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E-learning in Thailand: Mapping the digital divide

E-learning in Thailand: Mapping the digital divide

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Glossary of terms and abbreviations

ASEAN	Association of Southeast Asian Nations
DEEP	Digital Education Excellence Platform
EMIS	Education Management Information System
ESCS	Economic, social and cultural status
GNI	Gross national income
GPP	Gross provincial product
ICT	Information and communication technology
ITU	International Telecommunication Union
LISA	Local indicators of spatial association
MDES	Ministry of Digital Economy and Society
NBTC	National Broadcasting and Telecommunication Commission
NSO	National Statistical Office
OBEC	Office of the Basic Education Commission
OECD	Organization for Economic Co-operation and Development
PISA	Programme for International Student Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USO	Universal service obligation

Executive summary

COVID-19 has affected 60.5 per cent of total enrolled learners globally and over 15 million in Thailand alone (UNESCO, 2020a). The Government of Thailand temporarily closed all educational institutions nationwide on 18 March 2020, leading to a delay in the start of the academic year for 12 million students enrolled at the pre-primary, primary, lower-secondary and upper-secondary levels. When schools reopened, students and instructors needed to adapt to new norms, such as social distancing. When the second wave hit, in December 2020, schools were again closed in 28 provinces. The shift to online learning was swift and posed considerable challenges. The Government realized the importance of digital infrastructure for school education and made it a high priority. At the initiative of the United Nations resident coordinator, and with support from the Government, ITU, together with UNESCO and UNICEF, undertook to map the digital divide in the context of school education in Thailand.

This study presents data on access to digital devices and Internet connectivity among Thai students at school and at home. It assesses schools' readiness for e-learning by analysing secondary data obtained from the National Statistical Office, the Office of the Basic Education Commission, the Ministry of Digital Economy and Society, and the NBTC.

Data on school connectivity

The data on access to and use of digital devices and Internet connectivity in schools remain fragmented and of limited availability. Thailand's system of education governance involves various public and private institutions. In addition to the Ministry of Education, 14 other public bodies oversee their own institutions. Information about Internet connectivity in schools is available only for schools under the jurisdiction of the Office of the Basic Education Commission, which accounts for 79 per cent of educational institutions and 52 per cent of students. No Internet connectivity information was available for nearly half of students. Similarly, the study accessed data on desktop computer availability for management purposes from only six out of 17 jurisdictions, with no data available for 6 per cent of educational institutions and 20 per cent of students. Data regarding the number of desktop computers for teaching purposes were available for only five jurisdictions.

Access to Internet connectivity and digital devices among students at school

Analysis of connectivity in schools under the jurisdiction of the Office of the Basic Education Commission (78.65 per cent of academic institutions) shows that 97.47 per cent (28 889 schools) were connected to the Internet. Approximately 0.8 per cent (242 schools) did not have Internet connectivity, and there was no connectivity information for 1.7 per cent (509 schools). The unconnected schools were small, with an average of 30 students. Nearly 6 per cent (1 672) of schools used 3G and 4G cellular technology to connect to the Internet. Schools from Northern provinces used a slightly higher percentage of 3G and 4G Internet than those in other regions of the country. The study found subtle connectivity differences between schools across different regions, reflecting the digital divide.

Seventy per cent of schools were connected by fibre-optic Internet. Even though the study was able to identify the type of Internet connectivity in the school, it could not establish the quality from the dataset provided by the Office of the Basic Education Commission. However, analysis of OECD PISA survey data revealed that one in three school principals felt that their school had insufficient bandwidth. There was a visible gap between urban and rural schools, and between the bottom and top socio-economic quartiles.

On average, 17 students shared one computer at school. For students from Southern Thailand, the figure was 19; for students from Central Thailand, it was only 16. Sometimes the variance was even greater. For example, 27 students shared one computer in the Southern provinces of Narathiwat and Yala, whereas only 12 students shared one computer at schools in Central provinces like Ang Thong and Sing Buri.

Adequacy of digital devices and instructor capabilities

Successful e-learning initiatives are also contingent on the quality of digital resources, the presence of qualified technical staff and the availability of a robust online learning support platform. The analysis suggests significant gaps in school principals' opinions on the adequacy of computing devices depending on the school's location, the students' socio-economic status, and whether the school was public or private. Sixty-four per cent of rural school principals thought that their school's digital devices provided sufficient computing capacity, compared to 72 per cent in urban areas. Similar gaps were observed between public and private schools. It is vital to address these gaps to ensure equitable access to e-learning resources post COVID-19.

Most school principals from both urban and rural schools agreed that teachers had the skills needed to integrate digital devices into instruction. Irrespective of location, most schools in Thailand concurred on the practice of incentivizing teachers to incorporate digital devices into instruction. Nearly three-quarters of urban and rural school principals tended to agree that teachers had sufficient time to prepare lessons using digital devices. About 63 per cent of students from rural schools and 73 per cent of students from urban schools had principals who agreed or strongly agreed that they had sufficient qualified technical staff.

Student capabilities

Only 16 per cent of lower-secondary school-aged students (10–14) reported using computers to create presentations, compared to 46 per cent from the upper-secondary and early undergraduate cohorts (15–19). While there were differences in usage between different age groups, more than half of computer users did not use their device for educational activities like creating presentations.

School-aged children were much more likely to use the Internet to access social networks than to pursue online courses or engage in educational activities. Nearly all Internet users aged 15 to 19 engaged in social networks and VoIP calls, but only 70 per cent aged 10 to 14. Significantly lower percentages used the Internet for learning activities or for online courses. Less than 20 per cent of school-aged users connected to the Internet to pursue online courses, although that number might have gone up during the school closures. Initiatives are needed to ensure students use the Internet for learning purposes.

Access to Internet connectivity and digital devices at home

Access to Internet connectivity in the home is an essential indicator of e-learning readiness. Despite steady growth in the number of Internet users, nearly one in three residents was still not using the Internet (National Statistical Office, 2020a). The study also observed mobile access disparities across different socio-economic strata. Only 59 per cent of households from the provinces in the bottom quartile of GPP per capita had an Internet connection in the home, compared to 79 per cent in the top quartile. Moreover, two out of three households connected via a mobile network, raising the question of mobile data affordability and educational activities.

Between 2015 and 2019, the number of computer users continued to decline while the proportion of people using the Internet steadily rose. Only 11 per cent of households in the lowest quartile had access to a computer in the home, compared to 20 per cent in the top quartile. These differences in access to a computer and affordable Internet connectivity at home signify that most households in the bottom quartile will be left behind by e-learning initiatives that require a computer and Internet access.

Recommendations

As digital connectivity becomes paramount to the education sector, it is vital for the Government (Ministry of Education, Ministry of Digital Economy and Science, NBTC) to connect unconnected schools and communities, and ensure that students have equitable access to devices, learning content and opportunities. Some of the other specific recommendations in this regard are set out below.

a) Improve the quality and availability of data on the status of school connectivity

- The availability of data on students and schools specifically is limited. The Ministry of Education collects data on Internet connectivity and digital devices in schools under the jurisdiction of the Office of the Basic Education Commission. However, not all the information collected is readily available for analysis. Datasets indicating school location, state of access to digital devices and Internet connectivity, including quality, must be compiled at a centralized location to help researchers and other agencies identify schools requiring special attention.
- A pilot study should be conducted that analyses the gaps between schools across different jurisdictions bottom up. It should focus on collecting data from other jurisdictions (e.g. the Offices of the Private Education Commission, the Vocational Education Commission and the Basic Education Commission) and on schools that do not have readily available data for analysis. It should collect recent data on use of the Internet and digital devices and on teacher, student and administrator skills. The Government should prioritize collecting data on how the devices and connectivity are used and what skills students and teachers possess at the school level.

b) Set guidelines for the Internet and devices in schools

- The lack of clear data on each school's bandwidth poses a significant challenge when it comes to assessing Internet adequacy for e-learning.
- The jurisdictions overseeing educational institutions should establish criteria for assessing bandwidth adequacy by setting per capita student bandwidth targets and measuring progress. A pilot scheme should be run in a few schools under different jurisdictions, to understand and estimate bandwidth and digital device needs. The latest version of the ITU Last-mile Connectivity Toolkit can serve as a benchmark to determine per student bandwidth targets.

c) *Improve digital device-to-student ratios in schools*

- The relatively higher student-to-computer ratio in schools can pose a challenge in terms of learning digital skills and other subjects that require using devices in the schools. The Ministry of Education should therefore emphasize improving student access to computing devices that are instrumental for learning.

d) *Enhance connectivity information to include the community*

- The compatibility and visualization of data across different jurisdictions within the Ministry of Education and between the Ministry of Digital Economy and Science, the NBTC, the Ministry of Interior and other relevant agencies that have schools under their jurisdiction should be enhanced. In digital environments, the learning environment is expanded from schools to the community. It is important to assess connectivity more holistically, in the light of student experiences. For this purpose, school-based data need to be mapped using the existing telecommunication coverage connecting schools and communities. This should include access to fibre and high-speed broadband (mobile and fixed) coverage, preferably using a GIS platform. It should also bring together various initiatives, including the Ministry of Digital Economy and Science Net Pracharat project, NBTC universal service coverage and other initiatives.

e) *Increase the availability of information on traffic and bandwidth use from schools*

- The Office of the Basic Education Commission should enhance the quality of data collected through its Education Management Information System on computers, networking and the Internet, and make the information publicly available for further analysis.
- The Office of the Basic Education Commission and other jurisdictions overseeing schools should consider partnering with Internet service providers to track Internet usage accurately.
- The Ministry of Digital Economy and Science can collect data on Internet usage in schools through its Net Pracharat project. Currently, the project does not identify the schools clearly. As a result, crucial Internet and network usage data are missed. The Net Pracharat project should identify and collect network usage data from all educational institutions with access to its network.
- An analysis of Net Pracharat location and usage data reveals that students did not use the community-based networks to study during the pandemic. Rural connectivity projects should therefore widen their focus to incentivize home connections wherever possible.

f) *Improve the affordability of Internet connectivity for students*

- Internet use, particularly mobile data, remains expensive for students, especially those of low socio-economic status. In addition, online learning requires much longer and more stable Internet access than other uses. Commercial telecommunication providers and government agencies should consider subsidizing Internet costs for students from low-income families, to provide equal learning opportunities.

g) *Assess the impact of e-learning on education outcomes*

- Further studies should be undertaken to assess the impact of e-learning on education outcomes and see whether differences in access to the Internet and devices affects students' educational achievements.

1 Introduction

The COVID-19 pandemic is not only a global public health crisis, it is also a global education crisis. The pandemic has affected 60.5 per cent of total enrolled learners globally and over 15 million in Thailand alone (UNESCO, 2020a). In response to the pandemic, the Government of Thailand temporarily closed all educational institutions nationwide on 18 March 2020, requiring students to adapt to the new norms of distance education. Twelve million Thai students enrolled at the pre-primary, primary, lower-secondary and upper-secondary levels were affected by the delayed reopening of schools. The remaining three million students were at the tertiary level.

After the schools were closed on 18 March 2020, the period between 7 April and 17 May, which also coincided with the end-of-year school break, was used to prepare for remote learning. The Government expected that the time would be used to prepare remote learning materials and assess the readiness of pupils, teachers and parents for remote learning. Between 18 May and 30 June, it experimented with remote learning, making learning materials available to the public and collecting feedback from students, teachers and parents. The issues raised included teachers' readiness to teach remotely, the quality of content, infrastructure to support remote learning, and access to learning materials (Oxford Policy Management and United Nations, 2020).

The threat posed by the second wave of COVID-19 forced the Ministry of Education to announce the closure of all public and private educational institutions, both formal and informal, affiliated with it and under its supervision in 28 provinces between 2 and 27 January 2021.

In the wake of the first wave, the Ministry of Education applied a nationwide distance-learning television model via satellite or distance-learning television for primary school students and online learning for secondary school students (UNESCO, 2020b). Even after the schools reopened in July, the Ministry emphasized online and on-air classes. It informed schools across the nation to be prepared for online teaching in the event of a virus resurgence. It also emphasized the importance of e-learning, which it committed to develop and adopt. The Ministry set out four different scenarios for post-pandemic classes: onsite (physical classes at schools), on-air (television), online and on-demand (Bangkok Post, 2020). Three of the four presume that students have access to devices and connectivity, and that they have the skills required to pursue online learning. Those without access to digital devices and the knowledge to use them are likely to be the ones who will be hardest hit.

The pandemic laid bare the inherent divide in the education system, mainly in terms of access to and use of digital devices and the Internet for learning (Zhong, 2020). Those with access to digital devices were able to continue their education remotely despite school closures, while those without access were left out. COVID-19 has accentuated learning inequalities, and these are likely to increase due to pre-existing inequalities (see Oxford Policy Management and United Nations, 2020, for detailed scenarios). Evidence suggests that four in ten school-going Thai children do not have access to notebooks, and six in ten do not have access to tablets, which are instrumental for online learning during school closures (Tongliemnak, 2020). The shift to online education in Asia has widened learning inequality gaps (UNESCO, 2020c). The prolonged educational disruption has had the adverse consequence of causing a permanent recession in education (Wagner & Warren, 2020).

Evidence suggests that school interruptions generally affect academic performance. For example, the 2011 floods in Thailand significantly affected the learning outcomes of students in grades six, nine and twelve, with O-net examination scores declining overall during that time (Thamtanajit, 2020). Optimistic global estimates suggest that an average three-month school closure during COVID-19 will lead to a loss of 0.3 years of schooling and an estimated 1 per cent decline in PISA score levels. The average student in school today is expected to face a reduction of USD 355 in annual earnings and of an estimated USD 6 500 over the course of their lifetime due to school closures (Azevedo et al., 2020). These losses will vary in the context of Thailand, but are likely to be significant because learning-adjusted years of school are four years less than the expected years of schooling; in other words, children who start school at age 4 can expect to complete 12.7 years of school by their eighteenth birthday, but when what they actually learn is factored in, the expected years of schooling fall to 8.7 (Avitabile et al., 2020).

Given the growing importance of digital devices, connectivity and learning in the post-COVID era, it is important to identify and close the existing digital divide in school education. However, the data on access to digital devices, connectivity and other ICT resources are fragmented across different departments and ministries. The study undertaken by ITU in coordination with UNICEF and UNESCO is a scoping initiative to identify and map the available data sources. It aimed to produce a comprehensive map of the digital divide in school education and had three objectives:

1) scope, map and analyse available data across relevant ministries on access to digital devices, availability and use of the Internet, status of school connectivity and quality of access, so as to enable better understanding of the infrastructural challenges and opportunities for e-learning faced by some communities and disadvantaged groups in Thailand;
2) review and assess existing ICT initiatives (both specifically purposed to support e-learning and education and not specifically purposed but still essential to enabling it), so as to identify potential good practices and gaps requiring further assistance;
3) develop a set of evidence-based policy recommendations on the infrastructure required, including identification of standards where appropriate, to help bridge the digital divide and support Thailand's efforts to keep up with improved and inclusive technologies, in line with its vision of a digital nation.

Report structure

The report is organized into six sections covering the state of connectivity in schools and homes. This first section describes the study's background and policy context and outlines the research objectives. It looks at the goals of the National Education Plan and the Thai Government's commitment to achieve Sustainable Development Goal 4 and its subindicators on school connectivity and ICT resources in schools.

The second section presents the methodology and formulates an operational conceptual framework to guide data collection and analysis. It also provides a comprehensive assessment of existing data on school location and Internet connectivity.

Section three presents a descriptive analysis of Internet connectivity and digital devices in schools. It covers issues such as Internet connectivity, bandwidth sufficiency, digital devices in schools, and the digital skills that instructors and students need for e-learning initiatives to be successful.

The fourth section analyses Internet connectivity at the household level. It focuses on access to the Internet, type of Internet connectivity, and affordability for e-learning purposes.

Section five presents a case study of rural connectivity efforts and usage patterns during COVID-19. The report concludes in section six with recommendations.

Policy framework

Sustainable Development Goal 4

Thailand monitors its progress towards Sustainable Development Goal target 4A, focusing on schools and available resources at the school level. The Ministry of Education collects data on (a) the proportion of schools with access to electricity, (b) Internet use for pedagogical purposes, (c) computer use for pedagogical purposes, (d) infrastructure and materials adapted for students with disabilities, (e) basic drinking water, (f) single-sex basic sanitation facilities and (g) basic handwashing facilities. Reported rates for (a), (b) and (c) are nearly universal, and data for (d) to (f) are unavailable (Oxford Policy Management and United Nations, 2020).

Box 1: Information System for Equitable Education

The Equitable Education Fund established under the Equitable Education Act 2018 works primarily to provide financial support to the neediest children and young people. The Fund currently focuses on early childhood research and technical assistance, conditional cash transfers, the area-based initiative on out-of-school children, and higher education for educational equity.

The Fund maintains the Information System for Equitable Education, which compiles data from different sources to help understand the situation of education in Thailand. The system contains the location of 31 620 schools affiliated with the Office of the Basic Education Commission, the Ministry of Interior, the Border Patrol Police and the Bureau of National Buddhism. It uses an interactive mapping capability to identify areas without schools. It can also be used to explore the resources that schools have, including the type of Internet and computers available for pedagogical and management purposes.

See more: https://isee.eef.or.th/.

National Education Plan (2017–2036)

The National Education Plan sets out a dynamic vision for ICT use and knowledge in the education system. Some of the key skills that it aims to develop among learners are ICT usage and literacy, and information and media literacy.

In addition to developing twenty-first-century skills, the plan also aims to provide quality ICT resources to pupils. Strategy 4.2 of the National Education Plan seeks to ensure that every educational institution in Thailand has access to a modern, high-speed digital technology network providing quality Internet access. Strategy 4.3 covers the establishment of individual student information database projects to collect and share information across other institutions working in the fields of public health, social development, labour, education, and so on.

The Equitable Education Fund's Information System for Equitable Education (see Box 1) can serve as a prototype for building the individual student information database. Fund learning can be instrumental in creating a database that will be used by different stakeholders.

2 Methodology

In this section, the study discusses the literature on the digital divide. It proposes a conceptual framework based on an analysis of the literature and data available from different ministries and government agencies.

Conceptual framework

A growing body of research has examined digital inequalities. One common thread is uneven distribution in binary terms, i.e. those who have ownership/access/skills ("haves") and those who do not ("have-nots"). However, the distinction between haves and have-nots poorly represents a dynamic landscape (Hargittai, 2001, 2008). For instance, in technologically advanced countries, a significant proportion of the population has an Internet connection, but disparities appear once the analysis zooms in beyond the issue of access. The binary characterization is, therefore, only the first-level divide. Digital skills and usage gaps are found on the second level. The third level emerges when mere possession of skills and use are inadequate to determine the beneficial outcomes in the lives of ICT users (Van Deursen et al., 2017). Various studies have shown that the digital divide extends beyond access and that there are social implications to what people do online. Inequality is thus better understood as a persistent and dynamic target. Furthermore, the digital landscape demands an evolving understanding of shifting swathes of exclusion as connectivity is continuously reconfigured for universal access.

