (6.6)	90 (4.1)	92 (2.7)	60 (6.6)	70 (6.8)
Switzerland	97 (2.8)	27 (8.0)	100 (0.3)	49 (7.1)	36 (8.1)	12 (4.8)
Benchmarking participants						
Newfoundland and Labrador, Canada	95 (0.2)	77 (0.2)	94 (0.2)	44 (0.3)	82 (0.2)	38 (0.3)
Ontario, Canada	97 (1.5)	64 (4.5)	96 (2.1)	70 (5.2)	79 (4.1)	46 (5.6)
Benchmarking participant not meeting sample requirements						
City of Buenos Aires, Argentina	84 (7.9)	16 (8.2)	64 (10.0)	61 (9.8)	63 (10.5)	9 (5.0)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Met guidelines for sampling participation rates only after replacement schools were included.

¹ National Desired Population does not correspond to International Desired Population.

² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average
 △ Significantly above ICILS 2013 average
 ▽ Significantly below ICILS 2013 average
 ▼ More than 10 percentage points below ICILS 2013 average

64 percent in both Australia and Ontario (Canada) and 77 percent in Newfoundland and Labrador (Canada).

We can reasonably expect that the more access students have to computers during school time, the greater their engagement and ability to participate in ICT learning activities will be. Trends observed from past crossnational surveys indicate that the number of students per available computer is decreasing over time (Law et al., 2008; Martin, Mullis, Gonzalez, Smith, & Kelly, 1999; Pelgrum & Anderson, 2001). The European Commission (2013) reported a tendency toward lower ratios for older students. In Chapter 2 of this current report, we noted that several of the ICILS countries have a national policy of establishing a 1:1 ratio between students and computers.

ICT-coordinators at the ICILS schools provided information about the numbers of computers at school available to students, while school principals reported the number of students enrolled at their school. We used these data to compute ratios of the number of students per computer. Low ratios indicate a well-resourced school; high numbers indicate a school with only a few computers available to its students.

Table 6.4 displays the average student–computer ratios for each participating country. It also provides the findings from our comparison of these ratios across rural schools (i.e., schools in communities with fewer than 15,000 inhabitants) and urban schools (communities with 15,000 or more inhabitants).¹

The table shows considerable crossnational differences in the ratios. On average across all countries, every 18 students had access to one computer. However, the ratios ranged from two or three students per computer in Norway and Australia respectively to 80 students per computer in Turkey. Schools in rural areas in Croatia, the Czech Republic, Korea, Lithuania, Newfoundland and Labrador, Ontario, Poland, the Russian Federation, the Slovak Republic, and Turkey had significantly lower student–computer ratios (indicating greater access) than those in urban areas. The reason for this difference might be because of the smaller school and class sizes in rural areas or because of policies directed toward increasing ICT investment in rural schools.

ICT-coordinators at ICILS schools provided information on where computers used for Grade 8 teaching and learning were located in these schools. Table 6.5 shows the national percentages of students at schools where computers were available in the various locations specified in the ICT-coordinator questionnaire.

Typically, computers were located in computer laboratories. On average, 95 percent of students were enrolled at schools where this was the case. The national percentages ranged from 76 percent in Norway to 100 percent in a large number of countries. Majorities of students (64% on average) also tended to be studying at schools where computers were located in the library. Here, the national percentages ranged from 28 percent in the Czech Republic to 94 percent in Lithuania. On average, about one third of students were attending schools with class sets of computers that could be moved across classrooms (34% on average, with national percentages ranging from 6% in Croatia to 68% in Norway). Almost the same proportion of students (33% on average) could be found in schools where their classrooms had computers. The national percentages ranged from 12 percent in Chile to 81 percent in Slovenia.

¹ Information on community size was typically provided by school principals.

Table 6.4: National student–computer ratios at schools by school location

Country	School Location Differences for Student–Computer Ratios			
	All students	Urban	Rural	Differences (urban - rural)*
Australia	3 (0.3)	2 (0.3)	3 (1.0)	-1 (1.0)
Chile	22 (4.7)	18 (1.2)	34 (22.0)	-16 (22.0)
Croatia	26 (0.8)	30 (1.5)	23 (1.3)	7 (2.3)
Czech Republic	10 (0.3)	10 (0.5)	9 (0.5)	2 (0.7)
Germany [†]	11 (0.8)	11 (0.7)	12 (1.9)	0 (2.1)
Korea, Republic of	20 (2.3)	21 (2.5)	7 (1.2)	14 (2.7)
Lithuania	13 (0.7)	16 (1.2)	10 (0.7)	6 (1.4)
Norway (Grade 9) ¹	2 (0.1)	3 (0.1)	2 (0.2)	0 (0.2)
Poland	10 (0.5)	13 (0.8)	8 (0.4)	5 (0.9)
Russian Federation ²	17 (1.0)	19 (1.4)	13 (1.3)	6 (1.8)
Slovak Republic	9 (0.5)	11 (0.7)	8 (0.5)	3 (0.9)
Slovenia	15 (0.5)	16 (0.9)	15 (0.6)	2 (1.2)
Thailand ²	14 (0.9)	15 (1.4)	13 (1.0)	2 (1.7)
Turkey	80 (16.0)	97 (22.5)	41 (9.1)	56 (24.4)
ICILS 2013 average	18 (1.2)	20 (1.6)	14 (1.7)	6 (2.4)
Countries not meeting sample requirements				
Denmark	4 (0.4)	5 (0.6)	4 (0.6)	0 (0.8)
Hong Kong SAR	8 (0.8)	8 (0.8)		
Netherlands	5 (0.8)	5 (1.0)	5 (0.7)	0 (1.2)
Switzerland	7 (0.6)	6 (0.7)	7 (0.8)	-1 (1.0)
Benchmarking participants				
Newfoundland and Labrador, Canada	6 (0.0)	6 (0.0)	5 (0.0)	2 (0.0)
Ontario, Canada	6 (0.3)	7 (0.4)	5 (0.5)	2 (0.6)
Benchmarking participant not meeting sample requirements				
City of Buenos Aires, Argentina	33 (9.4)	33 (9.4)		

Notes:* Statistically significant ($p < .05$) coefficients in **bold**.

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

[†] Met guidelines for sampling participation rates only after replacement schools were included.¹ National Desired Population does not correspond to International Desired Population.² Country surveyed the same cohort of students but at the beginning of the next school year.

Minorities of students were studying at schools where computers resided in other places, such as cafeterias, auditoriums, and study areas (17% on average) and/or where students brought their own computers to class (18% on average). However, there were notable differences across countries with regard to use of the latter. While in some countries about half of the students were enrolled at a school where they could bring their own computers to class, in many countries the corresponding national averages were below 10 percent.

Table 6.5: National percentages of students at schools with school computers at different locations

Country	In Most Classrooms (80% or More)	In Computer Laboratories	As Class Sets of Computers That Can Be Moved Between Classrooms	In the Library	In Other Places Accessible to Students (e.g., Cafeteria, Auditorium, Study Area)	Student Computers (School-Provided or Student- Owned) Brought by Students to Class
Australia	20 (2.6) ▼	85 (2.5) ▽	58 (3.7) ▲	90 (2.1) ▲	24 (3.0) △	53 (3.9) ▲
Chile	12 (3.0) ▼	98 (0.8) △	47 (4.1) ▲	64 (4.1)	6 (1.9) ▼	20 (3.3)
Croatia	24 (3.2) ▽	100 (0.0) △	6 (1.7) ▼	56 (3.6) ▽	7 (2.4) ▼	7 (2.3) ▼
Czech Republic	27 (3.7)	100 (0.0) △	12 (2.5) ▼	28 (3.4) ▼	23 (3.0)	7 (1.7) ▼
Germany [†]	17 (3.4) ▼	100 (0.0) △	44 (4.6)	44 (4.3) ▼	23 (4.1)	18 (3.4)
Korea, Republic of	40 (3.3) △	87 (2.5) ▽	41 (4.2)	80 (3.4) ▲	21 (3.2)	4 (1.6) ▼
Lithuania	55 (4.4) ▲	98 (1.4)	22 (3.7) ▼	94 (1.8) ▲	12 (2.7)	11 (2.5) ▽
Norway (Grade 9) ¹	39 (4.7)	76 (3.6) ▼	68 (4.3) ▲	56 (4.4)	26 (4.3)	48 (4.3) ▲
Poland	24 (3.6) ▽	100 (0.0) △	33 (3.8)	87 (3.0) ▲	20 (3.4)	6 (1.9) ▼
Russian Federation ²	56 (4.2) ▲	99 (0.5) △	42 (3.5) △	71 (3.5)	24 (2.6) △	15 (2.5)
Slovak Republic	14 (3.0) ▼	100 (0.0) △	20 (3.7) ▼	30 (3.5) ▼	8 (2.3) ▽	6 (2.0) ▼
Slovenia	81 (3.7) ▲	100 (0.0) △	43 (3.9) △	82 (3.1) ▲	11 (2.1) ▽	9 (2.5) ▽
Thailand ²	13 (3.5) ▼	100 (0.0) △	23 (4.5) ▼	87 (3.0) ▲	20 (3.9)	37 (4.7) ▲
Turkey	37 (4.4)	84 (2.7) ▼	23 (4.0) ▼	33 (4.2) ▼	16 (3.4)	10 (2.8) ▽
ICILS 2013 average	33 (1.0)	95 (0.4)	34 (1.0)	64 (0.9)	17 (0.8)	18 (0.8)
Countries not meeting sample requirements						
Denmark	26 (6.3)	71 (5.4)	72 (6.2)	62 (5.4)	34 (6.1)	83 (3.6)
Hong Kong SAR	84 (4.3)	100 (0.0)	32 (4.8)	93 (2.7)	34 (5.3)	11 (3.4)
Netherlands	38 (6.1)	89 (4.1)	39 (7.2)	65 (6.4)	54 (6.3)	33 (6.9)
Switzerland	43 (8.0)	98 (2.3)	44 (7.5)	43 (6.0)	18 (6.0)	16 (6.1)
Benchmarking participants						
Newfoundland and Labrador, Canada	51 (0.3)	100 (0.0)	56 (0.3)	91 (0.1)	12 (0.2)	52 (0.3)
Ontario, Canada	60 (4.8)	75 (3.4)	64 (5.0)	82 (3.5)	8 (2.9)	56 (5.2)
Benchmarking participant not meeting sample requirements						
City of Buenos Aires, Argentina	15 (7.3)	80 (8.9)	22 (8.1)	47 (9.6)	9 (4.7)	51 (6.4)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

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

¹ National Desired Population does not correspond to International Desired Population.

² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

School policies and practices for using ICT

The ICILS principal questionnaire contained a question that asked principals if their schools or school systems had procedures in place regarding the following aspects of ICT use:

- Setting up security measures to prevent unauthorized system access or entry;
- Restricting the number of hours students are allowed to sit at a computer;
- Giving students access to school computers outside class hours (but during school hours);
- Giving students access to school computers outside school hours;
- Honoring intellectual property rights (e.g., software copyright);
- Prohibiting access to inappropriate material (e.g., pornography, violence);
- Playing games on school computers;
- Giving the local community (parents and/or others) access to school computers and/or the internet; and
- Providing students with their own laptop computers and/or other mobile learning devices for use at school and at home.

The percentages of students who were attending schools where these procedures were implemented are presented in Table 6.6. Setting up security measures at school was found almost universally. On average, 94 percent of students were enrolled in schools with security measures in place. The national percentages ranged from 85 percent to 100 percent.

Approximately half of the students across countries were enrolled at schools with restrictions on the amount of time that students could sit at a computer. National percentages of students ranged from 18 percent in Australia to 92 percent in the Russian Federation.

On average, four out of five students were studying at schools that had a policy in relation to access to computers outside class time (but still during school time). National percentages ranged from 68 percent in Ontario to 93 percent in Thailand. However, there was wide variation across countries with respect to the presence of this policy. While approximately half of all students internationally were at schools with such a policy, the national percentages ranged from 27 percent in Poland to 86 percent in the Russian Federation.

Procedures at schools to ensure compliance with intellectual property rights were evident for 89 percent of students on average across the ICILS countries, with the national average percentages ranging from 77 percent in Chile and Poland to 96 percent in the Czech Republic. The overwhelming majority of students (on average 97%) across all countries were in schools that had procedures regarding access to inappropriate material. The national percentages ranged from 90 percent in Lithuania to 100 percent in Newfoundland and Labrador, Ontario, and the Russian Federation.

The majority of students in all countries were at schools that had protocols regarding playing games on school computers (68%). The exceptions were the Russian Federation and Turkey (39% and 34% respectively). The highest percentage was reported in Australia (90%).

Table 6.6: National percentages of students at schools with procedures regarding different aspects of ICT

Country	Setting Up Security Measures To Prevent Unauthorized System Access or Entry	Restricting the Number of Hours Students Are Allowed To Sit at a Computer	Student Access to School Computers Outside Class Hours (but During School Hours)	Student Access to School Computers Outside School Hours	Honoring of Intellectual Property Rights (e.g., Software Copyright)	Prohibiting Access to Inappropriate Material (e.g., Pornography, Violence)	Playing Games on School Computers	Giving the Local Community (Parents and/or Others) Access to School Computers and/or the Internet	Providing Students With Their Own Laptop Computers and/or Other Mobile Learning Devices for Use at School and at Home
Australia	100 (0.0) △	18 (3.1) ▼	77 (3.3)	63 (3.6) ▲	95 (1.5) △	99 (0.6) △	90 (2.7) ▲	35 (3.7) ▼	80 (3.2) ▲
Chile	91 (2.6)	67 (4.0) ▲	83 (2.7)	47 (4.8)	77 (3.9) ▼	99 (1.2)	64 (4.2)	47 (4.4)	21 (3.7) ▼
Croatia	92 (2.6)	50 (4.2)	71 (4.1) ▽	55 (4.1)	90 (2.5)	98 (1.0)	71 (3.3)	24 (3.5) ▼	20 (3.6) ▼
Czech Republic	98 (1.0) △	42 (3.9) ▼	71 (3.5) ▽	52 (3.7)	96 (1.5) △	99 (0.4) △	79 (3.1) ▲	29 (3.7) ▼	18 (2.8) ▼
Germany [†]	99 (0.6) △	42 (4.6) ▼	76 (4.2)	32 (4.7) ▼	92 (2.3)	97 (1.7)	69 (4.5)	47 (4.5)	26 (3.7) ▽
Korea, Republic of	97 (1.4)	64 (3.9) ▲	71 (3.3) ▽	66 (4.0) ▲	95 (1.7) △	96 (1.4)	66 (3.6)	72 (3.7) ▲	33 (3.7)
Lithuania	88 (2.9)	57 (4.3)	90 (2.6) ▲	28 (3.9) ▼	87 (2.3)	90 (2.5) ▽	70 (4.1)	72 (4.1) ▲	13 (2.9) ▼
Norway (Grade 9) ¹	100 (0.0) △	32 (5.0) ▼	81 (4.4)	67 (4.8) ▲	88 (3.4)	93 (2.6)	81 (4.1) ▲	38 (4.8)	76 (4.3) ▲
Poland	93 (2.4)	36 (3.8) ▼	76 (3.8)	27 (4.2) ▼	77 (3.8) ▼	97 (1.5)	68 (4.2)	33 (3.6) ▼	7 (2.2) ▼
Russian Federation ²	99 (0.9) △	92 (2.1) ▲	89 (2.5) △	86 (2.3) ▲	92 (1.8)	100 (0.0) △	39 (3.4) ▼	33 (2.9) ▼	15 (2.8) ▼
Slovak Republic	98 (1.5) △	51 (4.1)	86 (3.3)	27 (4.1) ▼	91 (2.4)	98 (1.4)	75 (3.7)	45 (4.8)	27 (4.1)
Slovenia	92 (1.7)	39 (4.4) ▼	84 (3.2)	54 (4.4)	85 (2.8)	94 (1.7)	74 (3.1)	52 (4.0)	22 (4.0) ▼
Thailand ²	87 (3.1) ▽	71 (4.3) ▲	93 (2.7) ▲	68 (3.9) ▲	92 (2.9)	97 (1.5)	74 (4.9)	72 (4.2) ▲	61 (4.6) ▲
Turkey	85 (2.9) ▽	71 (4.1) ▲	75 (3.2)	51 (4.0)	85 (3.0)	94 (2.0)	34 (4.2) ▼	58 (4.0) ▲	71 (4.1) ▲
ICILS 2013 average	94 (0.5)	52 (1.1)	80 (0.9)	52 (1.1)	89 (0.7)	97 (0.4)	68 (1.0)	47 (1.1)	35 (1.0)
Countries not meeting sample requirements									
Denmark	86 (4.3)	4 (2.1)	69 (5.7)	47 (5.9)	86 (5.1)	56 (5.4)	52 (6.4)	36 (5.1)	79 (4.9)
Hong Kong SAR	100 (0.0)	33 (5.8)	87 (3.7)	72 (4.5)	100 (0.0)	100 (0.0)	77 (4.4)	39 (5.4)	43 (5.6)
Netherlands	97 (2.7)	5 (1.7)	70 (5.6)	46 (6.0)	87 (4.3)	95 (3.2)	85 (4.7)	65 (5.4)	55 (5.6)
Switzerland	100 (0.2)	25 (5.2)	72 (6.4)	33 (5.8)	86 (5.1)	97 (2.0)	71 (6.5)	48 (8.2)	32 (6.9)
Benchmarking participants									
Newfoundland and Labrador, Canada	99 (0.0)	36 (0.2)	73 (0.3)	52 (0.3)	84 (0.3)	100 (0.0)	87 (0.2)	25 (0.2)	29 (0.3)
Ontario, Canada	97 (2.0)	29 (4.8)	68 (4.6)	41 (5.3)	95 (1.6)	100 (0.0)	82 (4.4)	41 (5.5)	69 (4.6)
Benchmarking participant not meeting sample requirements									
City of Buenos Aires, Argentina	84 (6.7)	36 (8.8)	67 (7.7)	29 (8.6)	76 (7.4)	93 (4.8)	55 (6.4)	28 (7.7)	49 (6.9)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

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

¹ National Desired Population does not correspond to International Desired Population.

² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

On average, just under half of all ICILS students were attending schools where procedures were in place for giving people in the local community access to school computers. National percentages ranged from 24 percent in Croatia to 72 percent in Korea, Lithuania, and Thailand.

On average across countries, 35 percent of students were in schools where they had their own laptop and/or other mobile learning devices for use at school and at home. There was a large degree of crosscountry variation in this provision, with national percentages ranging from seven percent in Poland to 80 percent in Australia.

Principals were asked to rate the level of priority (“high priority,” “medium priority,” “low priority,” “not a priority”) in their school for the following methods of facilitating ICT use in teaching and learning:

- Increasing the numbers of computers per student in the school;
- Increasing the number of computers connected to the internet;
- Increasing the bandwidth of internet access for the computers connected to the internet;
- Increasing the range of digital learning resources;
- Establishing or enhancing an online learning support platform;
- Providing for participation in professional development on pedagogical use of ICT;
- Increasing the availability of qualified technical personnel to support the use of ICT;
- Providing teachers with incentives to integrate ICT use in their teaching;
- Providing more time for teachers to prepare lessons in which ICT is used; and
- Increasing the professional learning resources for teachers on using ICT.

