Chapter 6

Thailand's information and communication technology in education

Good information and communication technology (ICT) skills are essential for effective participation in today's world. This chapter outlines Thailand's ICT education policies and explores some of the reason why, despite significant investment, Thai students lag behind their peers in this area. It identifies five policy issues that may be holding Thailand back: 1) inequity in infrastructure provision; 2) limited digital learning materials relevant to the national curriculum; 3) teachers' confidence and capacity to use ICT in the classroom; 4) lack of effective monitoring of ICT policies; and 5) no coherent framework for investment in ICT.

It recommends the development of a national strategy to enhance the use of ICT in education as part of a broader long-term vision for education in Thailand. This strategy should focus on how teachers can integrate ICT into their teaching including the development of appropriate learning materials; improving Internet access, particularly in remote areas; and improved data gathering to monitor not just inputs but outcomes of its policy implementation.

Introduction

In the digital age, information and communication technology (ICT) plays a key role in creating and exchanging knowledge and information around the globe. ICT affects the everyday lives of citizens in many areas – at school, in the workplace and in the community. Knowledge about, access to and the ability to use ICT are vital for effective participation in an information society. ICT is transforming the nature of how work is conducted and the meaning of social relationships. Decentralised decision making, information sharing, teamwork and innovation are key in today's enterprises. Countries wanting to adequately prepare young people for the challenges and opportunities of a globalised economy need to make long-term, incremental changes in their education systems to adapt to these new demands. Acquiring and mastering ICT competencies has thus become a major component of education today. As UNESCO (2002) observes: "ICT adds value to the processes of learning, and in the organization and management of learning institutions. The Internet is a driving force for much development and innovation in both developed and developing countries. Countries must be able to benefit from technological developments."

Thailand has made significant investments in ICT education over the past few decades, setting out plans to use ICT as a tool to enhance teaching and learning, particularly at the basic education level; to encourage the acquisition of ICT competencies needed for success in the 21st century; and to put the infrastructure in place to support these efforts (Ministry of Education, 2008; Ministry of ICT, 2009a; Thai Consulate-General, 2015). However, Thailand's schools currently lack stable nationwide access to the Internet and widespread access to digital learning materials, Thai teachers lack confidence and competence in the use of ICT, and the country needs to establish data-gathering mechanisms and a coherent, overarching ICT strategy to support the ongoing development of aligned, evidence-based policies in this area. This chapter begins with an overview of Thailand's reforms relating to the use of ICT in education, and then provides an analysis of the policy issues surrounding this area, presenting recommendations for improvements to support ICT use to enhance the quality and equity of the education system as a whole.

Thai policies on ICT in education

ICT has been a central component of Thailand's economic development strategy for several decades, as evidenced by a series of national ICT policy frameworks. These include Thailand's ICT2010 (Ministry of ICT, 2009b, 2009a) and ICT2020 reports, which give a broad outline of the overall ICT

development strategy, as well as a series of ICT Master Plans, which give more specific implementation details and progress updates. The goal of these strategies has been to use ICT to create a "Smart Thailand": a society that is "smart and information literate," where knowledge benefits citizens and "society as a whole" (Ministry of ICT, 2009a). Education has been a key pillar in these efforts.

The first phase of ICT use in Thailand's education system began in 1984, when Thai schools began offering computer courses to students in order to provide them with basic skills for operating and applying ICT (Meleiseia, 2008). The courses were compulsory within the mathematics subject cluster and were revised in 1990 and 1997 to respond to technological developments. When Thailand introduced a new basic education curriculum in 2001, it included standards for what students in all 12 grades should know about ICT. Technological education comprised ICT and content on design and technology.

The second phase of ICT reforms began after the publication of the 2001 Second Information Technology in Education Study (SITES), which showed that the use of ICT in Thailand at the primary and secondary levels was below international averages (Pelgrum and Anderson, 2001; Waitayangkoon, 2007). Thailand expanded its efforts to integrate ICT in education by developing a series of four-year strategy documents and amendments to the basic education curriculum. The Ministry of ICT produced the first of these strategy documents, the *Master Plan for ICT in Education, 2007-2011*. It proposed the following:

- teach students to use ICT so they can compete in a global society
- integrate ICT into the classroom to unlock its pedagogical potential
- further develop ICT infrastructure in the education sector
- take advantage of ICT to more effectively manage the school system (Ministry of ICT, 2009b).

Thailand's 2008 revisions to its basic education curriculum added "capacity for technological application" as one of five key competencies to be taught across all subjects in the basic education system, and included ICT as a topic of study in all grades (OBEC, 2008). Special attention was given to ICT proficiency at the lower secondary level (Grades M1 to M3), the last stage of compulsory education in Thailand (see Chapter 3) (OBEC, 2008). The Ministry of Education has since produced two subsequent Master Plans setting out additional strategies for ICT integration for 2011-13 and 2014-18.

The importance of ICT to Thailand's education reform and broader social and economic development is evident in the breadth of initiatives introduced by the government and the royal family in recent years. HRH Princess Sirindhorn has initiated projects to reduce inequity by providing computer technology to students from disadvantaged backgrounds, as well as students with special needs, in over 72 rural schools (UNESCO, 2005). Between 2011 and 2014, the Thai government proposed seven priority programmes focused on the use of ICT in education, of which the flagship was the One Tablet Per Child (OTPC) policy. These programmes were intended to:

- provide students at all levels with tablet computers for educational purposes
- set up a student-centred national e-learning system to encourage lifelong learning
- develop an information network for education
- establish the "Cyber Home" system by which academic lessons can be transmitted to students at home via a high-speed Internet network
- increase the coverage of educational TV channels
- turn pilot classrooms into electronic classrooms
- enable the "Fund for Technology Development for Education" to fulfil its objectives (OEC, 2013).

Despite these investments in ICT in education, there is evidence that Thai students do not fully possess the level of computer, information processing and communication skills needed today.

ICT proficiency among Thai students

In 2013, Thailand participated in the International Computer and Information Literacy Study (ICILS), which tested the digital skills of 14-year-old students in 23 countries (Box 6.1; Fraillon et al., 2014). Thai students finished second from the bottom on the study, above only Turkey. Among Thai students, 64% scored below the lowest level of ICT proficiency, 23% scored at the lowest level (Level 1), 11% scored at Level 2 (the proficiency level of most students in other participating countries), 2% scored at Level 3 and none reached Level 4, the highest level.

