5

Students' Familiarity with Information and Communication Technologies

Which students benefit from information and communication technologies (ICT) and which are being left behind on the analogue side of the digital divide? This chapter examines students' access to and use of ICT and explores their attitudes towards and self-confidence in using computers. Findings are also discussed in relation to students' gender and socio-economic background. Trends in access to ICT and in students' self-confidence in using computers over the past decade are also examined.

Information and communication technologies (ICT) can support and enhance learning. With access to computers and the Internet, students can acquire knowledge beyond that which is available through the teachers and physical resources at their school. ICT provide students with new ways to present what they are learning through such tools as word processing, spreadsheets and multimedia presentations, or by creating online blogs and websites. ICT also allow students to collaborate, communicate and share their knowledge through e-mail, online chat and web forums. How do students use ICT at school and at home? Which students benefit from ICT and which students are being left behind on the analogue side of the digital divide?

The digital divide can separate people by national borders, socio-economic background, gender or geographic factors. Prior studies have shown that there is a digital divide in access to ICT between developed and less-developed countries (Dewan, *et al*., 2005; Carsten and Charles, 2003). Another study, which compares Asian and non-Asian countries (Wong, 2002), shows that Asian countries are lagging behind in adopting ICT compared with non-Asian countries with a similar level of GDP per capita.

The digital divide has also been examined within countries. Socio-economically disadvantaged students who have no or limited access to ICT at home have to spend more time looking for them outside the home. As a result, they have that much less time to finish the tasks required of them (Robinson and Laura, 2009). These disadvantages, in turn, make such students less efficient ICT users. They generally have few skills in searching for information on line, and are also less able to identify information that is relevant to the task at hand and to determine whether that information is credible.

Schools could play a more important role in bridging the digital divide. Studies have shown that public libraries and after-school lessons are frequently the places where disadvantaged students can gain access to and training in ICT (Gordon and Gordon, 2003; Sullivan and Vander, 2009).

The digital divide is no longer only about having physical access to a computer and the Internet at home and at school. While it is still true that students without or with only limited access to ICT at home and at school will not reap the same benefits as those with unrestricted access, a second digital divide is emerging between those who have the skills to benefit from ICT use and those who do not. Understanding how and where students use ICT, and their attitudes towards and confidence in using them, is essential for assessing the extent to which students are being prepared for full participation in the knowledge-based economy.

This chapter first presents and analyses data on students' access to ICT from PISA 2009, and examines changes in access to ICT from PISA 2000 to PISA 2009. The analysis is followed by the examination of students' use of ICT and students' attitudes towards and confidence in using computers. Changes in students' confidence in using computers between PISA 2003 and 2009 are also discussed.

Throughout the chapter, the relationship between gender and socio-economic background and student access, use and attitudes towards ICT is examined. These analyses offer a snapshot of the digital divide between and within countries and economies. This chapter also lays the groundwork for Chapter 6, in which the relationship between students' familiarity and engagement with ICT and performance in digital reading is discussed.

STUDENTS' ACCESS TO ICT

Do students have access to a computer and the Internet at home and/or at school? Is the digital divide among countries and socio-economic groups widening or narrowing? Does investing in ICT resources for schools mean that more students are using computers and connecting to the Internet at school? PISA tries to answer these and other questions by comparing students' access to ICT across countries and monitoring changes in that access over time. This chapter extends the analysis of ICT access beyond the physical presence of a computer or Internet connection and examines the extent to which students can actually use ICT at home and school.

The number of students who have never used a computer

The most basic measure of students' access to and familiarity with ICT is whether or not they have used a computer. In 2009, on average across OECD countries, fewer than 1% of students reported that they had never used a computer. In Greece, Turkey, Japan and Israel, between 2% and 3% of students so reported, while the partner countries Panama and Jordan showed the highest levels of non-use, with 10% and 7% of students, respectively, reporting that they had never used a computer (Figure VI.5.1 and Table VI.5.1).

Box VI.5.1 How information on students' familiarity with ICT was collected

PISA offers internationally comparable information on students' access to and use of computers and their general attitudes towards and self-confidence in using computers. In PISA 2009, 29 OECD countries and 16 partner countries and economies chose to administer the optional ICT familiarity component for the student questionnaire. This questionnaire was not designed to assess the quality of ICT use at school and the integration of ICT in pedagogy to enhance students' higher-order thinking skills; rather, it focuses on students' use of ICT to access, manage and present information.

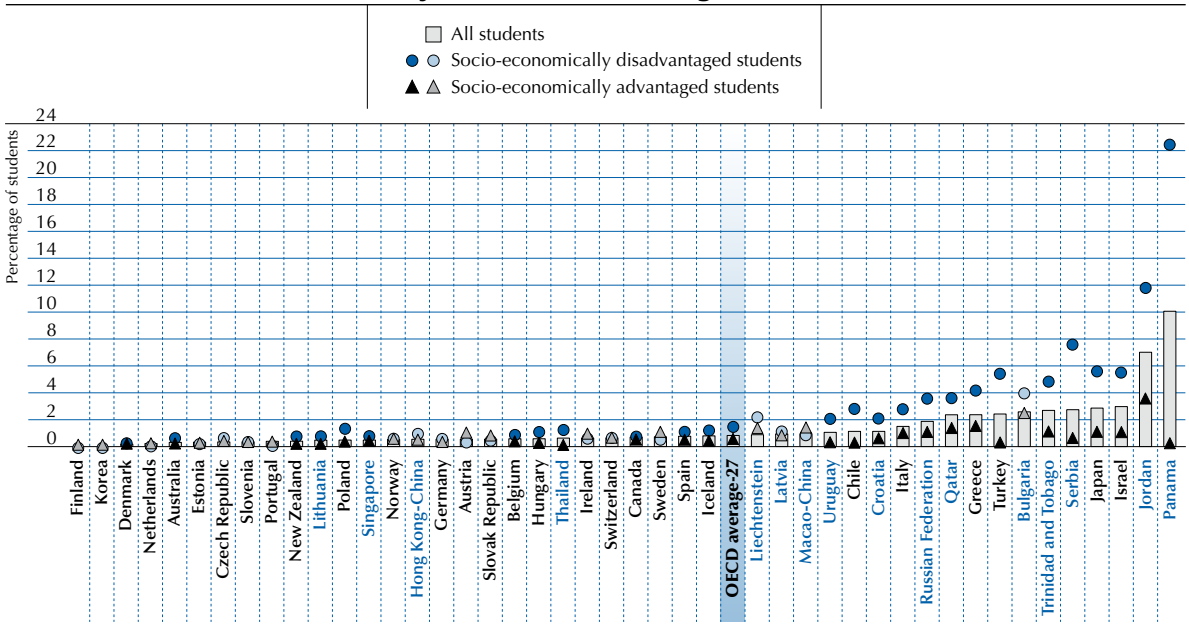
The OECD countries that participated were Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland and Turkey.

The partner countries and economies that participated were Bulgaria, Croatia, Hong Kong-China, Jordan, Latvia, Liechtenstein, Lithuania, Macao-China, Panama, Qatar, the Russian Federation, Serbia, Singapore, Thailand, Trinidad and Tobago and Uruguay.

In the ICT familiarity questionnaire, students provided information on how often they used a computer, and what type of computer they used at home and at school. Students also reported on their attitudes towards using a computer and their self-confidence in computer use and technical proficiency. Additional information on student ICT access at home and school was derived from particular items within the student and school questionnaires. In the student questionnaire, students answered questions on whether or not they had a home computer to use for schoolwork, educational software, a link to the Internet or other educational resources. As part of the school questionnaire, principals provided information on the availability of computers at their schools and on whether they felt that a lack of computers hindered instruction in their school. Given the availability of PISA data since 2000, it was possible to analyse trends in students' access to, attitudes towards and self-confidence in using computers for some of the participating countries.

■ Figure VI.5.1 ■

Percentage of students who reported that they have never used a computer, by socio-economic background



Note: Countries in which the difference between socio-economically advantaged and disadvantaged students (top and bottom quarters of the *PISA index of economic, social and cultural status*) is statistically significant are marked in a darker tone.

Countries are ranked in ascending order of the percentage of all students who reported that they have never used a computer.

Source: OECD, *PISA 2009 Database,* Table VI.5.1.

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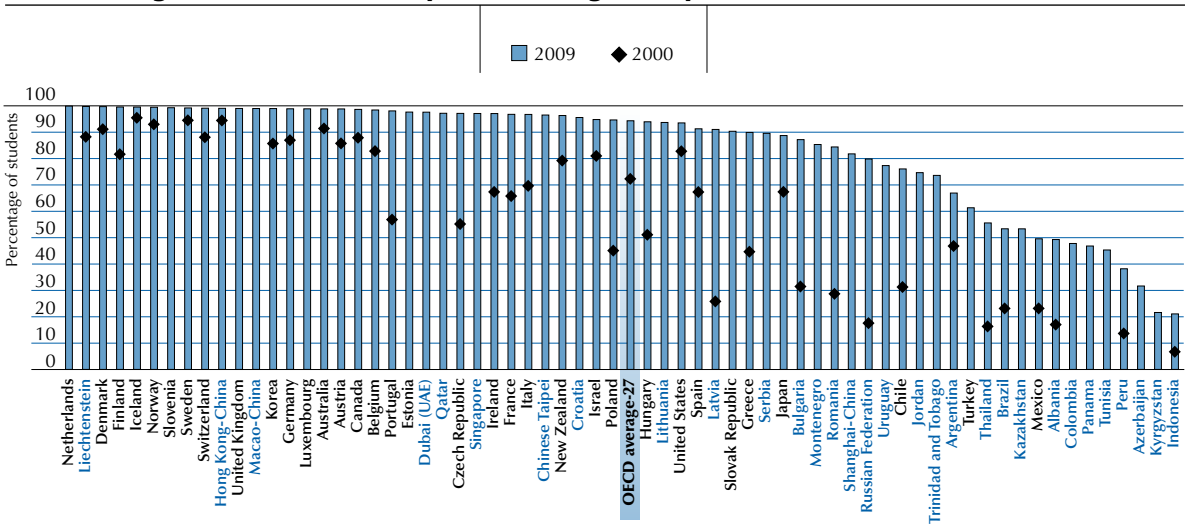
Students' access to a computer and the Internet at home

Access to a home computer

In the 2000 and 2009 PISA student questionnaires, students were asked to report how many computers they had at home. Figure VI.5.2 shows the percentage of students in each country who have at least one computer at home in 2009. This percentage is also shown for countries that took part in PISA 2000.

■ Figure VI.5.2 ■

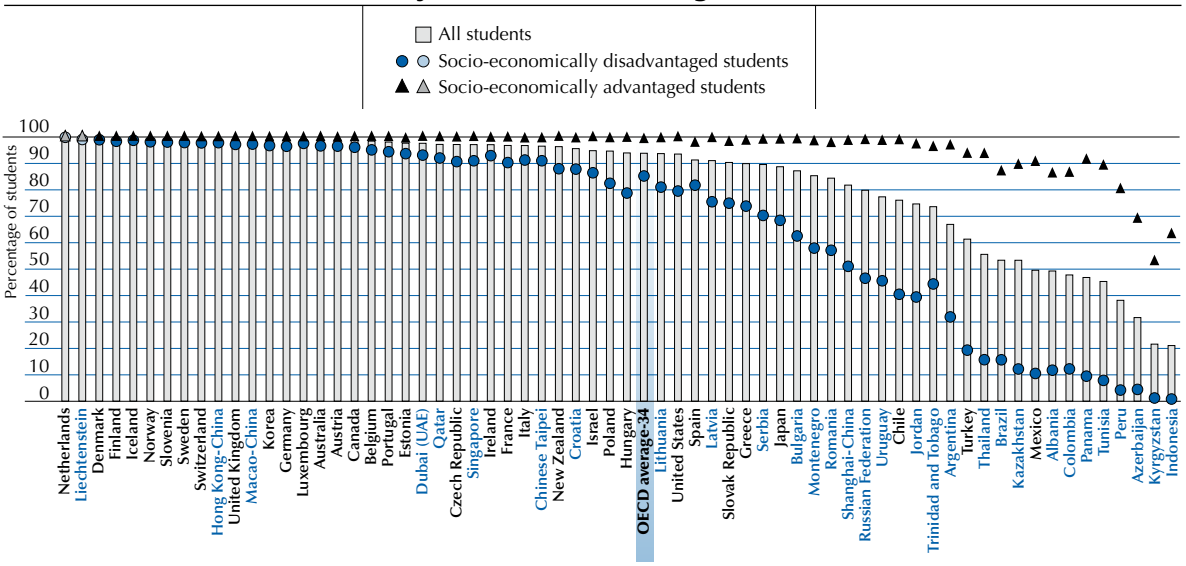
Percentage of students who reported having a computer at home in PISA 2000 and 2009



Notes: All differences between 2000 and 2009 are statistically significant.
OECD averages in 2000 and 2009 for 27 countries. OECD average in 2009 for 34 countries is 93.8%.
Countries are ranked in descending order of percentage of students who reported having a computer at home in PISA 2009.
Source: OECD, *PISA 2009 Database,* Tables VI.5.2 and VI.5.3.
StatLink http://dx.doi.org/10.1787/888932435435

■ Figure VI.5.3 ■

Percentage of students who reported having a computer at home, by socio-economic background



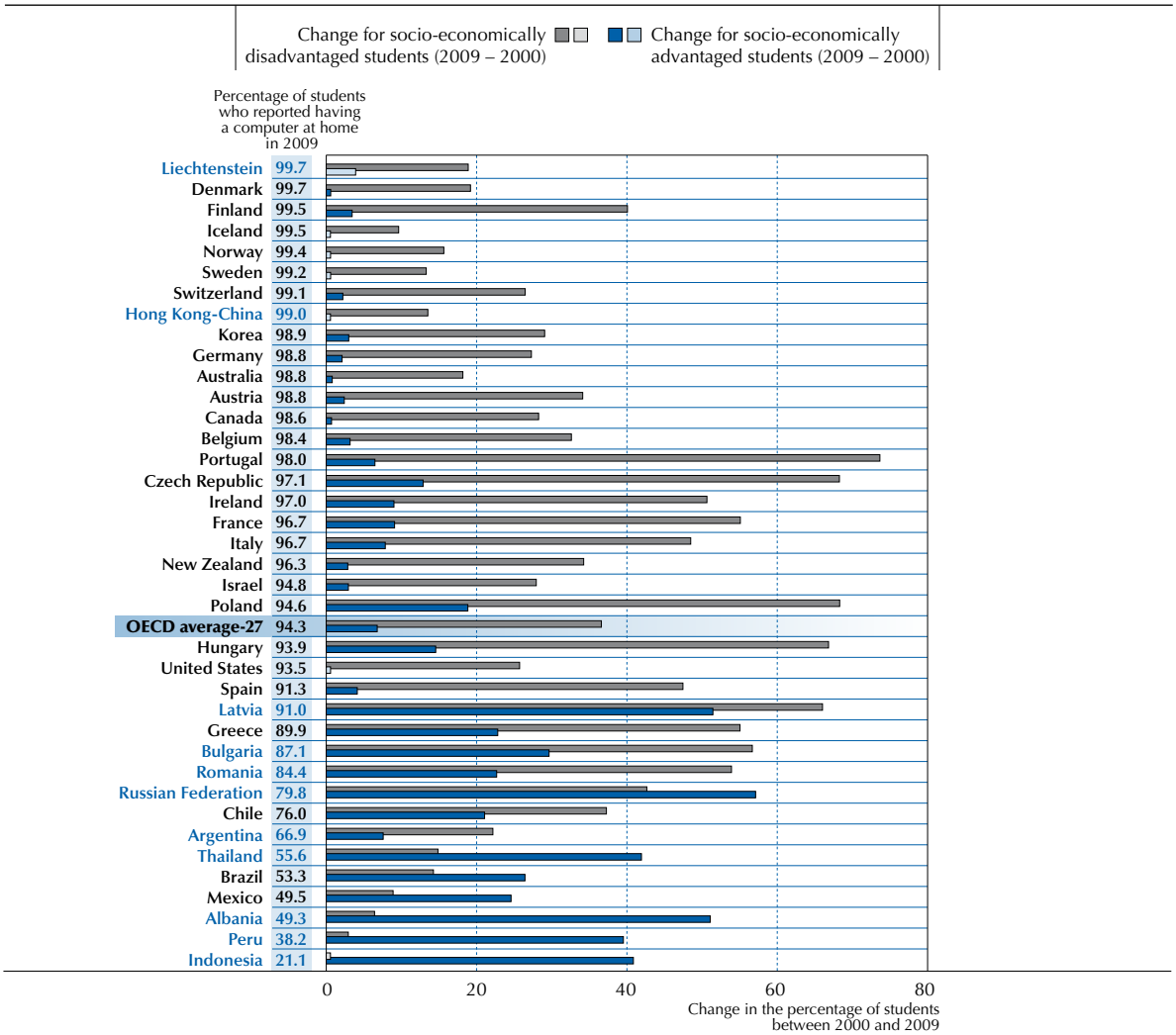
Note: Countries in which the difference between socio-economically advantaged and disadvantaged students (top and bottom quarters of the *PISA index of economic, social and cultural status*) is statistically significant are marked in a darker tone.
Countries are ranked in descending order of the percentage of all students who reported having a computer at home.
Source: OECD, *PISA 2009 Database,* Table VI.5.3.
StatLink http://dx.doi.org/10.1787/888932435435

On average across OECD countries, 94% of students reported that they had a computer at home. In 17 OECD countries and the partner countries and economies Liechtenstein, Hong Kong-China and Macao-China, at least 98% of students reported having a computer at home. Student access to a home computer was below 80% only in Chile (76%), Turkey (61%) and Mexico (50%) among OECD countries. Among the partner countries, fewer than 50% of students reported having a computer at home in Albania (49%), Colombia (48%), Panama (47%), Tunisia (45%), Peru (38%), Azerbaijan (31%), Kyrgyzstan (22%) and Indonesia (21%) (Figure VI.5.2 and Table VI.5.3).

On average across the OECD countries that took part in PISA 2000 and 2009, the percentage of students who reported having at least one computer at home increased from 72% in 2000 to 94% in 2009. Iceland, Sweden, Norway and the partner economy Hong Kong-China showed small gains to 99% in 2009, from levels of 93% or more in 2000. Between 2000 and 2009, Poland and the partner countries Latvia, the Russian Federation, Bulgaria and Romania showed gains of 50 percentage points or more in the proportion of students who reported that they had access to a computer at home (Figure VI.5.2 and Table VI.5.2).