Table 6.7 shows the percentages of students in schools where principals gave “medium” or “high” priority ratings to these ways of facilitating ICT use in teaching and learning. Principals tended to accord medium to high priority to increasing the computers per student ratio. On average across the countries, 88 percent of students were enrolled in schools where principals recorded these levels of priority. The national percentages ranged from 64 percent to 99 percent.

Principals gave similar ratings to increasing the number of computers connected to the internet and increasing the internet bandwidth of internet-connected computers. Crossnationally, an average of 89 percent of students were enrolled at schools where principals accorded medium or high priority to these ways of facilitating ICT use. National percentages ranged from 66 percent (Germany) to 99 percent (Slovak Republic) for the former and 71 percent (Germany) to 99 percent (Slovenia) for the latter. Principals considered a range of digital learning resources to be of medium to high priority on average at schools attended by 93 percent of students, with national percentages ranging from 82 percent in Germany to 100 percent in Slovenia.

Establishing or enhancing an online learning support platform was a medium to high priority at schools representing 79 percent of students on average across participating countries (with national percentages ranging from 54% in Germany to 97% in Slovenia). All countries had provision for participation in professional development on using ICT for pedagogical purposes. The schools where this was the case typically represented between 88 and 100 percent of students (with the exception of Germany, where this situation represented only 63% of students). The ICILS 2013 average was 91 percent.

Table 6.7: National percentages of students at schools where medium or high priority is given to different ways of facilitating ICT use in teaching and learning

Country	Increasing the Numbers of Computers per Student in the School	Increasing the Number of Computers Connected to the Internet	Increasing the Bandwidth of Internet Access for the Computers Connected to the Internet	Increasing the Range of Digital Learning Resources	Establishing or Enhancing an Online Learning Support Platform	Providing for Participative Professional Development on Pedagogical Use of ICT	Increasing the Availability of Qualified Technical Personnel to Support the Use of ICT	Providing Teachers With Incentives to Integrate ICT Use in Their Teaching	Providing More Time for Teachers to Prepare Lessons in Which ICT Is Used	Increasing the Professional Learning Resources for Teachers in the Use of ICT
Australia	81 (2.8) ▽	79 (3.0) ▼	84 (2.6) ▽	93 (2.0)	90 (2.1) ▲	97 (1.2) △	80 (2.8)	68 (3.6) ▼	54 (4.0) ▼	90 (2.2)
Chile	91 (2.5)	94 (1.9) △	95 (1.7) △	95 (1.9)	86 (2.8) △	93 (2.3)	81 (3.6)	56 (4.0) ▼	70 (3.5) ▽	90 (2.6)
Croatia	95 (1.8) △	98 (0.9) △	96 (1.5) △	90 (2.4)	74 (3.5)	88 (3.0)	87 (3.1)	99 (0.9) ▲	87 (2.6) △	93 (2.0)
Czech Republic	83 (3.0)	87 (2.7)	87 (2.9)	92 (2.1)	65 (4.0) ▼	92 (2.0)	80 (3.2)	96 (1.4) ▲	70 (3.3) ▽	96 (1.4) △
Germany [†]	64 (4.7) ▼	66 (4.7) ▼	71 (4.8) ▼	82 (4.0) ▼	54 (4.5) ▼	63 (4.5) ▼	62 (4.6) ▼	56 (4.6) ▼	45 (4.9) ▼	68 (3.9) ▼
Korea, Republic of	65 (3.6) ▼	71 (3.5) ▼	75 (3.8) ▼	89 (2.7)	94 (2.0) ▲	89 (2.5)	84 (3.1)	90 (2.6)	87 (2.7) △	96 (1.7) △
Lithuania	94 (2.2) △	90 (2.3)	89 (2.8)	93 (1.9)	55 (4.5) ▼	91 (2.3)	82 (3.4)	98 (1.2) ▲	89 (2.5) ▲	88 (2.8)
Norway (Grade 9) [†]	91 (2.8)	89 (3.0)	86 (3.5)	96 (2.0)	86 (3.1) △	94 (2.5)	77 (4.5)	71 (4.2) ▼	60 (4.8) ▼	76 (4.0) ▼
Poland	96 (1.7) △	95 (1.6) △	92 (2.6)	84 (3.7) ▽	79 (4.0)	93 (2.5)	84 (3.1)	85 (3.5)	79 (4.1)	94 (2.1)
Russian Federation ²	94 (1.7) △	95 (1.6) △	97 (1.3) △	96 (1.5)	72 (3.0) ▽	97 (1.0) △	95 (1.6) ▲	93 (2.0) △	75 (3.4)	93 (1.7)
Slovak Republic	97 (1.0) △	99 (0.7) △	97 (1.3) △	98 (1.1) △	76 (3.7)	97 (1.3) △	93 (2.1) △	99 (0.8) ▲	88 (2.8) ▲	96 (1.6) △
Slovenia	94 (2.7) △	95 (2.4) △	99 (0.3) △	100 (0.0) △	97 (1.8) ▲	100 (0.0) △	93 (2.3) △	99 (0.0) ▲	91 (2.7) ▲	98 (0.7) △
Thailand ²	99 (0.9) ▲	98 (0.9) △	97 (1.5) △	96 (1.7)	96 (1.4) ▲	95 (1.7) △	92 (2.7) △	94 (2.7) △	94 (2.6) ▲	94 (2.5)
Turkey	83 (3.3)	94 (2.0) △	88 (2.7)	93 (2.2)	82 (3.4)	91 (2.6)	84 (3.3)	98 (1.1) ▲	96 (1.6) ▲	97 (1.4) △
ICILS 2013 average	88 (0.7)	89 (0.7)	89 (0.7)	93 (0.6)	79 (0.9)	91 (0.6)	84 (0.9)	86 (0.7)	78 (0.9)	91 (0.6)
Countries not meeting sample requirements										
Denmark	90 (3.7)	87 (4.6)	87 (4.1)	97 (1.9)	81 (4.2)	91 (3.4)	82 (4.5)	96 (2.4)	28 (5.2)	93 (3.0)
Hong Kong SAR	50 (4.3)	74 (5.1)	84 (3.9)	83 (4.3)	87 (3.3)	79 (3.7)	68 (5.0)	69 (4.8)	55 (6.0)	80 (4.1)
Netherlands	74 (4.7)	76 (5.0)	81 (4.6)	93 (3.5)	82 (4.4)	83 (4.1)	50 (5.8)	28 (4.7)	26 (5.2)	77 (4.6)
Switzerland	61 (6.8)	63 (8.2)	71 (6.6)	74 (5.6)	66 (7.3)	57 (7.5)	46 (7.7)	51 (7.3)	24 (5.9)	39 (7.1)
Benchmarking participants										
Newfoundland and Labrador, Canada	97 (0.1)	91 (0.1)	92 (0.1)	96 (0.1)	88 (0.3)	95 (0.1)	84 (0.3)	71 (0.3)	80 (0.3)	95 (0.1)
Ontario, Canada	90 (3.0)	84 (3.9)	77 (3.8)	93 (2.7)	68 (4.0)	86 (3.4)	76 (4.2)	67 (4.7)	55 (5.2)	84 (3.4)
Benchmarking participant not meeting sample requirements										
City of Buenos Aires, Argentina	92 (5.1)	94 (4.8)	86 (5.3)	92 (4.6)	84 (6.4)	93 (4.5)	87 (5.5)	95 (4.0)	76 (6.2)	88 (5.5)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

[†] Met guidelines for sampling participation rates only after replacement schools were included.¹ National Desired Population does not correspond to International Desired Population.² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

Increasing the availability of qualified technical personnel to support the use of ICT was a medium to high priority for schools representing 84 percent of students on average (with the range extending from 62 percent in Germany to 95 percent in the Russian Federation).

On average across the ICILS countries, 86 percent of students were in schools where principals accorded medium or high priority to providing teachers with incentives to integrate ICT use in their teaching (with national percentages ranging from 56% in Chile and Germany to 99% in Croatia, the Slovak Republic, and Slovenia). Seventy-eight percent of students were enrolled at schools where principals gave priority to providing teachers with more time to prepare lessons encompassing ICT use. The national percentages ranged from 45 percent in Germany to 96 percent in Turkey.

More than 90 percent of students (on average) were attending schools that placed a medium or high priority on offering their teachers more professional learning resources focused on ICT. The national percentages ranged from 68 percent in Germany to 98 percent in Slovenia.

Perceptions of school ICT learning environments

Perspectives from SITES Module 2 (Kozma, 2003b) and the School Net 2013 Survey (European Commission, 2013) suggest that teachers use ICT more frequently when their school culture supports technology in particular and innovation in general. ICILS asked teachers to rate their agreement or disagreement (“strongly agree,” “agree,” “disagree,” “strongly disagree”) with the following five statements about aspects of their school’s approach to using ICT.

- I work together with other teachers on improving the use of ICT in classroom teaching.
- There is a common set of rules in the school about how ICT should be used in classrooms.
- I systematically collaborate with colleagues to develop ICT-based lessons based on the curriculum.
- I observe how other teachers use ICT in teaching.
- There is a common set of expectations in the school about what students will learn about ICT.

Table 6.8 records the percentages of agreement (“strongly agree” or “agree”) with each of these statements. The statement “I work together with other teachers on improving the use of ICT in classroom teaching” attracted an average level of agreement of 71 percent. The lowest level of agreement was found in Korea (45%) and the highest in Thailand (91%). The item “I observe how other teachers use ICT in teaching” attracted an average agreement of 69 percent, with the range extending from 45 percent in the Czech Republic to 92 percent in the Russian Federation. The statement that “There is a common set of expectations in the school about what students will learn about ICT” attracted agreement from schools representing 63 percent of students on average, with agreement ranging from 35 percent in Slovenia to 92 percent in Thailand.