Thai students also reported lower confidence than students in other countries in carrying out certain ICT tasks like locating a file on a computer; using software to eliminate viruses; working with digital photos; creating or editing documents; finding information on the Internet; and uploading text, images, or videos to an online profile.

Thai and Turkish students also had the greatest spread in national scores out of the countries participating, suggesting ongoing issues with equity in access to ICT, a problem also highlighted in the results of the OECD Programme for International Student Assessment (PISA). The 2012 PISA survey revealed a 71.4% difference between the percentage of disadvantaged students and advantaged students in Thailand who reported they were connected to the Internet at home, greater than the 66.5% difference in Malaysia and much higher than the 13.4% average difference across OECD countries (OECD, 2015).

Recent OECD analysis (2015) suggests that a higher rate of ICT use is not necessarily associated with greater ICT proficiency. This seems to be the case in Thailand, where students reported an above-average use of computers. Some 60% indicated they used computers to prepare reports or essays at least once a month, 51% said they had given presentations with computers and 23% stated that they had worked with a student from another school using a computer compared to ICILS averages of 45%, 44% and 13% respectively (Fraillon et al., 2014).

Above-average percentages of Thai students reported having learned to provide references to Internet sources, access information using a computer, determine whether to trust information from the Internet, and choose where to look for information about an unfamiliar topic. Thai students also reported above-average use of computers in seven of eight learning areas, including mother tongue, foreign languages, mathematics, sciences, humanities, creative arts and other.

However, Thai students reported lower than average computer use in the area of information technology and computer studies. They also experienced above-average obstacles to the use of ICT because their schools reportedly had too few computers connected to the Internet, insufficient Internet bandwidth or speed, insufficient computers for instruction, and unsatisfactory ICT skills among teachers (Fraillon et al., 2014). Together, these results suggest that, even if Thai students spend more time on computer tasks than many students elsewhere, variable quality of infrastructure and instruction limit the effect this has on their ICT proficiency.

Box 6.1. Assessing the computing and information literacy skills of young people

The ICILS studied the extent to which young people have developed computer and information literacy. Fourteen-year-old students from a variety of countries were given a computer-based test together with a survey. This was complemented by questionnaires to teachers and school managers.

The study constructed a four-level scale to measure and compare students' performance. Advanced students (Level 4) selected only the most relevant information to use for communicative purposes. They evaluated the usefulness of information based on criteria associated with need, and evaluated its reliability based on its content and probable origin. At Level 3 students demonstrated a capacity to work independently when using computers as information-gathering and information-management tools. Level 2 students were able to use their computers to complete basic and explicit information-gathering and information-management tasks. At Level 1 students demonstrated a functional working knowledge of computers as tools and a basic understanding of the consequences of computers being accessed by multiple users.

Source: Fraillon et al. (2014), *Preparing for Life in a Digital Age. The IEA International Computer and Information Literacy Study International Report*.

Policy Issue 1: Thailand lacks the infrastructure to support effective ICT use in schools

In order to use ICT in teaching and learning, students need access to a digital device of some kind, whether it be a computer, tablet PC, mobile phone or interactive whiteboard, and to have a stable, reasonably fast connection to the Internet. An education system that aims to prepare its students for full social and economic participation has to provide good access to the Internet and to all the information, communication opportunities and learning resources it has to offer. Thai students need to learn how to harness the potential of the Internet, making good use of the abundance of information it provides while understanding and managing risks. Thailand has made significant investments in hardware, but teaching and learning are hindered by slow, unstable Internet connections. Thailand's new hardware policies should be informed by its experiences implementing past digital device initiatives.

Access to computers and the Internet

The growing and critical importance of connectivity

During the 1980s the main focus of ICT use in education was on the computers themselves and on their basic applications such as word processing, calculation and database management. In time, the concept of information technology grew to also encompass laser discs, CDs and DVDs. With the emergence of the Internet in the mid-1990s the concept of ICT has expanded to include all technologies and applications intended to provide access to information and media and to support communication, such as Internet browsers and e-mail. Finally, the new generation of mobile phones that can access the Internet has further expanded the concept. The expression "information and communication technology" now comprises all the elements listed above, together with a number of hybrids such as smartphones, tablet PCs, netbooks, projectors, digital cameras and interactive whiteboards (OECD, 2012).

With cheaper hardware and software, as well as an ever-expanding Internet with less and less expensive high-speed access, attention is moving away from devices and towards the information, services and resources that can be used on line. As the OECD (2012) puts it, "although the concept of technology or ICT was a useful construct in the eighties and nineties, since the progressive generalization of access to the Internet, what really matters is the ability to connect either to others or to the Internet, irrespective of the type of device, service or platform used." According to the OECD, these changes require a shift in the focus of policy discussion away from access to particular types of technology, devices or gadgets, and towards the vast range of activities that can be carried out and the services accessed on line. Using the Internet for teaching and learning requires both digital devices and access to the Internet. To achieve this, many countries have made significant investments in computers and improved Internet access for schools.