■ Figure VI.5.4 ■

Change in the percentage of students who reported having a computer at home between 2000 and 2009, by socio-economic background



Note: Changes that are statistically significant are marked in a darker tone.
Socio-economically disadvantaged students are those in the bottom quarter of the *PISA index of economic, social and cultural status* (ESCS) and socio-economically advantaged students are those in the bottom quarter of this index.
Countries are ranked in descending order of the percentage of students who reported having a computer at home in 2009.
Source: OECD, *PISA 2009 Database,* Table VI.5.4.
StatLink http://dx.doi.org/10.1787/888932435435

Figure VI.5.3 shows the relationship between student socio-economic background and access to a computer at home. Students who were in the top quarter of the *PISA index of economic, social and cultural status* (ESCS) in their country were categorised as being relatively advantaged, and those in the bottom quarter were categorised as being relatively disadvantaged. In all countries and economies, other than the Netherlands and Liechtenstein, socio-economically advantaged students showed higher levels of access to a computer at home than disadvantaged students. The gap between advantaged and disadvantaged students is largest in countries with lower overall levels of access to home computers. A gap of 70 percentage points in favour of advantaged students is evident in Mexico, Turkey and the partner countries Panama, Tunisia, Thailand, Kazakhstan, Peru, Albania, Columbia and Brazil (Table VI.5.3).

Figure VI.5.4 shows the change from 2000 to 2009 in the proportion of socio-economically advantaged and disadvantaged students who reported having access to a computer at home. This can be seen as a measure of the extent to which countries have made progress in reducing the digital divide of physical access to a computer. On average across OECD countries, the increase in access to a home computer between 2000 and 2009 was larger for disadvantaged students (37 percentage points) than for advantaged students (7 percentage points). Countries that have narrowed the digital divide between advantaged and disadvantaged students are also those that show nearly universal access to computers. In contrast, in Mexico and the partner countries Albania, Indonesia, Peru, Thailand, the Russian Federation and Brazil, the digital divide between advantaged and disadvantaged students has widened since 2000, as more advantaged than disadvantaged students reported having access to home computers (Figure VI.5.4 and Table VI.5.4).

Home Internet access

Access to the Internet can represent a qualitative, as well as quantitative, difference in the educational resources available to students. Developing skills to navigate and use the Internet effectively is increasingly important for full participation in a knowledge-based society. Figure VI.5.5 shows the percentage of students in each country who reported having access to the Internet at home. On average across OECD countries, 89% of students reported that they have access to the Internet at home. The Netherlands, Norway, Finland, Denmark, Iceland, Sweden, Switzerland, the partner country Liechtenstein and the partner economy Hong Kong-China showed levels of home Internet access of 98% or more. In Mexico and 11 partner countries, less than 40% of students reported having a link to the Internet at home. The lowest levels were reported in Kyrgyzstan (14%) and Indonesia (8%) (Table VI.5.6).

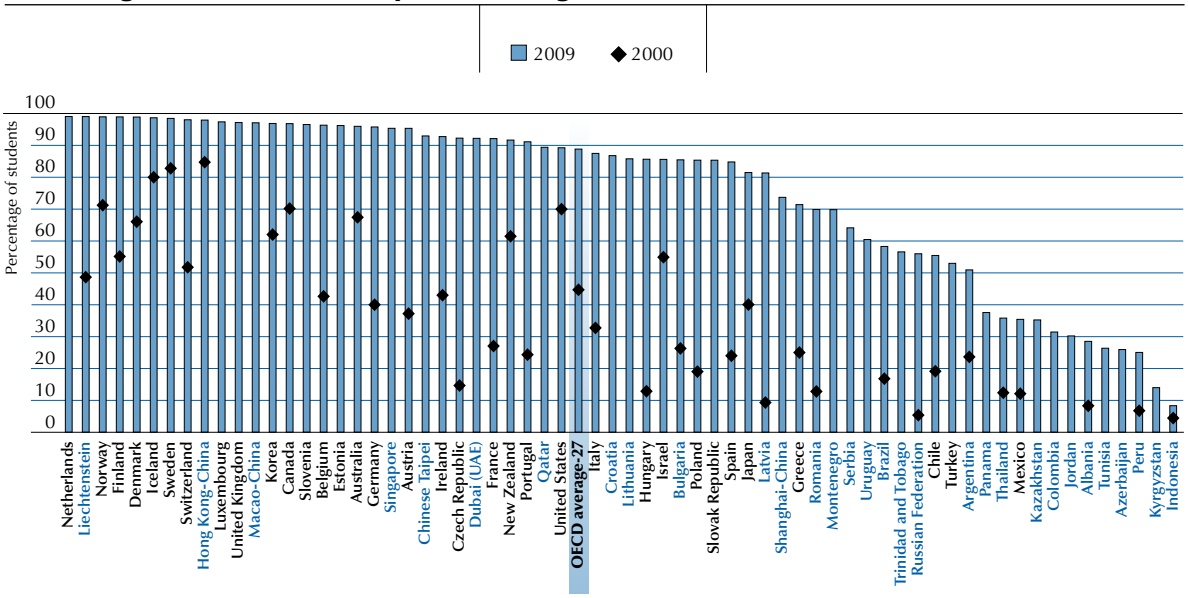
In the countries for which data from PISA 2000 is available, the opportunities for 15-year-old students to access the Internet have improved dramatically. On average across OECD countries, the proportion of students who reported having the Internet at home doubled from 45% to 89% between 2000 and 2009. There was notable growth in home Internet access in the Czech Republic, Hungary, Poland and the partner country Latvia, from less than 20% of students in 2000 to more than 80% of students in 2009 (Figure VI.5.5 and Table VI.5.5).

As shown in Figure VI.5.6, the relationship between students' socio-economic background and access to the Internet at home is more pronounced than that for computer access (Figure VI.5.3). In all countries and economies other than the partner country Liechtenstein, socio-economically advantaged students reported higher levels of Internet access at home than disadvantaged students. In general, countries with lower overall levels of Internet access have larger gaps in access to the Internet at home that are related to socio-economic background. The gap between advantaged and disadvantaged students in home Internet access is more than 70 percentage points in Chile, Mexico and the partner countries Panama, Thailand and Argentina (Table VI.5.6).

On average across OECD countries, the proportion of disadvantaged students with Internet access at home increased by 54 percentage points – from 22% in 2000 to 76% in 2009 – while home Internet access for advantaged students rose from 71% to 98% during the same period (Figure VI.5.7). While there is still a socio-economic gap of 22 percentage points, that gap has narrowed. In contrast, in Mexico, Chile, Hungary and the partner countries the Russian Federation, Albania, Thailand, Peru, Romania, Latvia, Indonesia, Argentina and Brazil, the increase in Internet access at home since 2000 was mainly seen among advantaged students, indicating a widening of the socio-economic gap (Table VI.5.7).

■ Figure VI.5.5 ■

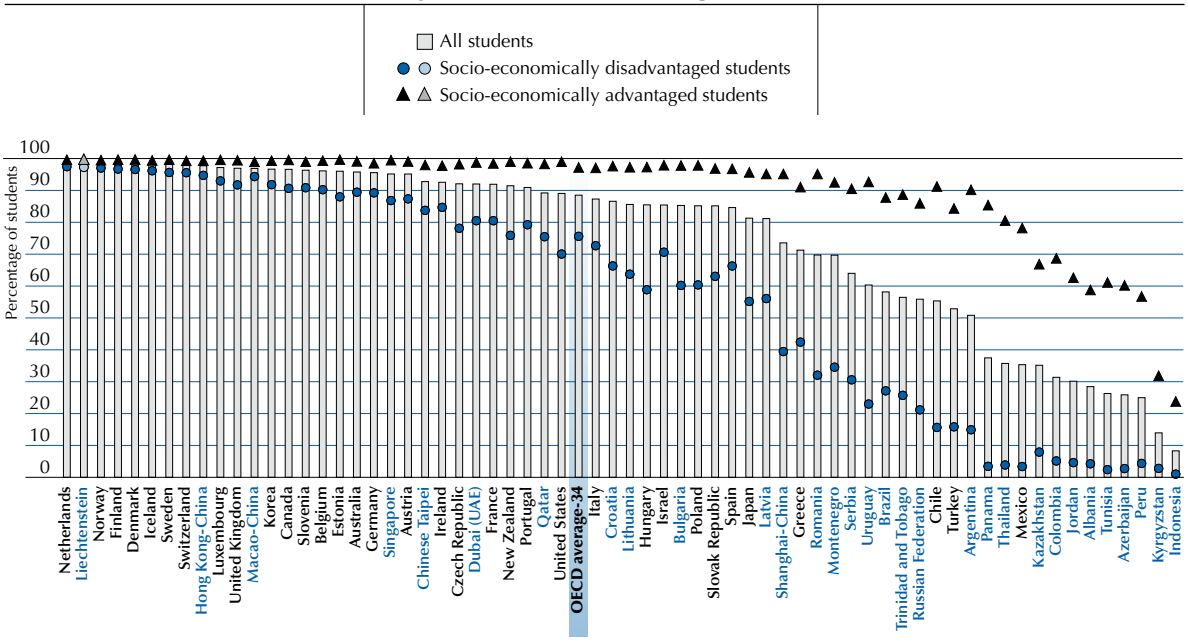
Percentage of students who reported having access to the Internet at home in 2000 and 2009



Notes: All differences between 2000 and 2009 are statistically significant.
OECD averages in 2000 and 2009 include 27 countries. The OECD average in 2009 for 34 countries is 88.7%.
Countries are ranked in descending order of the percentage of students who reported having access to the Internet at home in 2009.
Source: OECD, *PISA 2009 Database,* Tables VI.5.5 and VI.5.6.
StatLink http://dx.doi.org/10.1787/888932435435

■ Figure VI.5.6 ■

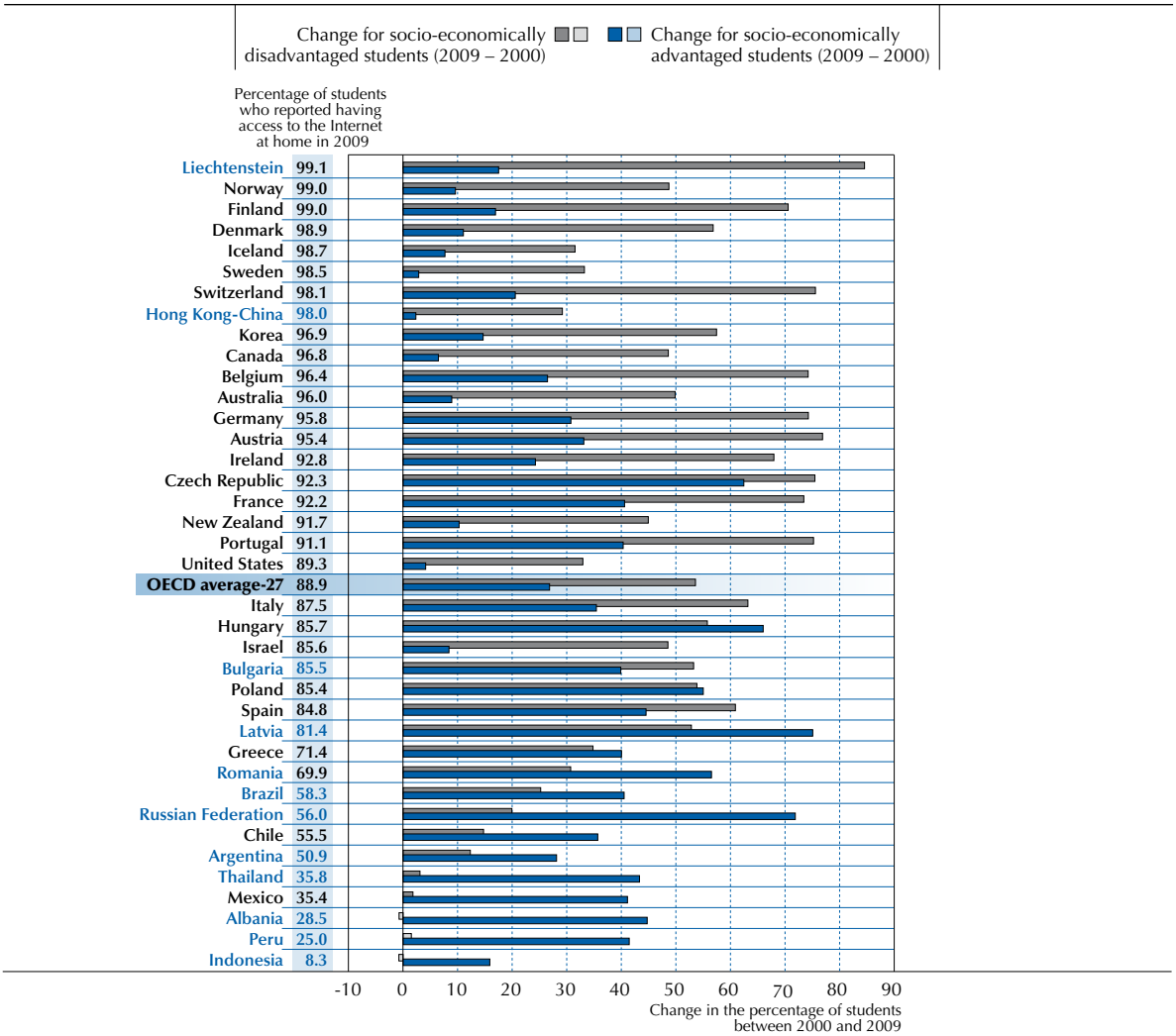
Percentage of students who reported having access to the Internet at home, by socio-economic background



Note: Countries in which the difference between socio-economically advantaged and disadvantaged students (top and bottom quarters of the *PISA index of economic, social and cultural status*) is statistically significant are marked in a darker tone.
Countries are ranked in descending order of the percentage of students who reported to have access to the Internet at home.
Source: OECD, *PISA 2009 Database,* Table VI.5.6.
StatLink http://dx.doi.org/10.1787/888932435435

■ Figure VI.5.7 ■

Change in the percentage of students who reported having access to the Internet at home between 2000 and 2009, by socio-economic background



Note: Changes that are statistically significant are marked in a darker tone.
Socio-economically disadvantaged students are those in the bottom quarter of the *PISA index of economic, social and cultural status* (ESCS) and socio-economically advantaged students are those in the bottom quarter of this index.
Countries are ranked in descending order of the percentage of students who reported having access to the Internet at home in 2009.
Source: OECD, *PISA 2009 Database,* Table VI.5.4.
StatLink http://dx.doi.org/10.1787/888932435435

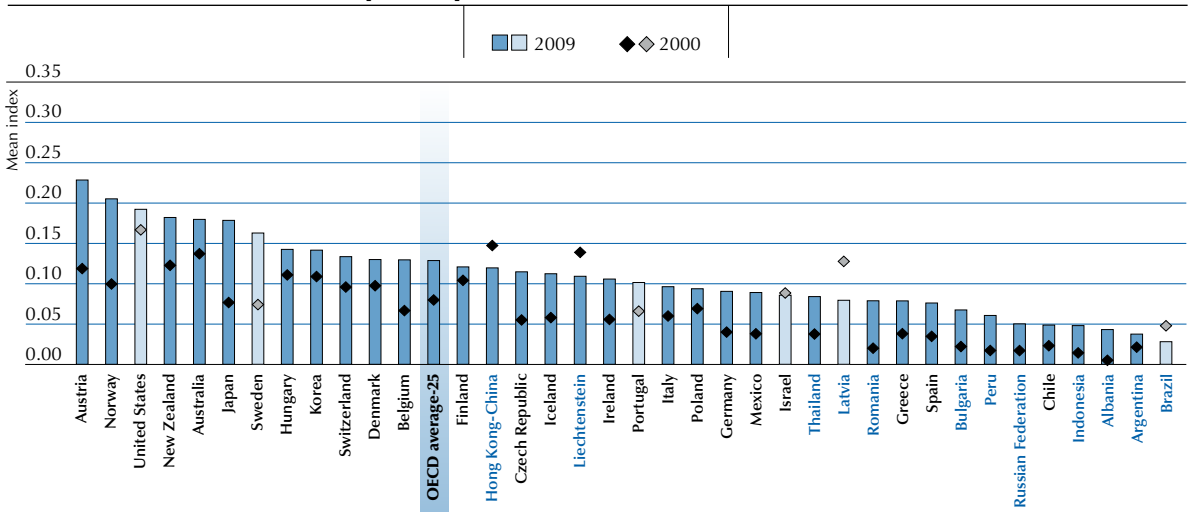
Students' access to computers and the Internet at school

The number of computers available per student

A key indication of students' physical access to ICT resources is the number of computers available per student at school and access to the internet. Access to ICT is important, as students' use of ICT for learning partly depends on the extent to which they can gain individual access to a computer. Two types of computer-student ratios were calculated from information provided by school principals in the PISA school questionnaire. The first type of ratio is the number of computers available for students in the modal grade for 15-year-olds, divided by the number of students in the modal grade for 15-year-olds. The second type of ratio is the number of computers available for students in the modal grade for 15-year-olds divided by the total number of students in school. The first ratio is the more precise indicator of the computers-per-student ratio, as both the denominator and numerator consider the same group of students. The second ratio is developed as a proxy only to examine the change in the ratios over time, since the number of students in the modal grade for 15-year-olds was not asked in PISA 2000. As expected, these two types of the ratios in PISA 2009 are highly correlated.[1]

■ Figure VI.5.8 ■

Computers-per-student ratio in 2000 and 2009



Notes: Countries where differences between 2000 and 2009 are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the computers-per-student ratio in 2009.
Source: OECD, *PISA 2009 Database,* Table VI.5.8b.
StatLink http://dx.doi.org/10.1787/888932435435

On average across OECD countries, the computers-per-student ratio – the ratio of computers available for students in the modal grade for 15-year-olds to students in that grade – was 0.56 (Table VI.5.8a). Countries with the highest levels of computers per student in 2009 were Australia, New Zealand, the United Kingdom, Austria, Denmark, Canada, the United States and Norway, all with computer-student ratios above 0.72. The lowest levels were reported in the partner countries Tunisia, Indonesia, Montenegro, Brazil and Kyrgyzstan, with only one computer available per five or more students (Table VI.5.8).

In all 25 OECD countries for which data are available for both PISA 2000 and 2009, there was an increase in the computer-per-student ratio, which is evidence of substantial investment in school ICT resources. Austria and Norway showed the largest increases, with an improvement of 0.11 ratio index points. Only in the partner country Liechtenstein and the partner economy Hong Kong-China was there a small decrease of 0.03 ratio index point in the number computers per student since 2000 (Figure VI.5.8 and Table VI.5.8). This change may have been the result of an increase in the student population during this period rather than a reduction in the number of computers available (OECD, 2003).