The two items that attracted the least agreement were “There is a common set of rules in the school about how ICT should be used in classrooms” (on average 58%, with national percentages ranging from 31% in Slovenia to 92% in Thailand), and “I

Table 6.8: National percentages of teachers who agree with statements regarding collaborative use of ICT in teaching and learning

Country	I Work Together with Other Teachers on Improving the Use of ICT in Classroom Teaching	There Is a Common Set of Rules in the School About How ICT Should Be Used in Classrooms	I Systematically Collaborate With Colleagues To Develop ICT-Based Lessons Based on the Curriculum	I Observe How Other Teachers Use ICT in Teaching	There is a Common Set of Expectations in the School about What Students Will Learn about ICT
Australia	72 (1.7)	58 (1.8)	48 (2.1) ▽	64 (2.4) ▽	48 (1.9) ▼
Chile	52 (2.0) ▼	49 (2.0) ▽	44 (2.1) ▽	49 (2.0) ▼	56 (2.3) ▽
Croatia	56 (1.4) ▼	34 (1.2) ▼	31 (1.1) ▼	53 (1.3) ▼	39 (1.5) ▼
Czech Republic	69 (1.4)	68 (1.5) △	36 (1.3) ▼	45 (2.0) ▼	73 (1.4) △
Korea, Republic of	45 (2.3) ▼	59 (2.3)	44 (1.9) ▽	71 (1.0) △	48 (1.4) ▼
Lithuania	83 (1.0) ▲	49 (1.4) ▽	62 (1.2) △	74 (1.1) △	71 (1.4) △
Poland	69 (1.3)	45 (1.9) ▼	41 (1.8) ▼	69 (1.6)	62 (1.6)
Russian Federation ¹	81 (1.3) ▲	81 (1.2) ▲	74 (1.9) ▲	92 (0.9) ▲	80 (1.3) ▲
Slovak Republic	80 (1.1) △	73 (1.5) ▲	60 (1.6) △	78 (1.1) △	80 (1.4) ▲
Slovenia	67 (1.2) ▽	31 (1.1) ▼	37 (1.4) ▼	61 (1.4) ▽	35 (1.6) ▼
Thailand	91 (1.6) ▲	92 (1.6) ▲	91 (1.7) ▲	89 (1.9) ▲	92 (1.6) ▲
Turkey	82 (1.4) ▲	60 (2.6)	71 (1.7) ▲	77 (1.5) △	71 (1.9) △
ICILS 2013 average	71 (0.4)	58 (0.5)	53 (0.5)	69 (0.5)	63 (0.5)
Countries not meeting sample requirements					
Denmark	60 (2.4)	35 (2.1)	27 (1.7)	60 (2.0)	48 (2.9)
Germany	30 (1.6)	56 (2.3)	12 (1.4)	41 (2.8)	54 (2.0)
Hong Kong SAR	57 (1.5)	57 (1.7)	39 (1.6)	61 (1.9)	54 (1.6)
Netherlands	55 (2.2)	41 (2.2)	26 (1.8)	47 (2.2)	25 (2.0)
Norway (Grade 9)	52 (2.1)	48 (2.7)	21 (1.8)	52 (2.4)	47 (2.6)
Benchmarking participant					
Newfoundland and Labrador, Canada	67 (2.3)	47 (2.6)	36 (1.9)	66 (2.8)	38 (2.8)
Benchmarking participant not meeting sample requirements					
Ontario, Canada	67 (2.8)	54 (2.8)	46 (4.0)	69 (2.4)	38 (3.3)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

▲ More than 10 percentage points above ICILS 2013 average
 △ Significantly above ICILS 2013 average
 ▽ Significantly below ICILS 2013 average
 ▼ More than 10 percentage points below ICILS 2013 average

systematically collaborate with colleagues to develop ICT-based lessons based on the curriculum.” The international average for this second statement was 53 percent, and the national percentages ranged from 31 percent in Croatia to 91 percent in Thailand.

We used the above five items to form a scale relating to collaborative approaches to using ICT. With a coefficient alpha of 0.80, the scale had sound reliability.² Table 6.9 records the national average scores on this scale as well as for teachers 40 years of age or more and those younger than 40 years.

National average scores on the *ICT collaboration scale* ranged from 45 scale score points (Croatia) to 58 such points (Thailand). The Russian Federation (55 points) and Turkey (53) had notably high scores, whereas Slovenia (46) and Chile (47) had notably low

² We used the Rasch partial credit model to construct the scale and standardized the item response theory (IRT) scores to have an ICILS 2013 average score of 50 points and a standard deviation of 10 points. This metric was used for most of the questionnaire-based scales derived from the ICILS data. The standard deviation of 10 points is appropriate for the numbers of items in most of these scales. However, we used a standard deviation of 100 for the CIL achievement scale because it had many more items than the questionnaires had.

Table 6.9: National averages for teachers collaborating when using ICT overall and by age group

Country	Collaboration Among Teachers When Using ICT by Age Group				Score Distribution by Age Group				
	All teachers	Under 40	40 and over	Differences (40 and over – under 40)*	30	40	50	60	70
Australia	49 (0.5) ▽	50 (0.3)	49 (0.7)	-1 (0.7)					
Chile	47 (0.5) ▼	46 (0.6)	48 (0.6)	2 (0.7)					
Croatia	45 (0.2) ▼	43 (0.4)	46 (0.3)	2 (0.6)					
Czech Republic	49 (0.4)	47 (0.5)	51 (0.5)	3 (0.5)					
Korea, Republic of	47 (0.3) ▽	47 (0.4)	48 (0.3)	1 (0.4)					
Lithuania	51 (0.3) △	50 (0.5)	52 (0.3)	2 (0.5)					
Poland	48 (0.3) ▽	47 (0.5)	49 (0.4)	2 (0.7)					
Russian Federation¹	55 (0.3) ▲	54 (0.4)	55 (0.4)	1 (0.5)					
Slovak Republic	52 (0.3) △	52 (0.4)	53 (0.3)	1 (0.4)					
Slovenia	46 (0.3) ▼	45 (0.5)	46 (0.3)	2 (0.4)					
Thailand	58 (0.9) ▲	59 (1.2)	57 (0.8)	-2 (1.1)					
Turkey	53 (0.6) ▲	53 (0.7)	55 (0.9)	2 (1.0)					
ICILS 2013 average	50 (0.1)	49 (0.2)	51 (0.1)	1 (0.2)					
Countries not meeting sample requirements									
Denmark	45 (0.4)	45 (0.7)	46 (0.4)	1 (0.6)					
Germany	41 (0.5)	40 (0.5)	41 (0.6)	1 (0.7)					
Hong Kong SAR	47 (0.3)	47 (0.4)	47 (0.4)	-1 (0.6)					
Netherlands	44 (0.4)	44 (0.4)	44 (0.5)	-1 (0.6)					
Norway (Grade 9)	45 (0.3)	44 (0.5)	45 (0.4)	1 (0.5)					
Benchmarking participant									
Newfoundland and Labrador, Canada	47 (0.4)	47 (0.7)	47 (0.5)	0 (0.9)					
Benchmarking participant not meeting sample requirements									
Ontario, Canada	49 (0.8)	49 (1.0)	48 (1.5)	-1 (1.9)					

Notes:

▲

More than three score points above ICILS 2013 average

△

Slightly above ICILS 2013 average

▽

Slightly below ICILS 2013 average

▼

More than three score points below ICILS 2013 average

* Statistically significant ($p < 0.05$) coefficients in **bold**.

Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

Under 40 average score +/- confidence interval

Over 40 average score +/- confidence interval

On average, teachers with a score in the range indicated by this color have more than a 50% probability of responding to the statements about collaboration between teachers in using ICT with:

Disagreement to positive, disagreement to negative items

Agreement to positive, disagreement to negative items

Notes:

* Statistically significant ($p < 0.05$) coefficients in **bold**.

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

▲ More than three score points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than three score points below ICILS 2013 average

■ Under 40 average score +/- confidence interval

■ Over 40 average score +/- confidence interval

On average, teachers with a score in the range indicated by this color have more than a 50% probability of responding to the statements about collaboration between teachers in using ICT with:

■ Disagreement to positive, agreement to negative items

■ Agreement to positive, disagreement to negative items

scores. Overall, the average scores on the ICT collaboration scale were about two scale points higher for teachers older than 40 than for teachers under 40 years of age.

ICT-coordinators were asked to indicate the extent (“a lot,” “to some extent,” “very little,” or “not at all”) to which a range of different obstacles hindered using ICT in teaching and learning at their school. Table 6.10 presents the national percentages of students at schools where ICT-coordinators reported that ICT use for teaching and learning was hindered a lot or to some extent by each obstacle. Typically, majorities of students across the ICILS countries came from schools where, according to the ICT-coordinators, the following obstacles relating to personnel and teaching support limited ability to use ICT for pedagogical purposes:

- A lack of ICT skills among teachers (63% on average, with national percentages ranging from 27% in Korea to 80% in Ontario);
- Insufficient time for teachers to prepare lessons (63% on average, with national percentages ranging from 38% in Croatia to 81% in Thailand);
- A lack of effective professional learning resources for teachers (60% on average, with national percentages ranging from 43% to 78%);
- A lack of incentives for teachers to integrate ICT use in their teaching (60% on average, with national percentages ranging from 40% to 80%); and
- A lack of qualified technical personnel to support the use of ICT (53% on average, with national percentages ranging from 27% to 82%).

ICT-coordinators across countries generally perceived personnel-related hindrances to be more prevalent than those related to resources. The extent of this difference varied considerably from country to country, however, as the following international average percentages show.