There is a consensus in the academic literature that measuring ICT use in schools requires attention to the educational practices once the technology is present. This process of measuring the state of ICT use comprises at least three dimensions: access, use and skills (see Table 9 in the annex to this report) (Dodel, 2015).

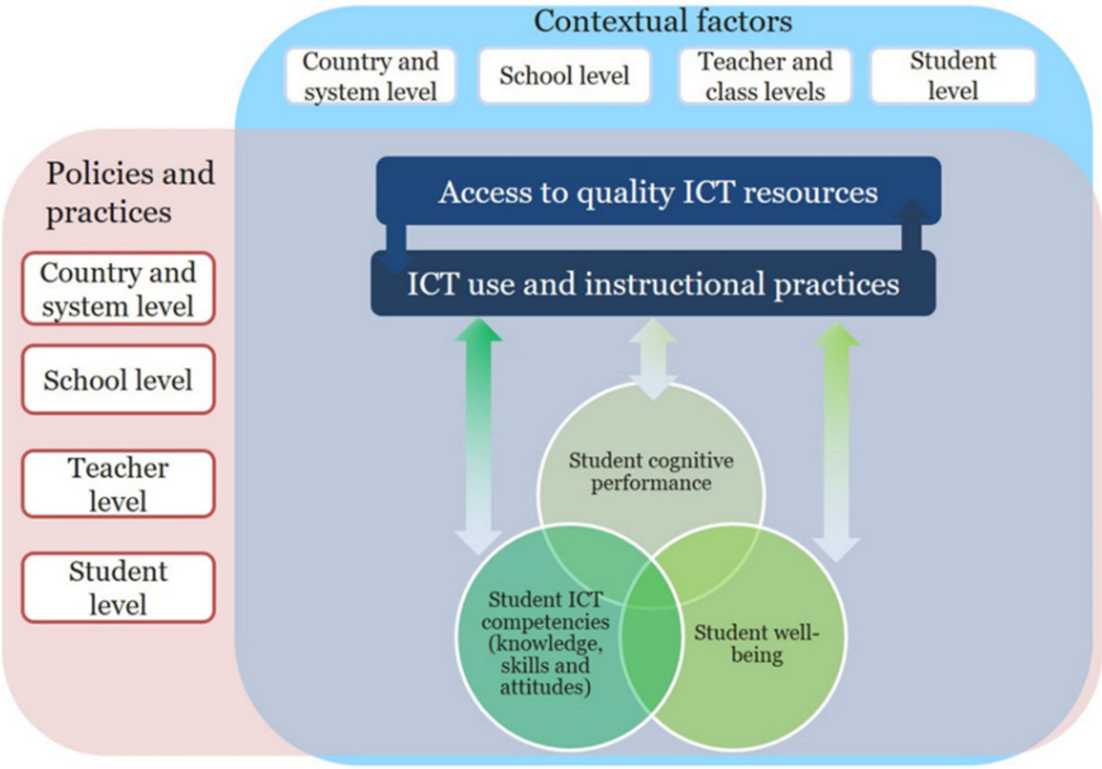
The OECD provides a comprehensive framework for assessing the relationship between ICT use and access by students based on the students' cognitive performance, well-being, and ICT attitudes and competencies. The framework covers three dimensions: access to ICT, ICT use, and students' ICT competencies both at school and at home (OECD, 2019).

- **Access to ICT** encompasses availability, accessibility and quality of ICT resources with a particular focus on (connected) technologies that can support learning (e.g. digital learning resources, learning management systems).
- **Use of ICT** covers the intensity and the types/modalities of ICT use by students in an informal, and possibly unsupervised, environment for learning and leisure, and in a supervised situation in the classroom, notably through teachers' pedagogical practices with ICT; it also includes alternative uses of ICT by teachers to support teaching.
- **Students' ICT competencies** describe the core competency areas identified in existing assessment frameworks for "digital literacy", and attitudes and dispositions towards ICT use (for learning and leisure). A self-efficacy measure is proposed to assess students' ICT competencies.

In general, ICT provides opportunities for students to learn outside school premises, which is crucial in a pandemic situation. In normal circumstances, using ICT can alter the pedagogical approaches adopted by teachers to enhance students' learning experience in school. Students' engagement with ICT both in and out of school can impact their cognitive processes and learning outcomes. The OECD framework also provides essential insight into how different contextual factors shape student outcomes. Figure 1 contains a conceptual framework, the OECD PISA 2021 ICT Framework, for assessing how access to quality ICT resources and ICT usage, alongside instructional practices, impact student performance. The framework acknowledges the critical roles policies and practices related to school, teacher and students have on both access to and use of ICT resources, and on student outcomes. Contextual factors may not be directly related to ICTs; they generally include the attributes of the education system, the school and the student's household (e.g. how well teachers are trained to use ICT at schools, or the level of a region's economic development).

Furthermore, ICT-related policies and practices directly influence access to and use of ICT resources. For example, whether schools have funding to procure ICT resources will affect whether students can access ICT resources. The perception of and attitude towards the use of ICT resources as instructional tools, and the availability of support for teachers using ICT in the classroom, will have a bearing on pedagogical purposes.

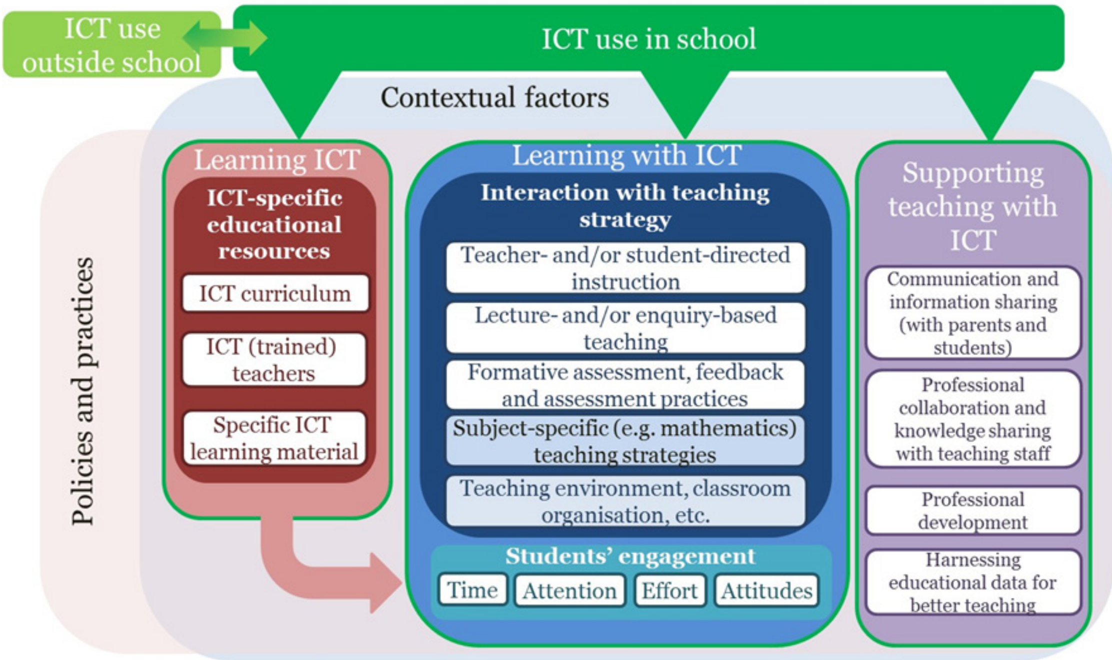
Figure 1: PISA 2021 ICT framework



Source: OECD (2019).

The framework further clarifies how student and teacher ICT usage influences student outcomes. It broadly illustrates ICT usage in the school in three domains: learning with ICT, learning ICT, and supporting teaching with ICT. Figure 2 shows the different ways in which ICT can be used in schools. First, students can use ICT resources to enhance their learning of traditional subjects like mathematics, reading or science. Teachers can also use ICT resources to enhance their teaching strategies in traditional subjects like mathematics, deploying, for example, simulations and interactive learning strategies. Second, students can learn ICT-related competencies through special ICT-related courses at school, which assumes that specific ICT learning material and ICT-trained teachers are available. Third, the entire teaching and learning process can be enhanced by using ICT for communication among teachers and creating online communities of teachers, parents and students. Furthermore, teachers can use ICT to share teaching/learning resources with students and keep track of their performance and work. School administrators, for their part, can use ICT to simplify administrative processes and tasks, freeing up time for meaningful engagement with students.

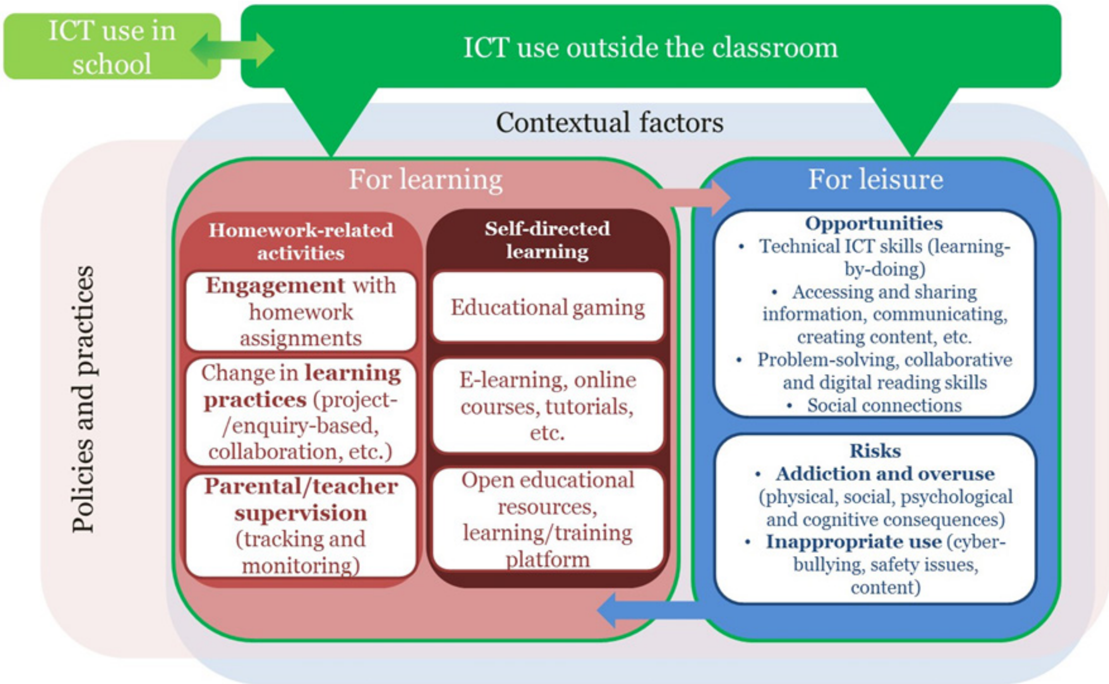
Figure 2: ICT use in schools



Source: OECD (2019).

Finally, the OECD framework provides a comprehensive view of how ICT can be used outside the classroom (see Figure 3). The fundamental distinction between ICT usage outside, as opposed to inside, the classroom is that the former occurs in an unsupervised environment, where different devices may be used for various purposes, such as learning and leisure. Students can use ICT to do assignments, work with their peers on group projects or engage in self-directed learning (e.g. e-learning, online courses, watching tutorials at home). Students worldwide have used ICT resources to connect with their teachers during the pandemic and continue learning.

Figure 3: ICT use outside the classroom



Source: OECD (2019).

The OECD framework also highlights the potential risks of ICT use outside the classroom. These include addiction problems caused by a possible lack of self-control combined with adolescent ICT users' curiosity, and exposure to cyberbullying or inappropriate content. The framework thus also highlights the vital role played by adult guardians in supervising use outside the classroom.

The study uses the OECD framework to gauge the availability of ICT resources both inside and outside the classroom, and to assess contextual factors such as the policies and practices that are instrumental in enhancing ICT access and usage among students.

Operational conceptual framework

The comprehensive OECD framework provides several important variables to further holistic understanding of the state of the digital divide. The OECD aims to collect data using the framework in the 2022 PISA round, with the framework providing a point of comparison for future studies. The study explored relevant indicators based on the framework, but a preliminary analysis of data availability revealed that the adoption of the model posed significant practical challenges in terms of identifying indicators to assess each of the components in the framework. The study therefore operationalized the framework as indicated in Table 1, to identify the state of existing data on the status of school connectivity, access to digital devices, availability and use of the Internet, and quality of access both in schools and at home.

Table 1: Indicators and sources of data

Dimension	Indicator	Source	Unit of analysis	Level of analysis	Data-collection frequency	Latest data	Data-collection method
Access at school	Number of students per desktop computer for pedagogical purposes	OBEC[1] (2020)	School	Provincial, regional, national	Annual	2020	OBEC EMIS
	Number of students per desktop computer for management purposes	OBEC (2020)	School	Provincial, regional, national	Annual	2020	OBEC EMIS
	Per cent of schools connected to the Internet	OBEC (2020)	School	Provincial, regional, national	Annual	2020	OBEC EMIS
	Per cent of people using the Internet	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of students with Internet access via wireless network at school	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Internet-connected computer available at school for use	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Portable laptop or notebook available at school for use	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Desktop computer available at school for use	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
Quality of Internet access at school	Per cent of schools connected to the Internet by Internet type	OBEC (2020)	School	Regional, national	Annual	2020	OBEC EMIS

[1] For the 2019 academic year. However, the data were collected each semester. The data in the report were limited to schools under OBEC jurisdiction; other jurisdictions were not included.

Table 1: Indicators and sources of data (continued)

Dimension	Indicator	Source	Unit of analysis	Level of analysis	Data-collection frequency	Latest data	Data-collection method
Student computing skills	Per cent of school-aged population able to send e-mails with attachments	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of school-aged population able to create electronic presentations using presentation software	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of school-aged population able to copy or move a file or folder	NSO (2020)	Population	National	Quarterly	2019	Household survey
Student Internet use	Per cent of school-aged population able to use social networks	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of school-aged population able to use VoIP	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of school-aged population able to take an online course	NSO (2020)	Population	National	Quarterly	2019	Household survey
	Per cent of school-aged population able to use the Internet to browse an encyclopedia, Wikipedia, for learning purposes	NSO (2020)	Population	National	Quarterly	2019	Household survey

Table 1: Indicators and sources of data (continued)

Dimension	Indicator	Source	Unit of analysis	Level of analysis	Data-collection frequency	Latest data	Data-collection method
Access at home	Per cent of students with a laptop or notebook at home	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Per cent of students with a desktop computer at home	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Per cent of students with television at home	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Per cent of students with cellphones with Internet access at home	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
	Per cent of students with a link to the Internet at home	OECD (2018)	Student	Gender, socio-economic status, school type, location, national	Every three years	2018	Survey of students
Quality of access to digital devices at school	Per cent of schools with sufficiently powerful computing devices	OECD (2018)	School principal	School type, location, socio-economic status	Every three years	2018	Survey of school principals
	Per cent of schools with sufficient digital devices for instruction	OECD (2018)	School principal	School type, location, socio-economic status	Every three years	2018	Survey of school principals
	Per cent of schools with sufficient Internet bandwidth	OECD (2018)	School principal	School type, location, socio-economic status	Every three years	2018	Survey of school principals
	Per cent of schools with sufficient digital devices connected to the Internet	OECD (2018)	School principal	School type, location, socio-economic status	Every three years	2018	Survey of school principals
Teacher skills	Per cent of schools with teachers able to integrate digital devices in instruction	OECD (2018)	School principal	School type, location, socio-economic status	Every three years	2018	Survey of school principals

Table 1: Indicators and sources of data (continued)

Dimension	Indicator	Source	Unit of analysis	Level of analysis	Data-collection frequency	Latest data	Data-collection method
Access at home	Per cent of households connected to the Internet	NSO (2020)	Household	Provincial, regional, national	Quarterly	2019	Household survey
	Per cent of households with a computer	NSO (2020)	Household	Provincial, regional, national	Quarterly	2019	Household survey
	Per cent of households with television	NSO (2020)	Household	Provincial, regional, national	Quarterly	2019	Household survey
Quality of Internet access at home	Per cent of households connected to the Internet, by Internet type	NSO (2020)	Household	National	Quarterly	2019	Household survey
Internet usage in the community	Internet bandwidth consumption of Net Pracharat project	MDES (202)	Village	National	Monthly	2020	ISP Bandwidth Usage Report

Assessment of data

Guided by the conceptual framework, the study attempted to understand the state of access, use and affordability of digital devices and the Internet at Thai students' schools and homes. It approached the analysis in two stages. First, it identified the relevant indicators and their individual data; second, it conducted a descriptive analysis of the available data.

This section of the report analyses data from various government agencies and intergovernmental organizations. The study used data from National Statistical Office household surveys of ICT and digital television, Internet traffic data from the Net Pracharat project, Ministry of Education data on school location and access to digital devices, data on Internet-connected schools obtained via NBTC's universal service obligation, and the OECD PISA 2018 survey dataset to triangulate the analysis.

The data on access to and use of digital devices and Internet connectivity in schools was fragmented. As shown in Table 2, Thailand's education system governance involves various public and private institutions. In addition to the Ministry of Education, 14 other public bodies oversee their own institutions. Each jurisdiction maintains its own data, which poses a significant challenge when it comes to aggregating and analysing data in order to understand the overall state of access to digital devices and Internet connectivity in schools.

Limited data exist on access to digital devices and connectivity in schools. The study accessed data on desktop computer availability for management purposes from only six out of 17 jurisdictions. No data were available for 6 per cent of the educational institutions with 20 per cent of the students. A similar problem was observed for data on the number of desktop computers for pedagogical purposes, which existed for only five jurisdictions.

Information about Internet connectivity in schools was available only for schools under the jurisdiction of the Office of the Basic Education Commission, which oversaw 79 per cent of the educational institutions and 52 per cent of the students covered by the study. There was no Internet connectivity information for nearly half of all students. Even in the Office's jurisdiction, Internet connectivity information was missing for 509 schools (1.7 per cent) (see Table 3). See Figure 4 for the location of schools for which there were no data.