The number of students who have access to a computer at school

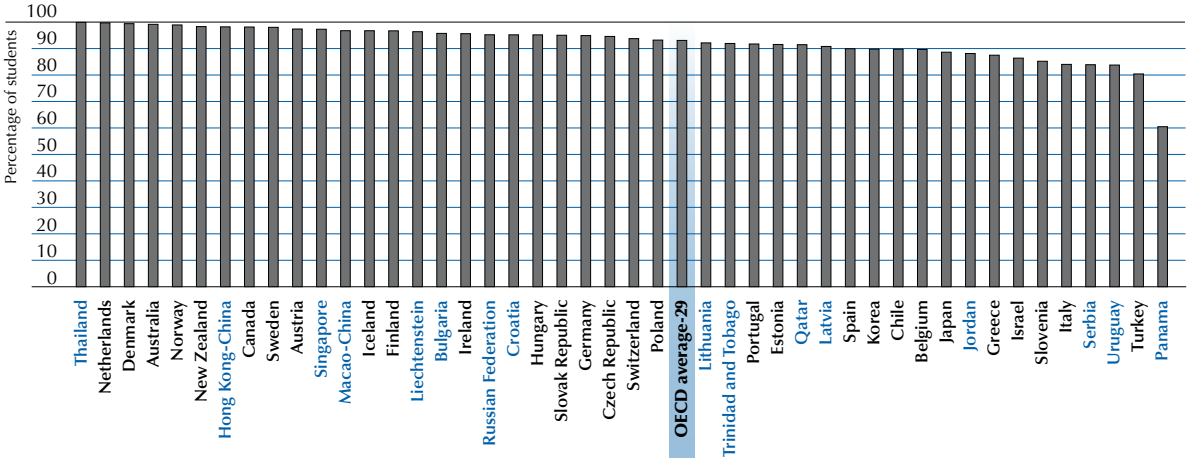
As part of the ICT familiarity questionnaire, students were asked if there are computers available to use at school. On average across OECD countries, 93% of students reported that they have access to a computer at school (Figure VI.5.9). More than 98% of students in the Netherlands, Denmark, Australia, Norway, New Zealand, Canada, Sweden, the partner country Thailand and the partner economy Hong Kong-China reported having access to a computer at school. In all OECD countries and the partner countries, except Panama, more than 80% of students reported having access to a computer at school. Only 61% of students in Panama, the lowest proportion among all participating countries, reported having access to a computer at school (Table VI.5.9).

The number of computers available that are connected to the Internet

On average across OECD countries, in 2009, 93% of students reported having access to computers connected to the Internet at school (Figure VI.5.10). Fewer than 85% of students reported having access to school computers that were connected to the Internet in Italy (72%), Turkey (77%), Japan (84%) and Israel (84%) and in the partner countries Serbia (65%), Qatar (73%), Jordan (73%), Uruguay (79%) and Trinidad and Tobago (83%). Fewer than 50% of students in the partner country Panama reported having access to school computers connected to the Internet (Table VI.5.9). This lack of Internet connectivity could deny students the benefits of educational resources available through the World Wide Web.

■ Figure VI.5.9 ■

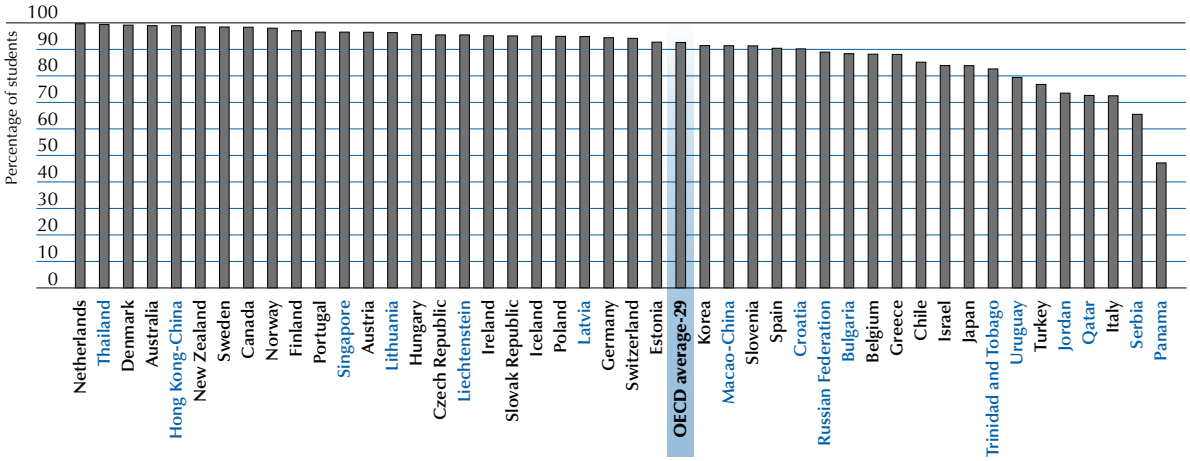
Percentage of students with access to computers at school



Countries are ranked in descending order of the percentage of students with access to computers at school.
Source: OECD, *PISA 2009 Database,* Table VI.5.9.
StatLink http://dx.doi.org/10.1787/888932435435

■ Figure VI.5.10 ■

Percentage of students with access to the Internet at school



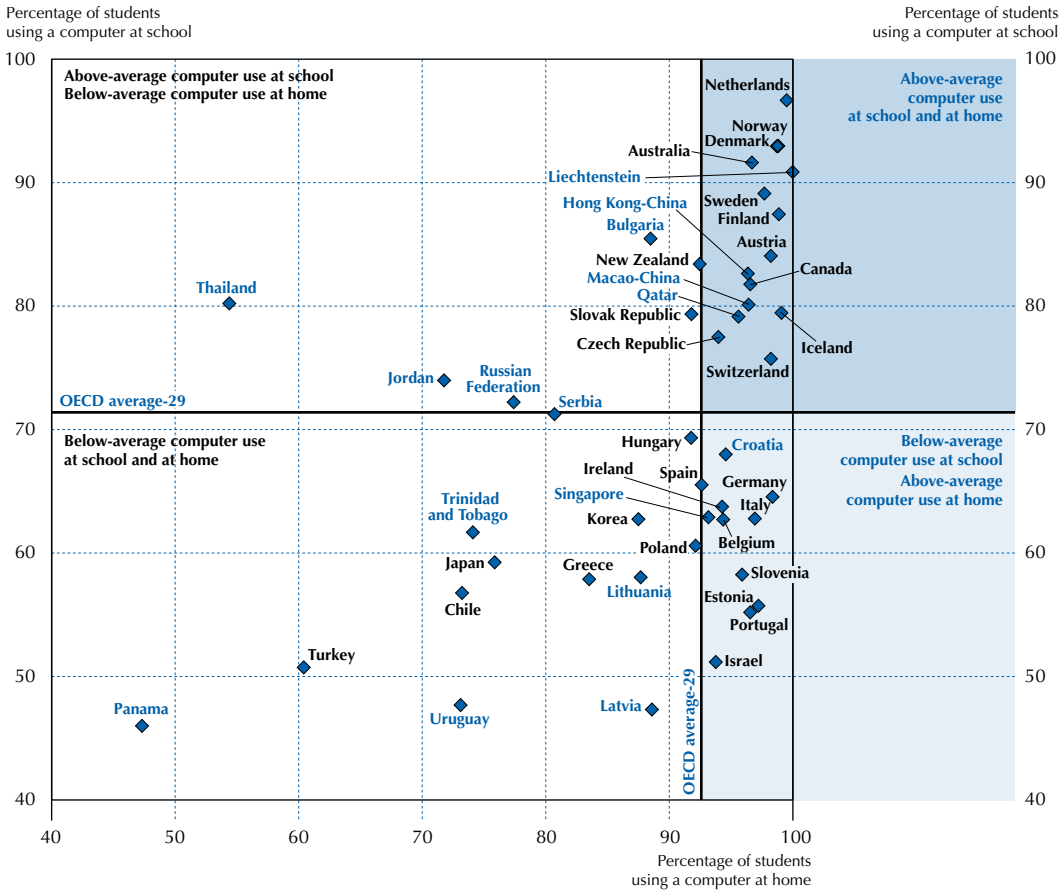
Countries are ranked in descending order of the percentage of students with access to the Internet at school.
Source: OECD, *PISA 2009 Database,* Table VI.5.9.
StatLink http://dx.doi.org/10.1787/888932435435

A comparison of computer use at home and at school

Students in PISA 2009 were asked whether or not they had a desktop or laptop computer available and used it, at home and/or at school. On average across OECD countries, a greater proportion of students reported that they use a computer at home (93%) than at school (71%). The proportion of students who reported that they use a computer at home and at school varied substantially across countries and economies (Figure VI.5.11 and Table VI.5.10a). Figure VI.5.11 shows the relationship between the percentage of students who use a computer at home (horizontal axis) and the percentage of students who use a computer at school (vertical axis). The top-right corner shows those countries that have a high percentage of students who use computers both at home and at school compared with the OECD average; the top-left corner shows those that are below the OECD average for home computer use but above the average for school computer use; the lower-left corner shows those with low levels of home and school computer use when compared to the OECD average; and the lower-right corner shows those countries where a high percentage of students use computers at home but a below-average proportion of students use them at school.

■ Figure VI.5.11 ■

Percentage of students who reported using a computer at home and at school



Source: OECD, *PISA 2009 Database*, Table VI.5.10a.
StatLink http://dx.doi.org/10.1787/888932435435

The proportion of students who reported that they use a computer at school varies substantially across countries and economies. Across OECD countries, an average of 71% of students reported that they use a computer at school. In the Netherlands, Denmark, Norway, Australia and the partner country Liechtenstein, more than 90% of students reported using a computer at school. In contrast, less than 60% of students reported doing so in Japan, Slovenia, Greece, Chile, Estonia, Portugal, Israel, Turkey and the partner country Lithuania. Less than 50% of students reported doing so – the lowest levels – in the partner countries Uruguay, Latvia and Panama.

The proportion of students who use a computer at home was greater, and varies less, across all participating countries and economies than that of students who use a computer at school. On average across OECD countries, 93% of students reported that they use a computer at home. In 16 OECD countries, and the partner country and economies Liechtenstein, Macao-China and Hong Kong-China, at least 95% of students reported that they use a computer at home. Among OECD countries, Japan (76%), Chile (73%) and Turkey (60%) show the lowest proportions of 15-year-olds who use a computer at home. The partner countries Thailand and Panama show the lowest levels of student computer use at home: 54% and 47% of students, respectively. Across OECD countries, the difference between students who reported using a computer at home and those who reported using a computer at school averages 21 percentage points; in 8 OECD countries and 2 partner countries, the difference is between 30 and 43 percentage points. This indicates that the adoption of ICT for learning in schools has not kept pace with the use of ICT at home. As data show that most students have access to a computer at school, it is likely that the low level of ICT use at school indicates that ICT has not yet been fully integrated into pedagogical practices. Only in the partner countries Thailand and Jordan is the proportion of students who reported using a computer at school larger than that of those who reported using a computer at home. In Thailand, an average of 26% more students reported using a computer at school than reported using a computer

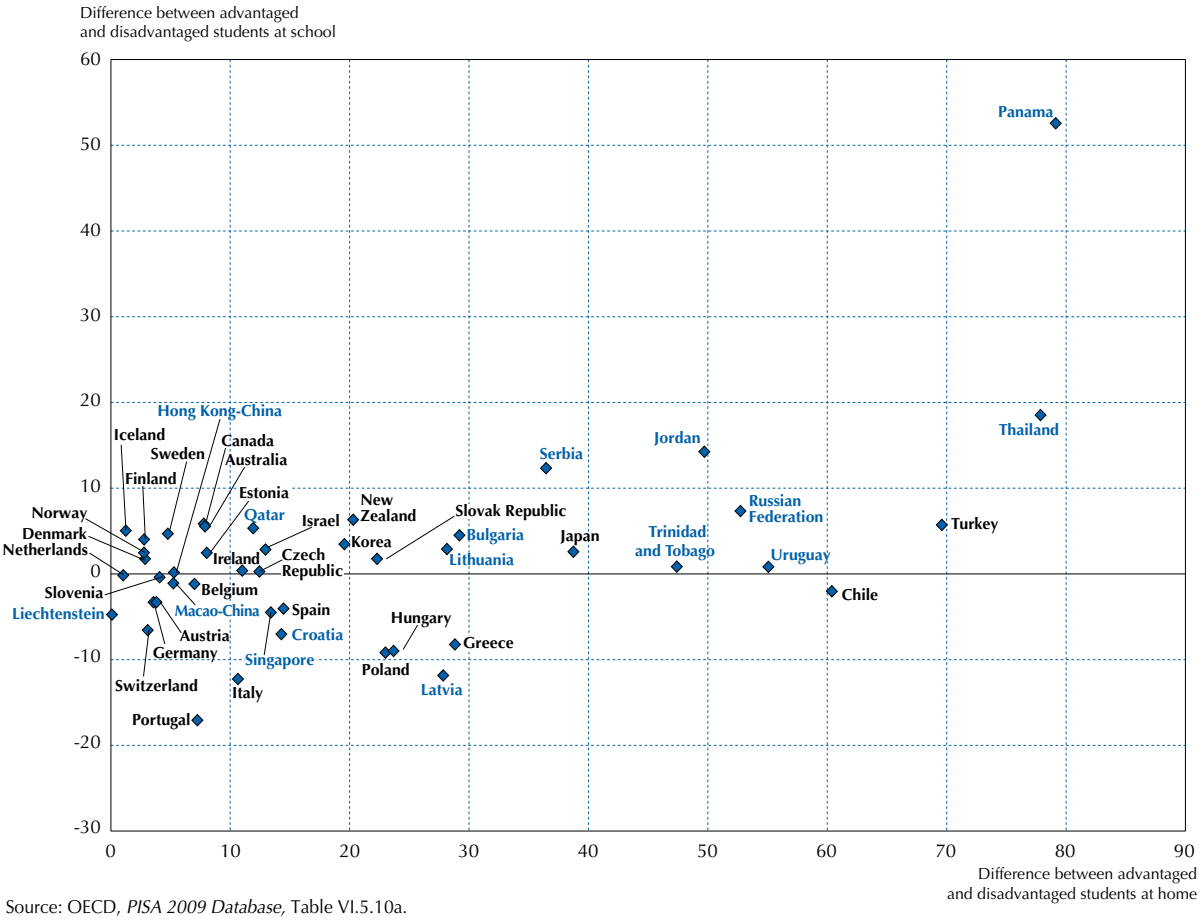
at home (Table VI.5.10a). The use of a computer at school may help to compensate for comparatively low levels of computer use at home. In fact, in Thailand, 46% of students reported that they do not use computers at home, but 67% of these students reported that they use computers at school (Table VI.5.10b).

Are there any digital divides in computer use among socio-economic groups? While in most countries and economies students' computer use at school is not related to their socio-economic background, students' computer use at home is linked to their socio-economic background in all countries and economies except Liechtenstein (Table VI.5.10a). Across OECD countries, 71% of both socio-economically advantaged and disadvantaged students reported that they use computers at school. However, 98% of socio-economically advantaged students reported that they use computers at home, while 83% of disadvantaged students reported that they do so. The gap between advantaged and disadvantaged students in the proportion who use computers at home is largest in countries with lower overall levels of computer use at home. The difference is 50 percentage points or higher in favour of advantaged students in Turkey, Chile, and the partner countries Panama, Thailand, Uruguay, and the Russian Federation. The difference is over 35 percentage points but less than 50 percentage points in Japan, and the partner countries Jordan, Trinidad and Tobago and Serbia.

Would students' use of computers at school help to compensate for comparatively low levels of computer use at home among disadvantaged students? As presented in Figure VI.5.12, in Portugal, Italy, Poland, Hungary, Greece, Switzerland, and the partner countries Latvia, Croatia and Singapore, socio-economically disadvantaged students are more likely to use computers at school than advantaged students. The differences vary between 4 and 17 percentage points. In these countries, disadvantaged students, who are less likely to use computers at home, are given more opportunities to use computers at school than advantaged students are.

■ Figure VI.5.12 ■

Percentage of students who reported using a computer at home and at school, by socio-economic background



Source: OECD, *PISA 2009 Database*, Table VI.5.10a.

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In contrast, in New Zealand, Canada, Australia, Iceland, Sweden, Finland and the partner countries Panama, Thailand, Jordan, Serbia, the Russian Federation, Qatar and Bulgaria, socio-economically advantaged students are more likely to use computers at school than disadvantaged students. In these countries, inequities in the levels of computers use at home between disadvantaged and advantaged students are further widened by computer use at school.

In the remaining 17 OECD countries and 6 partner countries and economies, there is no difference between disadvantaged and advantaged students in the proportion who use a computer at school. In all of these 23 countries and economies except Liechtenstein, schools fail to reduce inequities in the levels of computer use at home. But in some countries, such as the Netherlands, Denmark and Norway, no difference is observed between socio-economically advantaged and disadvantaged students in the proportion of those who use a computer at school. This is partly due to the fact that over 90% of students, regardless of their socio-economic background, use computers at school. These analyses, however, do not examine types of ICT usage. That is discussed in the next section.