- Fifty-five percent of students were enrolled at schools where ICT-coordinators reported a lack of sufficiently powerful computers for ICT use. The national percentages ranged from 27 percent in Australia to 85 percent in Turkey.
- Fifty-two percent of students were attending schools where ICT-coordinators reported that a lack of computers limited opportunity to use ICT for instructional purposes. The national percentages ranged from 26 percent in Australia to 81 percent in Turkey.
- Forty-five percent of students were enrolled at schools where insufficient internet bandwidth or speed was seen as a hindrance. The national percentages ranged from 21 percent in the Czech Republic and Lithuania to 89 percent in Thailand.
- Just under half (47%) of the ICILS students were at schools where the ICT-coordinators said insufficient computer software was hindering ICT use. National percentages ranged from 10 percent in Australia to 74 percent in Turkey.
- Approximately one third of students were attending schools that, according to the coordinators, had too few computers connected to the internet. The national percentages ranged from eight percent in Australia to 74 percent in Thailand.

ICILS asked teachers to report their perceptions of obstacles to using ICT in teaching. The study also asked teachers about the extent to which they collaborated with one another and how much they and their colleagues followed common procedures when using ICT in their teaching.

Table 6.10: National percentages of students at schools where different obstacles hinder using ICT in teaching and learning

Country	Too Few Computers Connected to the Internet	Insufficient Internet Bandwidth or Speed	Not Enough Computers for Instruction	Lack of Sufficiently Powerful Computers	Not Enough Computer Software	Lack of ICT Skills among Teachers	Insufficient Time for Teachers to Prepare Lessons	Lack of Effective Professional Learning Resources for Teachers	Lack of an Effective Online Learning Support Platform	Lack of Incentives for Teachers to Integrate ICT Use in Their Teaching	Lack of Qualified Technical Personnel to Support ICT Use
Australia	8 (2.0) ▼	39 (3.3)	26 (3.1) ▼	27 (3.4) ▼	10 (2.2) ▼	75 (2.9) ▲	67 (3.4)	51 (3.4) ▽	35 (3.5) ▼	51 (3.2) ▽	31 (3.0) ▼
Chile	25 (3.7)	52 (3.3) ▽	34 (4.1) ▼	46 (4.7)	53 (4.7)	71 (3.8) ▽	58 (4.6)	65 (4.2)	65 (4.6)	70 (4.2) ▲	45 (4.7)
Croatia	43 (4.0) ▲	35 (4.1) ▽	74 (3.6) ▲	66 (3.5) ▲	49 (4.0)	71 (3.8) ▽	38 (3.6) ▼	65 (3.7)	48 (4.3) ▽	57 (4.1)	67 (3.7) ▲
Czech Republic	13 (2.8) ▼	21 (3.8) ▼	32 (3.5) ▼	41 (3.8) ▼	40 (3.8)	56 (4.5)	59 (4.4)	43 (3.8) ▼	60 (4.2)	50 (4.1) ▽	37 (4.0) ▼
Germany [†]	41 (4.5)	49 (5.1)	54 (4.6)	44 (4.6) ▼	39 (4.0)	79 (3.7) ▲	76 (4.6) ▲	70 (4.2) ▲	52 (4.1)	80 (4.5) ▲	63 (5.2)
Korea, Republic of	12 (2.7) ▼	26 (3.7) ▼	30 (3.9) ▼	57 (4.1)	37 (3.7) ▽	27 (3.7) ▼	63 (3.8)	50 (4.0) ▽	52 (4.2)	61 (4.0)	66 (3.9) ▲
Lithuania	11 (2.6) ▼	21 (3.4) ▼	49 (5.0)	58 (4.8)	45 (4.7)	55 (4.8)	50 (4.4) ▼	60 (4.6)	57 (4.7)	40 (4.3) ▼	27 (3.8) ▼
Norway (Grade 9) [†]	27 (4.5)	28 (4.1) ▼	65 (4.5) ▲	33 (4.4) ▼	26 (3.9) ▼	77 (4.0) ▲	57 (4.8)	52 (4.9)	50 (5.0)	62 (4.7)	36 (4.5) ▼
Poland	50 (4.1) ▲	53 (4.4)	65 (4.1) ▲	52 (4.0)	65 (4.2) ▲	56 (4.4)	66 (4.1)	64 (3.7)	63 (4.3)	59 (3.7)	63 (4.0) ▽
Russian Federation ²	43 (3.4) ▲	62 (3.9) ▲	48 (3.2)	60 (3.0)	51 (3.6)	55 (4.1)	56 (3.9)	63 (3.7)	57 (4.1)	49 (3.7) ▼	59 (3.9)
Slovak Republic	24 (3.5) ▽	41 (4.2)	60 (4.5)	62 (4.0)	48 (4.1)	53 (4.6) ▼	73 (3.9) ▲	51 (4.3)	56 (4.2)	43 (4.2) ▼	50 (4.5)
Slovenia	21 (3.6) ▼	35 (3.7) ▽	45 (4.3)	64 (4.1) ▽	46 (4.0)	69 (3.3)	74 (3.5) ▲	56 (4.4)	53 (4.3)	59 (4.1)	41 (4.6) ▼
Thailand ²	74 (4.5) ▲	89 (3.3) ▲	73 (3.9) ▲	77 (3.9) ▲	71 (3.8) ▲	72 (4.4)	81 (3.6) ▲	78 (4.0) ▲	84 (3.7) ▲	76 (4.2) ▲	82 (4.3) ▲
Turkey	64 (4.0) ▲	77 (3.3) ▲	81 (3.2) ▲	85 (2.9) ▲	74 (3.8) ▲	66 (3.7)	61 (3.9)	70 (3.8) ▲	78 (3.6) ▲	78 (3.5) ▲	82 (3.2) ▲
ICILS 2013 average	33 (1.0)	45 (1.0)	52 (1.1)	55 (1.1)	47 (1.1)	63 (1.1)	63 (1.1)	60 (1.1)	58 (1.1)	60 (1.1)	53 (1.1)
Countries not meeting sample requirements											
Denmark	20 (4.3)	34 (6.2)	64 (5.2)	40 (5.9)	25 (5.2)	80 (4.5)	56 (5.5)	57 (5.2)	29 (5.6)	54 (6.2)	43 (5.9)
Hong Kong SAR	22 (4.7)	39 (5.6)	26 (4.0)	55 (4.7)	48 (4.5)	52 (5.6)	87 (4.1)	73 (5.8)	51 (5.4)	77 (4.8)	53 (5.2)
Netherlands	17 (5.0)	34 (6.4)	20 (5.9)	27 (6.2)	26 (5.7)	83 (5.6)	71 (6.0)	66 (6.5)	55 (6.8)	72 (6.2)	28 (5.5)
Switzerland	38 (6.8)	39 (7.9)	50 (6.0)	22 (6.9)	14 (4.2)	82 (6.1)	57 (7.1)	61 (7.2)	41 (6.8)	60 (8.2)	55 (6.1)
Benchmarking participants											
Newfoundland and Labrador, Canada	41 (0.3)	35 (0.3)	55 (0.3)	39 (0.3)	29 (0.3)	63 (0.3)	79 (0.3)	77 (0.3)	69 (0.3)	67 (0.3)	70 (0.3)
Ontario, Canada	29 (4.5)	52 (4.9)	66 (5.0)	59 (5.5)	30 (4.6)	80 (4.3)	59 (5.4)	58 (5.1)	48 (4.9)	64 (4.8)	54 (4.9)
Benchmarking participant not meeting sample requirements											
City of Buenos Aires, Argentina	37 (9.8)	51 (8.5)	66 (7.2)	47 (8.4)	32 (8.2)	60 (10.4)	67 (9.3)	64 (8.7)	60 (9.6)	68 (8.3)	52 (9.3)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

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

¹ National Desired Population does not correspond to International Desired Population.

² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average

▽ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

To gain teachers' perceptions about obstacles, the ICILS teacher questionnaire asked teachers to consider a number of statements and to use the following response key to state their level of agreement with each one: "strongly agree," "agree," "disagree," and "strongly disagree." Table 6.11 records the percentages of teachers who expressed agreement with each of the statements. On average, just over half of the teachers considered ICT to be a teaching priority in their school. The national average percentages ranged from less than a third of teachers in Slovenia to 87 percent of teachers in Newfoundland and Labrador.

Forty-two percent of the ICT equipment resources at schools were deemed insufficient. In the Czech Republic, less than a quarter of teachers thought this. In Thailand, however, approximately three quarters of teachers held this view.

Russian and Thai teachers were those most likely crossnationally to indicate a lack of access to digital learning resources as an issue. The respective percentages were 47 percent and 45 percent. Czech and Slovak teachers were least likely to identify this lack as an issue (only 8%). Across all ICILS countries, 22 percent of teachers thought the lack was a problem.

There was some inter-country variability in the percentages of teachers who said that limited internet connectivity presented a barrier to them using ICT for their teaching. On average, we recorded a 40 percent agreement internationally with this concern and majority agreement with it in Chile (54%), the Russian Federation (55%), Thailand (73%), and Turkey (59%).

On average across the ICILS countries, 38 percent of teachers agreed that their school computer equipment was out of date. The national percentages ranged from 22 percent in the Czech Republic to 60 percent in Thailand.

The most common issue that the teachers identified was insufficient time to prepare lessons encompassing ICT use. Fifty-seven percent of teachers, on average, endorsed this view. Except for the Czech Republic and Lithuania, with 46 percent and 44 percent agreement respectively, the majority of teachers in all countries specified lack of time as problematic.

Majorities of teachers from Korea (68%), Thailand (67%), Turkey (57%), and the Canadian province of Newfoundland and Labrador (66%) indicated insufficient provision for them to develop ICT-related expertise (the ICILS 2013 average was 39%). Fewer than half of the teachers in the remaining countries reported this lack as a problem.

On average crossnationally, 45 percent of teachers expressed agreement with the statement that they did not have sufficient technical support to maintain ICT resources. The highest national percentages of agreement were found in Turkey (65%) and Thailand (77%); the lowest such percentage was recorded in the Czech Republic (13%).