Table 2: State of data on Internet connectivity and digital devices in the Thai education system

					Percentage of schools with available data		
Jurisdiction	Total institutions*	Total students	Schools (%)	Students (%)	Desktop for management	Computer for pedagogical purpose	Internet type
Office of the Basic Education Commission	29 871**	6 653 160	78.65	52.07	99.2	99.2	99.2
Office of the Private Education Commission***	4 137	2 226 564	10.89	17.43	99.4	99.4	-
Ministry of Higher Education, Science, Research and Innovation****	155	1 729 973	0.41	13.54	-	-	-
Office of the Vocational Education Commission	913	1 012 580	2.40	7.93	96.3	96.3	-

Table 2: State of data on Internet connectivity and digital devices in the Thai education system (continued)

					Percentage of schools with available data		
Jurisdiction	Total institutions*	Total students	Schools (%)	Students (%)	Desktop for management	Computer for pedagogical purpose	Internet type
Ministry of Interior	1 733	747 084	4.56	5.85	-	-	-
Bangkok Metropolitan Administration	438	282 825	1.15	2.21	99.8	-	-
National Office of Buddhism	406	35 967	1.07	0.28	-	-	-
Border Patrol Police General Headquarters	218	26 417	0.57	0.21	89.9	88.5	-
Ministry of Public Health, Office of the Permanent Secretary	39	19 122	0.10	0.15	-	-	-
Ministry of Tourism and Sports	29	19 014	0.08	0.15	37.9	37.9	-
Ministry of Culture	16	10 868	0.04	0.09	-	-	-
Ministry of Defence	19	7 881	0.05	0.06	-	-	-
Ministry of Transport	2	2 932	0.01	0.02	-	-	-
Police Cadet Academy	1	959	0.00	0.01	-	-	-
Mahidol Wittayanusorn School	1	715	0.00	0.01	-	-	-
Police College of Nursing	1	276	0.00	0.00	-	-	-
Ministry of Social Development and Human Security	2	159	0.01	0.00	-	-	-
Total	**37 981**	**12 776 496**					

Source: Ministry of Education (2019).
* Total institutions and students for the 2019 academic year.
** The OBEC data analysed had information on 29 640 schools.
*** Information on the number of schools for general and vocational education (Office of the Private Education Commission) is somewhat redundant. The number of schools, teachers and students included data from international schools.
**** The number of institutions under the Office of the Higher Education Commission does not include the number of demonstration schools, which are considered to be under the jurisdiction of the Department of Universities and not separate institutions.

Table 3: OBEC jurisdiction, school connectivity data

	Total number of educational institutions	Per cent of educational institutions
Total educational institutions	37 981	100
Schools under OBEC jurisdiction	29 871	78.65
Analysable number of schools under OBEC jurisdiction	29 640	78.03

The study team was able to access and analyse data on only four out of twelve indicators related to computer/Internet use and networking collected through the Education Management Information System. Table 4 lists all the indicators on which the system collects data.

Table 4: Information on computer/Internet use and networking collected by the OBEC EMIS

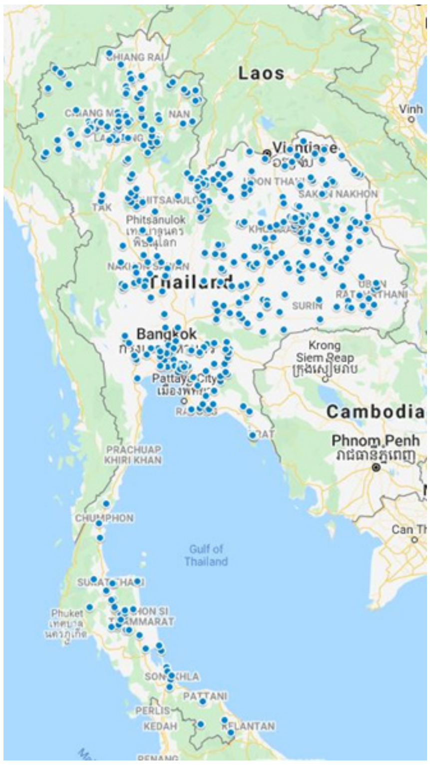
EMIS indicators	Information collected	Information available for analysis
1) Number of computers for pedagogical purposes	Yes	Yes
2) Number of computers for management purposes	Yes	Yes
3) Number of operational computers	Yes	No
4) Number of dysfunctional computers	Yes	No
5) Internet connectivity status	Yes	Yes
6) Internet service provider	Yes	No
7) Internet type	Yes	Yes
8) Internet speed	Yes	No
9) Internet sufficiency	Yes	No
10) Budget for Internet per month	Yes	No
11) Presence of LAN in the school	Yes	No
12) Presence of WLAN in the school	Yes	No

Source: EMIS, OBEC.

The quality of the data on access to digital devices and Internet connectivity in schools was wanting. The Education Management Information System collects data on 12 indicators, but a quick scan of the publicly available information suggested that several schools had not updated the information on computing devices and the Internet in the system. Furthermore, information on Internet connectivity was missing for nearly 3 per cent of the schools under the jurisdiction of the Office of the Basic Education Commission. The lack of good-quality data makes it difficult to identify the schools that need support.

Almost nothing is known about the availability of data on digital devices and Internet use at schools by pupils, teachers and administrators, nor were any data available on student and teacher digital skills. In the absence of such data, it was difficult to assess the efficacy of e-learning initiatives.

Figure 4: Location of schools under OBEC jurisdiction with no data on Internet connectivity

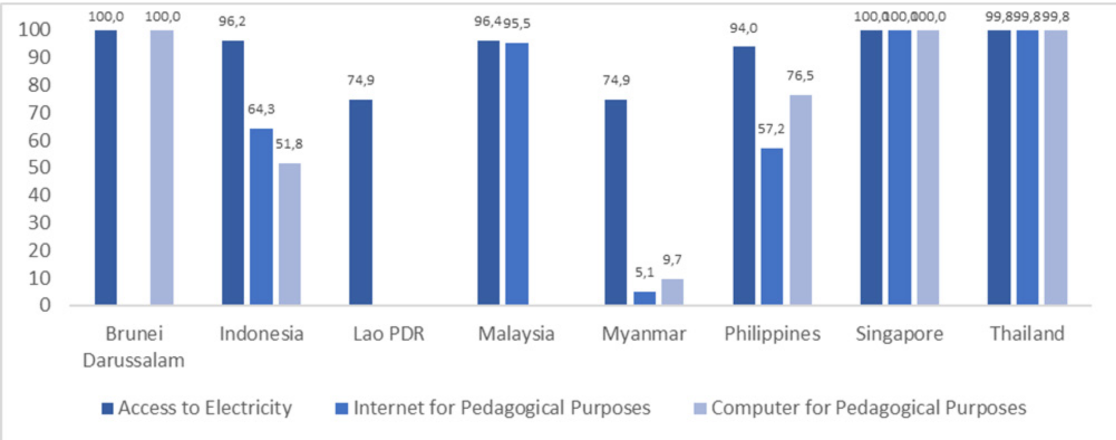


3 Internet connectivity and digital devices at school

This section of the report analyses the data on Internet connectivity and digital devices at schools. It starts with the analysis of the state of Internet connectivity in schools under the jurisdiction of the Office of the Basic Education Commission before discussing bandwidth adequacy in the schools. In the third subsection, it discusses access to digital devices, followed by instructor capabilities relating to use of the digital technologies essential for e-learning. The final subsection analyses the computing skills and Internet use of the school-aged population.

Thailand has almost universal official statistics on the proportion of schools with access to computers and the Internet for pedagogical purposes and ranks high among ASEAN Member States, behind Singapore and Brunei Darussalam, in that regard (see Figure 5). Its numbers are better than the average for upper-middle-income countries and for East Asia and the Pacific (UNESCO Institute for Statistics, 2020). However, differences between geographical regions and socio-economic statuses start appearing when the data are analysed at the subnational level and triangulated across alternative data sources.

Figure 5: Proportion[1] of schools with access to electricity and to computers and the Internet for pedagogical purposes, ASEAN Member States



Source: UNESCO Institute for Statistics (2020), author-generated chart.

Internet connectivity

National Statistical Office data showed that the percentage of Internet users in different age groups was rising steadily (see Table 5), with the highest growth being observed among those aged 35 to 49, followed by those aged 25 to 34, those older than 50 and those aged 15 to 24. In the meantime, the five-year average annual growth rate for Internet users of school-going age (6–14) was 4 per cent, and nearly a quarter of people still did not use the Internet (National Statistical Office, 2020a). These significant gaps might limit the number of students benefitting equitably from e-learning initiatives.

[1] The data for Brunei Darussalam, the Lao People's Democratic Republic, Malaysia and Thailand are from 2019; the data for Indonesia, Myanmar, the Philippines and Singapore are from 2018. The average was computed on the basis of primary, lower-secondary, secondary and upper-secondary school data.

Table 5: People aged 6 and older using the Internet, by age group (%)

Year	Age group				
	6–14	15–24	25–34	35–49	> 50
2015	58	76.8	60.1	31.8	9.6
2016	61.4	85.9	73.6	44.9	13.8
2017	63.4	89.8	80.3	54.9	18.2
2018	74.6	93.5	88.3	69.2	24.3
2019	73.9	93.5	92.3	79.1	33.2

Source: National Statistical Office (2020a).

In general, analysis of connectivity data in schools run by the Office of the Basic Education Commission (78.65 per cent of schools and 52.07 per cent of learners) shows that 97.47 per cent (28 889) of schools were connected to the Internet; 0.8 per cent (242) did not have access to Internet connectivity; and connectivity information was missing for 1.7 per cent (509). The study identified the location of the 242 schools that reported no connectivity (see Figure 7), each of which had an enrolment of 30 students on average. Ninety-three percent (226) of the unconnected schools were small, with fewer than 100.

Table 6: Schools under OBEC jurisdiction by Internet connection type

Internet type	Number of schools	Per cent
Satellite	158	0.5
Net Pracharat	216	0.7
No Internet	*242*	*0.8*
WI-NET	328	1.1
3G	418	1.4
No data	509	1.7
Leased line	687	2.3
4G	1 254	4.2
VDSL	1 370	4.6
ADSL	3 624	12.2
FTTx	20 834	70.3
Total	**29 640**	**100.0**

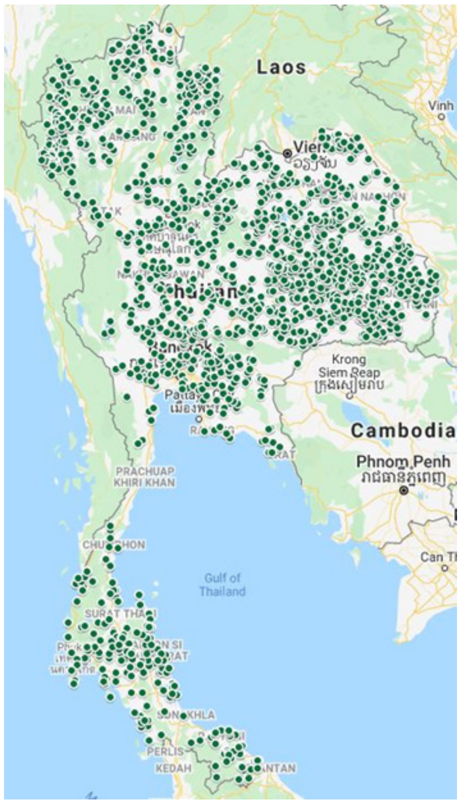
Table 6 illustrates the type of Internet connectivity in schools. Seven out of 10 schools in Thailand had a fibre-optic connection, with slight regional differences in access to fibre connectivity. Northeastern and Northern Thailand were below the national average, while the other two regions were relatively higher. More than 17 per cent of the schools had an ADSL or VDSL connection.

Nearly 6 per cent (1 672) of the schools were connected using 3G and 4G cellular technology (Figure 6). Schools in Northern Thailand were slightly more likely to have 3G or 4G Internet than those in other regions.

Northern Thailand also had a greater proportion of satellite connectivity than other areas of the country. While 3G and 4G cellular technology may be appropriate for an individual user with a single or a few devices, accessing the Internet via a cellular network would be unaffordable for schools. It is therefore important to find ways to connect these schools with more stable and affordable Internet (e.g. fixed broadband wherever possible).

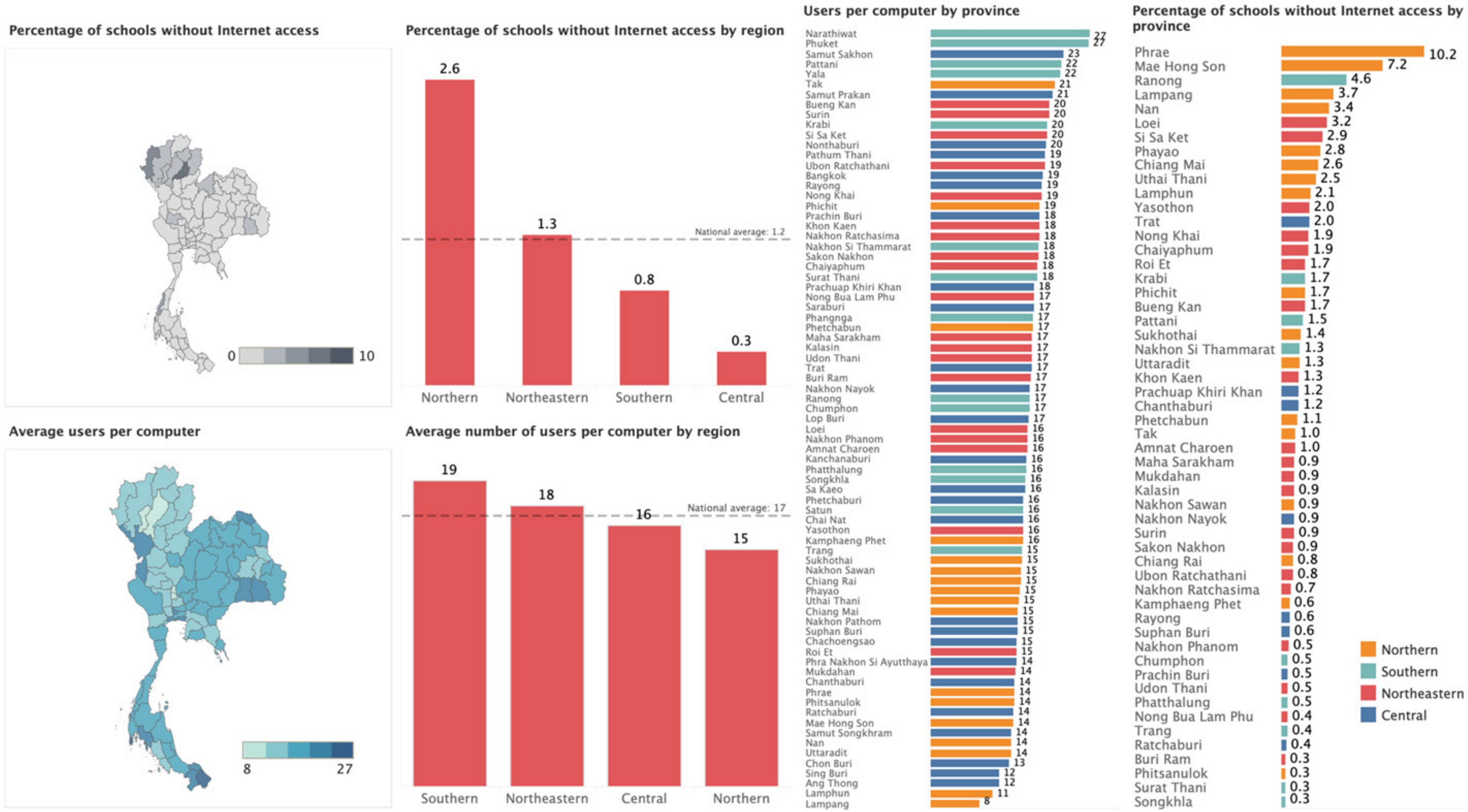
A small percentage of schools was also connected to the Internet through Net Pracharat, the village broadband project. Provinces in Northern and Northeastern Thailand reported using the Internet through the project, as did several schools in Nakhon Ratchasima, Loei, Chaiyaphum, Khon Kaen and Ubon Ratchathani.

Figure 6: Location of schools with a 3G or 4G Internet connection



The data also revealed variations in Internet connectivity between provinces within regions (see Figures 7 and 8). Schools in Central and Southern Thailand were relatively better connected than those in Northern and Northeastern Thailand. The average percentage of schools not connected to the Internet was 0.3 (Central Thailand), 0.8 (Southern Thailand), 1.3 (Northeastern Thailand) and 2.6 (Northern Thailand). For example, the connectivity rate in schools in the Northern provinces of Phrae, Mae Hong Son, Lampang, Nan and Phayao was lower than the regional average. The Northeastern provinces of Loei, Si Saket, Yasothon, Nong Khai, Chaiyaphum, Roi Et and Bueng Kan also had a greater number of unconnected schools than other provinces in the region. Nearly two-thirds of these unconnected schools had fewer than 100 students. In other words, relatively smaller schools from these provinces need special attention. Furthermore, provinces with a higher GPP per capita had a lower percentage of schools without Internet. The traditional economic fault lines were thus also evident when it came to connectivity. It is crucial to focus on minimizing these gaps. (See Figures 9 and 10 for further information.)

Figure 7: State of access to computer and Internet connectivity in Thai schools



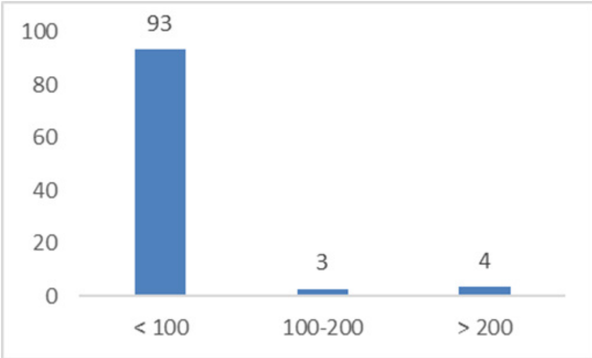
Source: Ministry of Education (2020), author-generated graphics.

Figure 8: Number of schools without Internet access in each province

Figure 9: Location of schools without Internet access under OBEC jurisdiction

Source: Ministry of Education (2020).

Figure 10: Percentage of schools without Internet access, by number of students



Internet bandwidth

Even though the study was able to identify the type of Internet connectivity in schools, it could not establish the quality thereof from the dataset provided by the Office of the Basic Education Commission. It therefore analysed the OECD PISA student survey dataset to understand how students and school principals perceived access to devices, Internet connectivity and the adequacy of ICT resources at school and at home.

Eighty-seven per cent of students participating in the PISA survey reported having access to the Internet via a wireless network in their schools. This was above the average of 73 per cent in OECD and non-OECD countries. Students at schools in urban areas reported better availability of Internet connectivity via wireless networks in their schools. Identical gaps were noticed between the top and bottom ESCS index quartiles of students. Ninety-five per cent of students in the top quartile had access to the Internet via wireless networks at school, compared to 77 per cent in the bottom quartile.

Analysis of data from the Office of the Basic Education Commission indicates that seven out of ten schools in Thailand had access to the Internet via fibre-optic cable. However, information on each school's Internet speed was not readily available.