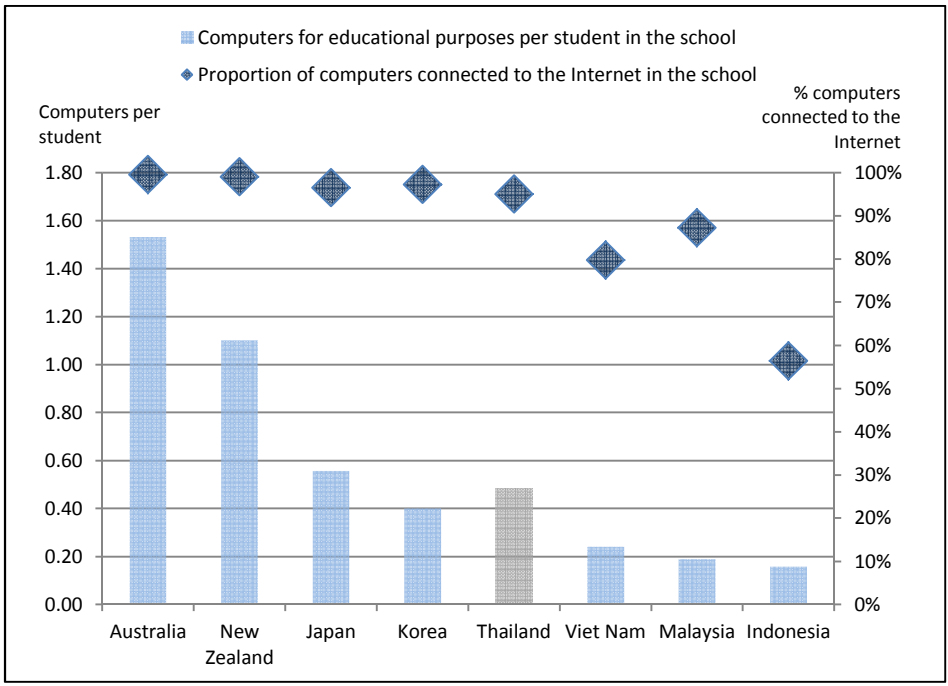
The learner-to-computer ratio

Internationally, countries strive for a low learner-to-computer ratio (LCR) in schools, as a lower ratio means each pupil has more time to access a computer. Research shows that the more computers are present in a classroom, the more likely it is that a teacher will have students use them frequently (Becker, 1999). Where students share a computer, group work complemented by structured sharing schedules may have significant learning benefits, especially if based on collaborative and co-operative learning models. On the other hand, if too many learners are sharing a single computer, the time required for different tasks may not allow each student to

have a meaningful learning experience. In most countries, the LCR is typically greater than 1:1, meaning that more than one student must share a single computer or device. In Europe, there are between three and seven students per computer on average, and nine out of ten students are in schools with broadband connections (European Schoolnet, 2013).

Thailand has made significant investments in hardware for schools in recent years. In 2008, the Ministry of Education recorded an average LCR in secondary education of 14:1 (Ministry of Education, 2011). More recent estimates vary considerably but suggest that this has improved (UIS, 2014a). According to data from PISA, in 2012 Thailand had a higher ratio of computers for educational purposes per student in secondary school than other countries with a similar level of development in the region: 0.48in Thailand compared to 0.24 in Viet Nam, 0.19 in Malaysia and 0.16 in Indonesia (Figure 6.1; OECD, 2013). Moreover, the ratio was higher in Thailand than in well-developed countries like Korea (0.40), and not far from that of Japan (0.56) (OECD, 2013).

Figure 6.1. Availability of computers at school, selected countries, 2012



Note: Results based on school principals' reports.

Source: OECD (2015), *Students, Computers and Learning: Making the Connection,* http://dx.doi.org/10.1787/9789264239555-en.

While average LCR figures shed light on the infrastructure available to support the integration of ICT-assisted instruction, they can mask sub-national differences, also known as the internal digital divide. Internationally, LCR values are frequently low in urban centres (indicating greater access) but high in rural and remote areas. For example, research in the People's Republic of China has shown that urban primary education centres have an LCR of 14:1, compared to 29:1 in rural centres (Zeng et al., 2012). By contrast, in Tajikistan computers are more available in rural areas due to the decision to provide all schools with a laboratory with the same number of devices regardless of enrolment. This has the effect of favouring pupils in small rural schools over large urban institutions (Asian Development Bank, 2012). The use of multi-seat computers or networked PCs, where users simultaneously operate from a single central processing unit (CPU) and server while using their own individual monitors and keyboards, is one possible option to minimise the effects of computer shortages.

Thailand's national data on computer access do not permit comparisons between schools of different socio-economic backgrounds or across different regions. PISA 2012 results suggest no significant difference in the LCR between advantaged and disadvantaged schools or between schools in urban and rural areas. However, these data do not reveal the age of the computers in use across the country's schools nor whether they are in good working condition. Evidence from PISA on the overall adequacy of educational resources in schools as reported by principals, which includes but is not limited to ICT resources, reveals significant differences in quality between rural and urban areas in Thailand and a close correlation between schools with poor-quality resources and high levels of socio-economic disadvantage (OECD, 2013).

Internet access

If schools are to make the best use of rich online curriculum resources, online assessment tools, web-based collaboration systems, digital textbooks and a host of Internet-based technologies such as online collaboration tools, Internet-enabled communication services and cloud computing, they need sufficient broadband bandwidth to facilitate their seamless use in schools (Cosgrove et al., 2014). Improved broadband access and wireless connectivity can also reduce inequity across an education system, extending learning opportunities beyond traditional classroom boundaries to meet the needs of under-served populations. This is a driving force behind ICT policies to improve service to rural communities in Australia, Canada, Iceland and New Zealand, (Bakia et al., 2011, in Cosgrove et al., 2014).

The density of devices and users in a school can be among the highest in any work environment (CISCO, 2013). Research recommends that education systems determine the bandwidth schools need to accommodate demand by using a bandwidth-per-student measure, which directly correlates with the quality of a student's online experience across a range of activities (Table 6.1; Fox et al., 2012; CISCO, 2013; Cosgrove et al., 2014). In America, some have set ambitious targets for schools of 2 Mbps per student or even 10 Mbps per student by 2018 (Fox et al., 2012; CISCO, 2013).

Table 6.1. Recommended download speeds

Activity	Recommended download speeds per user
Email and web browsing	500 Kbps
Download a 1 MB digital book in 5.3 seconds	1.5 Mbps
Online learning	250 Kbps
HD-quality video streaming	4 Mbps
Skype group video session, 7+ people	8 Mbps
Download a 6 144 MB movie in 8 minutes	100 Mbps
Multiple choice assessments	64 Kbps/student

Source: Fox et al., (2012), *The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs;* p. 21.

Information about the level of Internet access in Thai schools presents a mixed picture. According to PISA 2012, based on principals' reports, the proportion of school computers connected to the Internet was relatively high in Thailand (95%), particularly in comparison to other countries in the region (Figure 6.1), while the ICILS 2013 study found that 74% of Thai students were attending schools where too few computers were connected to the Internet (OECD, 2013; Fraillon et al., 2014). The latter result may be related to the poor quality of Internet connections across the country (Table 6.2; UIS, 2014a; OEC, 2015). In Thailand, whole schools share a connection of 6-8 Mbps, which is more appropriate for single-family use, and most use satellites for network connections, which are unstable and slow (Table 6.3; OEC, 2015).