We used six of the eight items listed to form a scale reflecting teachers' perceptions of ICT resource limitations at their school.³ The *ICT resource limitations at school scale*,

³ The items making up this scale were:

- My school does not have sufficient ICT equipment (e.g., computers).
- My school does not have access to digital learning resources.
- My school has limited connectivity (e.g., slow or unstable speed) to the internet.
- The computer equipment in our school is out of date.
- There is not sufficient provision for me to develop expertise in ICT.
- There is not sufficient technical support to maintain ICT resources.

The remaining two items were concerned with priorities ("ICT is not considered a priority for use in teaching") and time ("There is not sufficient time to prepare lessons that incorporate ICT").

Table 6.11: National percentages of teachers who agree with statements about the use of ICT in their school

Country	ICT Is Not Considered a Priority for Use in Teaching	My School Does Not Have Sufficient ICT Equipment (e.g., Computers)	My School Does Not Have Access to Digital Learning Resources	My School Has Limited Connectivity (e.g., Slow or Unstable Speed) to the Internet	The Computer Equipment in Our School Is Out of Date	There Is Not Sufficient Time to Prepare Lessons that Incorporate ICT	There Is Not Sufficient Provision for Me to Develop Expertise in ICT	There Is Not Sufficient Technical Support to Maintain ICT Resources
Australia	17 (1.2) ▼	32 (1.7) ▼	13 (1.1) ▽	37 (1.6) ▽	28 (1.7) ▼	54 (1.2) ▽	48 (1.7) ▽	37 (1.8) ▽
Chile	36 (2.2) ▼	33 (2.7) ▽	21 (2.4)	54 (2.4) ▲	34 (2.7)	68 (2.1) ▲	38 (2.2)	42 (2.6)
Croatia	66 (1.8) ▲	43 (2.3)	25 (1.7)	39 (1.8)	46 (2.2) ▽	51 (1.6) ▽	43 (1.6)	54 (2.0) ▽
Czech Republic	55 (1.6) ▽	22 (1.8) ▼	8 (0.9) ▼	23 (1.5) ▼	22 (1.7) ▼	46 (1.4) ▼	17 (1.0) ▼	13 (1.3) ▼
Korea, Republic of	45 (2.2)	46 (4.0)	30 (2.0) ▽	35 (1.8) ▽	48 (1.8) ▲	70 (1.9) ▲	68 (2.3) ▲	62 (1.6) ▲
Lithuania	27 (1.4) ▼	49 (2.8) ▽	17 (1.6) ▽	30 (2.1) ▼	39 (2.4)	44 (1.4) ▼	25 (1.2) ▼	33 (2.3) ▼
Poland	63 (1.3) ▲	42 (2.2)	11 (1.1) ▼	32 (1.9) ▽	39 (2.4)	54 (1.5)	30 (1.5) ▽	44 (2.0)
Russian Federation ¹	44 (1.7)	45 (3.1)	47 (2.9) ▲	55 (2.3) ▲	34 (2.7)	52 (2.0) ▽	32 (1.9) ▽	48 (2.3)
Slovak Republic	42 (1.6) ▽	28 (2.3) ▼	8 (1.0) ▼	26 (1.9) ▼	28 (2.4) ▽	57 (1.6)	27 (1.6) ▼	33 (2.3) ▼
Slovenia	69 (1.4) ▲	34 (1.7) ▽	10 (0.8) ▼	16 (1.1) ▼	26 (1.6) ▼	68 (1.1) ▲	22 (1.1) ▼	28 (1.5) ▼
Thailand	28 (2.8) ▼	75 (2.4) ▲	43 (3.5) ▲	73 (2.3) ▲	60 (3.0) ▲	65 (2.9) ▽	65 (2.4) ▲	77 (2.4) ▲
Turkey	63 (2.5) ▲	58 (3.0) ▲	35 (2.9) ▲	59 (2.6) ▲	52 (2.4) ▲	57 (2.1)	57 (2.4) ▲	65 (2.4) ▲
ICILS 2013 average	46 (0.5)	42 (0.7)	22 (0.6)	40 (0.6)	38 (0.7)	57 (0.5)	39 (0.5)	45 (0.6)
Countries not meeting sample requirements								
Denmark	12 (1.5)	50 (4.5)	12 (1.5)	38 (3.5)	39 (4.1)	54 (2.5)	55 (2.7)	44 (2.7)
Germany	61 (1.8)	42 (2.4)	28 (2.0)	46 (3.4)	43 (2.9)	57 (1.9)	49 (1.8)	51 (2.3)
Hong Kong SAR	38 (1.8)	23 (1.9)	14 (1.5)	27 (2.1)	39 (2.4)	63 (1.4)	51 (1.8)	46 (2.0)
Netherlands	29 (2.6)	56 (2.5)	13 (1.2)	35 (2.2)	41 (2.4)	53 (1.7)	37 (1.6)	38 (2.1)
Norway (Grade 9)	24 (2.2)	53 (3.3)	11 (1.3)	43 (2.5)	34 (2.9)	50 (1.8)	52 (2.3)	49 (3.1)
Benchmarking participant								
Newfoundland and Labrador, Canada	13 (1.8)	35 (2.5)	22 (2.7)	35 (2.8)	29 (2.5)	68 (2.9)	66 (3.0)	59 (2.8)
Benchmarking participant not meeting sample requirements								
Ontario, Canada	20 (2.5)	56 (4.8)	31 (3.9)	49 (4.4)	49 (3.8)	60 (4.5)	62 (4.3)	57 (5.1)

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

▲ More than 10 percentage points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

which we constructed via the Rasch partial credit model, had a reliability (coefficient alpha) of 0.83 and IRT scores standardized to an ICILS 2013 average score of 50 points and a standard deviation of 10 points. The higher scores on the scale represent stronger perceptions of inadequate resourcing. Table 6.12 presents the mean scores on this scale for all teachers overall, for teachers under 40 years, and for teachers over 40 years of age. Teachers from the Czech Republic and Slovenia scored more than three points lower than the ICILS 2013 average, indicating a perception that the school had relatively adequate ICT resources. In comparison, Thailand and Turkey both had scale scores more than three points above the ICILS 2013 average, indicating that teachers saw ICT resourcing at their schools as inadequate.

In general, we found little difference between the scale scores of teachers under and the scale scores of teachers over the age of 40. However, we did record significantly higher scale scores for teachers 40 years of age and under (compared to the 40 and over group) in Croatia and Turkey.

Teachers' professional development in using ICT for pedagogical purposes

Two sources of information provided perspectives on teachers' professional development in the pedagogical use of ICT. One of these was the school principal, who provided information on the extent to which teachers in his or her school had participated in various forms of professional development. The other source of information was the teachers themselves. They identified the forms of professional development they had participated in over the past two years.

School perspectives

The ICILS school questionnaire asked principals to indicate the extent to which teachers in their respective schools had participated in different forms of professional development focused on using ICT for teaching and learning. The response categories were "none or almost none," "some," "many," and "all or almost all." Table 6.13 shows the national percentages of students attending schools where many or all or almost all of the teachers had taken part in various forms of professional development.

Participation in courses is a traditional form of professional development. These are typically provided by the school in which the teacher is located, by an external agency or expert, or as a program delivered online. About two thirds of the schools (the ICILS 2013 average was 68%) indicated that many teachers had participated "in courses on the use of ICT in teaching provided by the school." This type of participation was by far the most prevalent among the various forms of professional development listed. In the following countries, 79 percent or more of the ICILS students were studying at schools where many or almost all teachers had participated in a course on using ICT in their teaching: Slovenia, Lithuania, Croatia, Thailand, the Russian Federation, Australia, and the Slovak Republic. In four other countries—Chile, Germany, Turkey, and the Canadian province of Ontario—less than half of the students were enrolled at schools that had this level of participation in such a course.

Smaller proportions of students were studying at schools where many or almost all of their teachers had taken part in "courses conducted by an external agency or expert" (a crossnational average of 39%) or in "professional learning programs delivered through ICT" (also 39%).

Table 6.12: National averages for teachers' perceptions of ICT resources at their school overall and by school characteristics

Country	Teacher Perceptions of ICT Teaching by Age Group				Score Distribution by Age Group				
	All teachers	Under 40	40 and over	Differences (40 and over – under 40) *	30	40	50	60	70
Australia	49 (0.4) ▽	49 (0.4)	48 (0.4)	0 (0.4)					
Chile	49 (0.7)	49 (0.8)	50 (0.7)	0 (0.9)					
Croatia	51 (0.4) △	52 (0.5)	51 (0.5)	-1 (0.5)					
Czech Republic	42 (0.4) ▼	42 (0.5)	41 (0.4)	0 (0.5)					
Korea, Republic of	53 (0.4) △	53 (0.4)	53 (0.6)	1 (0.7)					
Lithuania	49 (0.4)	50 (0.6)	49 (0.4)	0 (0.6)					
Poland	49 (0.5)	49 (0.6)	49 (0.7)	0 (0.8)					
Russian Federation ¹	52 (0.5) △	52 (0.5)	52 (0.5)	0 (0.5)					
Slovak Republic	48 (0.4) ▽	47 (0.5)	48 (0.4)	1 (0.5)					
Slovenia	46 (0.4) ▼	46 (0.5)	47 (0.4)	1 (0.5)					
Thailand	58 (0.8) ▲	58 (0.9)	57 (0.8)	0 (0.8)					
Turkey	54 (0.7) ▲	55 (0.7)	53 (1.1)	-2 (1.1)					
ICILS 2013 average	50 (0.1)	50 (0.2)	50 (0.2)	0 (0.2)					
Countries not meeting sample requirements									
Denmark	51 (0.6)	51 (0.7)	51 (0.7)	-1 (0.7)					
Germany	50 (0.7)	52 (0.8)	49 (0.7)	-2 (0.9)					
Hong Kong SAR	50 (0.4)	49 (0.5)	51 (0.4)	2 (0.5)					
Netherlands	51 (0.3)	50 (0.5)	51 (0.4)	0 (0.5)					
Norway (Grade 9)	51 (0.5)	51 (0.6)	51 (0.6)	0 (0.7)					
Benchmarking participant									
Newfoundland and Labrador, Canada	51 (0.6)	51 (0.9)	52 (0.7)	1 (1.2)					
Benchmarking participant not meeting sample requirements									
Ontario, Canada	54 (1.4)	53 (1.2)	54 (1.9)	0 (1.3)					

Notes:* Statistically significant ($p < .05$) coefficients in bold.