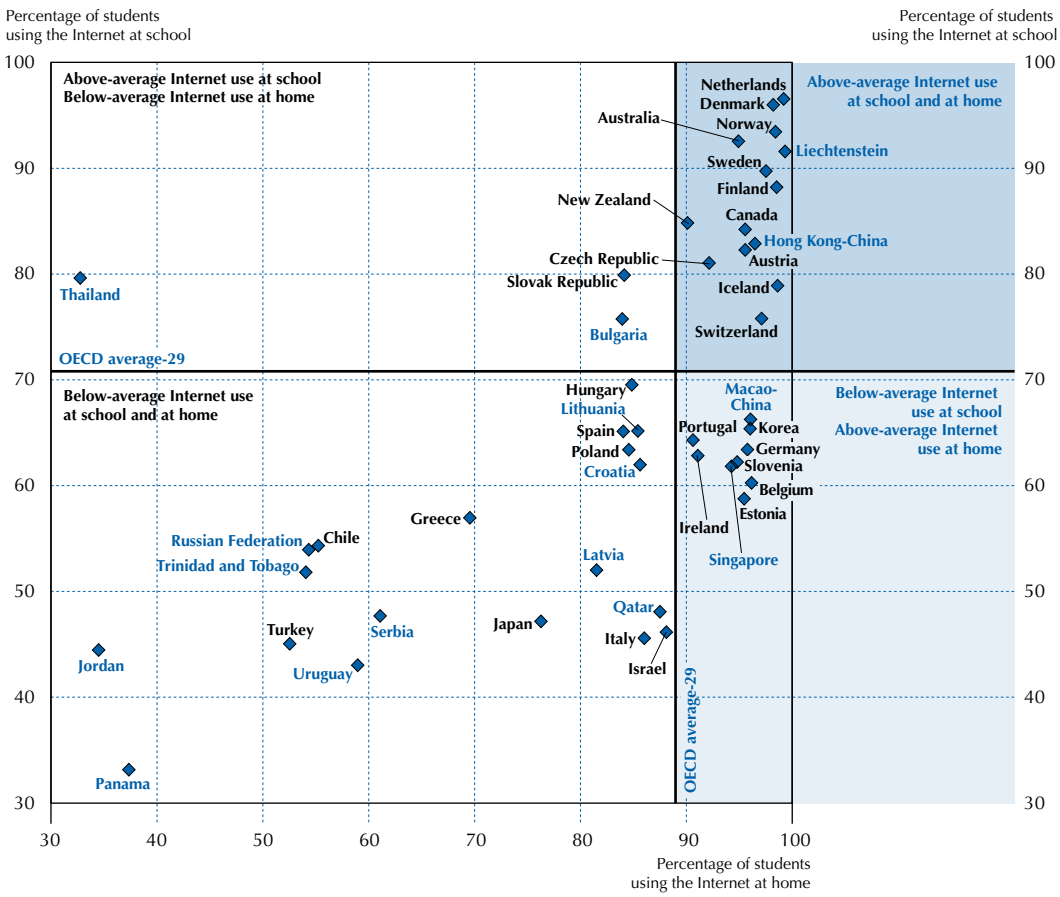
Comparison of Internet use at home and at school

PISA 2009 also sought to determine whether students used the Internet. While students may use a computer, many ICT tasks, such as searching for information, e-mailing and engaging in a social network, require connection to the Internet. Students were asked whether they have an Internet connection available, and use it, at home and/or at school.

As illustrated in Figure VI.5.13, across the vast majority of countries, the proportion of students who reported that they use the Internet at home was greater than that of students who reported using the Internet at school (Table VI.5.11). Across OECD countries, an average of 71% of students reported that they use the Internet at school.

■ Figure VI.5.13 ■

Percentage of students who reported using the Internet at home and at school



Source: OECD, *PISA 2009 Database*, Table VI.5.11.

StatLink http://dx.doi.org/10.1787/888932435435

In the Netherlands, Denmark, Norway, Australia, Sweden, Finland and the partner country Liechtenstein, at least 88% of students reported using the Internet at school. The lowest levels of Internet use at school were reported in Turkey, Italy, Israel, Japan, and the partner countries and economy Panama, Uruguay, Jordan, Serbia and Qatar, where at most 48% of students reported using the Internet at school.

The proportion of students who reported that they use the Internet at home was much greater, and varied less across countries and economies, than that of students who reported that they use the Internet at school. On average across the OECD area, 89% of students reported that they use the Internet at home. In 19 OECD countries and 4 partner countries and economies, at least 90% of students reported using the Internet at home. Meanwhile, Internet use at home is nearly universal in the Netherlands and the partner country Liechtenstein. In Chile, Turkey and three partner countries, between 50% and 60% of students reported using the Internet at home. Students in the partner countries Thailand, Jordan and Panama reported the lowest levels of home Internet use, with less than 40% of students so reporting.

Across OECD countries, the proportion of students who reported using the Internet at home is 18 percentage points greater than that of students who use the Internet at school. The difference between home and school Internet use was less than 10 percentage points in 9 OECD countries and 5 partner countries, but more than 30 percentage points in Israel, Italy, Estonia, Belgium, Slovenia, Germany, Korea and two partner countries and economies. Only in the partner countries Thailand and Jordan is the proportion of students who use the Internet at school larger than that of students who use the Internet at home – by 47 and 10 percentage points, respectively.

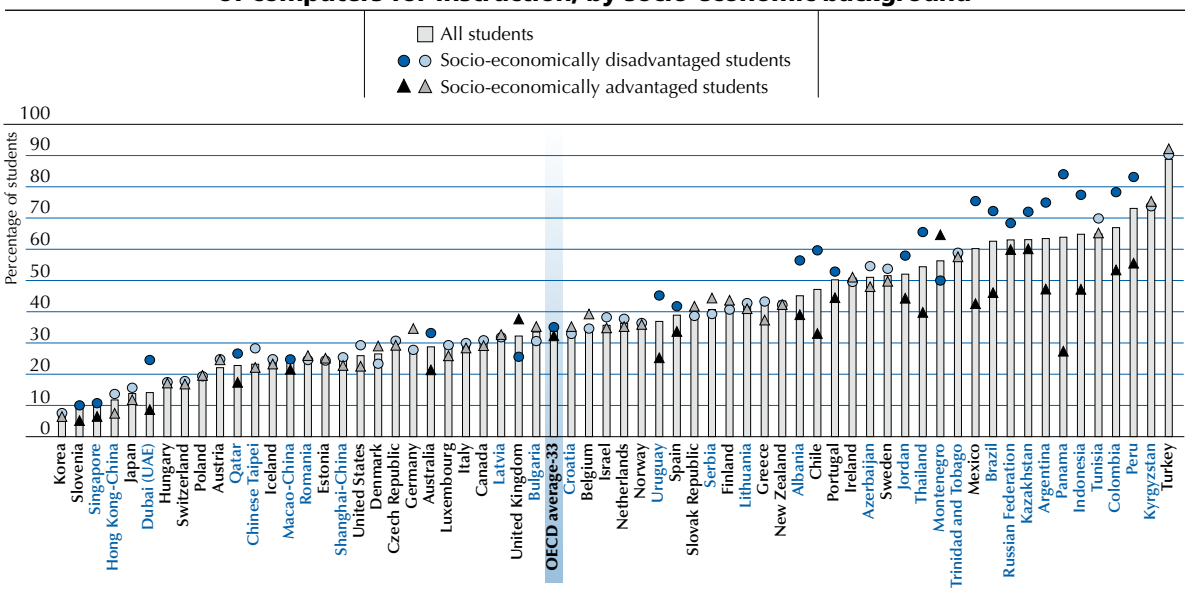
The use of computers and the Internet is not restricted to the home or school. Students might also use computers at the homes of relatives or friends or in public spaces, such as libraries or Internet cafes.

Principals' perceptions of the adequacy of ICT resources for instruction

School principals' perceptions offer another way of looking at student access to ICT resources. In the PISA 2009 school questionnaires, principals reported on whether their school's capacity to provide instruction was hindered by a shortage of computers for teaching. The principals' subjective perceptions of shortages should be interpreted with some caution, because cultural factors and expectations, along with pedagogical practices, may influence the degree to which principals consider shortages a problem. Perceptions of inadequacy may be related to higher expectations among principals for ICT-based instruction rather than fewer computers available for learning.

■ Figure VI.5.14 ■

Percentage of students in schools where the principal reported shortage or inadequacy of computers for instruction, by socio-economic background



Note: Countries in which the difference between socio-economically advantaged and disadvantaged students (top and bottom quarters of the *PISA index of economic, social and cultural status*) is statistically significant are marked in a darker tone.

Countries are ranked in ascending order of the percentage of students in schools whose principals reported a shortage or inadequacy of computers for instruction.

Source: OECD, *PISA 2009 Database,* Table VI.5.12.

StatLink http://dx.doi.org/10.1787/888932435435

When taken on average at the country level, principals' perception of a shortage of computers for instruction can indicate the quality of student access to computers at school. For this analysis, schools are considered to have a shortage or inadequacy of computers for instruction when school principals reported that this situation was hindering the instruction "to some extent" or "a lot".

Figure VI.5.14 illustrates principals' perceptions of computer shortages for instruction. On average across OECD countries, one-third of students are in schools whose principals reported that a computer shortage hindered instruction. Less than 10% of students are in such schools in Korea, Slovenia and the partner countries Liechtenstein and Singapore. In contrast, in Mexico, Turkey and 10 partner countries, more than 60% of students attend schools whose principal reported that instruction was hindered by a shortage of computers. Across OECD countries, students from socio-economically disadvantaged backgrounds are slightly more likely – by three percentage points – to be in schools whose principals reported a shortage. In Mexico, Chile and the partner countries Panama, Indonesia, Peru, Argentina, Brazil, Thailand and Colombia, disadvantaged students are at least 25 percentage points more likely than advantaged students to be in schools whose principals reported a shortage of computers (Table VI.5.12). It can thus be inferred that students from disadvantaged backgrounds in these countries are less likely to benefit from ICT-enhanced teaching.

HOW STUDENTS USE TECHNOLOGY AT SCHOOL AND AT HOME

Once more and more students have access to computers and the Internet, how, in practice, are they using these ICT resources at home and at school? The PISA 2009 ICT familiarity questionnaire collected information on the frequency of computer use (daily/weekly) at home and school, the tasks students do on computers at home and school, and the duration (minutes/hours) of computer use during classroom lessons for some core subjects. This section examines the patterns of student use of ICT at home and at school.

Box VI.5.2 Indices to analyse frequency of ICT use

Three indices were generated to analyse how frequently students complete different types of ICT activities either at home or at school: an *index of computer use at home for leisure;* an *index of computer use at home for schoolwork;* and an *index of computer use at school.*

Each index combines student responses to several questions in a composite score. These indices were constructed so that the average OECD student would have an index value of zero, and about two-thirds of the OECD student population would be between -1 and 1. Country and economy index points above 0 indicate a frequency of ICT use above the OECD average. Each index is self-contained: it is designed to show only the relative use made of that particular set of ICT functions by different groups of students. A country's score on one index cannot be directly compared with its score on another index.

Students' use of ICT at home

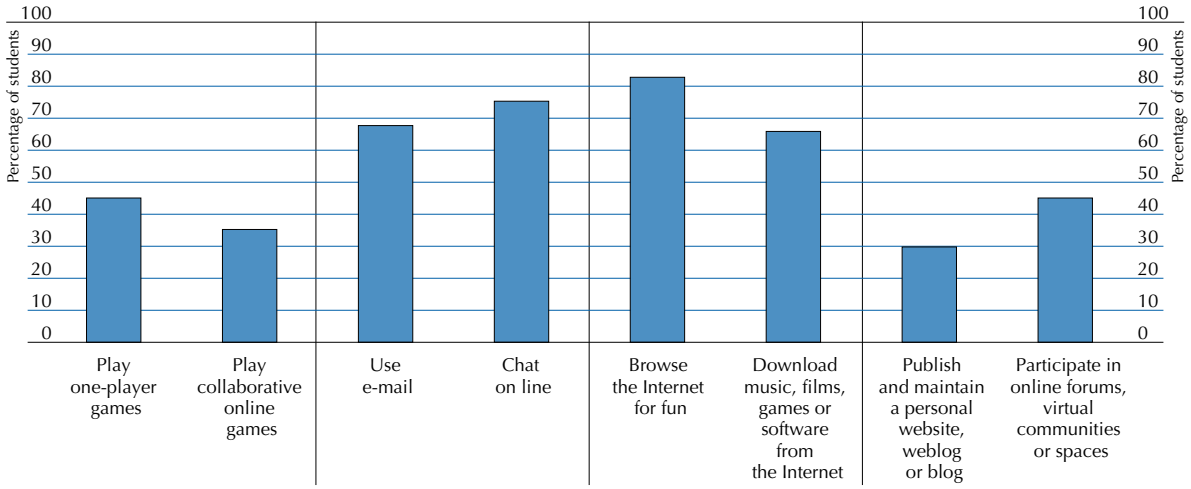
How do students use computers at home? And how does this vary by gender and socio-economic background? In PISA 2009 students were asked how often they use a computer at home for 14 different ICT tasks. These tasks can be divided into two groups: eight leisure-related activities and six schoolwork-related activities. There were four possible responses: "never or hardly ever", "once or twice a month", "once or twice a week", and "everyday or almost every day". Those who reported doing the task at home at least once per week are considered frequent users for that task. Two indices were generated to summarise the results for ICT task-frequency at home: one for leisure-related activities and one for schoolwork-related activities.

Students' use of computers at home for leisure

Students reported how frequently they perform various Internet and entertainment activities using computers at home. The activities included in the PISA questionnaire were: play one-player games; play collaborative online games; use e-mail; chat on line; browse the Internet for fun; download music, films, games or software from the Internet; publish and maintain a personal website, weblog or blog; and participate in online forums, virtual communities or spaces. If students reported that they use computers for these activities "every day or almost every day" or "once or twice a week", they were considered frequent users of computers for this activity.

■ Figure VI.5.15 ■

Percentage of students who reported that they did the following activities at home for leisure at least once a week, OECD average-28



Source: OECD, *PISA 2009 Database,* Table VI.5.13.
StatLink http://dx.doi.org/10.1787/888932435435

Across OECD countries, more than 80% of students reported that they frequently browsed the Internet for fun, and around two-thirds of students reported frequently downloading music, films, games or software (Figure VI.5.15). Over two-thirds of students reported chatting on line and using e-mail at least once a week, yet a greater proportion of students reported that they chat on line (75%) than reported that they use e-mail (68%). A large minority of students frequently use their computers at home to participate in online forums, virtual communities or spaces (45%), while a little less than one-third reported that they frequently publish and maintain personal websites and blogs (30%). Meanwhile, 45% of students reported frequently playing one-player games, while 35% reported playing collaborative online games.

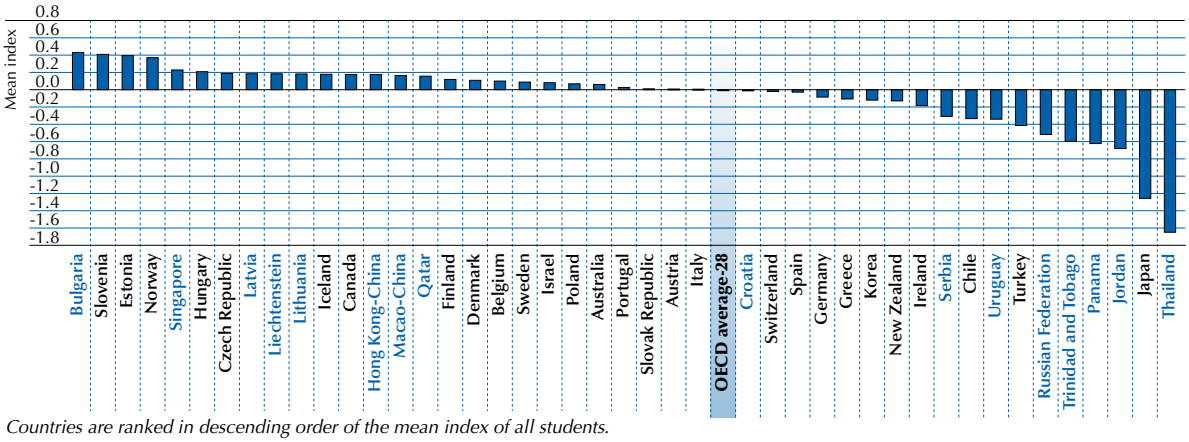
Students in Slovenia, Estonia, Norway and the partner country Bulgaria use computers at home for leisure more frequently than those in other countries (Figure VI.5.16 and Table VI.5.14). Students in Japan, Turkey and the partner countries Thailand, Jordan, Panama, Trinidad and Tobago, and the Russian Federation use computers at home for leisure the least frequently; however in some of these countries, such as Thailand and Panama, over 45% of students do not use computers at home at all (Table VI.5.10a).

The results for individual countries for each activity are listed in Table VI.5.13. The frequency of using computers to browse the Internet and download content varies substantially across countries. In Norway, Sweden, Finland, Iceland, Estonia, Denmark, Slovenia and the partner country Liechtenstein, more than 90% of students reported that they frequently browse the Internet for fun, while in Turkey and Japan, fewer than 60% of students reported doing so. More than 80% of students in Slovenia and the partner countries Bulgaria and Lithuania reported that they frequently download content from the Internet.

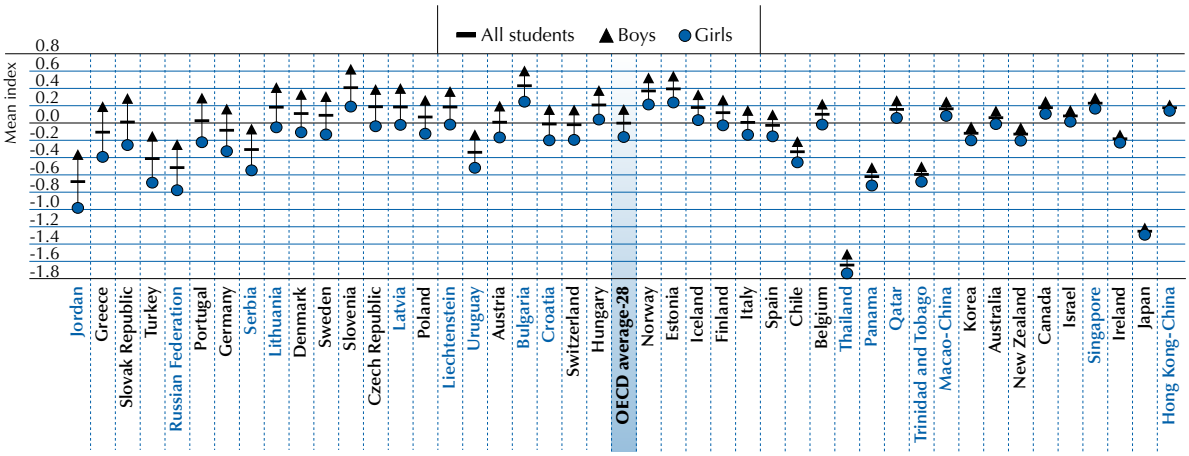
The frequency of computer use for communicating also varies substantially across countries. At least 90% of students in Estonia, Iceland and Norway reported that they chat frequently on line while more than 80% of students in Canada, the Czech Republic, Slovenia, Estonia and the partner country Liechtenstein reported that they frequently use e-mail. More than 70% of students in Norway, Estonia, Iceland, Canada, and the partner country Latvia reported participating in forums and virtual communities frequently, while only in Belgium did more than 50% of students use the computer for publishing and maintaining websites or blogs. No more than 20% of students in Japan reported using the computer frequently for e-mail or for maintaining a personal website or blog, and 10% or fewer reported using a computer frequently for chatting or participating in forums or virtual communities on line.