Table 6.2. Type and speed of Internet connections in schools, 2012

Share of schools	Type of connection	Average speed
42%	XDSL	8 Mbps
33%	Wi-Fi	6 Mbps
11%	Analogue modem	4 Mbps
6%	Leased lines	8 Mbps
5%	ISDN	6 Mbps
3%	Cable modem	10 Mbps

Source: OEC (2015), *Master Plan for ICT in Education, 2014–2018.*

Table 6.3. Internet connections for schools, 2012

Linkage format	Schools	Educational service areas	Total
Leased line	1 468	85	1 553
ADSL	5 710		5 710
Satellite	22 939		22 939
Total	30 117	185	30 302

Source: OEC (2015), *Master Plan for ICT in Education, 2014-2018.*

The Thai government has taken measures to improve connectivity across the education system, with plans to upgrade Internet access in over 30 000 schools by leasing networks at a cost of approximately THB 1 000 million (Thai baht) per year beginning in fiscal year 2014, and proposed funding for Internet capacity in the Master Plan for ICT in Education, 2014-2018.

Although international targets for connectivity may not be realistic for Thailand in the short term, the country should consider using Mbps per student or per 1 000 students as a metric for bandwidth needs than Mbps per school. Thailand should also expand Internet access in rural areas, and look at similar projects implemented in the European Union to support this work (Box 6.2).

Box 6.2. The European Commission's rural broadband proposal

In 2009, the European Commission committed to supporting the economic recovery of the European Union through a development policy that provided funding to expand broadband infrastructure in rural areas. Broadband connectivity was viewed as key to the use of ICT to spur growth and innovation for the benefit of the economy and society. Specifically, the commission provided funding to:

- create new broadband infrastructure (e.g. fixed, terrestrial wireless, satellite-based or a combination of technologies)
- upgrade existing broadband infrastructure
- lay down passive broadband infrastructure in tandem with other infrastructure projects (e.g. civil engineering work).

Sources: European Commission (2009a), "Commission earmarks €1bn for investment in broadband – Frequently asked questions", http://europa.eu/rapid/press-release_MEMO-09-35_en.htm; European Commission (2009b), *Community Guidelines for the Application of State Aid Rules in Relation to Rapid Deployment of Broadband Networks*, http://ec.europa.eu/competition/consultations/2009_broadband_guidelines/guidelines_en.pdf.

One Tablet Per Child policy

A lack of equipment is often cited as an obstacle to ICT use in classrooms (Becker, 1999; European Schoolnet, 2013). A number of countries have introduced one laptop per child (OLPC) programmes, although the results of these initiatives have thus far been mixed (Box 6.3). Thailand implemented a small-scale OLPC programme in 2008, comprising approximately 500 XO laptops designed to be low cost and durable machines for school use (Ibarrarán, 2012). A 2009 evaluation of the programme found no strong indication that the academic performance of students using the laptops was appreciably different from that of other students (Mahachai, 2010). However, there were positive differences among participating students, such as enthusiasm about work, and the ability to link computers into their learning and searches for information (Mahachai, 2010).

A more recent One Tablet Per Child policy was launched in Thailand by the government of former Prime Minister Yingluck Shinawatra (2011-14).

A 2012-13 Office of the Basic Education Commission (OBEC) evaluation of the use of tablet computers in a sample of 596 schools in 175 Educational Service Areas, along with other research relating to Thailand's OTPC policy,[1] found that:

- A total of 28 413 schools (99%) had received their tablets, although delivery was late in 22% of the cases and defects were found in 44% of the tablets and in 28% of the software.
- Half of the teachers involved in the programme found the speed of the distribution of the tablets too slow, but 93% of school administrators and 88% of teachers were satisfied with the digital content.
- Teacher attitudes were positive overall: 58% of teachers liked to use the tablet device in their teaching and 62% believed it was of benefit to their students.
- The programme would benefit from the development of contextualised content, greater usability, teacher support and an assessment of learning outcomes. (OBEC, 2013; Viriyapong and Harfield, 2013).

Box 6.3. International one laptop per child policies

One of the most extensive long-term initiatives providing one laptop per student began in the state of Maine, United States, in the 2002/03 school year. More than 17 000 seventh graders and their teachers in over 240 middle schools across Maine received laptop computers. The following year all eighth graders and their teachers also received laptops, and each subsequent year thereafter all students entering the seventh and eighth grades, as well as their teachers, have been supplied by the state with laptop computers. A 2011 review of the programme concluded that it has had a significant impact on curriculum, instruction and learning, improving students' performance in writing, mathematics and science. The elements that have made the Maine programme successful include:

- a focus on teacher and school leader professional development, including seven contracted tech professionals who train teachers, principals, superintendents and technology co-ordinators
- well-developed support and Internet infrastructure
- political commitment and long-term funding.

Box 6.3. International one laptop per child policies *(cont.)*

By contrast, a similar programme in Syracuse, New York, that began two years later ended due to implementation failures, including a lack of clear and measurable goals and a lack of in-service training for teachers, who were not given laptops before their students.

India's Aakash Project and Turkey's FAITH project are OLPC programmes that have advanced slowly, contending with logistical challenges posed by large geographical areas. Peru and Uruguay both began implementing OLPC programmes in 2007. Evaluations of these programmes have found mixed results regarding the effectiveness of laptops in improving educational quality and equity, although questions have been raised about the focus and methodology of these evaluations. What has not been questioned is the finding that technology alone does not solve educational deficiencies.

Sources: Silvernail and Gritter (2007), *Maine's Middle School Laptop Program: Creating Better Writers*; Waters (2009), "Maine ingredients", *T H E Journal*; Mahachai (2010), "Laptops a success only in some cases", www.nationmultimedia.com/home/2010/11/22/national/Laptops-a-success-only-in-some-cases-30142835.html; Silvernail et al. (2011), *A Middle School One-to-One Laptop Program: The Maine Experience*; Cristia et al., (2012), "Technology and child development: Evidence from the One Laptop per Child Program". Ibarrarán (2012), "And the jury is back: One Laptop per Child is not enough", http://blogs.iadb.org/desarrolloefectivo_en/2012/03/06/and-the-jury-is-back-one-laptop-per-child-is-not-enough; Trucano (2013), "Big educational laptop and tablet projects: Ten countries to learn from", http://blogs.worldbank.org/edutech/big-educational-laptop-and-tablet-projects-ten-countries.