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

▲ More than three score points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than three score points below ICILS 2013 average

Under 40 average score +/- confidence interval

Over 40 average score +/- confidence interval

On average, teachers with a score in the range indicated by this color have more than a 50% probability of responding to the statements about perceptions of ICT teaching at their school with:

Disagreement to positive, agreement to negative items

Agreement to positive, disagreement to negative items

Table 6.13. National percentages of students at schools where teachers participate in professional development about ICT for teaching and learning

Country	Participating in School-Provided Courses on the Use of ICT in Teaching	Working With Another Teacher Who Has Attended a Course and Then Trains Other Teachers	Discussing the Use of ICT in Education as a Regular Item During Meetings of the Teaching Staff	Observing Colleagues Using ICT in Their Teaching	Discussion Within Groups of Teachers About Using ICT in Their Teaching	Participating in a [Community of Practice] Concerned with ICT in Teaching	Participating in Courses Conducted by an External Agency or Expert	Participating in Professional Learning Programs Delivered Through ICT
Australia	80 (2.6) ▲	67 (3.6) ▲	75 (2.8) ▲	55 (3.6) ▲	72 (3.2) ▲	44 (3.6) ▲	41 (3.4)	58 (3.0) ▲
Chile	44 (4.6) ▼	31 (4.8) ▼	39 (4.4) ▼	41 (3.7)	42 (4.5) ▼	23 (3.9)	23 (4.1) ▼	20 (4.0) ▼
Croatia	85 (2.9) ▲	50 (3.9)	39 (3.6) ▼	36 (3.6) ▽	51 (3.9)	27 (2.8)	45 (4.2)	47 (4.1)
Czech Republic	75 (3.5)	44 (4.1)	39 (4.5) ▼	21 (3.3) ▼	44 (4.3) ▼	13 (3.1) ▼	37 (3.9)	23 (3.4) ▼
Germany ¹	42 (4.7) ▼	22 (3.9) ▼	22 (4.1) ▼	4 (1.7) ▼	37 (4.4) ▼	5 (2.0) ▼	13 (2.9) ▼	10 (3.6) ▼
Korea, Republic of	61 (4.3)	48 (4.2)	36 (3.7) ▼	60 (4.1) ▲	37 (4.4) ▼	25 (3.8)	34 (4.1)	45 (4.0)
Lithuania	86 (3.0) ▲	54 (4.8)	67 (4.5) ▲	57 (4.7) ▲	76 (3.8) ▲	36 (4.5)	31 (4.4)	35 (4.6)
Norway (Grade 9) ¹	58 (4.5) ▼	52 (4.9)	62 (5.1)	22 (4.2) ▼	65 (5.2)	7 (2.5) ▼	10 (2.5) ▼	19 (3.9) ▼
Poland	56 (4.0) ▼	53 (4.4)	45 (4.7)	48 (4.4)	60 (4.0)	28 (4.2)	38 (4.3)	13 (2.6) ▼
Russian Federation ²	82 (2.8) ▲	62 (3.4) ▲	85 (3.2) ▲	85 (2.6) ▲	86 (3.0) ▲	77 (3.2) ▲	72 (3.6) ▲	64 (3.2) ▲
Slovak Republic	79 (3.3) ▲	48 (4.4)	66 (4.3) ▲	44 (4.3)	60 (3.9)	9 (2.5) ▼	47 (3.9) ▽	45 (4.1)
Slovenia	87 (3.0) ▲	35 (3.9) ▼	60 (3.7)	32 (2.7) ▼	56 (4.1)	27 (4.0)	71 (3.9) ▲	59 (4.1) ▲
Thailand ²	83 (2.9) ▲	78 (3.8) ▲	60 (4.7)	59 (4.8) ▲	63 (4.9)	64 (5.0) ▲	58 (4.9) ▲	65 (4.0) ▲
Turkey	41 (4.4) ▼	20 (3.1) ▼	51 (4.3)	52 (4.4)	29 (3.6) ▼	24 (3.7)	22 (3.7) ▼	38 (4.0)
ICILS 2013 average	68 (1.0)	47 (1.1)	53 (1.1)	44 (1.0)	56 (1.1)	29 (1.0)	39 (1.0)	39 (1.0)
Countries not meeting sample requirements								
Denmark	63 (5.8)	40 (6.3)	56 (6.2)	20 (4.3)	52 (6.3)	37 (5.6)	36 (5.5)	27 (4.8)
Hong Kong SAR	39 (5.6)	15 (4.4)	18 (4.5)	36 (5.3)	19 (4.4)	11 (3.9)	21 (4.6)	26 (5.2)
Netherlands	58 (5.4)	36 (5.6)	53 (5.8)	13 (4.0)	40 (5.9)	8 (3.4)	20 (4.4)	10 (3.4)
Switzerland	42 (6.7)	26 (6.4)	44 (7.7)	21 (7.0)	42 (6.8)	10 (2.5)	11 (5.1)	13 (5.6)
Benchmarking participants								
Newfoundland and Labrador, Canada	53 (0.3)	63 (0.3)	67 (0.3)	51 (0.3)	58 (0.3)	44 (0.3)	21 (0.1)	24 (0.3)
Ontario, Canada	49 (5.1)	43 (5.7)	53 (5.8)	43 (5.2)	53 (5.0)	34 (4.7)	15 (4.0)	24 (4.8)
Benchmarking participant not meeting sample requirements								
City of Buenos Aires, Argentina	26 (7.0)	20 (7.8)	62 (8.1)	24 (8.3)	36 (8.4)	12 (5.8)	20 (5.2)	11 (5.7)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Met guidelines for sampling participation rates only after replacement schools were included.¹ National Desired Population does not correspond to International Desired Population.² Country surveyed the same cohort of students but at the beginning of the next school year.

▲ More than 10 percentage points above ICILS 2013 average

△ Significantly above ICILS 2013 average

▽ Significantly below ICILS 2013 average

▼ More than 10 percentage points below ICILS 2013 average

The percentage of students at schools with higher levels of teacher participation in externally provided courses was significantly higher than the ICILS 2013 average in the Russian Federation (72%), Slovenia (71%), and Thailand (58%). The percentages of students at schools with teacher participation at this level in learning programs delivered online was significantly higher than the ICILS 2013 average in Thailand (65%), the Russian Federation (64%), Slovenia (59%), and Australia (58%).

Other forms of professional development involve collaboration among teachers in various forums. Schools representing more than half of the student population reported that many or all of their teachers had participated in discussions “within groups of teachers about using ICT in their teaching” (56%) or in discussions about “the use of ICT in education as a regular item during meetings of the teaching staff” (53%). These forms of professional development for teachers were reported also by schools representing high percentages of students (above the ICILS 2013 average) in the Russian Federation (86% and 85% respectively for the two statements), Australia (72% and 75%), and Lithuania (76% and 67%).

Collaborative learning with colleagues, such as “working with another teacher who has attended a course” and “observing colleagues using ICT in their teaching,” was reported by schools representing less than half of the student population: 47 and 44 percent respectively. The percentages of students at schools where many or all teachers had worked with another teacher were significantly higher than the ICILS 2013 average in Thailand (78%), Australia (67%), and the Russian Federation (62%). In five countries, schools representing proportions of the student population larger than the ICILS average said that many or all of their teachers had observed colleagues using ICT in their teaching. These countries were the Russian Federation (85%), Korea (60%), Thailand (59%), Lithuania (57%), and Australia (55%).

Only 29 percent of students were enrolled at schools where many or all teachers had participated in a “community of practice concerned with ICT in teaching.” The percentage of students at schools where teachers participated in this type of community was significantly higher than the ICILS 2013 average in the Russian Federation (77%), Thailand (64%), and Australia (44%).

Teacher perspectives

The teacher questionnaire included a question that asked teachers about their participation (“yes” or “no”) in a range of professional development activities. Table 6.14 provides information on the types of professional development programs teachers had participated in during the previous two years.

The most common form of participation involved observing other teachers using ICT. On average across countries, 46 percent of teachers reported this type of participation. The countries whose teachers most frequently reported observing their colleagues’ use of ICT were Lithuania (60%), Australia (57%), and Korea (57%). The next most widely reported form of professional development concerned integrating ICT into teaching and learning. On average, 43 percent of teachers across the ICILS countries had participated in such a course. The highest percentages were recorded in Slovenia (64%) and Australia (57%).