■ Figure VI.5.16 ■

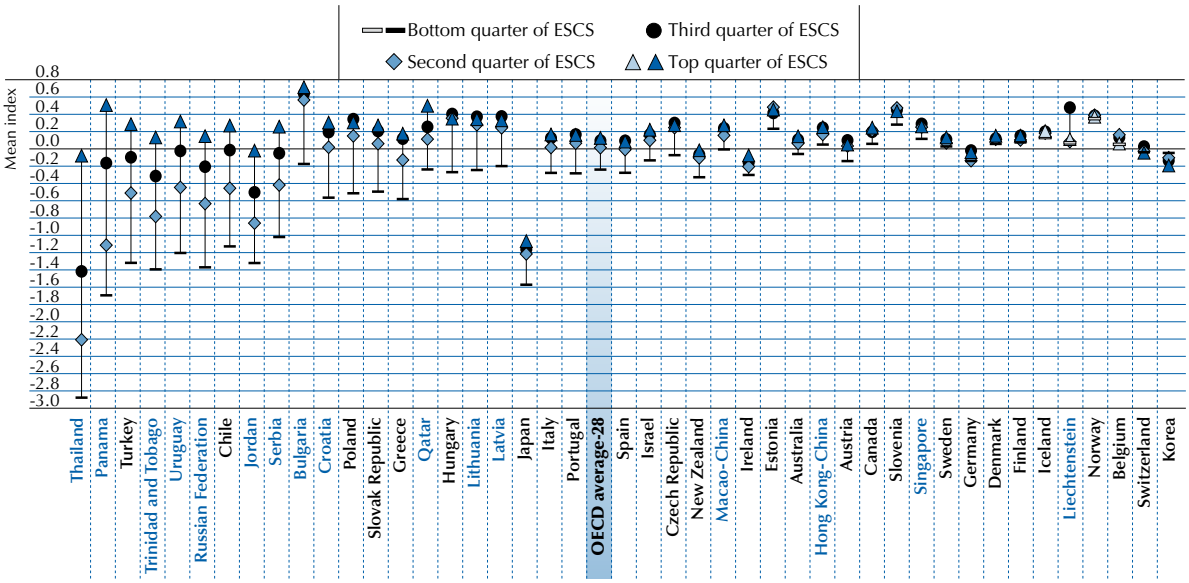
Index of computer use at home for leisure, by gender and socio-economic background



Countries are ranked in descending order of the mean index of all students.



Note: All gender differences are statistically significant.
Countries are ranked in descending order of the gender differences (B – G).



Note: Countries in which differences between the top and bottom quarters of the *PISA index of economic, social and cultural status* (ESCS) are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the differences between the top and bottom quarters (top – bottom) of ESCS.
Source: OECD, *PISA 2009 Database,* Table VI.5.14.
StatLink http://dx.doi.org/10.1787/888932435435

The frequency with which students play games is more homogeneous across OECD countries, except in Japan, where students use computers at home for this activity infrequently. In most OECD countries, the proportion of students who reported that they frequently play one-player games ranged from 30% to 60%; in Japan, fewer than 20% of students reported doing so. A similar pattern was shown for collaborative online games. In most OECD countries, some 20% to 50% of students reported that they play those games frequently, but fewer than 10% of students in Japan so reported. Some 69% of students in the partner country Serbia reported playing one-player games frequently, and in the partner country Bulgaria more than 50% of students reported frequently playing collaborative games on line.

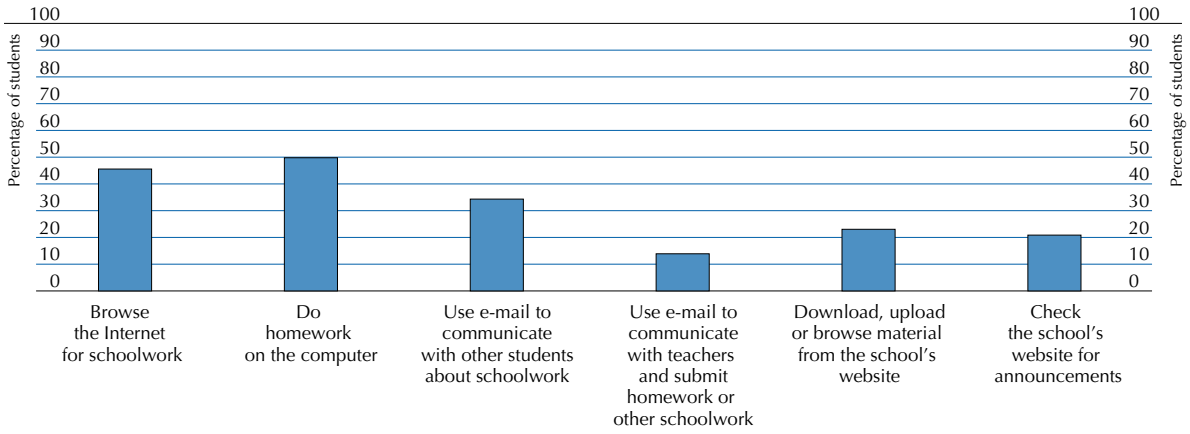
Students' use of computers at home for schoolwork

Students reported how frequently they performed six schoolwork-related activities using computers at home: do homework on the computer; browse the Internet for schoolwork; use e-mail to communicate with other students about schoolwork; use e-mail to communicate with teachers and submit homework or other schoolwork; download, upload or browse material from the school's website; and check the school's website for announcements. If students reported that they use computers for these activities "every day or almost every day" or "once or twice a week", they were considered frequent users of computers.

Figure VI.5.17 shows that across OECD countries, about a half of students reported that they frequently do homework (50%) or browse the Internet for schoolwork (46%) on a computer at home. One-third of students reported that they frequently use their computers to communicate with other students (34%) and 14% reported communicating with teachers by e-mail. Some 23% of students upload or download material frequently from their school's website, and 21% of students reported that they frequently check the school's website for announcements.

■ Figure VI.5.17 ■

Percentage of students who reported that they did the following activities at home for schoolwork at least once a week, OECD average-29



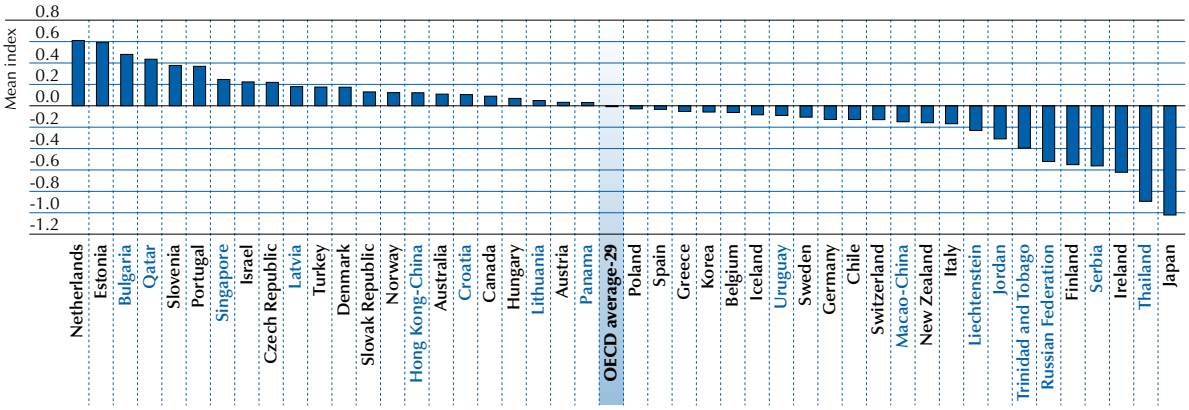
Source: OECD, *PISA 2009 Database,* Table VI.5.15.
StatLink http://dx.doi.org/10.1787/888932435435

Across countries, only in Denmark, Australia and Norway did more than 70% of students report that they frequently do homework, and more than 60% report that they browse the Internet for schoolwork on a home computer (Table VI.5.15). In contrast, fewer than 20% of students in Finland and fewer than 10% of students in Japan reported that they do either of these tasks frequently.

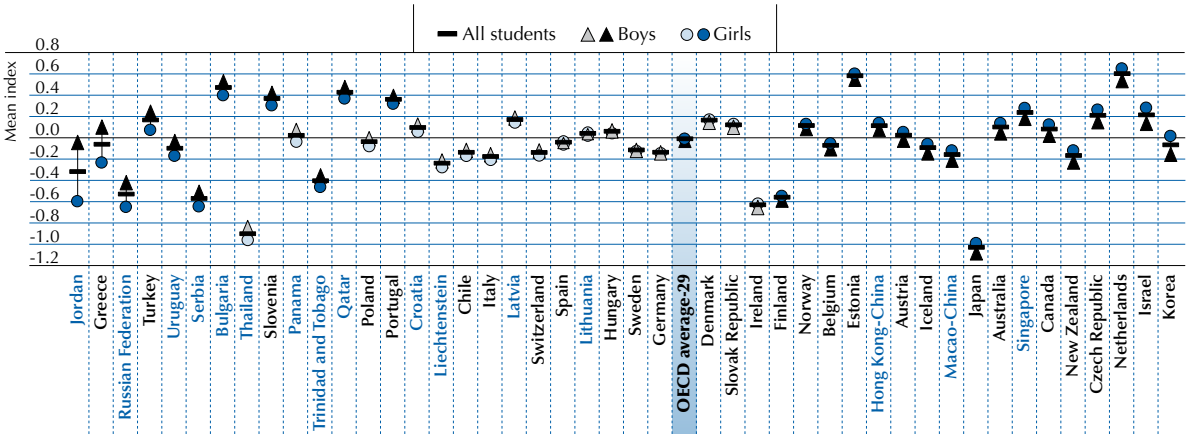
Students tend to communicate by e-mail more frequently with other students than with teachers about schoolwork. At least 50% of students in the Slovak Republic, Portugal, Chile and the partner economy Qatar reported that they communicate frequently with their peers by e-mail about schoolwork. Only 11% of students in Finland reported doing so. In Turkey, Portugal, the partner countries and economy Bulgaria, Singapore and Qatar, more than 25% of students reported frequently communicating with teachers by e-mail about schoolwork.

■ Figure VI.5.18 ■

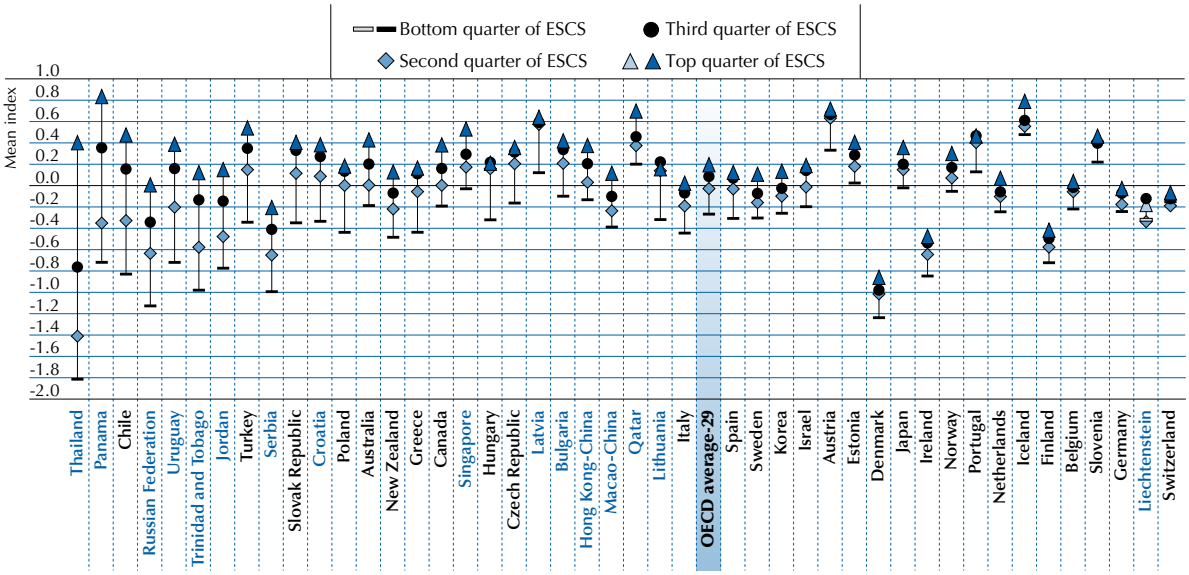
Index of computer use at home for schoolwork-related tasks, by gender and socio-economic background



Countries are ranked in descending order of the mean index of all students.



Note: Countries in which gender differences are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the gender differences (B – G).



Note: Countries in which differences between the top and bottom quarters of the *PISA index of economic, social and cultural status* (ESCS) are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the differences between the top and bottom quarters (top – bottom) of ESCS.
Source: OECD, *PISA 2009 Database,* Table VI.5.16.
StatLink http://dx.doi.org/10.1787/888932435435

Most students rarely use home computers to access their school's websites. The reasons for this may include no or little access to a computer and the Internet, no school website, few homework assignments, or assignments that do not require ICT use. Estonia and the Netherlands are the exceptions, however; in these countries, more than 45% of students reported that they frequently use a computer at home to check the school's website for announcements or to download or upload material.

Figure VI.5.18 shows the cross-country differences in the *index of computer use at home for schoolwork*. This index was generated using all activities outlined above, other than doing homework on the computer. The frequency of students' computer use at home is highest in the Netherlands, Estonia, Slovenia, Portugal, the partner country Bulgaria and the partner economy Qatar. Students in Japan, Ireland, Finland and the partner countries Thailand, Serbia, the Russian Federation and Trinidad and Tobago use home computers for schoolwork the least frequently, yet Finland scores above the OECD average on the *index of computer use at home for leisure*. This might be because Finnish students have less homework overall or fewer computer-based homework assignments.

Are boys more leisure-oriented than girls when using home computers?

As shown in Figure VI.5.16, on average across the OECD, more boys than girls (0.16 and -0.16 index points, respectively) reported that they frequently use home computers for leisure, and this holds across all participating countries and economies. The countries with the largest gender differences are Greece (0.58), the Slovak Republic (0.54), Turkey (0.54), Portugal (0.51), and the partner countries Jordan (0.62) and the Russian Federation (0.53). Japan (0.08), Ireland (0.09), and the partner economy Hong Kong-China (0.07) show the narrowest gender differences for these activities (Table VI.5.14).

On the other hand, on average across OECD countries, more girls than boys (0.01 and -0.02 index points, respectively) reported that they frequently use home computers for schoolwork; however, the difference between boys and girls is only 0.03 (Figure VI.5.18). Korea, Israel, the Netherlands, the Czech Republic, New Zealand, Canada, Australia, Japan, the partner country Singapore and the partner economy Macao-China show the largest gender gap in favour of girls, with more than 0.1 score point difference. But in Greece, Turkey and the partner countries Jordan, the Russian Federation, Uruguay, Serbia and Bulgaria, boys use home computers for schoolwork more frequently than girls (Table VI.5.16).

Does socio-economic background influence the way students use computers at home?

On average across OECD countries, students from socio-economically advantaged backgrounds use their home computers for leisure more frequently than disadvantaged students, with 0.13 and -0.24 index points, respectively. This pattern is evident in all countries and economies apart from Norway, Belgium, Switzerland and the partner country Liechtenstein, which showed no socio-economic difference, and Korea, where disadvantaged students use home computers for leisure more frequently than advantaged students. The countries with the widest gap in favour of advantaged students include Turkey (1.61), Chile (1.40), and the partner countries Thailand (2.80), Panama (2.20), Uruguay (1.52), the Russian Federation (1.53) and Jordan (1.31) (Figure VI.5.16 and Table VI.5.14).

On average across OECD countries, students from socio-economically advantaged backgrounds use home computers for schoolwork more frequently than disadvantaged students, with 0.20 and -0.26 index points, respectively. This pattern is evident in all countries and economies apart from Liechtenstein, which showed no socio-economic difference, and Switzerland and Germany, where disadvantaged students use home computers for schoolwork more frequently than advantaged students. The countries with the widest gap between the top and bottom quarters of this index are Chile (1.30) and the partner countries Thailand (2.21), Panama (1.55), the Russian Federation (1.13), Uruguay (1.11) and Trinidad and Tobago (1.10) (Figure VI.5.18 and Table VI.5.16).

Students' use of ICT at school

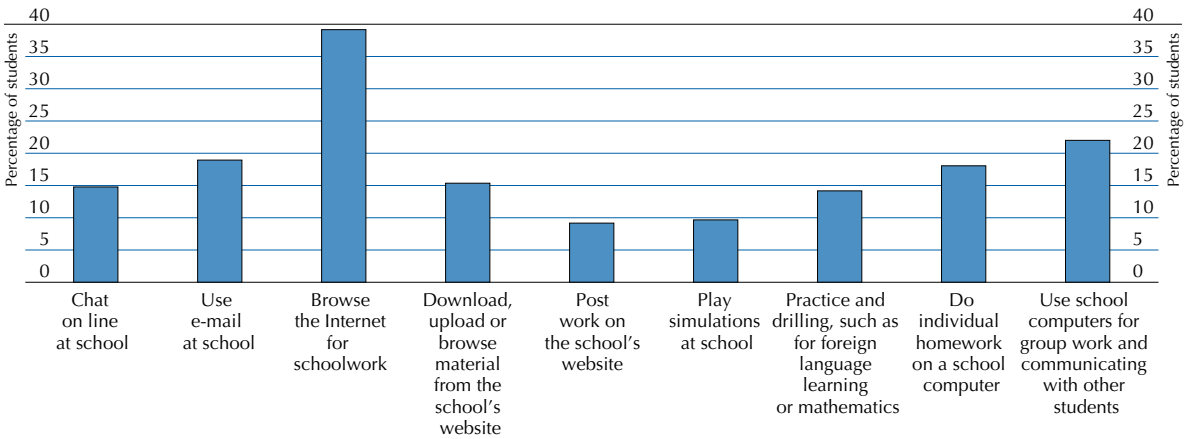
What do students most frequently use school computers for?

Students reported how frequently they perform nine activities using computers at school: chat on line; use e-mail; browse the Internet for schoolwork; download, upload or browse material from the school's website; post work on the school's website; play simulations at school; practice and drilling, such as for learning a foreign language and mathematics; do individual homework on a school computer; and use school computers for group work and to communicate with other students. Figure VI.5.19 shows how students use computers at school. Students who reported that they do a listed activity at least once a week were considered frequent users. Across OECD countries,

39% of students reported that they frequently browse the Internet for schoolwork and 22% reported that they frequently use school computers for group work and communicating with other students. At least 14% of students reported that they frequently use e-mail (19%), do individual homework on a school computer (18%), chat on line (15%) or use a computer for drill and practice (14%). Some 15% of students reported that they frequently download, upload or browse material from the school's website, while 9% reported that they frequently post work on the school's website. Some 10% of students reported that they frequently play simulations on a computer at school. These results should be interpreted in the context that only 71% of students across OECD countries reported that they use a computer with a link to the Internet at school (Table VI.5.11).