In June 2014, after approximately 1.2 million tablets had been distributed to students in Grade 1 (P1), Thailand's new government suspended the OTPC programme. Based on information obtained during the review, funds remaining from this programme are to be used for an initiative called Smart Classroom. According to OBEC and Microsoft, this programme aims to integrate four factors into the classroom: 1) teaching with technology; 2) digital content; 3) cloud-based services and Microsoft Office 365; and 4) technological devices. These are intended to create a classroom environment that is more conducive to learning and teaching (Bangkok Post, 2014). The design and implementation of this and other new programmes should be informed by evidence gathered from evaluations of the OTPC initiative and any similar programmes involving the provision of digital devices to Thai schools.

Moving forward, Thailand could continue to invest in television as a potentially powerful educational tool to decrease social and economic inequality. Currently, the "Kru Truu", Educational TV and Tutor Channel projects produce and distribute educational content to Thai television (Laohajaratsang, 2010). While many Thai students do not have access to

computers or the Internet at home, 99.6% of Thai households have a television (Bangkok Post, 2013). This near universal access means that televised educational content has the greatest chance of reaching the most students in disadvantaged and rural areas.

Thailand may also wish to explore unorthodox methods of using ICT in education, such as bring your own device (BYOD) policies as applied in the United States or in Scandinavian countries, providing these do not disenfranchise students from disadvantaged backgrounds. As of December 2014, Thailand had 97.7 million mobile subscribers (Leesanguansuk, 2015). It currently has the third highest mobile broadband penetration rate among Association of Southeast Asian Nations (ASEAN) countries, around 50 million users, and will become the second largest mobile broadband subscriber in Southeast Asia after Singapore once the rollout of the high-speed, fourth generation (4G) network is complete.

Recommendations

The review team recommends that Thailand:

- **Address the need for a stable, responsive and widely available ICT infrastructure by setting clear, long-term goals to expand Internet access backed by adequate funding to cover devices, connectivity and maintenance.**

While broadband connections cannot be used without digital devices, computers or tablet PCs are of limited value for learning where there is no access to the Internet. Thailand should continue its digital investments in both, making sure it balances spending between expenditure on devices and Internet access, and expenditure on technical maintenance costs for schools. It should also invest in professional development for educators and digital learning resources, addressed later in this chapter.

Policy makers might consider including BYOD approaches in this investment strategy, but with special support for students from disadvantaged backgrounds or those living in remote rural areas to ensure the policy does not further disadvantage them. In order to reach all regions of the country, Thailand should continue to use television as a medium for providing educational content.

- **Prioritise investments in ICT infrastructure and connectivity in remote areas to ensure equity of access.**

Providing Internet connectivity to schools in remote areas is expensive, as is technical maintenance. Nevertheless, they are necessary to support any initial investment in hardware. Without Internet access in schools and

trained teachers who can use computers to their best advantage, very little of the equipment's potential can be harnessed, increasing the risk of a digital divide between urban and rural areas. To support the expansion of ICT infrastructure, Thailand should begin to use bandwidth-per-student to measure progress and look at similar projects undertaken in other regions, including the European Union.

Policy Issue 2: Digital learning materials are not yet fully incorporated into the basic education system

Improving the quality of education relies to a significant extent on ensuring teachers and students have access to relevant and high-quality textbooks and other learning materials, in printed and digital format. For most teachers, there is a close relationship between being able to implement the school curriculum and having access to high quality learning materials. Digital learning resources such as audio or video files, images or software have great potential to promote learning, particularly in comparison to traditional, static textbooks (OECD, 2009). Unlike printed material, digital learning resources can be interactive, receiving and responding to input from the user, making simulations and hypertext possible. For example, a simulation might represent a physical environment that would otherwise be too difficult, expensive or dangerous for students to explore. Although there is some evidence that these types of resources are used in Thailand's basic education system, more could be done to ensure their quality, relevance and widespread availability.

Developing and using digital learning resources

Policies aimed at promoting the use of ICT in schools often focus on infrastructure, equipment and the in-service training of teachers. Realising the full potential of ICT to support teaching and learning also means investing in the development and publication of digital learning resources. In contrast to textbooks, which are generally created within the traditional framework and rules of the public school system, digital learning resources tend to arise from a broad commercial market or social or research context. They are often available for free on the Internet. They may take the form of open educational resources (OERs), which are "teaching, learning or research materials that are in the public domain or released with an intellectual property license that allows for free use, adaptation, and distribution" (UNESCO, 2015). OERs are particularly important in developing countries where students may not be able to afford textbooks, access to classrooms may be limited, and professional learning programmes for teachers may be lacking. In industrialised countries, OERs can also offer significant cost savings.

Box 6.4. The Paris OER Declaration

In 2012, UNESCO issued the Paris OER Declaration, which encourages governments to develop strategies to integrate OERs in education. To support the declaration, UNESCO is working with five member states, including Indonesia in the Asia-Pacific region, to conduct activities in three key areas:

1. Advocacy – organising events and creating publications to raise awareness of OERs, building the capacity of policy makers and educators to increase their understanding of open licences and issues surrounding the use of OERs, and introducing standards to increase sharing of OERs.
2. Policy development – developing plans for the production and use of OERs and policies to encourage the open licensing of learning materials produced with public funds.
3. Teacher development – developing training materials using OERs and about OERs, within the context of UNESCO's ICT Competency Framework for Teachers (Box 6.7).

Source: UNESCO (2012a), *Implementing the Paris OER Declaration*, www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/implementing-the-paris-oer-declaration/.

Due to language issues and the need for "localised" learning materials adapted to national curricula, countries should not rely solely on internationally developed OERs but should invest in developing their own digital learning resources. These can be created by the public sector or procured, directly or indirectly (e.g. by having students' families purchase them) from educational publishers. In either case, governments should design a clear and consistent policy setting out the processes they will follow to make the digital learning resources available. In addition to governments, the private sector, bottom-up entities such as non-governmental organisations (NGOs), or users themselves may establish initiatives to develop digital learning resources (OECD, 2009). The changing education landscape makes new scenarios for the production of these resources possible. Involving teachers in their production can be a particularly effective way to reduce costs and improve teachers' digital competency (Box 6.5). As Thai teachers' capacity to work with ICT increases, the country should explore the role they can play in developing digital learning resources.