Table 6.14: National percentages of teachers participating in ICT-related professional development activities

Country	Introductory Course on General Applications (e.g., Basic Wordprocessing, Spreadsheets, Databases)	Advanced Course on General Applications (e.g., Advanced Wordprocessing, Spreadsheets, Databases)	Introductory Course on Internet Use (e.g., Compiling Internet Searches, Digital Resources)	Advanced Course on Internet Use (e.g., Creating Websites, Building Web-Based Resources)	Course on Integrating ICT into Teaching and Learning	Training on Subject-Specific Software	Observing Other Teachers Using ICT in Teaching	Course on Multimedia Involving Use of Digital Video/Audio Equipment	Course on Subject-Specific Digital Resources	An ICT-Mediated Discussion or Forum on Teaching and Learning	Sharing and Evaluating Digital Resources with Others within a Collaborative Work Space
Australia	23 (1.1) ▼	14 (0.7) ▽	23 (1.2) ▽	18 (0.9)	57 (1.5) ▲	45 (1.7) ▲	57 (1.5) ▲	23 (1.0)	30 (1.3) ▽	35 (1.3) ▽	48 (1.5) ▲
Chile	34 (1.9)	15 (0.9) ▽	33 (1.8)	15 (1.1) ▽	39 (2.1)	21 (1.7) ▽	37 (1.9) ▽	18 (1.3) ▽	19 (1.6) ▽	26 (1.7)	29 (1.5)
Croatia	53 (1.7) ▲	23 (1.4)	61 (2.0) ▲	14 (0.9) ▽	45 (1.8)	18 (1.1) ▼	36 (1.4) ▼	15 (1.0) ▽	15 (0.9) ▽	19 (0.8) ▽	14 (0.8) ▼
Czech Republic	25 (1.7) ▽	21 (1.6)	16 (1.1) ▼	11 (0.9) ▽	36 (1.8) ▽	28 (1.7)	27 (1.8) ▼	24 (1.4)	18 (1.2) ▽	21 (1.3) ▽	31 (1.4)
Korea, Republic of	36 (2.2)	21 (1.2)	31 (1.3)	15 (0.9) ▽	42 (1.7)	32 (1.3)	57 (2.0) ▲	35 (1.0) ▲	28 (1.3) ▽	20 (1.3) ▽	23 (1.3) ▽
Lithuania	31 (1.7)	30 (1.8) ▽	30 (1.8)	23 (2.1) ▽	54 (1.5) ▲	49 (1.5) ▲	60 (1.4) ▲	23 (1.2)	28 (1.4) ▽	28 (1.0)	16 (1.3) ▼
Poland	15 (1.0) ▼	12 (1.1) ▽	12 (1.0) ▼	11 (0.9) ▽	29 (1.4) ▼	29 (1.3)	43 (1.4) ▽	36 (1.6) ▲	18 (1.4) ▽	22 (1.5) ▽	23 (1.4) ▽
Russian Federation ¹	47 (2.0) ▲	29 (1.7) ▽	46 (1.9) ▲	17 (1.3)	44 (1.7)	34 (1.3) ▽	83 (1.2) ▲	24 (1.8)	40 (1.6) ▲	39 (2.2) ▲	57 (1.9) ▲
Slovak Republic	32 (1.5)	25 (1.3) ▽	26 (1.2) ▽	8 (0.7) ▽	40 (1.4)	21 (1.0) ▽	33 (1.4) ▼	23 (1.3)	20 (1.1) ▽	21 (1.2) ▽	15 (1.1) ▼
Slovenia	26 (2.2) ▽	26 (1.3) ▽	19 (1.0) ▼	26 (1.4) ▽	64 (1.6) ▲	41 (1.5) ▲	47 (1.4)	25 (1.1)	27 (1.1) ▽	40 (1.6) ▲	29 (1.1)
Thailand	48 (3.3) ▲	32 (3.6) ▲	59 (2.6) ▲	33 (2.7) ▲	50 (2.8) ▽	36 (2.2) ▽	53 (2.3) ▽	36 (2.7) ▲	32 (2.7) ▽	45 (3.2) ▲	40 (2.8) ▲
Turkey	27 (2.2) ▽	13 (1.1) ▽	22 (1.8) ▽	13 (1.2) ▽	14 (1.6) ▼	12 (1.3) ▼	23 (1.5) ▼	9 (0.9) ▼	9 (1.0) ▼	17 (1.4) ▼	23 (1.8) ▽
ICILS 2013 average	33 (0.6)	22 (0.5)	32 (0.5)	17 (0.4)	43 (0.5)	30 (0.4)	46 (0.5)	24 (0.4)	24 (0.4)	28 (0.5)	29 (0.5)
Countries not meeting sample requirements											
Denmark	19 (2.3)	15 (2.0)	19 (1.9)	14 (1.5)	43 (2.8)	39 (2.8)	25 (1.7)	21 (3.0)	36 (3.5)	27 (1.8)	27 (1.8)
Germany	10 (1.1)	7 (0.9)	8 (1.0)	5 (0.8)	18 (1.6)	28 (2.3)	19 (1.9)	14 (1.4)	10 (1.1)	8 (1.2)	9 (1.1)
Hong Kong SAR	21 (1.5)	14 (1.3)	20 (1.6)	14 (1.4)	34 (1.9)	24 (1.5)	41 (1.6)	22 (1.5)	13 (1.2)	26 (1.4)	26 (1.3)
Netherlands	13 (1.6)	7 (1.3)	8 (1.0)	7 (1.3)	35 (2.2)	27 (1.6)	24 (1.7)	13 (1.2)	26 (2.0)	15 (1.1)	23 (1.6)
Norway (Grade 9)	25 (1.7)	10 (1.1)	16 (1.4)	7 (1.0)	28 (1.9)	35 (2.1)	31 (2.1)	12 (1.3)	22 (1.6)	37 (1.8)	35 (1.8)
Benchmarking participant											
Newfoundland and Labrador, Canada	11 (2.0)	5 (1.4)	13 (2.0)	23 (2.6)	44 (3.2)	42 (2.4)	47 (3.3)	17 (2.2)	25 (2.7)	28 (2.5)	47 (3.2)
Benchmarking participant not meeting sample requirements											
Ontario, Canada	12 (2.4)	7 (1.9)	13 (2.6)	20 (3.2)	44 (3.6)	47 (3.7)	44 (3.2)	21 (3.0)	24 (3.4)	27 (3.6)	41 (3.9)

Notes:

() Standard errors appear in parentheses. Because some results are rounded to the nearest whole number, some totals may appear inconsistent.

¹ Country surveyed teachers retrospectively to the previous school year when they were teaching the target grade.

▲ More than 10 percentage points above ICILS 2013 average
 ▽ Significantly above ICILS 2013 average
 ▽ Significantly below ICILS 2013 average
 ▼ More than 10 percentage points below ICILS 2013 average

On average across countries, teachers took part in introductory courses on the following topics: general ICT applications (33%), internet use (32%), and subject-specific software (30%). The highest rates of participation in introductory courses on general applications were recorded in Croatia (53%), Thailand (48%), and the Russian Federation (47%). These countries also reported the highest levels of participation in introductory courses on internet use (61%, 57%, and 46% respectively). Training on subject-specific software was reported most frequently in Lithuania (49%), Australia (45%), and Newfoundland and Labrador (42%).

Two activities involving collaboration attracted lesser mention. Twenty-nine percent of teachers across the ICILS countries reported “sharing and evaluating digital resources with others using a collaborative work space.” The highest percentages were 57 percent in the Russian Federation and 48 percent in Australia. Corresponding percentages for participating in “an ICT-mediated discussion or forum on teaching and learning” were 28 percent (the ICILS 2013 average), 46 percent in Thailand, and 40 percent in Slovenia.

Relatively few teachers crossnationally mentioned the following professional development courses focused on more advanced aspects of ICT:

- Course on multimedia involving use of digital video/audio equipment (24%);
- Course on subject-specific digital resources (24%);
- Advanced course on general applications (e.g., advanced wordprocessing, spreadsheets, databases) (22%); and
- Advanced course on internet use (e.g., creating websites, building web-based resources) (17%).

No more than a quarter of teachers said they had taken part in these courses. None of the ICILS countries recorded a large proportion of teachers who said they had engaged in these activities.

Conclusion

Data from the ICILS ICT-coordinator and principal questionnaires confirmed that schools in most of the participating countries had access to computer and ICT resources. Unsurprisingly, the provision of such infrastructure had increased in comparison to the levels seen in earlier IEA studies on ICT use in education (Law et al., 2008; Pelgrum & Anderson, 2001). However, in keeping with these studies, ICILS 2013 still showed considerable crosscountry variation in the relative abundance of resources.

Resourcing included ICT that could be used to support collaborative work. It also included learning management systems, portable computing devices, and specialized software, such as data-logging and monitoring tools and simulations and modeling software. Student to computer ratios varied from two or three students per computer in some countries to more than 20 students per computer in other countries (and 80 in one of the countries), with lower ratios reported on average in schools in rural areas. On average, students from countries with better student to computer ratios gained higher scores on the CIL assessment.

Some aspects of school policy, such as setting up security measures and restricting inappropriate online material, were almost universally applied in schools, whereas policies such as providing students with laptops and allowing the local community access to school computers had far greater inter-country variation. In general, schools

reported that they accorded medium to high priority to facilitating ICT as teaching and learning tools. Also, according to teachers, ICT generally enabled them to work collaboratively with their colleagues.

However, schools identified a number of obstacles to using ICT pedagogically. ICT-coordinators varied in their ratings of such hindrances. In general, personnel issues featured as more of a concern than did those related to resources. Teachers also varied in their perceptions of whether the resources available to them (both in terms of ICT infrastructure and pedagogical support) were sufficient.

The main forms of teacher professional development with respect to the pedagogical use of ICT typically operated at school level, either through participation in school-organized professional development activities or through teachers observing one another using these resources. Teachers were more likely to attend professional development activities conducted outside the school if these encompassed less advanced aspects of ICT use.

Overall, the results from this chapter provide insight into the school-related contexts for students' use of ICT. Despite the global increase in ICT-infrastructure uptake, all of the ICILS countries reported challenges in their delivery of ICT-related education. Understandably, those countries with relatively lower levels of infrastructure were those most likely to have both teachers and ICT-coordinators reporting this lack as a barrier to this type of education.

However, even those countries with well-established infrastructure for ICT use in teaching and learning activities reported barriers, such as lack of skills, training, time available, and incentive to integrate ICT in educational practice. These findings suggest that more needs to be done in terms of nonphysical ICT resourcing. In particular, there seems to be a need for much greater pedagogical support. It is not enough to simply provide the physical resources that are needed for ICT in teaching and learning activities; the appropriate procedures and training also need to be in place to complement that infrastructure.

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