The study revealed a significant gap in terms of school bandwidth. Ninety-three per cent of private school principals agreed that their school had sufficient bandwidth, compared to 70 per cent of public school principals. The same difference of opinion was apparent between rural and urban schools (only 66 per cent of rural school principals agreed that their school had sufficient bandwidth, compared to 85 per cent of urban principals) and between schools with disadvantaged and privileged students (86 per cent of principals of schools with privileged students agreed that their school had sufficient bandwidth, compared to 63 per cent of principals of schools with disadvantaged students).

These differences of opinion on bandwidth sufficiency in the school call for careful analysis of bandwidth adequacy and quality, for which the existing data were not sufficient. Consequently, the following section of the report highlights some of the global practices to set minimum Internet bandwidth targets for each student in the school.

As discussed earlier, one in three school principals did not feel that their school had sufficient bandwidth. There were staggering differences between private and public schools, between urban and rural schools, and between schools for the socio-economically advantaged and disadvantaged (OECD, 2018). It is crucial to identify a tentative required bandwidth for each school. In the absence of a one-size-fits-all solution for estimating the exact bandwidth, a few factors – curriculum delivery, the school's administrative and operational needs – are key.

The broadband requirements can be assessed for cost-effective and efficient (a reasonable download wait time) access to the Internet. The literature suggests considering four factors to determine the broadband for a student and staff located in a shared network (Kamaludeen et al., 2017a; Kamaludeen et al., 2017b):

1) the software applications being used;
2) a reasonable wait time for the student and educator;
3) the number of concurrent users on the network;
4) the overall network layout (topology) and its relationship with the Internet service provider.

Table 7: Common application types needed in schools and recommended broadband

Application type	Recommended broadband per device (Mbit/s)
Web browsing	0.25–0.5
E-mail	0.25–0.5
Download file/digital document	0.5–1.5
Online web-based learning	0.5–1.4
Online telepresence	1.5
HD video streaming	1.5–5.0
Cloud application access (web)	0.5
Google Hangout or MS Teams	1.5–5.0
Microsoft Office 365	0.5–1.4
Google apps for education	0.5–1.4
Google Drive	0.75–5.0
Virtual learning environment	0.5–1.4
Device synchronization traffic (auto update and notification)	0.06

The software applications commonly used in schools are listed in Table 7 (Kamaludeen et al., 2017a). As indicated in the table, the broadband requirements range from 0.06 kbit/s to 5 Mbit/s per student, with an average of 2.78 Mbit/s. The application's functionality depends on the broadband. While most static websites are accessible at speeds as low as 0.06 kbit/s, most collaborative applications would not launch without at least 1.5 Mbit/s. Increasingly, therefore, organizations have started suggesting required bandwidth per student. For instance, the State Educational Technology Directors Association recommends that school districts have minimum broadband access per user. Schools in small districts are recommended to have at least 2.8 Mbit/s per user, mid-sized districts at least 2 Mbit/s per user, and large districts at least 1.4 Mbit/s per user.

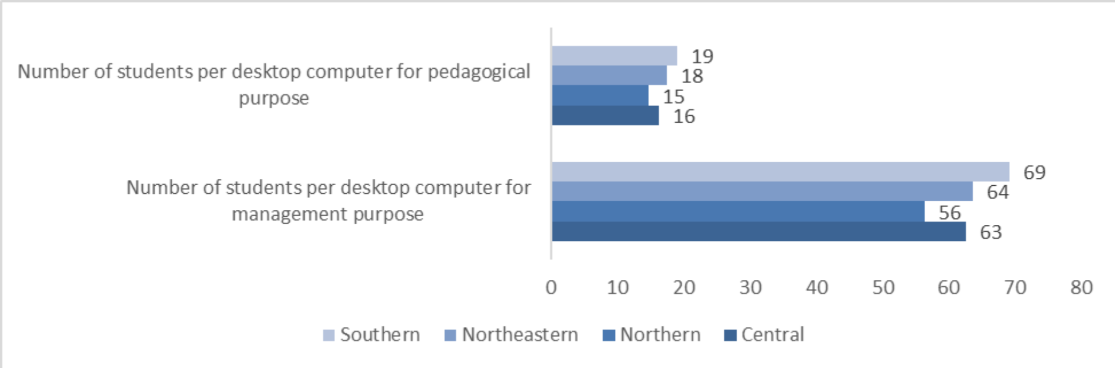
In its Last-mile Connectivity Toolkit, ITU presents a methodology for introducing sustainable, affordable connectivity solutions in unconnected and underserved regions (ITU, 2020c).

The initial analysis, which was based on school data on the type of Internet connectivity, was insufficient on its own to understand the infrastructural challenges for e-learning. It is also important to assess whether students and teachers have access to the Internet or not. Alternative data sources indicate potential gaps in Internet use. For example, the Digital Kids Asia Pacific survey, conducted with UNESCO support, revealed that only six out of ten students accessed the Internet using a desktop computer, and only 44 per cent of students used school laptops to connect (Chaimongkol, 2021). An analysis of PISA ICT survey data revealed that only 56 per cent of public-school principals felt that their school had enough digital devices for instruction, compared to 83 per cent of private school principals. Furthermore, three out of ten public school principals did not feel that their school had sufficient bandwidth, compared to one in ten private school principals. Similar disparities appeared between rural and urban schools and between various levels of socio-economic status (OECD, 2018).

Digital devices

The study analysed the data on access to computers for pedagogical purposes in schools under the jurisdiction of the Ministry of Education's Office of the Basic Education Commission. It found differences across regions regarding desktop computer availability for pedagogical purposes (see Figure 11). While nationwide an average of 17 students shared one computer at school, 19 students from Southern Thailand were reported to share a computer, compared to 16 students from Central Thailand. For example, 27 students shared one computer in the Southern provinces of Narathiwat and Yala. In contrast, at schools in Central provinces like Ang Thong and Sing Buri, 12 students shared a computer.

Figure 11: Access to desktop computers for pedagogical and management purposes, by region

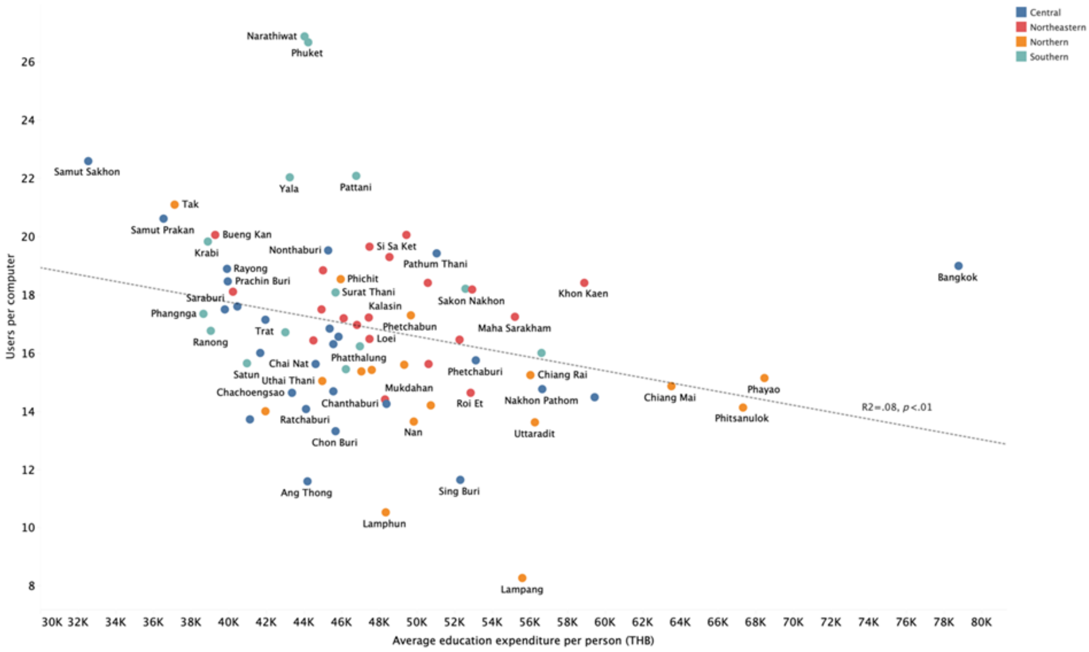


Source: Ministry of Education (2020), author-generated chart.

The Northeastern provinces of Bueng Kan, Surin, Si Sa Ket, Ubon Ratchathani and Nong Khai had slightly more students on average per computer than the average for all Northeastern provinces. The number was slightly higher than the regional average for the Northern provinces of Tak, Phichit and Phetchabun. (See Figure 7 for a detailed breakdown of provinces and average computer-to-student ratio.)

There was a negative correlation between education expenditure and computer-to-student ratio. Provinces that spent more on education per person had a better computer-to-student ratio than those that spent relatively less (see Figure 12). This is indicative of the importance of investing equitably in education across the country. Some provinces had a better computer-to-student ratio despite similar educational investment levels. For example, Ratchaburi and Ang Thong in Central Thailand had a relatively better computer-to-student ratio than Phuket and Narathiwat in Southern Thailand.

Figure 12: Relationship between average education expenditure per person and computer-to-student ratio



Source: Ministry of Education (2020), Equitable Education Fund (2020b), author-generated chart.

Furthermore, as shown in Figure 13, students in schools in three Southern provinces (Pattani, Yala and Narathiwat) shared computers with a significantly higher number of other students than the national average. In contrast, those in Northern provinces like Chiang Rai, Chiang Mai, Lampang, Phrae, Uttaradit and Sukhothai, and in Central provinces like Suphanburi, Ang Thong and Chainat, shared computers with significantly fewer other students than the national average.

Box 2: CONNEXT ED Foundation

The CONNEXT ED Foundation aims to minimize disparities and inequality in the Thai education system and to develop human capital with a view to enhancing the competitiveness of Thai children. It serves as a springboard for collaboration across sectors to develop sustainable education in Thailand.

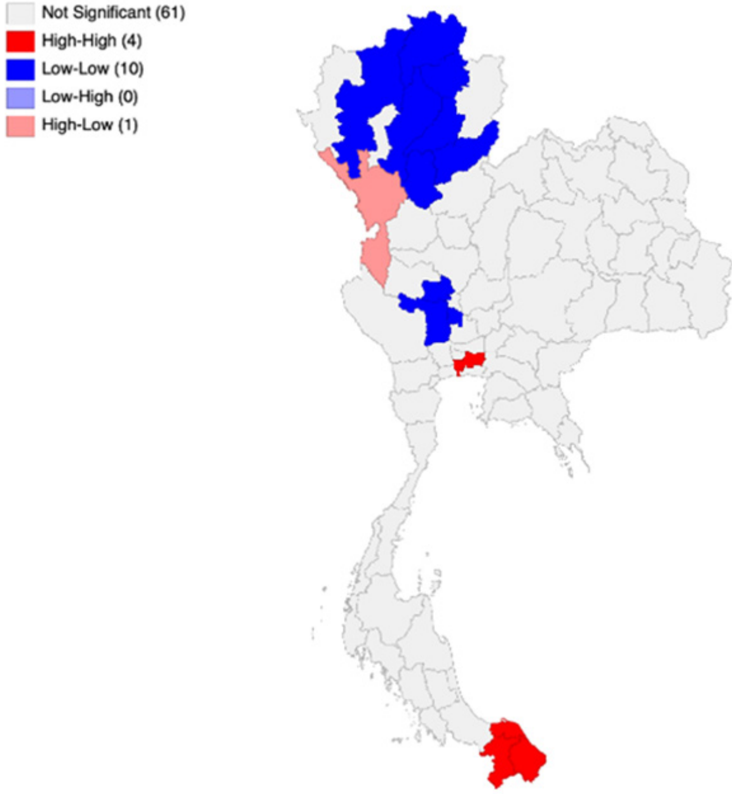
Between 2017 and 2019, the Foundation partnered with over 41 private sector organizations in Thailand to provide leadership training and digital resources to students and teachers. It developed a school management system that provides a dashboard of overall school information for schools to use. It is building new modules that provide digital report cards for students and teachers, and information on school assets.

The Foundation also aims to install high-speed Internet in 1 294 schools and ICT media and equipment in 3 351 schools covering a total of 39 830 classrooms. It also plans to provide 5 000 notebooks to teachers and students in selected schools in 17 provinces.

The Foundation’s crowdfunding platform is currently raising funds for 22 projects, several of which aim to provide notebooks to needy students and establish learning centres.

Learn more: https://donate.connexted.org/.

Figure 13: LISA cluster map of the computer-to-student ratio



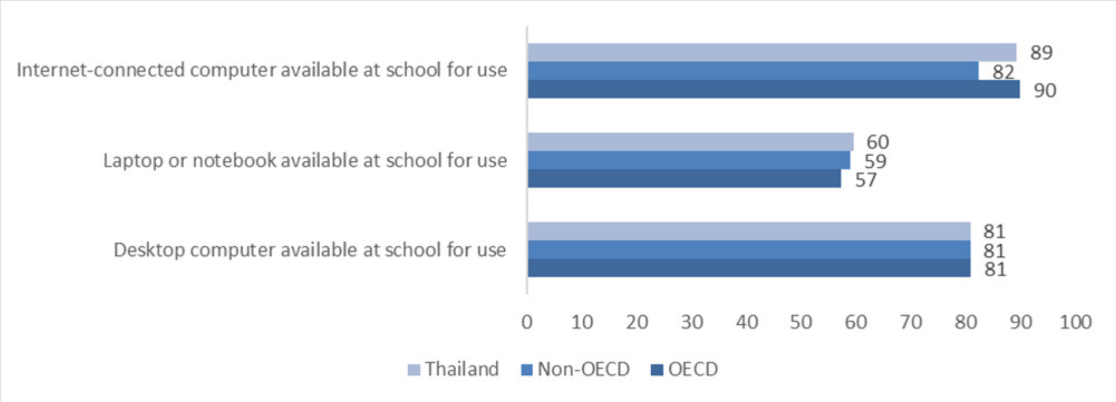
Source: Ministry of Education (2020), author-generated map.

In addition to the state of connectivity and access to desktop computers for pedagogical purposes, it is crucial to understand the state of other digital devices at school and how accessible they are. In the absence of official data from the Ministry of Education and other relevant agencies, the study based its analysis on the PISA 2018 survey dataset.

As Figure 14 illustrates, Thailand was on a par with the average in OECD and non-OECD countries regarding access to desktop computers at school. It ranked better than the average for OECD and non-OECD countries for laptop accessibility. That being said, however, 40 per cent of students reported not having a notebook available for use at school. Nearly a quarter of students reported having access to the school's digital projector, and almost half reported having access to interactive whiteboards. For both devices, Thailand fell behind the OECD average and was on a par with the average in non-OECD nations.

Moreover, nine out of ten students reported having access to a computer that was connected to the school Internet. This was above the non-OECD average and very close to the OECD average.

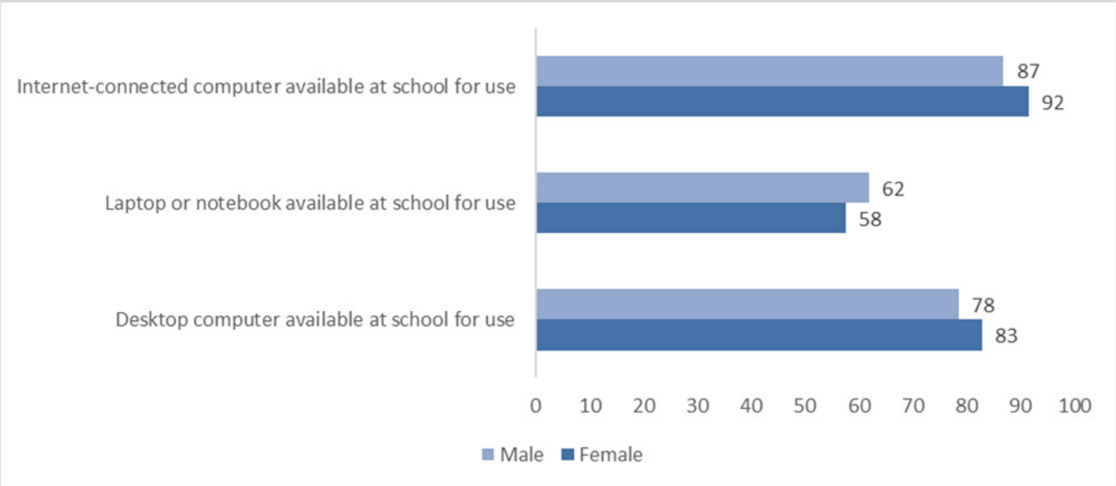
Figure 14: Access to digital devices at school (%)



Source: OECD (2018), author-generated chart.

Figure 15 illustrates the differences in access to digital devices at school by gender, with no significant gaps being noticed in Thailand: the study found that females had slightly better access to digital devices at school than males.

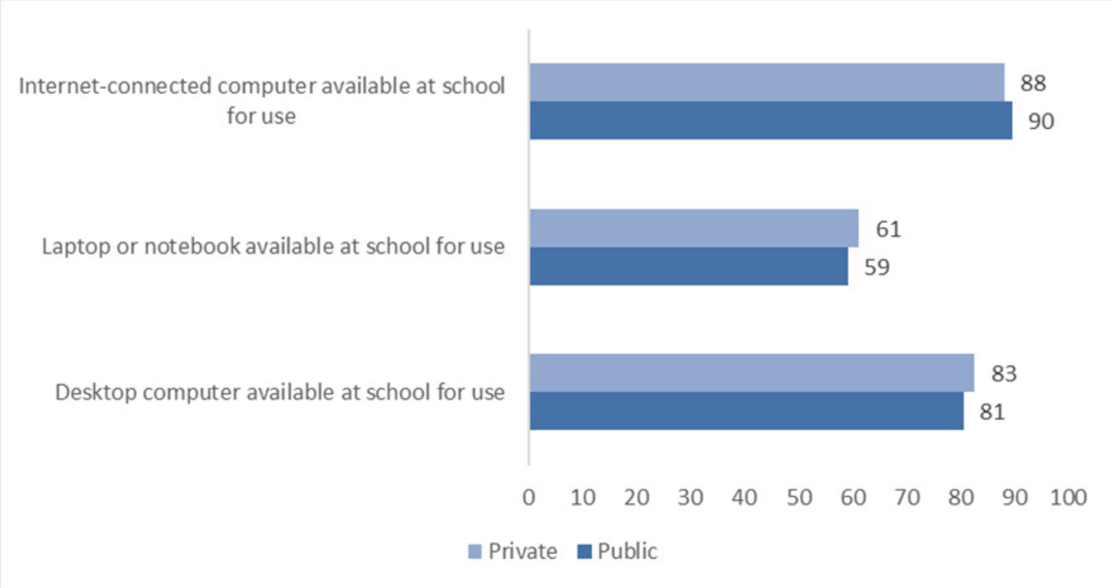
Figure 15: Access to digital devices at school, by gender (%)



Source: OECD (2018), author-generated chart.