Box 6.5. The Norwegian Digital Learning Arena

The Norwegian Digital Learning Arena (NDLA) involves teachers in the production of digital learning material. In 2007, the Norwegian government decided to provide students in upper secondary education with free educational materials. The regional educational authorities were tasked with distributing these resources, using funds provided by the national government. A total of 18 out of 19 regional educational authorities teamed up to produce some of their own learning materials instead of purchasing materials produced by publishers.

The regional educational authorities designated a group of teachers to author the new material. Because the teachers produced this material on behalf of their employers and used their schools' own resources, all intellectual property rights to the material belonged to the regional educational authority. The material they produced was combined with content purchased from publishers and media companies. All materials were scrutinised by university experts before publication and then issued in digital format using Creative Commons licenses. This project is still ongoing. It represents not only a cost-efficient way to make digital learning materials available across the country, but also a new way to improve the digital skills of teachers.

Source: OECD (2009), *Country Case Study Report on Norway*, www.oecd.org/edu/ceri/42214660.pdf.

Digital learning materials in Thailand

Thailand has invested in the development of digital learning resources. The country's One Tablet Per Child project involved the production of e-books, learning objects, multimedia and songs to be installed on tablets distributed to students. For this project, OBEC produced 336 learning objects in 5 clusters – Thai language, English language, mathematics, science and social studies – which paralleled the textbook content. It is unclear whether these materials were also made available to students who lacked a tablet but had access to a computer.

In recent years, the Institute for the Promotion of Teaching Science and Technology (IPST) has made significant investments in digital learning materials, primarily for science, technology, engineering and mathematics (STEM) subjects. However, this review could not determine the use and quality of these digital learning materials. It was also not possible to determine whether high-quality digital learning materials are widely available on the private market.

The government's Master Plan for ICT in Education 2014-2018 states that digital learning materials have not yet been developed for a number of basic education subjects and grade levels (OEC, 2015). In addition, most

high-quality OERs are not available in Thai, limiting their potential use unless teachers translate them or students are capable of working in English. The 2013 ICILS study found that while Thai students have levels of access in school to some software resources (e.g. software for word processing and spreadsheets) and Internet-related resources (e.g. websites, wikis) that are on par with or higher than the average across other countries, only 75% had access to interactive digital learning resources such as learning objects compared to an ICILS average of 84% (Fraillon et al., 2014). All of this suggests the need for a national strategy to produce digital learning materials, including OERs, for the basic education system.

Repositories for digital learning resources

A national hub or repository for teachers to use to find and compare digital learning materials like OERs can stimulate the use of ICT in schools (OECD, 2007). Such a repository need not be in a central physical location. Storage can be decentralised, with materials hosted by an organisation or company that owns the copyright on the material. An outstanding example of a repository for digital learning materials is the European Schoolnet Learning Resource Exchange for Schools. It is a federation of repositories from across Europe, allowing schools and teachers to search for educational content from different countries and providers. All materials are free and most are published under a Creative Commons license. Denmark has a national repository containing both OERs and commercial learning materials. Foundations like the Khan Academy and the CK-12 Foundation offer high-quality materials mainly in the STEM area.[2]

In Thailand, the Asian Institute of Technology initiated the Knowledge, Imagination, Discovery and Sharing – Digital (KIDS-D) project in 2008 as a network of digital libraries for collecting and sharing OERs through the Internet (Bacsich and Salmon, 2014). KIDS-D@SWU is one of the digital libraries under the KIDS-D project that aims to assist educational development by providing high-quality, on-demand learning resources to schools, university students and the general public through the Internet. The project also promotes the sharing of learning resources, knowledge, and thinking between schools, universities, organisations and students.

Of the three different network providers that offer Internet access to schools in Thailand, two also have repositories for learning resources: the National Learning Centre as part of NEdNet and the Digital Content Centre as part of the OBEC-Net (Bureau of Information and Communication Technology, 2015). Thailand's Master Plan for ICT in Education 2014-2018 contains plans to integrate these networks. These plans should also apply to the repositories, so that teachers can visit a well-curated one-stop shop for digital learning materials rather than having to search multiple repositories.

Recommendation

The review team recommends that Thailand:

- **Build a national strategy for developing digital learning materials, and create a national repository where such materials can be accessed.**

Policy makers should address the limited access to digital learning materials in Thailand in part by encouraging and enabling Thai teachers and students to make use of high quality OERs. Thailand should also expand its work on OERs and integrate ongoing projects such as KIDS-D into a national strategy. Thailand could follow UNESCO's advice under the Paris OER Declaration of 2012 (Box 6.4), specifically working to build the capacity of policy makers and educators to understand, develop and use OERs (UNESCO, 2012a). In particular, Thailand should explore the role teachers could play in developing digital learning materials for use in the basic education system.

Thailand should establish a common national repository or a one-stop shop for digital learning materials, where teachers could search for material by grade level and subject, thus stimulating the use of such materials. In creating such repositories, it is recommended to involve or at least consult teachers in how these repositories should be laid out, the relevance of content to curriculum, curation tags, etc. Such repositories are most effective if they are online and allow teachers to rate/comment on available content as well as share content.

Policy Issue 3: Teachers need more confidence and capacity to use ICT effectively in the classroom

Research points to the following pre-conditions for teachers' effective use of ICT: 1) access to computers and the Internet at school; 2) competence in using software and the Internet and applying it to teaching; and 3) motivation, gauged by the attitude that using computers in classrooms results in significant learning benefits (Empirica, 2006). Teachers' confidence in their expertise, as well their opinions and attitudes about ICT, affect not only their use of it but also their students' ICT competency (European Schoolnet, 2013; Fraillon et al., 2014; Box 6.6). Teachers in Thailand need more effective preparation and professional learning to increase their confidence and competency in using ICT to support student learning.

Thai teachers' use of ICT

Thai teachers are not as confident about their ICT use as their counterparts in other countries, and they have mixed attitudes to ICT as a

teaching and learning tool. In the ICILS 2013 study, they reported a low level of confidence with regard to basic ICT skills like writing a letter with a word processing programme, e-mailing a file as an attachment, storing digital photos on a computer, filing digital documents in folders and subfolders, and monitoring student progress (Fraillon et al., 2014). While over 90% agreed that ICT helps students access better sources of information, consolidate and process information more efficiently, and develop a greater interest in learning, teachers in Thailand were more likely than in other countries to endorse the view that ICT ''only encourages'' students to copy material from published Internet sources (68%) and report that it ''merely distracts'' students from learning (48%).