■ Figure VI.5.19 ■

Percentage of students who reported that they did the following activities at school at least once a week, OECD average-29



Source: OECD, *PISA 2009 Database,* Table VI.5.17.
StatLink http://dx.doi.org/10.1787/888932435435

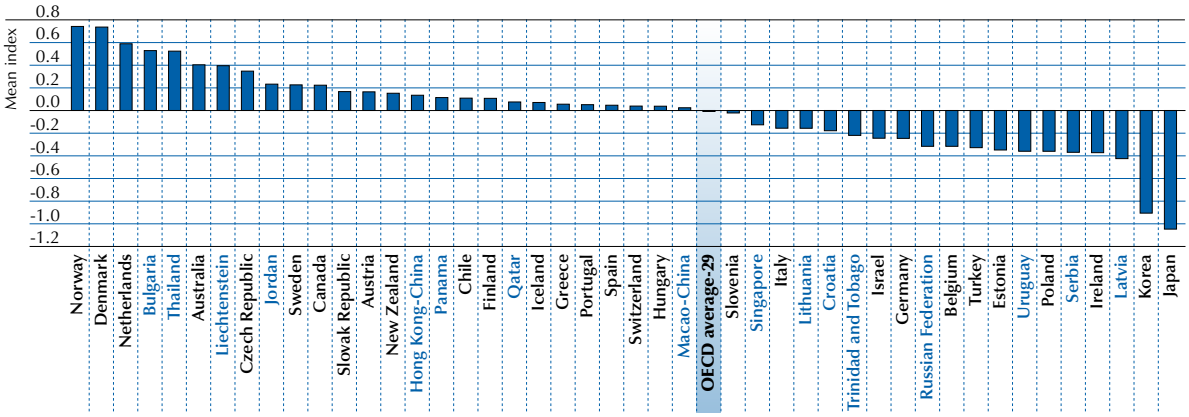
Browsing the Internet gives students access to a vast store of information that no school can physically accommodate. At least 60% of students in Denmark, Norway, the Netherlands, Australia and Sweden reported that they frequently browse the Internet at school (Table VI.5.17). In the partner country Liechtenstein, 57% of students reported doing so. In contrast, fewer than 20% of students in Japan, Korea, Belgium, and the partner countries the Russian Federation, Latvia and Serbia reported that they frequently browse the Internet at school.

Using computers and the Internet for communicating and collaborating varies across countries. Some 56% of students in Denmark and 40% in Norway reported that they frequently use computers at school for group work and communicating with other students, while fewer than 6% of students in Korea and Japan reported doing so. Over 30% of students in Denmark, the Czech Republic, the Slovak Republic, Austria and the partner country Bulgaria reported that they frequently chat on line at school, well above the OECD average of 15%. E-mail can also be viewed as a key communication tool, yet in Japan and Korea, fewer than 5% of students reported frequently using e-mail, and in Poland, Italy, Germany, Belgium and the partner country Uruguay, fewer than 10% did.

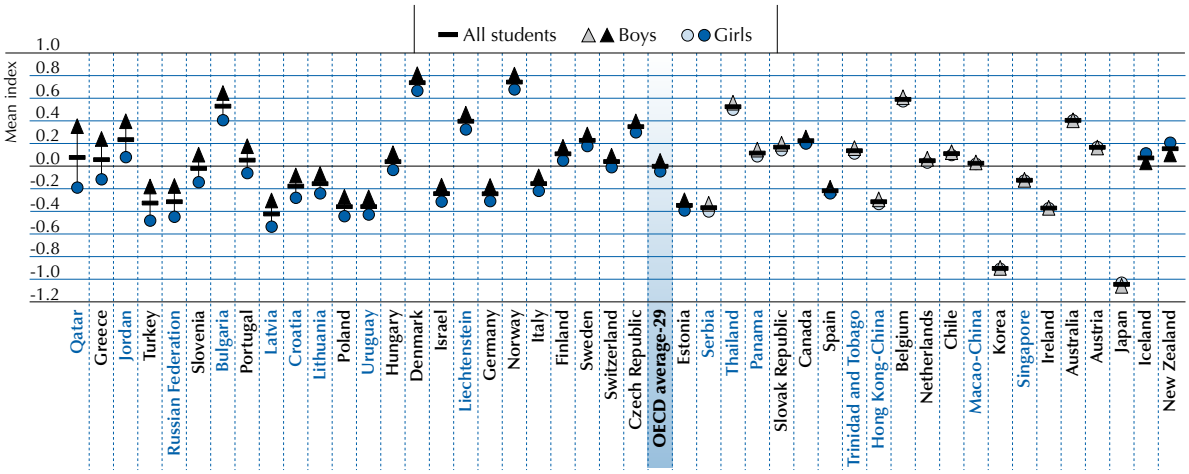
Most students in OECD countries do not access their school's website frequently. Among OECD countries, Norway shows a relatively high use of school websites, with 30% of students reporting that they use the school site to download, upload or browse material (the OECD average was 15%) and 42% reporting that they frequently post work to the site (the OECD average was 9%). In the Netherlands, 36% of students reported using the school website to download, upload or browse material, although only 13% reported that they frequently post work to the site. The differences may be due to how the schools use their websites. More than 20% of students in the partner countries Bulgaria, Thailand and Jordan reported frequently using school websites for both activities. Meanwhile, 57% of students in Denmark, and over 30% of students in Norway, Australia, Canada, Chile and the partner countries Panama and Thailand reported that they do homework on a computer at school.

■ Figure VI.5.20 ■

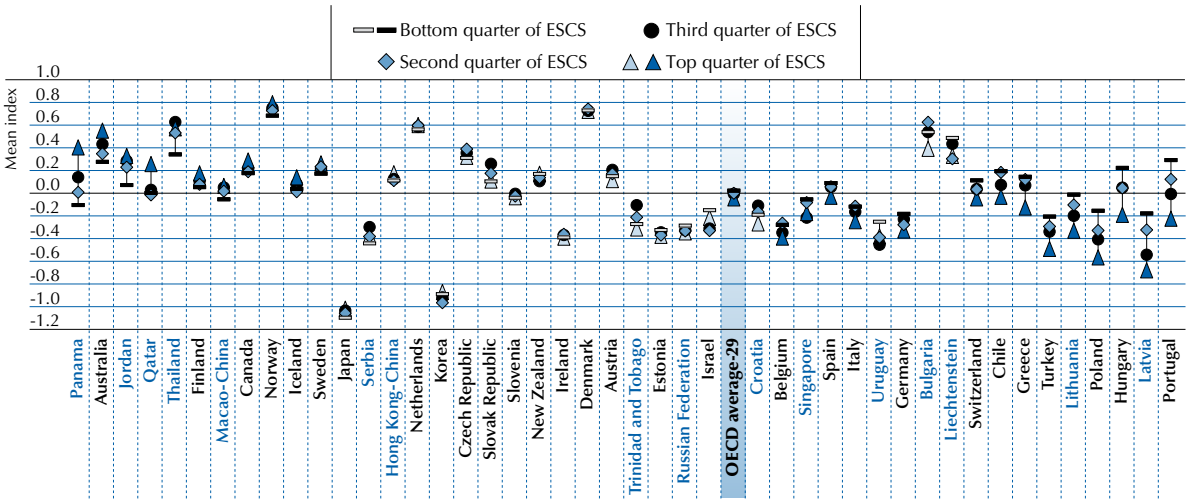
Index of computer use at school, by gender and socio-economic background



Countries are ranked in descending order of the mean index of all students.



Note: Countries in which gender differences are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the gender differences (B – G).



Note: Countries in which differences between the top and bottom quarters of the *PISA index of economic, social and cultural status* (ESCS) are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the differences between the top and bottom quarters (top – bottom) of ESCS.
Source: OECD, *PISA 2009 Database,* Table VI.5.18.
StatLink http://dx.doi.org/10.1787/888932435435

In order to analyse the data, an *index of computer use at school* was constructed using the nine proposed ICT activities. As shown in Figure VI.5.20, the frequency of students' computer use at school is greatest in Norway, Denmark, the Netherlands and the partner countries Bulgaria and Thailand, while the frequency is the least in Japan and Korea. Comparatively low levels of ICT use at school were also evident in Ireland, Poland, Estonia and the partner countries Latvia, Serbia and Uruguay (Table VI.5.18).

Do gender and socio-economic background influence the way students use computers at school?

As shown in Figure VI.5.20, on average across the OECD area, more boys than girls (0.04 and -0.05 index points, respectively) use school computers frequently. In 18 OECD countries and 9 partner countries, the difference is significant in favour of boys. This gender gap is widest in Greece, Turkey, the partner countries Jordan and Qatar. In contrast, in New Zealand and Iceland, more girls than boys reported that they frequently use computers at school (Table VI.5.18).

On average across OECD countries, students from socio-economically advantaged backgrounds use school computers less often than disadvantaged students, with -0.04 and 0.03 index points, respectively. However, this pattern was not replicated everywhere. In Australia, Finland, Canada, Norway, Iceland, Sweden and the partner countries and economies Panama, Jordan, Qatar, Thailand and Macao-China, advantaged students use computers at schools more frequently than do disadvantaged students. The opposite pattern was evident in 11 OECD countries and 3 partner countries (Figure VI.5.20 and Table VI.5.18).

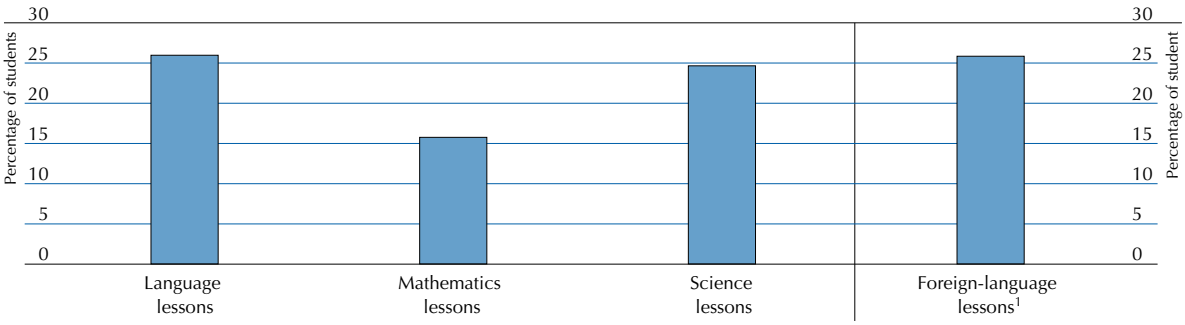
Do students use computers more intensively for some subjects than for others?

For the first time, PISA 2009 asked students how much time they spend using the computer in language-of-instruction, mathematics, science and foreign-language classroom lessons during a typical school week. There were four possible responses: no time; 0-30 minutes; 30-60 minutes; or 60 minutes or more. If students reported that they use a computer for 0-30 minutes per week or more, they were considered to use computers during lessons. Interpretation of ICT use in classroom lessons, measured by minutes and hours, is one way researchers can determine the extent to which ICT has been included in classroom activities.

As it is possible that some students are not enrolled in particular subjects at age 15, the analysis for language-of-instruction, mathematics and science lessons only included those students who indicated in their PISA questionnaire that they regularly attend lessons in those subjects. The percentages represent those students who regularly attend lessons in the subject and use a computer during the lesson for at least some time in a typical week. For foreign-language classes, no information is available on whether or not students regularly attend lessons. As a result, it is possible that the data under-reports the proportion of students who take foreign-language classes and use a computer during those lessons. In addition, the number of foreign-language classes on offer varies across countries.

■ Figure VI.5.21 ■

Percentage of students who reported that they use a computer during regular classroom lessons at least some time during a typical week, OECD average-29



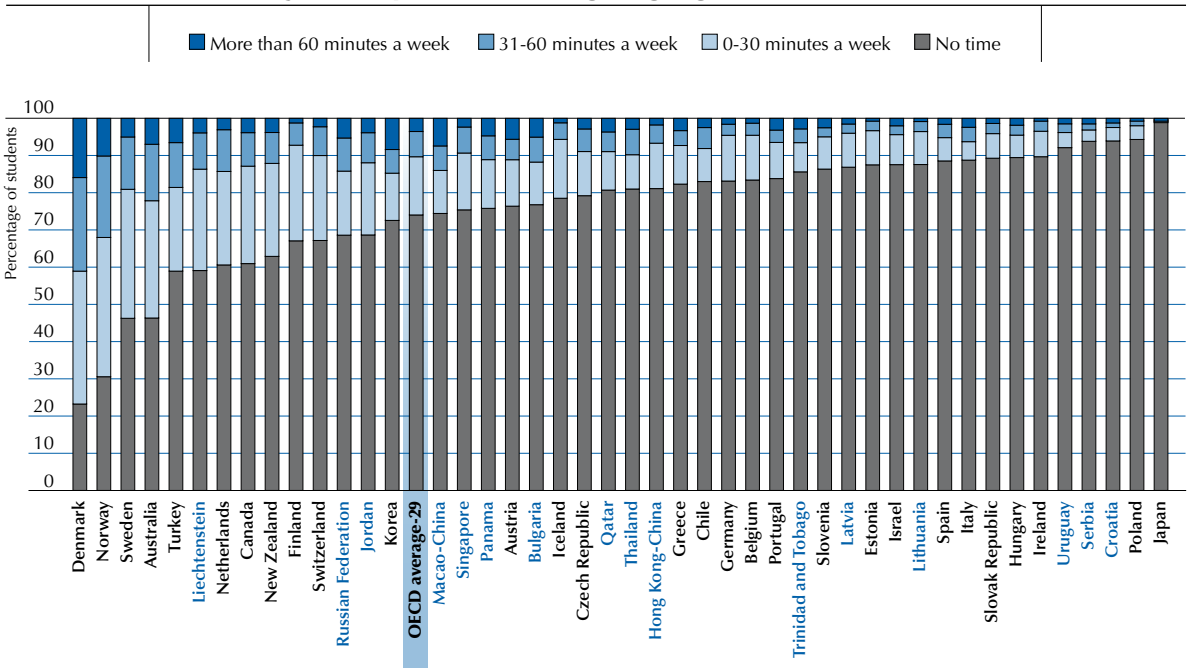
1. OECD average for computer use during classroom lessons in a typical school week, not adjusted for the number of students who do not have any lessons in the subject each week.
Source: OECD, *PISA 2009 Database,* Table VI.5.19.
StatLink http://dx.doi.org/10.1787/888932435435

As shown in Figure VI.5.21, on average across OECD countries, a smaller percentage of students use computers during their mathematics lessons (16%) than use them during language-of-instruction classes (26%), science classes (25%) and foreign-language classes (26%).

As reading is the major testing domain for PISA 2009, computer use in language-of-instruction lessons is examined in more detail. The amount of time students spend using computers in language-of-instruction classes varies across countries (Figure VI.5.22 and Table VI.5.19). At least 50% of students in Denmark, Norway, Sweden and Australia use a computer in a language-of-instruction class each week, while fewer than 1% of students in Japan do so. Of those students who do use a computer in classroom lessons, most do so for less than 31 minutes per week. Only in Denmark and Norway did more 30% of students report that they use a computer for more than 30 minutes per week.

■ Figure VI.5.22 ■

Intensity of computer use during language-of-instruction lessons



Countries are ranked in ascending order of the percentage of students who use a computer during language-of-instruction lessons at least some time.
Source: OECD, *PISA 2009 Database,* Table VI.5.19.
StatLink http://dx.doi.org/10.1787/888932435435

There is substantial variation between countries and economies in when students use computers in the classroom (Table VI.5.19 and Table VI.5.20). The OECD countries Denmark, Norway, Sweden, Australia, Turkey, the Netherlands, Finland, Switzerland, Iceland, and Korea show above OECD average levels of classroom computer use in at least three of the four subjects. Denmark and Norway show the highest proportion of students using computers in three subjects during a typical school week: around 70% or more in language-of-instruction classes; over 50% in foreign-language classes; and around 40% in mathematics and science classes. Denmark, Australia, Norway and Sweden show the highest levels for science lessons.

Among the partner countries and economies, Liechtenstein, the Russian Federation and Jordan show above OECD average computer use in at least three of the four subjects. Some 36% of students in Jordan and 31% in the Russian Federation use computers in mathematics classes – the subject with the lowest OECD average (16%). Only in Norway and Denmark does a greater proportion of students use computers during mathematics classes. A relatively large proportion of students in Jordan (39%) and the Russian Federation (44%) reported using computers during science lessons.

Meanwhile, fewer than 5% of Japanese students use computers in their classes, and at most 9% of students in Poland do so.

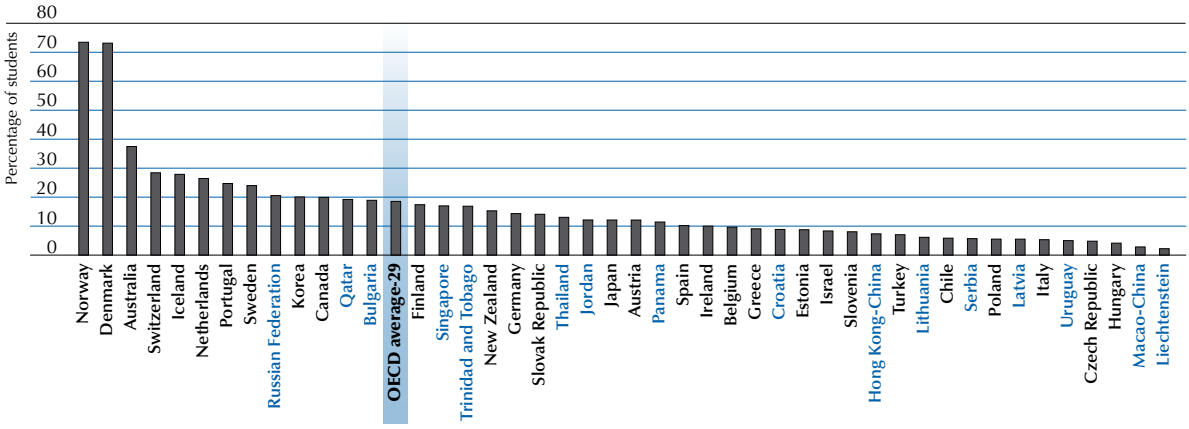
The use of computers during class lessons varies even within countries. For example, in Sweden, more than one-third of students reported using computers in a typical week during language-of-instruction (54%), science (44%) and foreign-language (34%) lessons. In contrast, only 10% of Swedish students reported doing so during mathematics lessons. A similar pattern was evident in Korea, where only 8% of students reported that they use a computer during mathematics lessons, despite relatively high levels of use during language-of-instruction (27%), science (31%), and foreign-language lessons (41%). In Italy, the pattern is very different. Around one-quarter of Italian students reported using a computer during mathematics (27%) and foreign-language (25%) lessons, while fewer than 12% reported doing so in language-of-instruction and 13% in science classes. These differences may be related to different teaching methods for mathematics throughout the school systems in these countries. The infrequent use of computers in mathematic lessons is a clear trend across OECD and partner countries and economies.