Figure 16 shows the differences in access to digital devices between private and public schools in Thailand. Desktop computers, laptops and interactive whiteboards were slightly more likely to be available in private than in public schools. On the other hand, public schools had slightly better Internet connection availability via a wireless network and more Internet-connected computers for student use. There was no difference in access to a data projector.

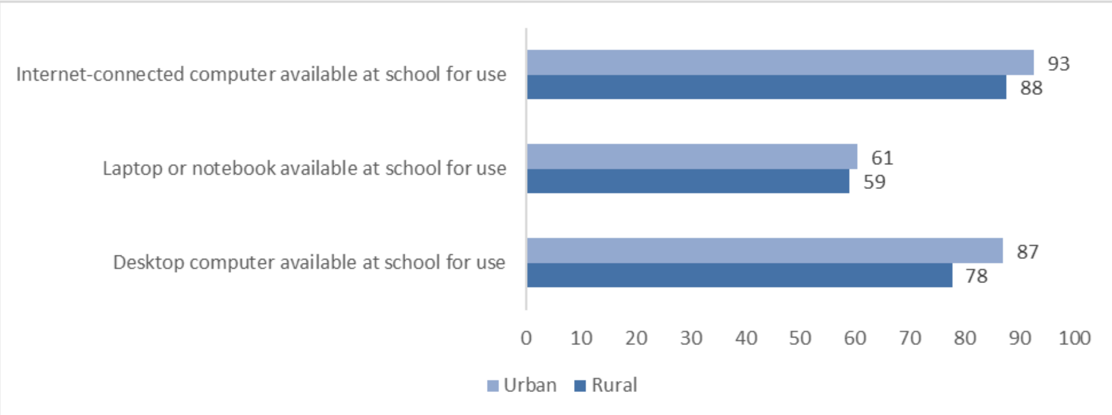
Figure 16: Access to digital devices at school, by school type (%)



Source: OECD (2018), author-generated chart.

Figure 17 shows the variations in student access to school digital devices by school location. In general, students attending schools in urban areas had better access to digital devices and the Internet. For example, schools in urban areas were 9 per cent more likely to have desktop computers, which are instrumental for e-learning initiatives – their absence in schools in rural areas will result in a loss of learning opportunities for students in rural schools.

Figure 17: Access to digital devices at school, by school location (%)



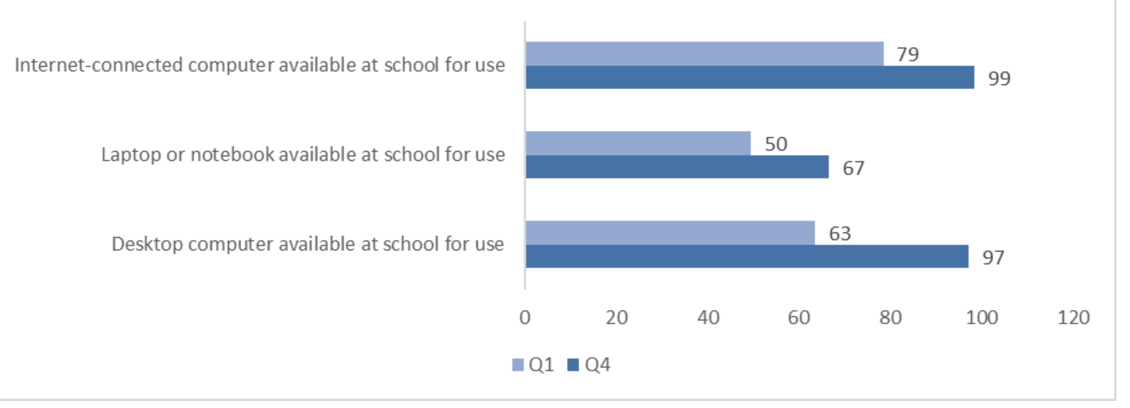
Source: OECD (2018), author-generated chart.

The sharpest differences in digital device availability related to student socio-economic status. For example, nearly all students in the top ESCS[2] quartile (Q4) had a desktop computer and Internet-connected computer available for use at school (Figure 18). However, in the bottom quartile (Q1), only six out of ten students had access to a desktop computer, and eight out of

[2] PISA estimates a student's socio-economic status by the ESCS index, a composite measure that combines into a single score the financial, social, cultural and human capital resources available to students. A student's ESCS is derived from three variables related to family background: parents' education, parents' occupation and the index of home possessions are weighted equally. Students are considered socio-economically disadvantaged if they are in the bottom quartile of the ESCS index in their country, and socio-economically advantaged if they are in the top quartile.

ten students to an Internet-connected computer. Similar gaps were seen in the availability of data projectors and interactive whiteboards: students in Q1 were 30 per cent less likely to have access to data projectors at school than students in Q4.

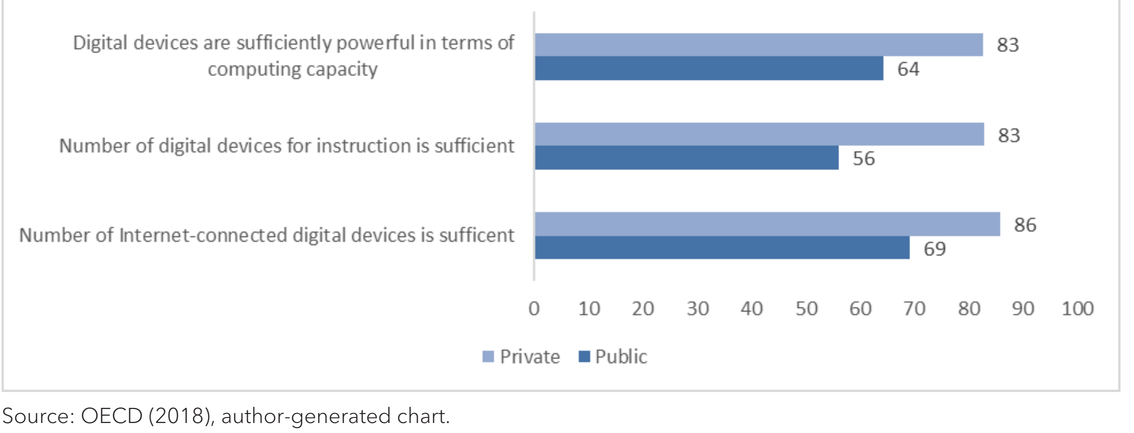
Figure 18: Access to digital devices at school, by socio-economic status (%)



Source: OECD (2018), author-generated chart.

Figure 19 shows how school principals viewed the digital resources available in their schools. Sixty-five per cent of public-school principals agreed that they had adequate software, while 94 per cent of private school principals agreed or strongly agreed with that statement. Eighty-six per cent of private school principals agreed that the number of Internet-connected devices was sufficient, while only 69 per cent of public-school principals felt that way. Similar differences were expressed when it came to computing capacity and adequacy of digital devices. The evidence suggests that these gaps between private and public institutions should be addressed for students to benefit equitably from e-learning initiatives.

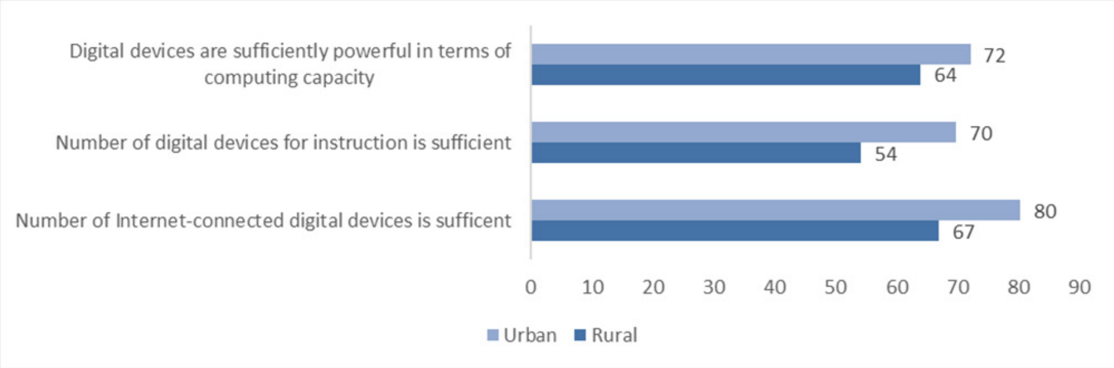
Figure 19: School principals who agreed or strongly agreed that their school had sufficient access to digital devices, by school type (%)



Source: OECD (2018), author-generated chart.

School principals from rural areas highlighted similar gaps (see Figure 20). They were more likely to feel that their school lacked sufficient devices for instruction and Internet-connected digital devices than principals from urban areas. A similar trend emerged with regard to software and computing power, with school principals from urban areas tending to agree more strongly than those from rural areas that their devices were powerful enough.

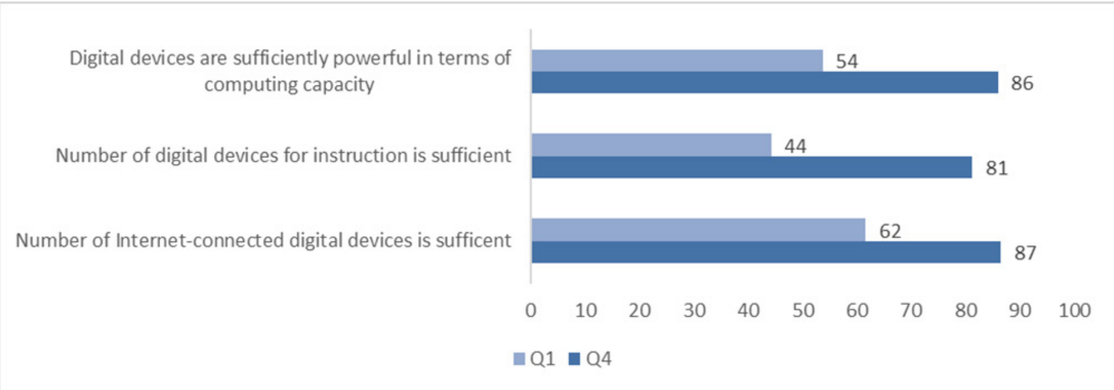
Figure 20: School principals who agreed or strongly agreed that their school had sufficient access to digital devices, by school location (%)



Source: OECD (2018), author-generated chart.

The opinions of school principals also differed significantly depending on whether their students were socio-economically advantaged or disadvantaged (Figure 21). Schools for advantaged students generally had access to better digital devices than schools for the disadvantaged. Only 54 per cent of principals of the latter agreed or strongly agreed that their schools had sufficient software and devices with sufficient computing power, whereas 86 per cent of the former held that view. Only 44 per cent of principals of the latter agreed that their schools had sufficient digital devices for instruction, whereas 81 per cent of the former held that view.

Figure 21: School principals who agreed or strongly agreed that their school had sufficient access to digital devices, by ESCS quartile (%)



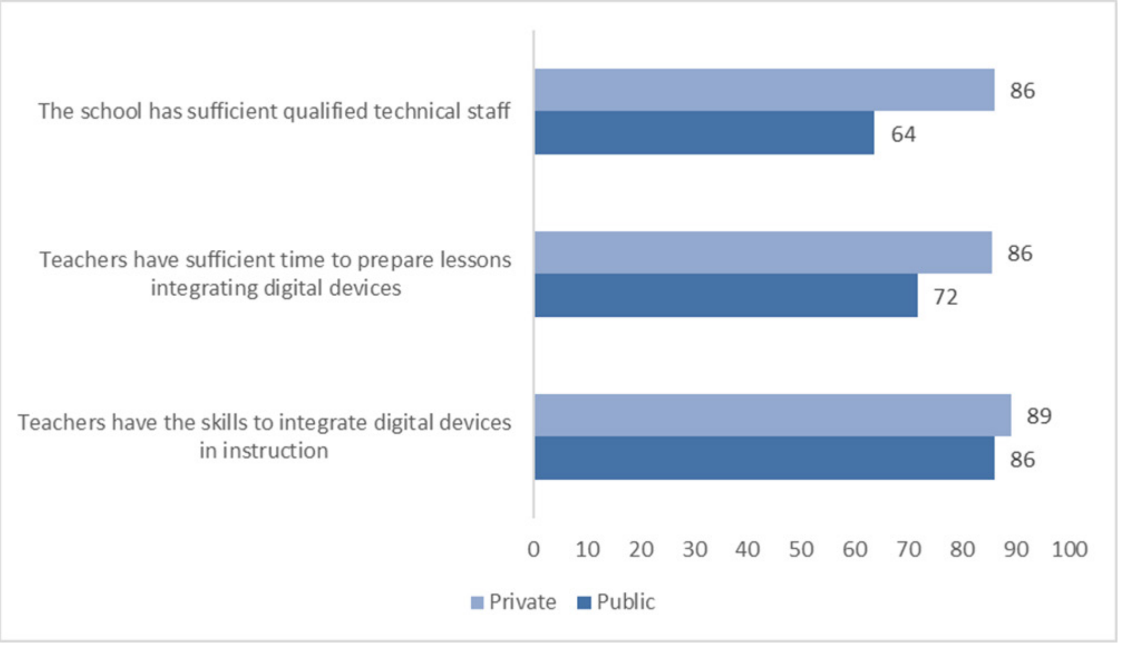
Source: OECD (2018), author-generated chart.

Instructor capabilities

The success of e-learning initiatives is also contingent on qualified technical staff and a robust online learning support platform. Any such initiatives will not meet their goals if teachers are not prepared or do not have the necessary skills. The analysis suggests that there are variations in teacher readiness and the availability of technical staff.

Only 64 per cent of public-school principals agreed or strongly agreed that their school had enough qualified technical staff, compared to 86 per cent of private school principals (Figure 22). Eighty-seven per cent of both public and private school principals agreed or strongly agreed that teachers had been given incentives to use digital devices for instruction. However, 90 per cent of private school principals agreed or strongly agreed that they had adequate professional resources available for teachers to learn how to use digital devices, compared to 76 per cent of public-school principles. Both public and private school principals concurred that teachers had the skills needed to use digital devices for instruction. However, only 72 of public-school principals felt that their teachers had sufficient time to prepare lessons that used digital tools, compared to 86 per cent of private school principals. About 79 per cent of public-school principals and 82 per cent of private school principals agreed or strongly agreed that their school had an effective online learning support platform.

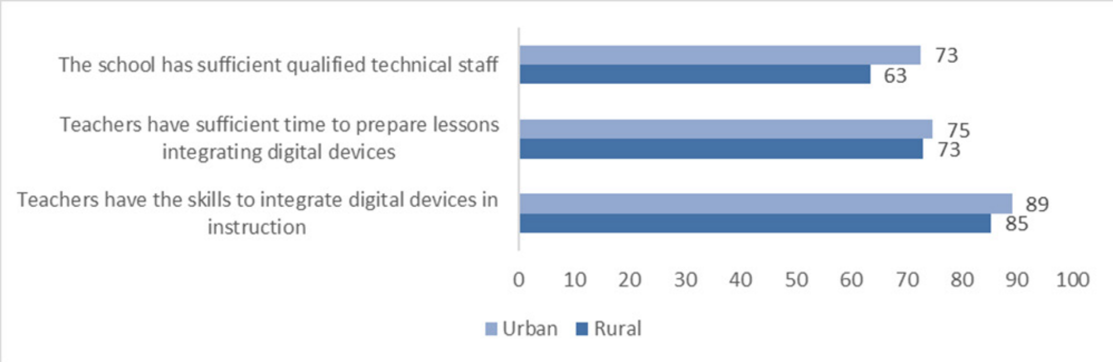
Figure 22: School principals who agreed or strongly agreed that their school was ready to use digital devices, by type of school (%)



Source: OECD (2018), author-generated chart.

Most school principals from both urban and rural schools agreed that teachers had the skills needed to use digital devices for instruction (see Figure 23). Irrespective of their location, most schools in Thailand concurred that teachers had been incentivized to do so. Nearly three-quarters of urban and rural school principals agreed that teachers had sufficient time to prepare lessons integrating digital devices. About 63 per cent of students from rural schools and 73 per cent of students from urban schools had principals who agreed or strongly agreed that they had sufficient qualified technical staff. Furthermore, three-quarters of rural school principals acknowledged the availability of effective online learning support platforms, compared to 90 per cent of urban principals.

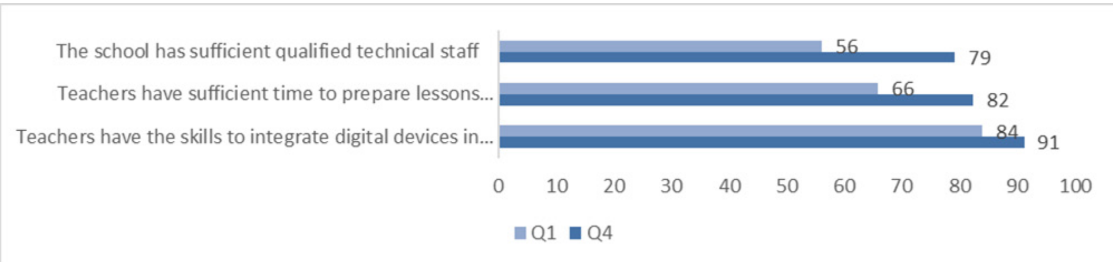
Figure 23: School principals who agreed or strongly agreed that their school was ready to use digital devices, by school location (%)



Source: OECD (2018), author-generated chart.

While the differences between rural and urban schools may appear marginal, they are staggering when the students' socio-economic status is considered. Fifty-six per cent of students in disadvantaged schools and 79 per cent of students in advantaged schools had principals who agreed or strongly agreed that they had sufficient qualified technical staff (Figure 24). Seventy per cent of principals of disadvantaged schools agreed or strongly agreed that effective online learning support platforms were available, compared to 93 per cent of principals of advantaged schools. Nearly one in three of the former disagreed or strongly disagreed that professional resources were available for teachers to learn how to use digital devices, compared to only 8 per cent of the latter. Furthermore, one in three principals from the bottom socio-economic quartile disagreed or strongly disagreed that teachers had sufficient time to prepare lessons using digital devices in their schools, compared to 12 per cent from the top quartile. However, most school principals from both advantaged and disadvantaged schools agreed that teachers were incentivized to use digital devices for instruction.