Box 6.6. Norwegians SMILE

A Norwegian study called SMILE, conducted in 2012 among 17 500 students and 2 500 teachers, looked at the relationship between ICT use and learning outcomes in secondary schools. It focused on how school officials exercise leadership, how teachers teach, and how students learn in technology-saturated classrooms. Those teachers who are successful in their pedagogical ICT use are characterised as having high digital competency, good classroom management skills, the ability to master digital formative assessment, and flexibility in adapting their teaching to an increasingly digitalised society. The study also found that students look up to digitally competent teachers as role models of professional ICT use. More specifically, they need teachers who exercise strong leadership in the classroom, who possess an array of teaching modalities, and who monitor students closely with formative assessments and individualised instruction.

The researchers concluded that the relationship between students' ICT use and their learning outcomes seems to be closely related to digital formative assessment in the SMILE schools. The SMILE study also reveals that the pedagogical use of ICT varies substantially between different groups of students, groups of teachers, professional groups and education programmes. Some of these differences are related to the characteristics of different subjects, the lack of appropriate digital tools in different subjects, as well as a lack of digital competence. For this reason, one of the most important implications of the findings of the SMILE study is that an increase in digital competency among teachers is one of the most important means of increasing students' learning outcomes in schools and subjects that make use of ICT.

Source: Krumsvik et al. (2013), *Sammenhengen Mellom IKT-bruk og Læringsutbytte (SMIL) i Videregående Opplæring*.

The ICILS 2013 study indicates that for some tasks, Thai teachers use ICT at the same rate or more frequently than teachers in other countries. These include providing remedial or enrichment support to individuals or

small groups of students, student-led classroom discussions and presentations, and assessing student learning (see Chapter 4 for more information about student assessment). However, other results were significantly below the ICILS 2013 average. Some 68% of Thai teachers said they used ICT in any given class, compared to 94% in Australia and 81% in Korea, and just 22% reported that they "often" use ICT to present information in the classroom, compared to the average of 33% (Table 6.4; Fraillon et al, 2014). These results, combined with Thai teachers' reported negative views about ICT use, suggest a need for the government to do more to ensure all teachers understand the benefits of ICT in teaching and learning and to build teachers' confidence and capacity to use ICT through effective preparation and professional learning, particularly within collaborative school environments.

Table 6.4. Use of ICT for teaching practices in classrooms

National percentages of teachers often using ICT for learning activities in classrooms, 2013

	Presenting information through direct class instruction	Providing remedial or enrichment support to individual students or small groups of students	Enabling student-led whole-class discussions and presentations	Assessing students' learning through tests
Czech Republic	31	4	7	8
Denmark	41	22	23	18
Germany	13	4	5	3
Croatia	28	10	14	5
Lithuania	36	15	15	14
Netherlands	44	14	11	15
Poland	23	19	10	28
Slovenia	35	15	19	7
Slovak Republic	29	10	13	9
Australia	46	19	18	10
Chile	43	20	22	22
Hong Kong, China	38	9	8	12
Korea	42	22	10	12
Norway (Grade 9)	33	12	9	14
Russian Federation	43	21	24	33
Thailand	22	13	14	25
Turkey	22	15	15	20

Source: Fraillon et al. (2014), *Preparing for Life in a Digital Age: The IEA International Computer and Information Literacy Study International Report*.

Table 6.4. Use of ICT for teaching practices in classrooms *(cont.)*

National percentages of teachers often using ICT for learning activities in classrooms, 2013

	Providing feedback to students	Reinforcing learning of skills through repetition of examples	Supporting collaboration among students	Mediating communication between students and experts or external mentors	Enabling students to collaborate with other students
Czech Republic	11	14	8	1	3
Denmark	21	16	16	4	4
Germany	4	4	4	1	2
Croatia	8	14	9	3	3
Lithuania	17	19	12	3	5
Netherlands	10	26	11	1	3
Poland	28	24	24	3	5
Slovenia	13	21	12	3	5
Slovak Republic	11	18	10	3	3
Australia	17	20	14	3	7
Chile	33	29	27	6	12
Hong Kong, China	15	16	8	3	5
Korea	15	20	8	5	8
Norway (Grade 9)	25	11	6	1	5
Russian Federation	16	34	26	5	10
Thailand	19	21	30	10	18
Turkey	17	20	11	7	7

Source: Fraillon et al. (2014), *Preparing for Life in a Digital Age: The IEA International Computer and Information Literacy Study International Report*.

Developing innovative teaching practices

ICT can support innovative teaching practices and the creation of learning environments intended to develop students' competencies for success in the 21st century, such as problem solving and critical thinking (see Chapter 3). Rather than being used as a means to simply transmit information and content to students, ICT can be used as a tool to support students' higher order learning. For example, research recommends that teachers use ICT to develop authentic learning environments that offer students contexts and activities that reflect the way the knowledge will be used in real life (Herrington and Kervin, 2007). Within these learning environments, authentic activities involving ICT could include: planning a

trip to a foreign country; using online discussion forums and email; creating a digital story (movie or slides) to raise awareness of local issues; facilitating an exchange of views with peers from other countries; collecting credible data and inferring possible solutions from Internet research. Such approaches can be engaging for both students and teachers.

Innovative teaching practices are more likely to flourish when certain supportive conditions are in place. These conditions include:

- teacher collaboration that focuses on peer support and the sharing of teaching practices
- professional development involving the active and direct engagement of teachers, particularly in practicing and researching new teaching methods
- a school culture with a common vision of innovation, and consistent support that encourages new types of teaching (Wong et al., 2008; ITL Research, 2011).

In Thailand, teachers do collaborate and participate in professional development devoted to ICT, but these elements are not working optimally to increase their confidence and capacity and, ultimately, improve their students' ICT proficiency.

Pre-service preparation in ICT

Thailand has made significant efforts to improve the ICT skills of teachers, both through government-initiated programmes and through public-private partnerships. These efforts focus on pre-service education as well as in-service competency development. In 2002, Thailand's pre-service programmes expanded from four to five years to include an entire year of practicum time. One reason given for this expansion was to prepare teacher candidates for "the real life situation of twenty-first century Thai classrooms, which are equipped with educational television, networked computers, and interactive whiteboards, not to mention the pedagogical skill to interact with self-directed students" (OEC, 2014).