How many students use a laptop at school?

Using laptops in school may help to integrate ICT into classrooms, as it would obviate the need for a dedicated computer lab in school. In Norway and Denmark, more than 70% of students reported using a laptop at school (Figure VI.5.23 and Table VI.5.21). Between 20% and 40% of students in Australia, Switzerland, Iceland, the Netherlands, Portugal, Sweden, Korea, and the partner country the Russian Federation reported using a laptop at school. Students in all of these countries, except Portugal, show above OECD average use of computers during class in two or more of the four core subjects.

■ Figure VI.5.23 ■

Percentage of students who reported using laptops at school



Countries are ranked in descending order of the percentage of students who reported using laptops at school.
Source: OECD, *PISA 2009 Database*, Table VI.5.21.
StatLink http://dx.doi.org/10.1787/888932435435

In 11 OECD countries and 8 partner countries and economies, at most 10% of students reported using a laptop at school. Only 2% of students in the partner country Liechtenstein reported using a laptop, the lowest level among participating countries and economies. However, Liechtenstein shows relatively high levels of computer use during lessons across all four subjects (Table VI.5.19 and Table VI.5.20). This difference stems from the fact that 91% of students reported using laptop and/or desktop computers at school (Table VI.5.10a).

STUDENTS' ATTITUDES TOWARDS AND SELF-CONFIDENCE IN USING COMPUTERS

Students' attitudes towards using computers

The use of computers can be strongly affected by how positive students feel about computers and by how confident they are in performing particular ICT tasks. Being interested and feeling confident in ICT use may affect both the frequency and degree of engagement in learning through ICT.

How positive are students' attitudes towards computers?

In the PISA 2009 ICT survey, students were asked to indicate the extent to which they agreed with four statements about their experience with computers: "It is very important to me to work with a computer"; "I think playing or working with a computer is really fun"; "I use a computer because I am very interested"; and "I lose track of time when I am working with the computer". Students responded to each statement with "strongly disagree", "disagree", "agree" or "strongly agree". Students are considered to have positive attitudes towards computers if they agreed or strongly agreed with the statements. When interpreting the results for both attitudes, it is important to remember that the data is generated by students' subjective self-report and not from information that is directly measured or observed. Students across countries may not interpret or respond to the survey questions in the same way.

■ Figure VI.5.24 ■

Percentage of students who reported positive attitudes towards computers, OECD average-28

Percentage of students who agreed or strongly agreed with the following statements

Source: OECD, *PISA 2009 Database,* Table VI.5.22.

StatLink http://dx.doi.org/10.1787/888932435435

As shown in Figure VI.5.24, on average across the OECD area, over two-thirds of students reported positive attitudes towards computers across all four statements. The highest proportion of students reacted the most positively to the statements "playing or working with a computer is really fun" (87%) and "it is very important to me to work with a computer" (83%). Across OECD countries, 76% of students indicated that they "use a computer because they are interested", while 69% reported they "lose track of time when working with a computer" (Table VI.5.22).

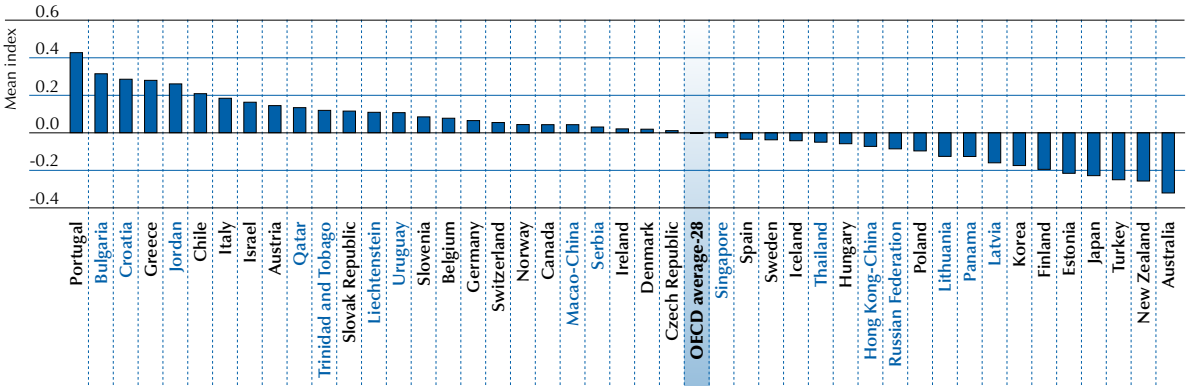
Student responses were used to create an *index of attitudes towards computers*. For this index, a negative score does not necessarily signify a negative attitude towards computers, but rather an attitude that is less positive than the average for students in OECD countries. Students in Portugal, Greece, Chile and the partner countries Bulgaria, Croatia and Jordan expressed more positive attitudes towards computers, whereas students in Australia, New Zealand, Turkey, Japan, Estonia and Finland expressed far less positive attitudes than the OECD average (Figure VI.5.25 and Table VI.5.23).

Do gender and socio-economic background influence students' attitudes towards computers?

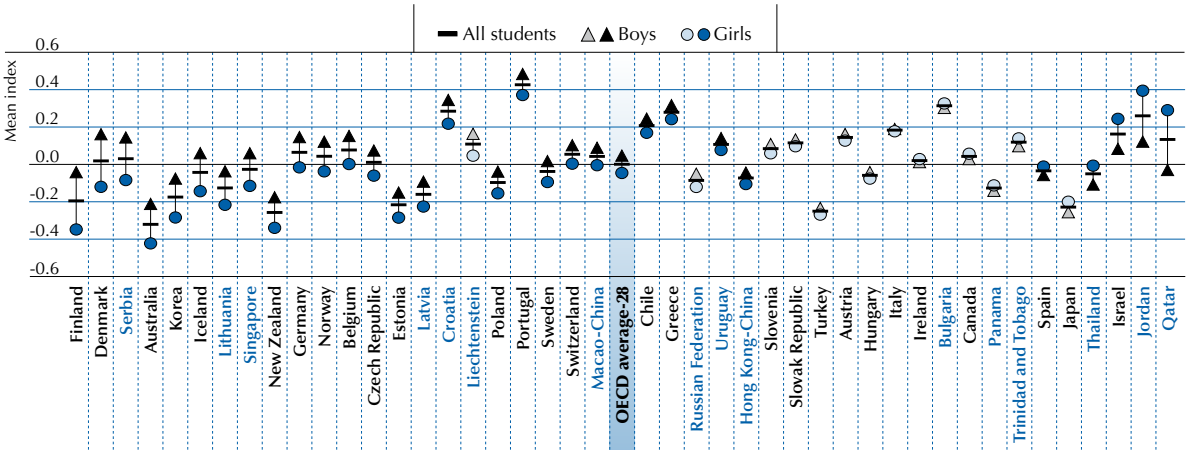
In 17 OECD countries and 8 partner countries and economies, boys show more positive attitudes towards computers than girls (Figure VI.5.25 and Table VI.5.23). On average across OECD countries, boys feel more positive towards computers than girls, with 0.05 and -0.05 index points, respectively. Finland, Denmark, Australia, Korea, Iceland and the partner country Serbia show the widest gender gap in favour of boys, of 0.20 index points or more. In contrast, girls in Israel, Spain, the partner countries and economy Jordan, Thailand and Qatar have more positive attitudes towards computers than boys.

■ Figure VI.5.25 ■

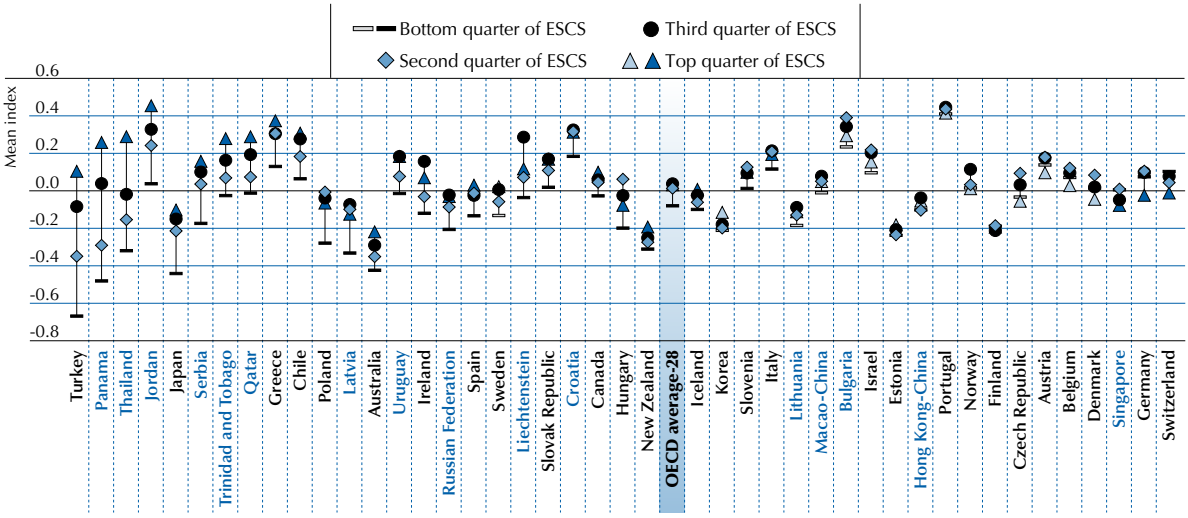
Index of attitudes towards computers, by gender and socio-economic background



Countries are ranked in descending order of the mean index of all students.



Note: Countries in which gender differences are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the gender differences (B – G).



Note: Countries in which differences between the top and bottom quarters of the *PISA index of economic, social and cultural status* (ESCS) are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the differences between the top and bottom quarters (top – bottom) of ESCS.
Source: OECD, *PISA 2009 Database,* Table VI.5.23.

StatLink http://dx.doi.org/10.1787/888932435435

On average across OECD countries, students from socio-economically advantaged backgrounds expressed more positive attitudes towards computers than students from disadvantaged backgrounds, with 0.03 and -0.08 index points, respectively (Figure VI.5.25 and Table VI.5.23). Advantaged students reported more positive attitudes than disadvantaged students in 16 OECD countries and 10 partner countries and economies, with the largest differences evident in Turkey and the partner countries Panama and Thailand. In Switzerland, Germany and the partner country Singapore, disadvantaged students expressed slightly more positive attitudes towards using computers than advantaged students.

Students' confidence in computer use and technical proficiency

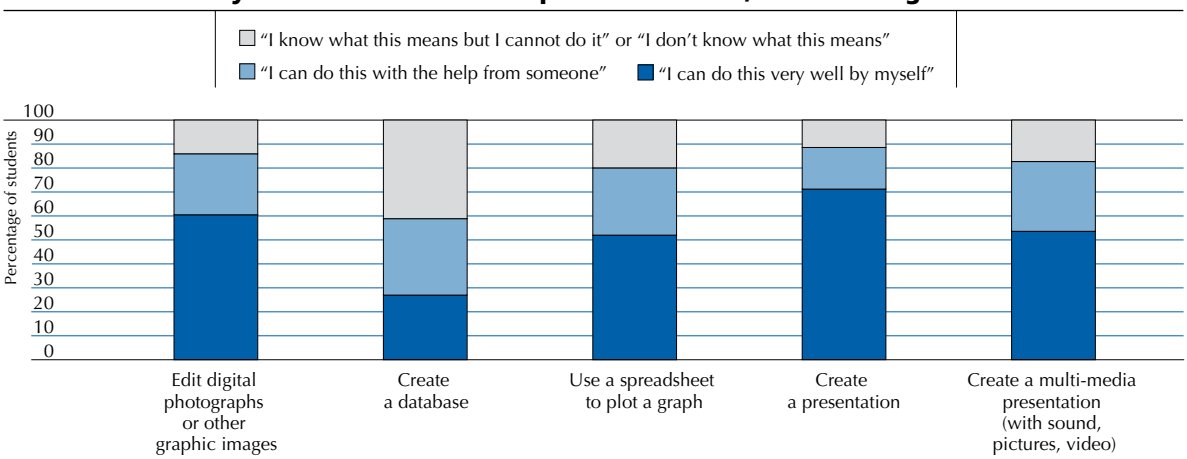
Students provided information on the extent to which they felt they could perform five different levels of technical proficency: "edit digital photographs or other graphic images"; "create a database (*e.g.* using Microsoft Access®)"; "use a spreadsheet to plot a graph"; "create a presentation (*e.g.* using Microsoft PowerPoint®)"; "create a multimedia presentation (with sound, pictures, video)". There were four possible responses: "I can do this very well by myself"; "I can do this with help from someone"; "I know what this means but I cannot do it"; "I don't know what this means". When interpreting the ratings of self-confidence it is important to recognise that students' subjective judgements of task competency may vary across countries and economies.

How confident are students in using computer?

Figure VI.5.26 shows the OECD averages for the percentage of students who reported they could do each task very well by themselves. On average across OECD countries, "create a presentation" was the task that students felt most confident performing by themselves (71%). To "edit digital photographs or other graphic images" received the second-highest rating, with 61% of students indicating that they could perform this task very well by themselves. Slightly over a half of students reported that they could "create a multimedia presentation" (54%) and "use a spreadsheet to plot a graph" (52%) by themselves, while the smallest proportion of students (27%) felt confident enough to "create a database" (Table VI.5.24).

■ Figure VI.5.26 ■

Percentage of students who reported being able to do each of the following tasks very well by themselves or with help from someone, OECD average-29



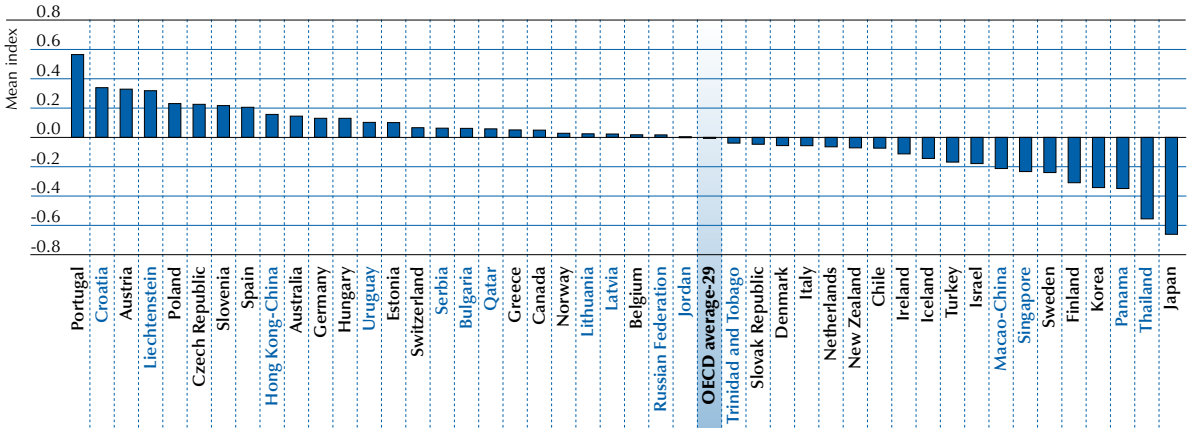
Source: OECD, *PISA 2009 Database,* Table VI.5.24.
StatLink http://dx.doi.org/10.1787/888932435435

Student responses were used to create an *index of self-confidence in ICT high-level tasks.* For this index, a negative score does not necessarily signify a lack of ability to complete the tasks, but rather a level of confidence that is lower than the average for students in OECD countries.

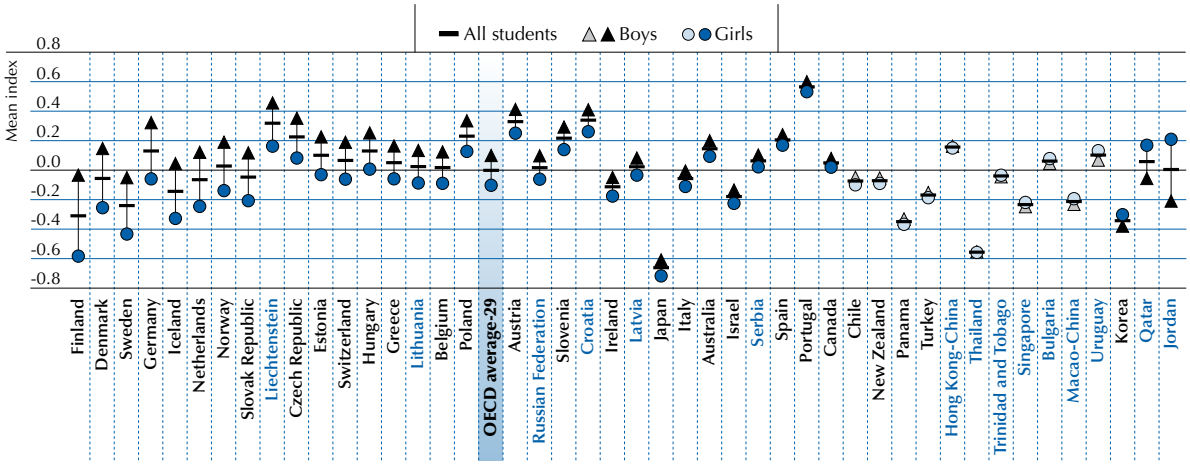
As shown in Figure VI.5.27, students in Portugal, Austria, Poland, the Czech Republic, Slovenia, Spain and the partner countries Croatia and Liechtenstein show relatively high levels of self-confidence in completing high-level ICT tasks, while students in Japan, Korea, Finland, Sweden, and the partner countries and economy Thailand, Panama, Singapore and Macao-China show lower levels of self-confidence (Table VI.5.25).