Figure 24: School principals who agreed or strongly agreed that their school was ready to use digital devices, by ESCS quartile (%)



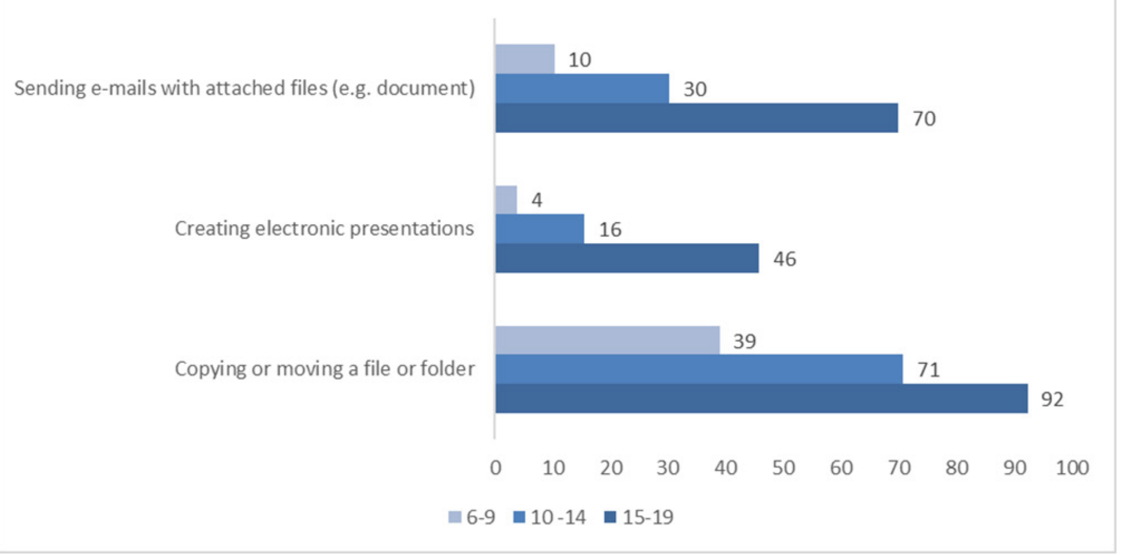
Source: OECD (2018), author-generated chart.

Student capabilities

Nationwide disaggregated comparable data of ICT use among students were not readily available. The study therefore used National Statistical Office data to estimate the percentage of the school-aged population possessing computer skills and understanding how to use the Internet.

In general, users in older cohorts reported greater proficiency in computer and Internet usage (Figure 25). For example, only 30 per cent of computer users aged 10 to 14 (P5 to M3) reported having the skills to send e-mails with attachments, compared to 70 per cent of those aged 15 to 19 (M4 to UG2). Only 16 per cent of lower-secondary school students (10 to 14 years old) reported using computers to create presentations, compared to 46 per cent of upper-secondary and early undergraduate students aged 15 to 19. While there were differences in usage between different age groups, more than half of computer users did not use the computers for educational activities like creating presentations.

Figure 25: Computer skills in the school-aged population, by age cohort[3] (%)



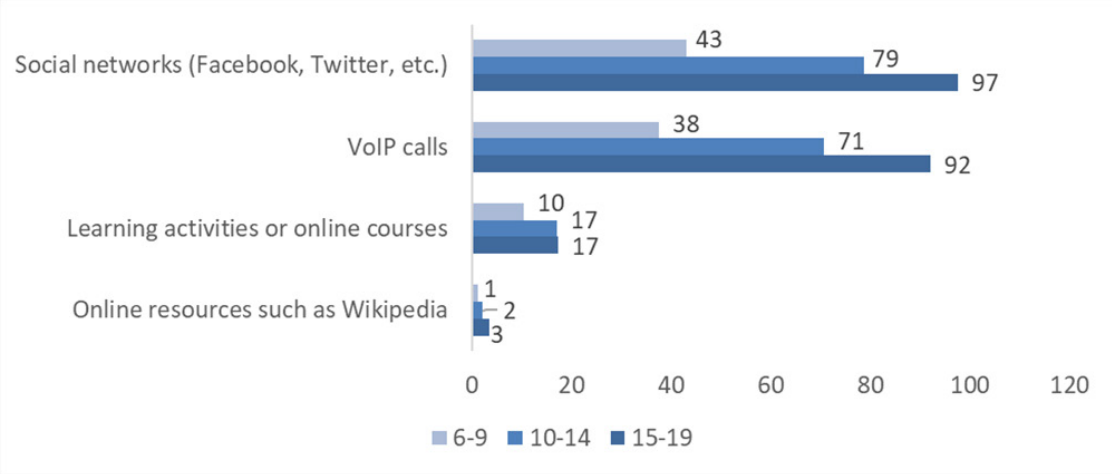
Source: National Statistical Office (2020a).

It is apparent that school-aged children use the Internet much more for its social networks than to take online courses or engage in educational activities (Figure 26). Nearly all Internet users aged 15 to 19 used social networks and VoIP calls, compared to 70 per cent of 10 to 14 year olds. Significantly fewer used the Internet for learning activities or online courses: less than 20 per cent of school-aged Internet users took online courses (that number might have gone up during the school closures). Initiatives are needed to ensure students use the Internet for learning purposes.

The success of the Ministry of Education e-learning platform, DEEP (see Box 3), will depend on how well students and teachers use it. The current numbers on Internet use for e-learning are not very encouraging. The relevant agencies and stakeholders must devise strategies accordingly and ensure that their objectives are met.

[3] Adapted from OECD and UNESCO (2016) on the following assumption: P1 students are typically 6 years old; M1 students are 12; and UG1 students are 19.

Figure 26: Internet use by the school-aged population, by age cohort (%)



Source: National Statistical Office (2020a).

Box 3: Digital Education Excellence Platform (DEEP)

The Ministry of Education launched its DEEP platform in August 2020. The platform gives teachers and students direct access to curricula and modules. Platform users can use Google and Microsoft learning tools with a single sign-on. The platform incorporates online learning to support learning outside the classroom. The initial aim is to build the capacity of students, teachers and school administrators in English and digital literacy, with plans to expand to other areas of study in the future.

The DEEP platform has three primary integrated management systems: classroom management, school management and office management. These systems allow the Ministry to monitor the allocation of school budgets, the use of school resources and the enforcement of school policies.

The platform also allows the private sector to create learning resources. In the initial stage, companies like Google, Microsoft, Cambridge Assessment English, Pearson, the British Council, IC3, ICDL, Arkki and some 40 Rajabhat Universities have partnered to create learning materials.

Learn more: www.deep.go.th

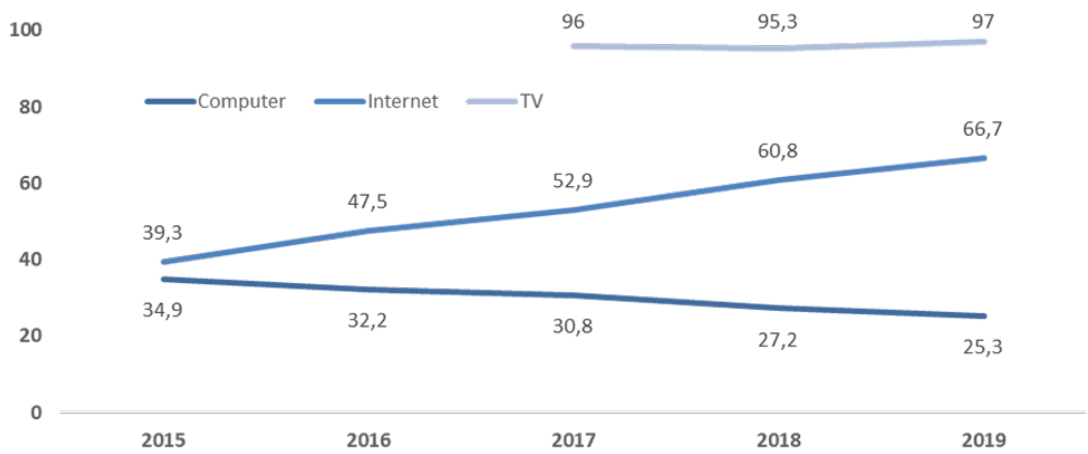
4 Internet connectivity and digital devices in households

This section of the report presents the state of Internet connectivity and access to digital devices among Thai households.

Internet connectivity

The number of Internet users in Thailand reached 42.4 million (66.7 per cent of the population) in 2019. The proportion of people using the Internet continues to climb, but nearly one in three still does not use the Internet (National Statistical Office, 2020a). Figure 27 shows the trends of the last five years. Bangkok had the highest number of users, followed by Central, Southern and Northern Thailand, with the lowest being Northeastern Thailand. Twelve per cent more municipal than non-municipal households had access to the Internet.

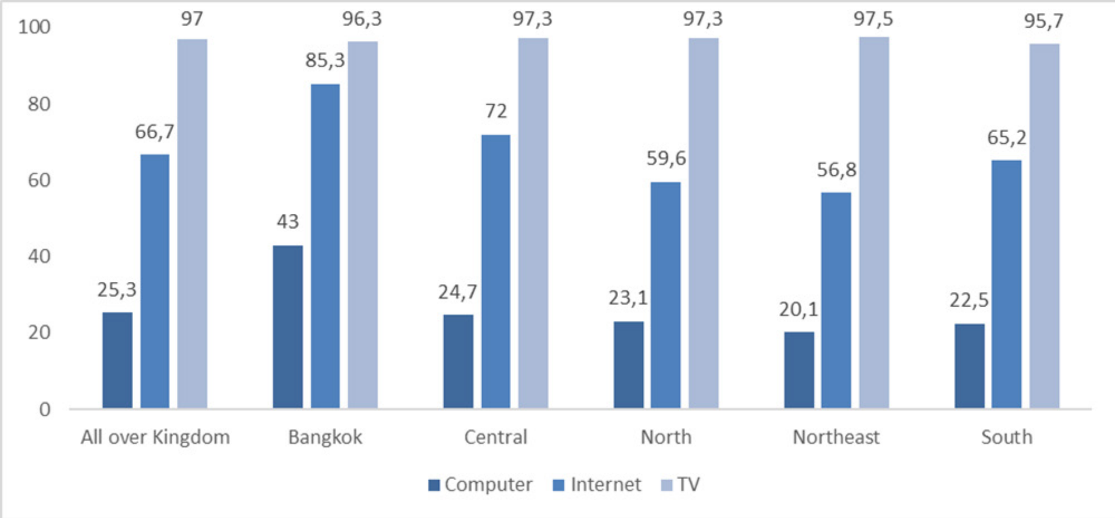
Figure 27: People aged 6 and older using computers and the Internet, and households with television at home, 2015–2019 (%)



Source: National Statistical Office (2020a, 2020b).

Figure 28 shows the differences in Internet connectivity for remote learning at the household level by region. Only 59 per cent of households in provinces in the bottom quartile of GPP per capita had an Internet connection in the home, compared to 79 per cent in the top quartile.

Figure 28: People aged 6 and older using computers and the Internet, by region, 2019 (%)



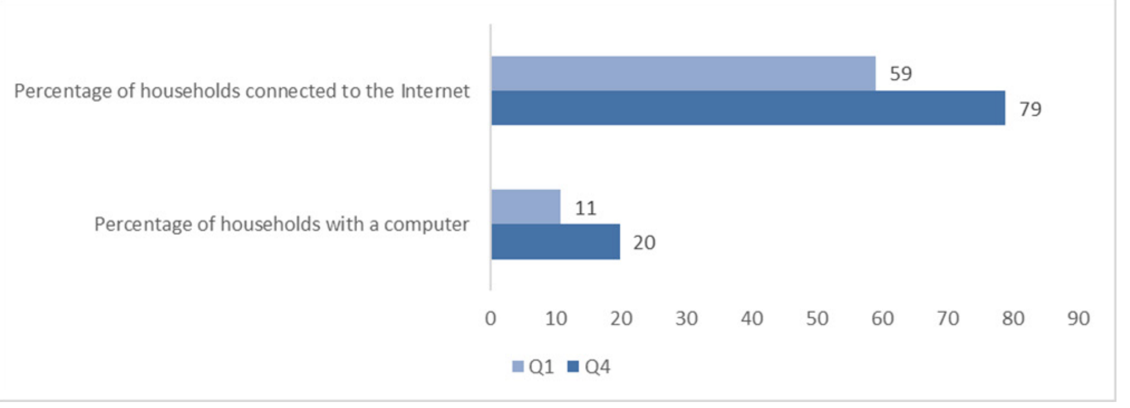
Source: National Statistical Office (2020a, 2020b), author-generated chart.

Digital devices

The rate of home television ownership is one of the highest in the ASEAN region: 97 per cent of households had access to a TV in the home, and the penetration rate was above 95 per cent in all four regions of the country (National Statistical Office, 2020b).

According to the National Statistical Office, approximately 16.1 million (25.3 per cent) of 63.6 million residents above the age of 6 used computers. Between 2015 and 2019, the number of computer users continued to decline. Bangkok had the highest number of individual computer users, followed by Central, Northern, Southern and Northeastern Thailand, in that order. Urban households were twice as likely as rural households to have access to a computer. The difference in access to a household computing device was nearly double when provincial economic performance was taken into account: only 11 per cent in the bottom quartile had access to a household computer, compared to 20 per cent in the top quartile (Figure 29). This signifies that households in the bottom quartile will be left behind by e-learning initiatives that require a computer and Internet access.

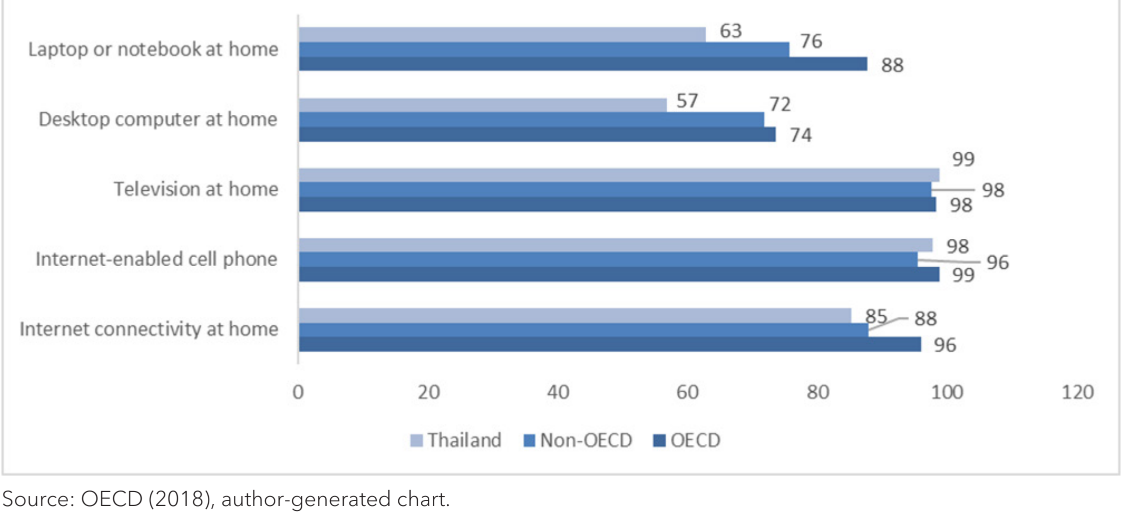
Figure 29: Differences in household access to computers and the Internet, by quartile[4] (%)



Source: National Statistical Office (2019), Office of the National Economic and Social Development Council (2020), author-generated chart.

Approximately four out of ten 15-year-old students in Thailand did not have access to either a portable notebook or desktop computer at home (Figure 30). Both numbers are below the average for OECD and non-OECD countries. However, access to a television at home seemed to be above the average for OECD and non-OECD countries. Access to Internet-enabled cell phones was above the average for non-OECD countries and marginally below the average for OECD countries. Eighty-five per cent of the students reported having Internet connectivity at home, i.e. 11 per cent below the OECD average and slightly below the non-OECD average.

Figure 30: Access to digital devices among 15-year-old students (%)

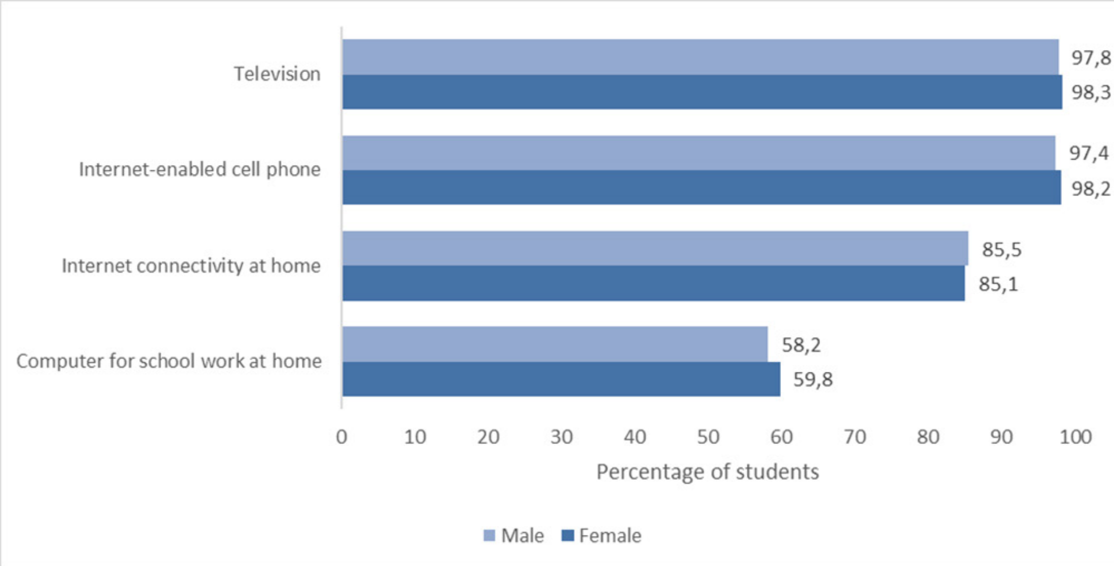


Source: OECD (2018), author-generated chart.

There were slight differences in access to digital devices at home when the numbers were disaggregated by gender (Figure 31): in general, more female than male students had access. Female students had marginally better access to television at home, Internet-enabled cell phones and a computer at home for schoolwork.

[4] The quartiles are based on GPP per capita.

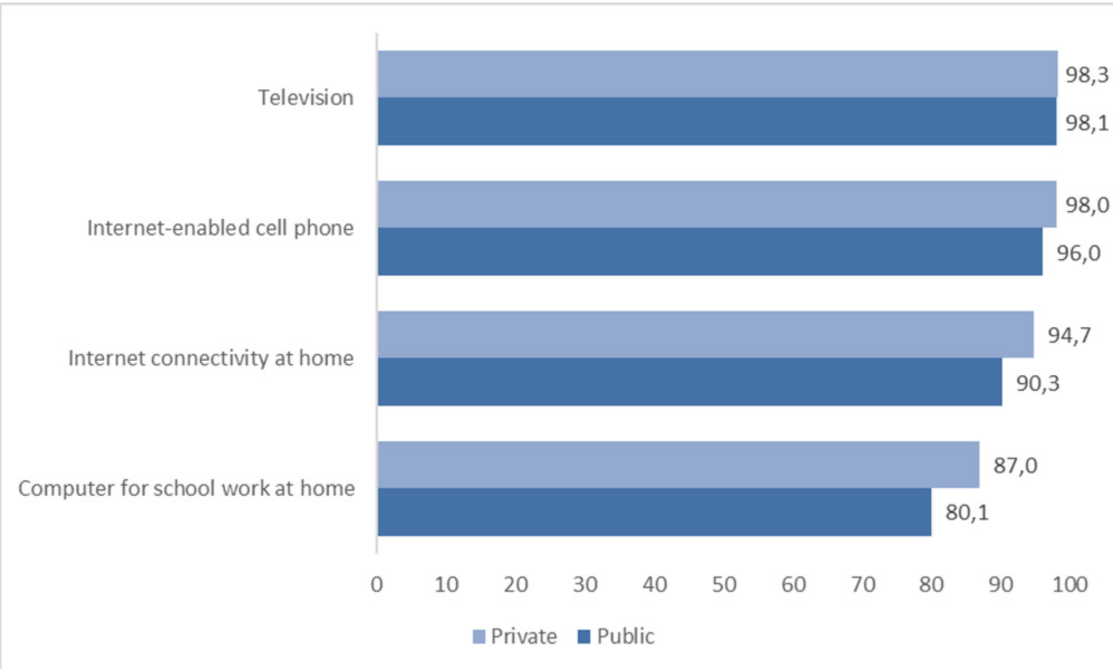
Figure 31: Differences in access to digital devices and the Internet at home, by gender (%)



Source: OECD (2018), author-generated chart.