■ Figure VI.5.27 ■

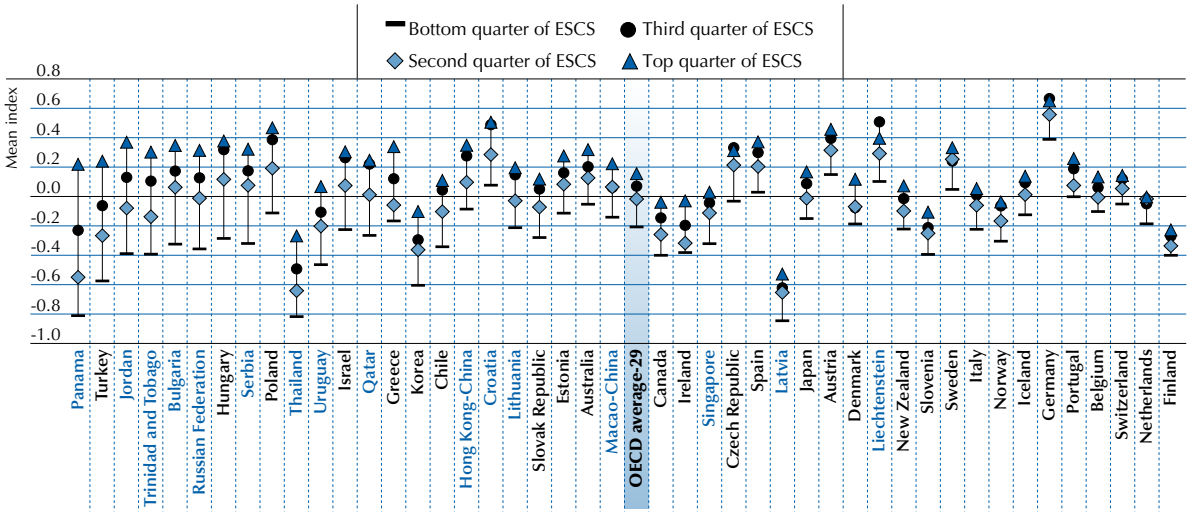
Index of self-confidence in ICT high-level tasks, by gender and socio-economic background



Countries are ranked in descending order of the mean index of all students.



Note: Countries in which gender differences are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the gender differences (B – G).



Note: Countries in which differences between the top and bottom quarters of the *PISA index of economic, social and cultural status* (ESCS) are statistically significant are marked in a darker tone.
Countries are ranked in descending order of the differences between the top and bottom quarters (top – bottom) of ESCS.
Source: OECD, *PISA 2009 Database,* Table VI.5.25.
StatLink http://dx.doi.org/10.1787/888932435435

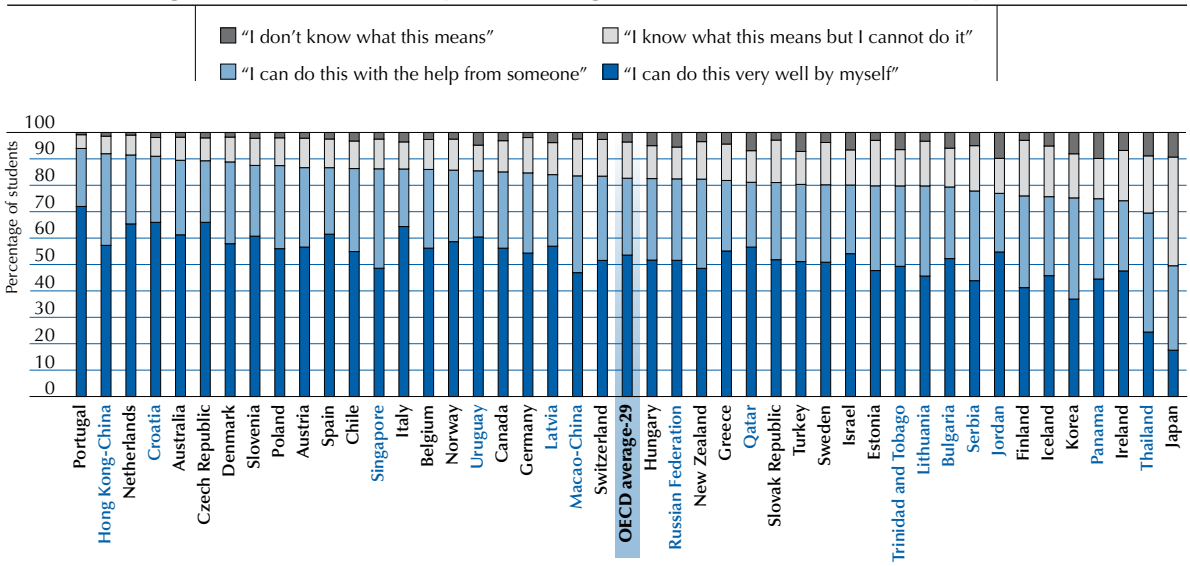
Do gender and socio-economic background influence students' self-confidence in using computers?

Across OECD countries, boys reported higher levels of self-confidence than girls. Korea was the only OECD country where girls reported higher self-confidence than boys. Among the partner countries and economies, girls reported higher levels of self-confidence than boys in Jordan and Qatar (Figure VI.5.27 and Table VI.5.25).

On average across OECD countries, students from advantaged backgrounds reported higher levels of self-confidence in high-level ICT tasks (0.15 index points) than students from disadvantaged backgrounds (-0.21 index points). This pattern was evident across all OECD countries and partner countries and economies. Turkey, Hungary, Poland and the partner countries Panama, Jordan, Trinidad and Tobago, Bulgaria, the Russian Federation and Serbia showed the largest differences in favour of socio-economically advantaged students, with more than 0.58 index points (Figure VI.5.27 and Table VI.5.25). This finding indicates a digital divide in ICT skills between students from advantaged and disadvantaged backgrounds.

■ Figure VI.5.28 ■

Percentage of students who reported being able to create a multi-media presentation



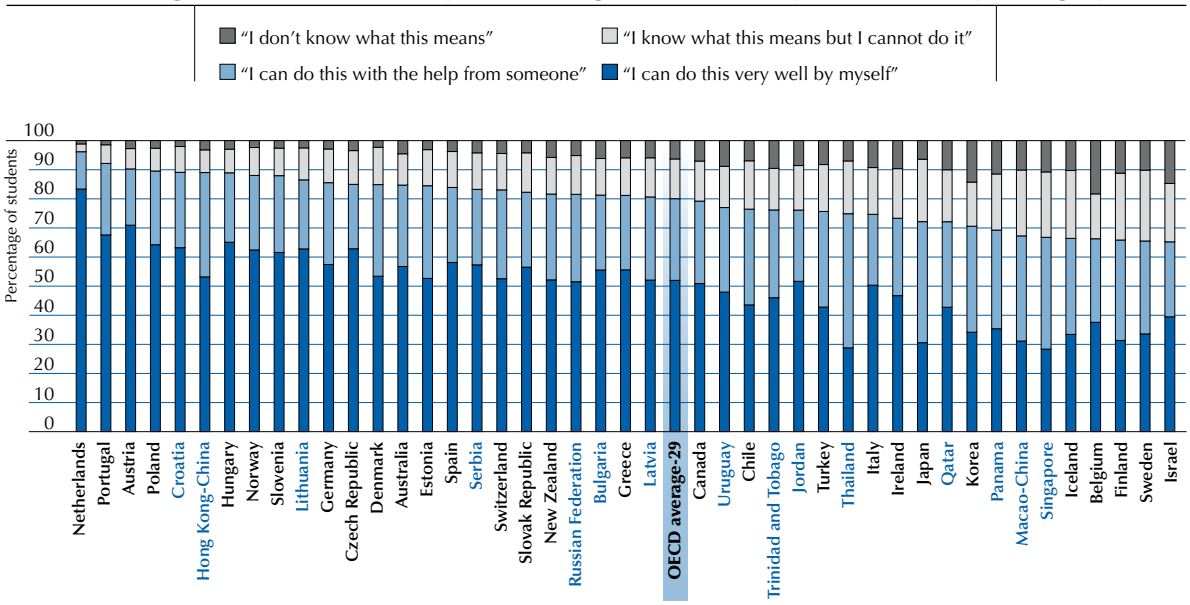
Countries are ranked in descending order of the percentage of students who reported being able to create a multi-media presentation very well by themselves or with the help from someone.
Source: OECD, *PISA 2009 Database,* Table VI.5.26.
StatLink http://dx.doi.org/10.1787/888932435435

Figures VI.5.28 and VI.5.29 show students' self-confidence in creating a multimedia presentation and in using a spreadsheet to plot a graph – two tasks directly applicable to the knowledge-based labour market. This analysis allows for a further breakdown by the four levels of self-confidence: "I can do this very well by myself"; "I can do this with help from someone"; "I know what this means but I cannot do it"; "I don't know what this means". The highest levels of self-confidence to complete a multimedia presentation, either by the students themselves or with some help, were reported by students in Portugal, the Netherlands, Australia, the Czech Republic, Denmark, Slovenia, Poland and the partner countries and economy Hong Kong-China, Croatia and Liechtenstein. More than 8% of students in Japan, Korea and the partner countries Panama, Jordan and Thailand reported that they did not know what it meant to create a multimedia presentation (Table VI.5.26).

Higher levels of self-confidence were evident in the Netherlands, Portugal, Austria, Poland, Hungary, the partner country Croatia and the partner economy Hong Kong-China in using a spreadsheet to plot a graph. Some 83% of students in the Netherlands reported that they could complete the task by themselves, which is 12 percentage points more than the second-highest proportion of students who reported that they could complete the task (71%), found in Austria. In Belgium, Israel and Korea, at least 14% of students reported that they did not know what it meant to use a spreadsheet to create a graph (Table VI.5.27).

■ Figure VI.5.29 ■

Percentage of students who reported being able to use a spreadsheet to plot a graph



Countries are ranked in descending order of the percentage of students who reported being able to use a spreadsheet to plot a graph very well by themselves or with help from someone.
Source: OECD, *PISA 2009 Database*, Table VI.5.27.
StatLink http://dx.doi.org/10.1787/888932435435

Trends in students' self-confidence in using computers

Trend data on student self-confidence in three of the four high-level ICT tasks are available for 22 OECD countries and 6 partner countries from PISA 2003 to 2009. As shown in Figure VI.5.30, the vast majority of countries shows large increases in students' self-confidence in being able to "use a spreadsheet to plot a graph", "create a presentation", and "create a multimedia presentation" by themselves. Most of the improvement in self-confidence occurred for the latter two tasks (Table VI.5.28).

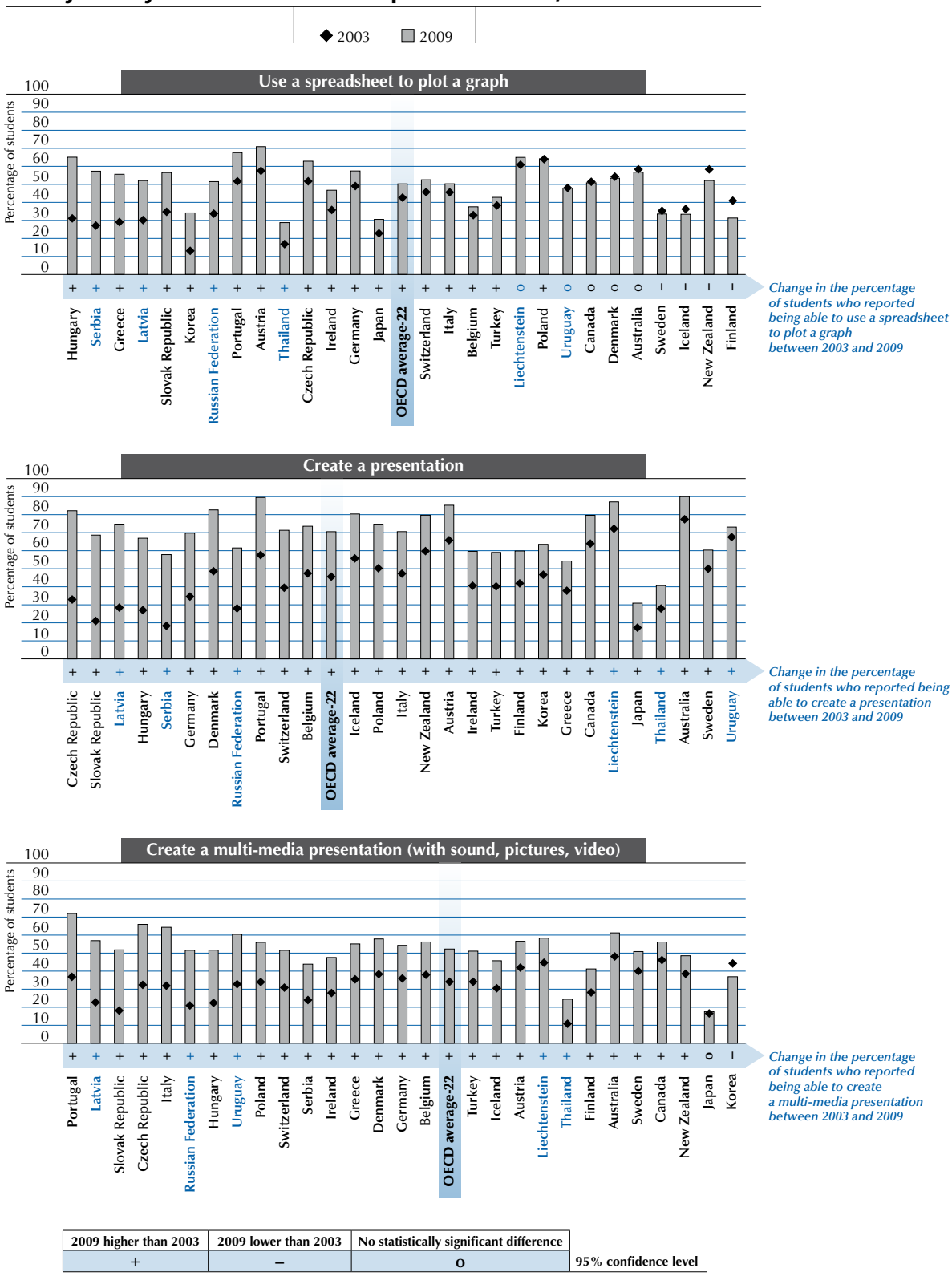
From 2003 to 2009, gains of more than 20 percentage points in student self-confidence in using a spreadsheet to plot a graph were reported in Hungary, Greece, the Slovak Republic and the partner countries Serbia and Latvia. Gains of more than 35 percentage points in student self-confidence in creating a presentation were reported in the Czech Republic, the Slovak Republic, Hungary, Germany and the partner countries Latvia and Serbia over the period; and gains of more than 30 percentage points in student self-confidence in creating a multimedia presentation were reported in Portugal, the Slovak Republic, the Czech Republic, Italy and the partner countries Latvia and the Russian Federation (Table VI.5.28).

During the same period, across OECD countries, girls' self-confidence improved, leading to a narrowing of the gender gap by 5 percentage points for using a spreadsheet to plot a graph; by 12 percentage points for creating a presentation; and by 11 percentage points for creating a multimedia presentation. Only in Japan, and only for the "create a multimedia presentation" task, was there an evident widening of the gender gap (Table VI.5.28).

From 2003 to 2009, on average across OECD countries, the gap between socio-economically advantaged and disadvantaged students in their ability to "use a spreadsheet to plot a graph" narrowed by eight percentage points. It was the only task for which that gap narrowed (Table VI.5.29). In the Slovak Republic, the Czech Republic, Poland, Switzerland, New Zealand and the partner countries Uruguay and Liechtenstein, disadvantaged students became more self-confident in using a spreadsheet to create a graph; and in Portugal, Switzerland, Poland and the Czech Republic, they become more self-confident in creating a presentation. The gap between advantaged and disadvantaged students in self-confidence in using a spreadsheet to plot a graph widened in Turkey, Korea, Australia, Belgium and Canada. It also widened in Sweden, Hungary, Turkey, Finland and the partner country Serbia for creating a presentation.

■ Figure VI.5.30 ■

Percentage of students who reported being able to do the following tasks very well by themselves or with help from someone, in 2003 and 2009



2009 higher than 2003	2009 lower than 2003	No statistically significant difference	
+	−	o	95% confidence level

Countries are ranked in descending order of change in the percentage of students for each of these items between 2003 and 2009.
Source: OECD, *PISA 2009 Database,* Table VI.5.28.
StatLink http://dx.doi.org/10.1787/888932435435

Only in Italy was there an improvement among disadvantaged students in their self-confidence in creating a multimedia presentation; while in Hungary, Turkey, Germany, Iceland, Australia, and the partner country the Russian Federation the socio-economic gap in self-confidence widened. These results indicate that improving access to computers for disadvantaged students in schools has not led to greater self-confidence in computer use and technical proficiency – evidence of the second digital divide.

CONCLUSIONS

Students' access to ICT has continued to improve since 2000. On average across OECD countries, the percentage of students who reported having a computer at home increased from 72% in 2000 to 94% in 2009. During the same period, home Internet access grew from 45% to 89%, on average across the OECD area.

Despite this improvement, the digital divide is evident between countries. While many OECD countries, such as the Netherlands, Finland and Norway, now have near universal home computer and Internet access, fewer than half of students in Mexico have access to a computer or the Internet at home. Eleven partner countries show low levels of access to a computer or the Internet, with the lowest levels reported in Kyrgyzstan (14%) and Indonesia (8%).

Within countries, the digital divide is linked to students' socio-economic background. Students from socio-economically advantaged backgrounds have higher levels of computer and Internet access at home; however, in some countries, the inequalities in the level of computer use at home is narrowed when disadvantaged students have more opportunities to use a computer at school.

Students from advantaged backgrounds reported higher levels of home computer access and use, both for leisure and schoolwork, than students from disadvantaged backgrounds. In addition, advantaged students expressed more positive attitudes towards computers and reported greater self-confidence in completing high-level ICT tasks. This may be due to the more limited access to computers at home for disadvantaged students compared to advantaged students. However, computer use at school helps to compensate for comparatively low levels of home computer use in Portugal, Italy, Poland, Hungary, Greece, Switzerland, and the partner countries Latvia, Croatia and Singapore. In these countries, disadvantaged students are more likely than advantaged students to use computers at school.

There is no clear pattern linking gender to a digital divide. Overall, boys reported a slightly higher frequency of using a computer at school than girls, while girls reported a higher frequency of computer use at home for schoolwork. Yet, some countries showed no difference or the inverse. Across all participating countries, boys reported a higher frequency of leisure-related activities than girls. Among OECD countries, boys expressed more positive attitudes towards computers and higher levels of self-confidence in completing high-level ICT tasks than girls.

Note

1. Among OECD countries, the correlation coefficient between the ratio of computers to the number of students in the modal grade of 15-year-olds in PISA 2009 and the ratio of computers to the number of students in school in PISA 2009 is 0.72.