While there seem to be no gender differences in access, evidence suggests differences in access between different types of school (Figure 32). In general, there were no significant differences among students in public or private schools when it came to access to television at home. However, private school students had slightly better access than public school students to Internet-enabled cell phones. In addition, more private than public school students had Internet connectivity and a computer at home for schoolwork.

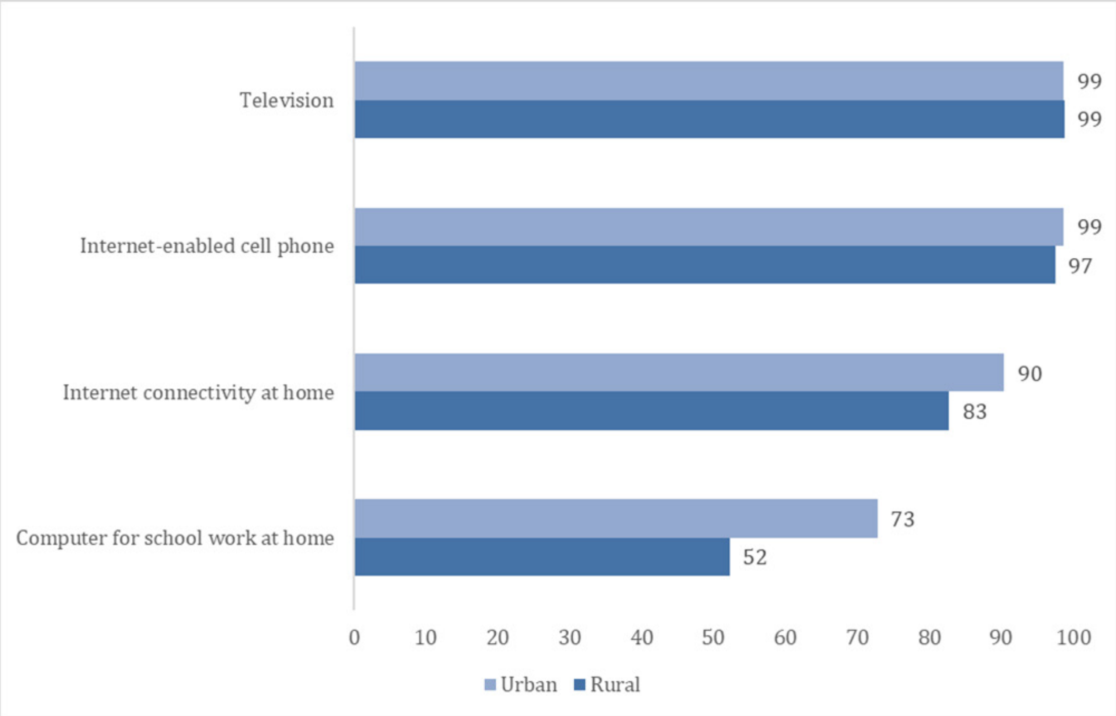
Figure 32: Differences in access to digital devices, by type of school (%)



Source: OECD (2018), author-generated chart.

Figure 33 shows the differences in access to digital devices and the Internet based on school location. The analysis revealed no differences between urban and rural areas regarding access to television at home, but a slight difference in terms of access to Internet-enabled cell phones and Internet connectivity at home, which was slightly better for students in urban than in rural areas. However, students in urban areas had 20 per cent better access than those in rural areas to a computer for schoolwork at home.

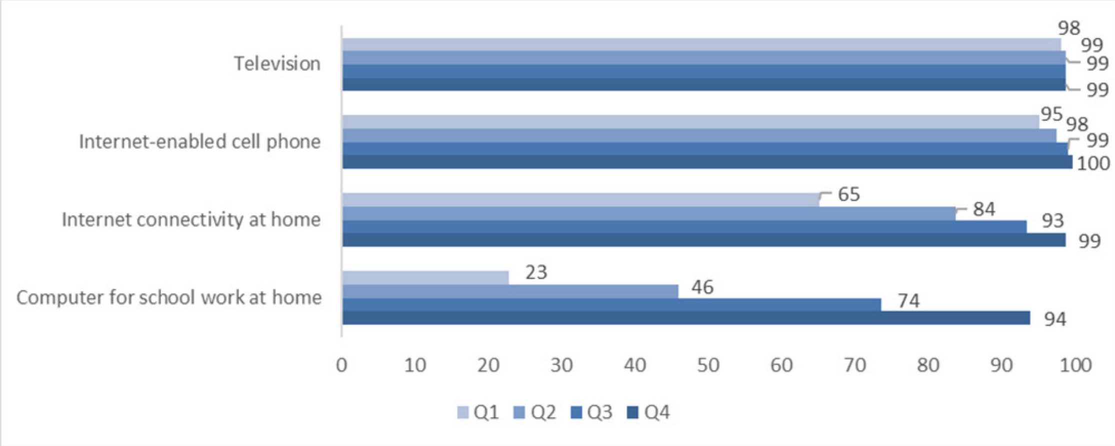
Figure 33: Differences in access to digital devices at home, by school location (%)



Source: OECD (2018), author-generated chart.

The analysis found stark differences between students of various socio-economic status (Figure 34). The PISA ESCS index was used to construct four socio-economic quartiles for the analysis. There were no significant differences between quartiles in terms of access to television. When it came to access to Internet-enabled cell phones, however, the top quartile of students had 100 per cent access while the bottom quartile had slightly less (95 per cent). Access to a computer for schoolwork at home was a possibility for only two out of ten students in the bottom quartile, compared to nine out of ten in the top quartile. The figures were identical when it came to access to education software at home.

Figure 34: Difference in access to digital devices and the Internet, by socio-economic status (%)



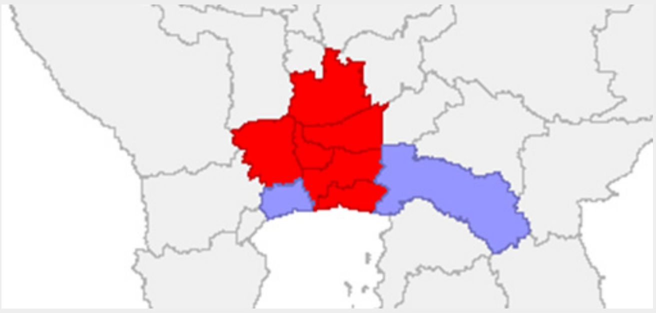
Source: OECD (2018), author-generated chart.

Box 4: Samut Sakhon – The hotspot of the second wave of COVID-19

Samut Sakhon's central shrimp market was considered the hotspot for the second wave of the COVID-19 outbreak in Thailand. Between 19 December 2020 and 3 January 2021, the province was locked down and a curfew imposed from 10 p.m. to 5 a.m. The curfew was then lifted, but the province's schools remained closed for almost two more months, until 1 February 2021. In the meantime, schools in other provinces had resumed their in-person classes after the Ministry of Education imposed a nationwide 25-day closure of educational institutions between 2 and 27 January 2021.

A careful analysis of Samut Sakhon's case provides a critical perspective for understanding the spatial nature of digital inequalities in a country. Only 14 per cent of households had access to a computer, 1 per cent less than the national average and 3 per cent less than the regional average. As indicated in the LISA cluster map below, the percentage of households with access to a computer was statistically significantly lower in Samut Sakhon than in neighboring provinces.

LISA cluster map of the percentage of households with access to a computer



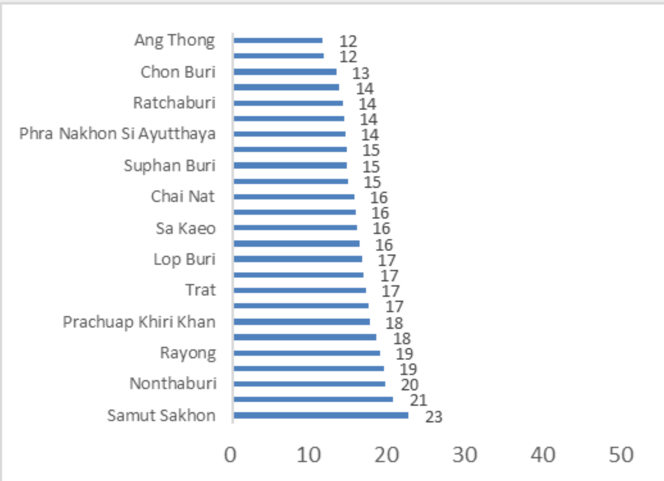
Source: National Statistical Office (2019), author-generated chart.

This disparity in access to computers entailed a potential lack of appropriate home devices for accessing educational materials and remote learning. Furthermore, the province experienced a relatively more extended school closure period, which indicated a greater learning loss in general – potentially compounded by the absence of a household device.

Samut Sakhon had the lowest rate of educational spending per person: over THB 15 000 less than the national average of THB 47 773. Compared to its neighbour, Bangkok, the province received 1.42 times less.

The potential implication of this lack of investment can be seen in the number of computers shared by students in the province. Twenty-three students in Samut Sakhon share a computer at school, compared to the national average of 16.

Number of students per computer

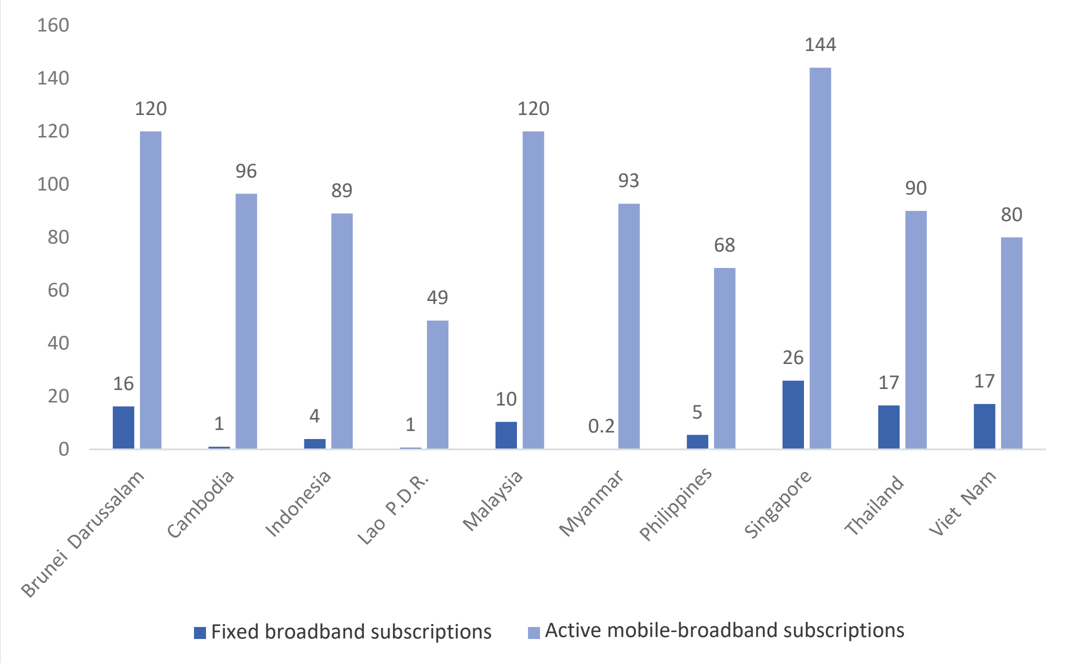


Source: Ministry of Education (2020), author-generated chart.

Internet affordability

Information on Internet affordability was hard to obtain. Neither the OECD PISA survey nor the Ministry of Education data captured Internet affordability at home. ITU (2020b) provides a basis for comparing Internet affordability between countries. In Thailand, 2 GB of mobile Internet cost USD 7.91 in 2019, and fixed-line monthly broadband cost USD 19.84 (ITU, 2020b). Fixed-broadband Internet would be an ideal choice during school closures, given its relatively faster speeds and unlimited data. Even though Thailand had a high fixed-broadband subscription rate for an ASEAN country, in 2020 only 17 out of 100 inhabitants had access to wired Internet (ITU, 2021) (see Figure 35).

Figure 35: Internet subscriptions[5] per 100 inhabitants, 2019



Source: ITU (2021), author-generated chart.

Box 5: Thammasat University Educational SIM

Thammasat University launched a free SIM card distribution scheme for its students during the COVID-19 pandemic. The project aimed to ease the financial burden of having to pay for data to attend online classes and to provide a reliable Internet speed, so as to facilitate learning while the campus was closed.

The university partnered with three leading telecommunication providers – AIS, DTAC and TRUE – for the project. One week after enrolling at the university, students were given a new SIM card enabling them to access the Internet at 4 Mbit/s with unlimited data for three months.

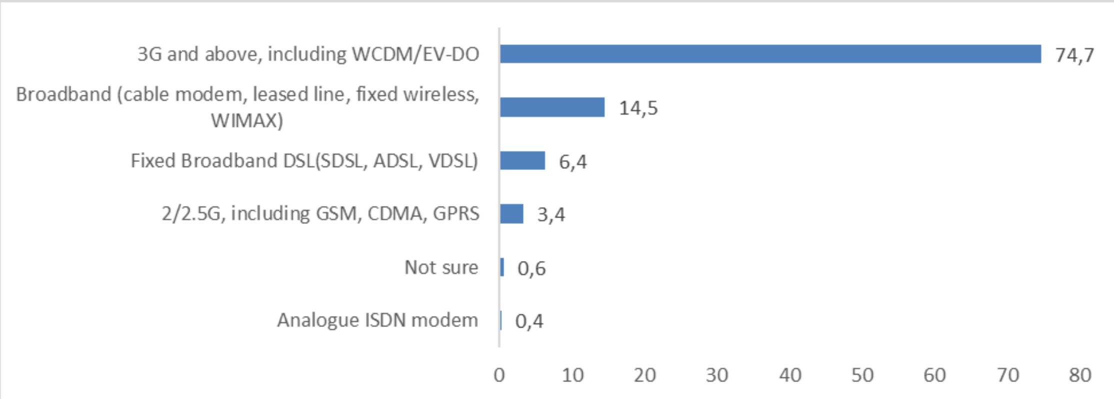
Learn more: https://tu.ac.th/thammasat-educational-sim.

The relatively lower fixed-broadband subscription rate suggests a higher dependence on mobile broadband to access learning materials (ITU, 2020a). An analysis of survey data from the National Statistical Office shows that more than 75 per cent of households were connected

5 The data for Cambodia, Lao P.D.R. and the Philippines are from 2019 and for Myanmar from 2018.

to the Internet via a 3G or higher mobile network (Figure 36). Only 6 per cent of households accessed the Internet using fixed broadband (National Statistical Office, 2020a). This poses a significant financial challenge for students wishing to access online teaching resources via a mobile-broadband network. The video conferencing platforms used during school closures required an amount of bandwidth that was unaffordable for students without a fixed-broadband subscription. For example, an average of 20 hours of live online group learning sessions per week over a prepaid mobile-broadband package would cost a total of THB 4 629 a month (see Table 8). Households with more than one child would face a significant financial burden.

Figure 36: Type of Internet connection, by household (%)



Source: National Statistical Office (2020a).

Table 8: Tentative bandwidth requirement[6] for one student attending an hour-long Zoom session

Class type	Weekly cost (in THB)[7]	Monthly cost (in THB)	High quality	720p HD	1080p HD
1:1	771	3 086	540 MB	1.08 GB	1.62 GB
Group	1 157	4 629	810 MB	1.35 GB	2.4

While postpaid Internet packages are more affordable than prepaid plans, not all students can commit to postpaid plans. Ministries and telecommunication providers should therefore seek an alternative solution to subsidize the cost of mobile broadband for students during the pandemic and in the future.

Box 5 contains a description of a partnership model between an educational institution and telecommunication providers. Such partnerships, involving telecommunication providers, educational institutions and relevant ministries, can provide affordable Internet connectivity to students for e-learning purposes.

[6] See https://support.zoom.us/hc/en-us/articles/201362023-System-Requirements-for-PC-Mac-and-Linux#h_d278c327-e03d-4896-b19a-96a8f3c0c69c.

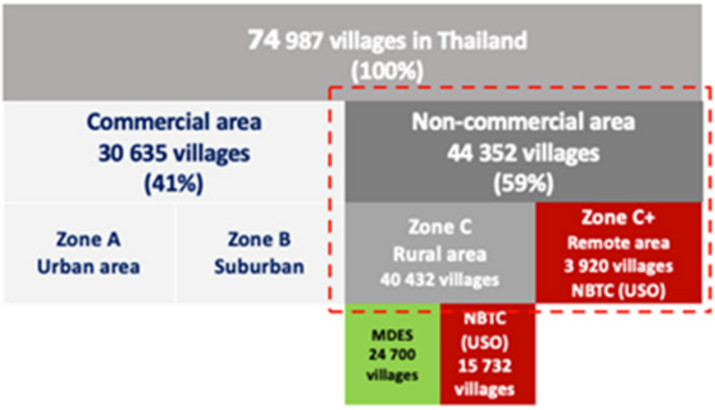
[7] It is assumed that a student is expected to spend 20 hours per week in the class using high-quality video. The cost per GB is calculated using the AIS prepaid tariff for a 14-GB monthly package (see https://www.ais.co.th/one-2-call/en/main_pack.html).

5 Rural connectivity initiatives

This section presents the village broadband project deployed during the COVID-19 pandemic. It illustrates that community-based networks are used relatively less in such situations.

The NBTC and the Ministry of Digital Economy and Society are working to extend Internet access in rural non-commercial areas. Out of 44 352 villages, 40 432 are classified as rural; the remaining 3 920 are classified as remote. The Ministry, through its village broadband project (Net Pracharat), and NBTC, through its universal service obligation, have extended connectivity to 51 per cent of Thai villages (MDES & APT, 2019).

Figure 37: Net Pracharat and USO target areas



Source: MDES and Asia-Pacific Telecommunity (2019).

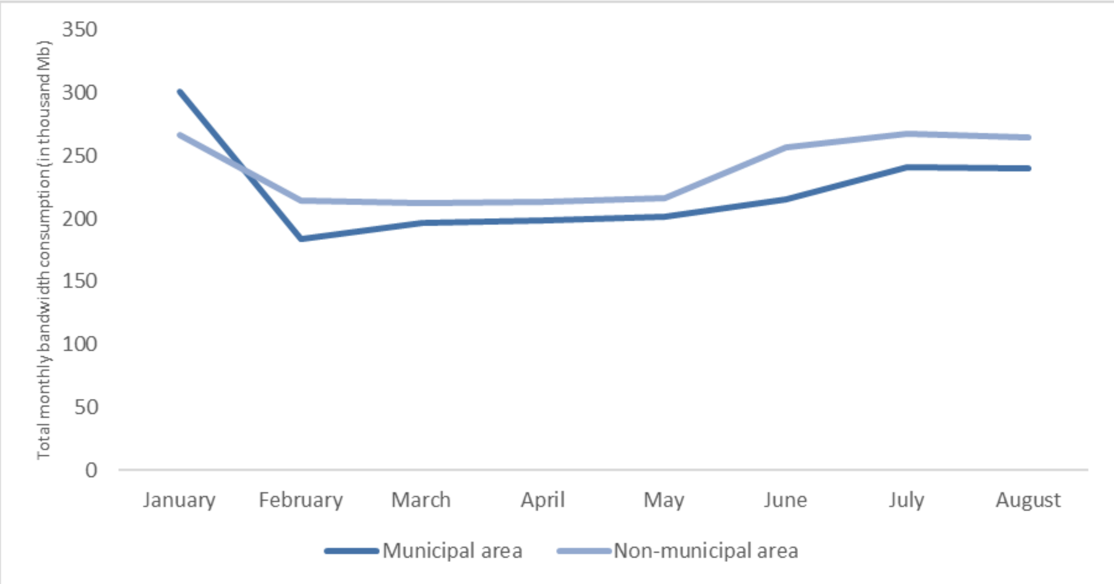
Box 6: Village broadband project

Village Broadband Internet (Net Pracharat) is a nationwide project aimed at developing and strengthening the national broadband network through the digital infrastructure. In December 2017, the Ministry of Digital Economy and Society and the Telephone of Thailand Public Company Limited installed fibre-optic cable networks with free public Wi-Fi hotspots (30/10 Mbit/s) in 24 700 rural villages. By July 2019, a total of 6.6 million users were connected to the Net Pracharat Wi-Fi. In addition, the Internet literacy training programme, aimed at advocating use of the Net Pracharat project, has trained over 1 000 teachers from the Office of Non-Formal and Informal Education. The Ministry plans to implement the Open Access Network model, which, at no charge, allows licensed telecommunication service providers to connect with Net Pracharat infrastructure to provide locals with affordable Internet services. Furthermore, fibre-optic cables are being installed nationally in areas with schools and hospitals that lack access to the networks.

The NBTC has provided Internet connectivity to over 6 000 schools throughout the country via school Wi-Fi, establishing computer centres in schools (USO wrap centre) and USO net centres. The Ministry of Digital Economy and Science, through its Net Pracharat project (see Box 6), has established a national broadband network that enables all Thais in every village to access and make use of broadband Internet services. The project has connected over 1 200 schools that did not have access to broadband Internet. Similarly, it is now expanding its coverage to over 500 local hospitals (MDES and Asia-Pacific Telecommunity, 2019). The project has installed a Wi-Fi hotspot in each village, in public places such as the community hall, the headman's office, an auditorium or a temple (see Figure 37).

Thailand saw a surge in domestic and international bandwidth consumption from March to July 2020: 1215 Gbit/s more of domestic and 537 Gbit/s more of international bandwidth in April compared to February (NBTC, 2021). However, during the same time, use of the Net Pracharat network declined (see Figure 38). In January, total bandwidth (upload and download) consumed in municipal areas was 266 GB per month. With the onset of COVID, bandwidth consumption declined to 214 GB in February and continued to drop until May. A similar phenomenon occurred in non-municipal areas, with bandwidth consumption dropping to 214 GB per month in February from 301 GB in January. Consumption started picking up after June in municipal and non-municipal areas.

Figure 38: Bandwidth consumption, Net Pracharat project (January–August 2020)



Source: Office of the Permanent Secretary (2020).

According to the Digital Kids Asia Pacific survey, 68 per cent of students had access to shared community Internet and 52 per cent used wireless Internet. Smartphones were the devices most used to access the Internet, followed by desktop computers, laptops and tablets (Chaimongkol, 2021).

These findings suggest that Internet use from a community location declines in a pandemic. Furthermore, even if they are accessed using mobile devices, educational activities that require greater computing power will not be carried out. The analysis of Internet traffic suggests that Facebook remains the number one application on the network (Office of the Permanent Secretary, 2020). The decline in bandwidth consumption coupled with greater numbers of mobile devices connecting to the Internet, along with Facebook being the number one accessed platform, suggests that these community-based networks are not being used solely for educational purposes.

6 Recommendations

The study's primary objectives were to assess the state of data on access to digital devices and connectivity in schools in Thailand, which are crucial enablers for e-learning initiatives, and to map the state of access to and use of these devices and connectivity so as to identify potential gaps.

As digital connectivity becomes paramount to the education sector, it is vital for the Government (Ministry of Education, Ministry of Digital Economy and Science, NBTC) to connect unconnected schools and communities, and to ensure that students have equitable access to devices, learning content and opportunities. Other specific recommendations in this regard are set out below.

a) *Improve the quality and availability of data on the status of school connectivity*

- Out of 12 Internet connectivity and computing device-related indicators examined by the Education Management Information System, data for only four were publicly available for analysis. It is crucial to ensure that data on other indicators are available in the public domain for analysis.
- While the information about students and teachers appeared to be up to date in the Education Management Information System, the information related to Internet connectivity and computing devices had not been updated for a few years for several schools. The Office of the Basic Education Commission should encourage schools to update information on the Internet and digital devices in each data-collection cycle.
- The data available on students and schools specifically are limited and fragmented. The Ministry of Education collects data on Internet connectivity and digital devices in schools under the jurisdiction of the Office of the Basic Education Commission. However, not all the information collected is readily available for analysis. Datasets containing the school location, state of access to digital devices and Internet connectivity, including Internet quality, must be compiled at a centralized location to help researchers and other agencies identify schools requiring special attention.
- A pilot study should be conducted that analyses the gaps between schools across different jurisdictions bottom up. The study should collect data from other jurisdictions (e.g. the Offices of the Private Education Commission, the Vocational Education Commission and the Basic Education Commission), focusing on schools that do not have readily available data for analysis. It should collect recent data on use of the Internet and digital devices, and on the skills of teachers, students and administrators. The Government should prioritize collecting data on how devices and connectivity are used and what skills students and teachers possess at the school level.

b) *Set guidelines for the Internet and devices in schools*

- The lack of clear data on each school’s bandwidth poses a significant challenge when it comes to assessing Internet adequacy for e-learning.
- The jurisdictions overseeing educational institutions should establish criteria for assessing bandwidth adequacy by setting per capita student bandwidth targets and measuring progress. A pilot scheme should be run in a few schools under different jurisdictions, to understand and estimate bandwidth and digital device needs. The latest version of the ITU Last-mile Connectivity Toolkit can serve as a benchmark to determine per student bandwidth targets.

c) *Improve digital device-to-student ratios in schools*

- The relatively higher student-to-computer ratio in schools can pose a challenge in terms of learning digital skills and other subjects that require using devices in the schools. The Ministry of Education should therefore emphasize improving student access to computing devices that are instrumental for learning.

d) Enhance connectivity information to include the community

- The compatibility and visualization of data across different jurisdictions within the Ministry of Education and between the Ministry of Digital Economy and Science, the NBTC, the Ministry of Interior and other relevant agencies that have schools under their jurisdiction should be enhanced. In digital environments, the learning environment is expanded from schools to the community. It is important to assess connectivity more holistically, in the light of student experiences. For this purpose, school-based data need to be mapped using the existing telecommunication coverage connecting schools and communities. This should include access to fibre and high-speed broadband (mobile and fixed) coverage, preferably using a GIS platform. It should also bring together various initiatives, including the Ministry of Digital Economy and Science Net Pracharat project, NBTC universal service coverage and other initiatives.

e) Increase the availability of information on traffic and bandwidth use from schools

- The Office of the Basic Education Commission should enhance the quality of data collected through its Education Management Information System on computers, networking and the Internet, and make the information publicly available for further analysis.
- The Office of the Basic Education Commission and other jurisdictions overseeing schools should consider partnering with Internet service providers to track Internet usage accurately.
- The Ministry of Digital Economy and Science can collect data on Internet usage in schools through its Net Pracharat project. Currently, the project does not identify the schools clearly. As a result, crucial Internet and network usage data are missed. The Net Pracharat project should identify and collect network usage data from all educational institutions with access to its network.
- An analysis of Net Pracharat location and usage data reveals that students did not use the community-based networks to study during the pandemic. Rural connectivity projects should therefore widen their focus to incentivize home connections wherever possible.

f) Improve the affordability of Internet connectivity for students

- Internet use, particularly mobile data, remains expensive for students, especially those of low socio-economic status. In addition, online learning requires much longer and more stable Internet access than other uses. Commercial telecommunication providers and government agencies should consider subsidizing Internet costs for students from low-income families, to provide equal learning opportunities.

g) Assess the impact of e-learning on education outcomes

- Further studies should be undertaken to assess the impact of e-learning on education outcomes and see whether differences in access to the Internet and devices affects students' educational achievements.

Annex

Table 9 summarizes key indicators across the three dimensions of access, use and ICT skills development. These indicators have been adapted from practical guides for implementing ICT use surveys in primary and secondary schools (Cetic.br and UNESCO Institute for Statistics, 2020). The table indicates the data sources and assesses data availability.

Table 9: State of data on connectivity and ICT infrastructure in Thai schools

Dimension	Indicator	Granularity	Source	Source type	Latest data
Access	Average of working digital devices with Internet access, available for pedagogical use at schools, by type of digital device	School	OBEC	School survey	2020
	Per cent of schools by Internet access location	School	OBEC	School survey	2020
	Per cent of schools by main Internet connection speed	School	OBEC	School survey	2020
	Per cent of schools by restrictions in student access to the school's Wi-Fi network	NA			
	Per cent of schools with digital devices or software that meet the requirements of students with disabilities	NA			
	Per cent of students with access to digital devices at home	National	OECD	OECD student survey	2019
	Per cent of students with Internet access at home	National	OECD	OECD student survey	2019
	Per cent of students with access to mobile phones	National	OECD	OECD student survey	2019
	Per cent of students with access to television	National	OECD	OECD student survey	2019
Use	Per cent of students/teachers who use the Internet, at any location	National	OECD	OECD student survey	2019
	Per cent of students/teachers who use the internet, by location	National	OECD	OECD student survey	2019
	Per cent of students/teachers who frequently use the Internet at school	NA			

Table 9: State of data on connectivity and ICT infrastructure in Thai schools (continued)

Dimension	Indicator	Granularity	Source	Source type	Latest data
	Per cent of schools that use digital devices and the Internet to perform administrative tasks	School	OBEC	School survey	2020
	Per cent of teachers by activities performed when using the Internet at any location, by purpose	NA			
	Per cent of teachers by learning and teaching activities performed with students when using digital devices and the Internet at any location	NA			
ICT skills development	Per cent of schools by workshops or courses on safe and responsible use of ICT	National	OECD	OECD school survey	2019
	Per cent of schools by preparatory activities for ICT use	National	OECD	OECD school survey	2019
	Per cent of teachers by continued professional development training for ICT use in learning and teaching practices	National	OECD	OECD school survey	2019
	Per cent of teachers by perception of ICT impact on pedagogical practices	National	OECD	OECD school survey	2019
	Per cent of teachers by perceived barriers to ICT use at school	National	OECD	OECD school survey	2019

References

Avitabile, C., D'Souza, R., Gatti, R.V. and Chapman, E.W. (2020). *Insights from Disaggregating the Human Capital Index – Thailand*. Working Paper, World Bank. Retrieved from https://databank.worldbank.org/data/download/hci/HCI_2pager_THA.pdf.

Azevedo, J.P., Hasan, A., Goldemberg, D., Iqbal, S.A. and Geven, K. (2020). *Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates*. Policy Research Working Papers, World Bank Group. Retrieved from https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-9284.

Bangkok Post (2020). Education in classrooms, not online, comes first: Minister (14 June). Retrieved from www.bangkokpost.com/thailand/general/1934636/education-in-classrooms-not-online-comes-first-minister.

Cetic.br and UNESCO Institute for Statistics (2020). *Practical guide to implement surveys on ICT use in primary and secondary schools*. Retrieved from http://uis.unesco.org/sites/default/files/documents/practical-guide-to-survey-schools_1.pdf.

Chaimongkol, N. (2021). *Digital Kids Asia Pacific (DKAP) in Thailand* (Bangkok, Thailand, Faculty of Education, Chulalongkokrn University and UNESCO).

Dodel, M. (2015). An Analytical Framework to Incorporate ICT as an Independent Variable. In A. Chib, J. May and R. Barrantes (eds), *Impact of Information Society Research in the Global South* (Singapore, Springer), pp. 125-144.

Equitable Education Fund (2020a). Information System for Equitable Education (in Thai). Retrieved from https://isee.eef.or.th/screen/schooldata/school.html.

– (2020b). National education account of Thailand (NEA) (in Thai). Retrieved from https://research.eef.or.th/nea/.

Hargittai, E. (2001). Second-level digital divide: Mapping differences in people's online skills. *First Monday* 7(4). Retrieved from https://doi.org/10.5210/fm.v7i4.942.

– (2008). The digital reproduction of inequality. In *Social stratification*, edited by David Grusky (Boulder, CO. Westview Press), pp. 936–944.

ITU (2021). World telecommunication/ICT indicators database, August 2021. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx.

- (2020b). *Measuring digital development – ICT Price Trends 2019*. Retrieved from http://handle.itu.int/11.1002/pub/8155ab0c-en.

- (2020c). *The Last-mile Internet Connectivity Solutions Guide: Sustainable Connectivity Options for Unconnected Sites*. Retrieved from www.itu.int/en/ITU-D/Technology/Documents/LMC/The%20Last-Mile%20Internet%20Connectivity%20Solutions%20Guide.pdf.

ITU and A4AI (2021). *The affordability of ICT services 2020*, policy brief (Geneva, February). Retrieved from www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2020/ITU_A4AI_Price_Briefing_2020.pdf.

Kamaludeen, M., Ismaeel, S., Petrocelli, F., Carrington, C. and Scarfo, C. (2017a). Data-driven technique to estimate the required broadband speed for K-12 schools, paper presented at the 2017 IEEE Canada International Humanitarian Technology Conference (IHTC).

Kamaludeen, M., Ismaeel, S., Scarfo, C. and Carrington, C. (2017b). Recommended broadband capacity estimation system for school boards, paper presented at the 2017 IEEE Canada International Humanitarian Technology Conference (IHTC).

Ministry of Digital Economy and Science (MDES) and Asia-Pacific Telecommunity (2019). *Village Broadband Internet Project (Net Pracharat) of Thailand*.

Ministry of Education (2020). School Location and Access to Device Database (accessed on 14 December, 2020).

National Statistical Office (2019). *Survey of the use of information technology and communication in the household, 2018*. Retrieved from www.nso.go.th/sites/2014en/Pages/Statistical%20Themes/ICT/The-2012-Information-And-Communication-Technology-Survey-In-Household.aspx.

– (2020a). *Survey of the use of information technology and communication in the household, 2019* (in Thai). Retrieved from https://bit.ly/3maomWF.

– (2020b). *Survey on television ownership, 2019* (in Thai). Retrieved from https://bit.ly/2V3zbOr.

NBTC (2021). Internet statistics report, Thailand (in Thai). Retrieved from http://webstats.nbtc.go.th/netnbtc/BANDWIDTH.php.

OECD (2018). PISA 2018 Database. Retrieved from: https://webfs.oecd.org/pisa2018/SPSS_STU_QQQ.zip.

- (2019). *PISA 2021 ICT Framework*. Retrieved from https://www.oecd.org/pisa/sitedocument/PISA-2021-ICT-Framework.pdf.

OECD and UNESCO (2016). *Education in Thailand: An OECD-UNESCO Perspective*. (Paris, OECD Publishing).

Office of the National Economic and Social Development Council (2020). *Gross Regional and Provincial Product Chain Volume Measure 2018 Edition*. Retrieved from https://www.nesdc.go.th/nesdb_en/ewt_w3c/ewt_dl_link.php?filename=national_account&nid=4317.

Office of the Permanent Secretary (2020). *The internet use of Net Pracharat villages report(in Thai)*. Retrieved from: https://data.go.th/en/dataset/village_internet_usage.

Oxford Policy Management and United Nations (2020). *Social Impact Assessment of COVID-19 in Thailand*. Retrieved from www.unicef.org/thailand/media/5071/file/Social%20Impact%20Assessment%20of%20COVID-19%20in%20Thailand.pdf.

Thamtanajit, K. (2020). The Impacts of Natural Disaster on Student Achievement: Evidence From Severe Floods in Thailand. *The Journal of Developing Areas*, 54(4):129–143 (doi:10.1353/jda.2020.0042).

Tongliemnak, P. (2020). A framework to guide an education response to the COVID-19 pandemic of 2020 (in Thai). Retrieved from https://www.eef.or.th/378/.

UNESCO (2020a). COVID-19 educational disruption and response. Retrieved from https://en.unesco.org/news/covid-19-educational-disruption-and-response.

– (2020b). Education minister Nataphol Teepsuwan on COVID-19 strategy in Thailand (21 April). Retrieved from https://bangkok.unesco.org/content/education-minister-nataphol-teepsuwan-covid-19-strategy-thailand.

– (2020c). Education: From disruption to recovery. Retrieved from https://en.unesco.org/covid19/educationresponse.

UNESCO Institute for Statistics (2020). Sustainable Development Goals 1 and 4. Available at http://data.uis.unesco.org/.

Van Deursen, A.J., Helsper, E., Eynon, R. and Van Dijk, J.A. (2017). The compoundness and sequentiality of digital inequality. *International Journal of Communication,* 11, pp. 452-473.

Wagner, E. and Warren, H. (2020). *Save Our Education: Protect every child's right to learn in the COVID-19 response and recovery*. Retrieved from https://resourcecentre.savethechildren.net/node/17871/pdf/save_our_education_0.pdf.

Zhong, R. (2020). The Coronavirus Exposes Education's Digital Divide. *The New York Times*. Retrieved from https://www.nytimes.com/2020/03/17/technology/china-schools-coronavirus.html.

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