Accreditation requirements mandate that pre-service programmes include ICT as an area of skill and knowledge to be covered. For example, programmes are required to prepare primary teacher candidates to analyse, communicate and draw conclusions about appropriate information for primary school students in an ICT context. Typically, teacher candidates also exercise ICT skills during pre-service programmes through the use of PowerPoint, word processing software and the Internet. However, as highlighted in Chapter 5, pre-service programmes reportedly do not provide

sufficient preparation in key areas, including the use of ICT, and teacher preparation needs to be strengthened to support Thailand's education reform.

Professional development in ICT

In the early years of integrating ICT into education in Thai schools, most in-service professional development programmes were designed specifically to build the capacity of teachers assigned to teach computer classes. Today, all teachers are required to participate in ICT training. Schools can organise and deliver this professional development in-house to save on travel expenses, or they can send teachers to attend training offered by Educational Service Areas (ESAs). In practice, only large or medium-sized schools can afford to organise their professional development in-house.

Several ICT in-service training programmes have used the "training-the-trainer model", an educational model in which a group of teachers are trained in ICT skills and then required to train other teachers in their schools. One of the largest programmes of this kind was the IPST's Lead Teacher Programme, which began in 1999 and focused on training secondary ICT teachers to become lead teachers. These ICT lead teachers became valuable resources for the IPST and the Ministry of Education and provided expertise on a range of ICT projects (Waitayangkoon, 2007). They were in charge of reviewing digital materials and creating educational resources and training course content, and they "played a major role in building the capacity of both ICT and non-ICT teachers and in creating a technology-friendly culture in their schools" (Waitayangkoon, 2007). By 2007, 555 lead teachers were providing both ICT and non-ICT training to approximately 1 000 teachers a year at 20 ESA training centres. However, the programme faced a number of challenges, including the need to scale up to provide training opportunities to more teachers, and a lack of co-ordination between the elements of the education system to provide adequate support to enable teachers to change their practices (Waitayangkoon, 2007). Possibly as a result of these challenges, the programme was discontinued, although there is no information available as to when and why. Unfortunately, there was no evaluation of its impact and there is no record of the total number of teachers it trained.

A number of public-private (PP) teacher-training initiatives have also used the training-the-trainer model. These include Microsoft's Partners in Learning programme, which began in 2003 and has currently trained more than 12 000 school leaders and 160 000 teachers in over 12 000 schools.[3] The overall programme objectives include improving teachers' ICT literacy, integrating technology into pedagogy and developing students' competencies for the 21st century.[4] Another private initiative is Intel's Teach Thailand programme, which has a similar profile and content. Since 2002, the Intel programme has trained more than 150 000 teachers,[5] and has received positive feedback from

participants (SRI International, 2012). Since 2013, Samsung has been engaged in a Smart Classroom project that has built futuristic classrooms and provides training for 21st century competency development in 15 schools (Nation, 2014).

Overall, PP initiatives make a significant contribution towards preparing Thai educators to use ICT in their teaching. However, they also suffer from limitations, for instance in terms of scale, alignment with the basic education curriculum and reaching teachers in disadvantaged areas of the country. It is also risky for national school systems to become too dependent on private initiatives for their development. It is far better for a government to provide an overall vision and a clear focus and to build momentum for activities to ensure equitable development in line with government policies, which might then be supplemented by various private initiatives.

Research indicates that Thai teachers have relatively high participation rates in professional development devoted to ICT, including school-based collaboration. Over 80% of Thai students in the ICILS 2013 study reported that their teachers have attended courses provided by their school on the use of ICT in teaching; 78% have a teacher who has worked with another teacher trained in an ICT course and who has, in turn, trained other teachers; and 65% have teachers who have participated in professional training programmes delivered through ICT (Fraillon et al., 2014). These figures are well above the average for the study. Among teachers, 91% reported working together with other teachers to improve their use of ICT in classroom teaching (the average in the ICILS study was 71%); 91% report systematically collaborating with colleagues to develop ICT-based lessons using the curriculum (the highest proportion in the study); and in 64% of Thai schools, teachers are part of a community of practice involved in using ICT in teaching, more than double the ICILS average of 29% (Fraillon et al., 2014). These practices are very much in line with those in innovative schools.

Given these relatively high levels of reported ICT training and collaboration, it is unclear why Thai teachers are still less confident at using ICT and why the ICT achievement scores of Thai students are lower than their international peers. However, it is likely that the professional development intended to develop ICT competency has not been effective and/or it has been delivered using an approach that does not prepare teachers adequately, which would be consistent with findings presented in Chapter 5. One observation made by the review team suggests that at least some of the training courses might not have had an optimal design: the IPST courses were largely technological, rather than pedagogical (Waitayangkoon, 2007). Thailand may wish to borrow elements from the UNESCO ICT Competency Framework for Teachers, as well as whole-school approaches, to develop future professional learning on ICT (Box 6.7).

Box 6.7. Professional development to foster ICT competency

UNESCO has developed a comprehensive ICT Competency Framework for Teachers, outlining the policy context needed; specifying the scope, structure and modules for in-service training for teachers; and providing guidance for its implementation. The Framework argues that teachers need to use teaching methods that are appropriate for evolving knowledge societies. Students need to be enabled not only to acquire an in-depth knowledge of their school subjects, but also to understand how they themselves can generate new knowledge, using ICT as a tool. The teacher competencies and associated professional development modules relate to six areas of teachers' work: 1) understanding ICT in education; 2) curriculum and assessment; 3) pedagogy; 4) use of ICT; 5) organisation and administration; and 6) professional learning.

Twenty-First Century Learning Design is a professional development programme for teachers and schools that encourages the creation of innovative pedagogies to prepare students with skills for the contemporary world. The programme is sponsored globally by Microsoft Partners in Learning, and builds on the findings of the Innovative Teaching and Learning (ITL) study. Its purpose is: to inspire teachers and school officials to analyse and "code" learning activities to determine how deeply they integrate 21st century skills; to collaborate in designing new learning activities that provide greater development of those skills; to examine the impact of these learning activities on student work; and to use ICT as part of the overall process. Its goal is to provide teachers with practical guidance on how they may incorporate ICT into their own teaching.

One country that has taken a holistic approach to upgrading the digital skills of its teachers is Ireland, where a government agency, PDST Technology in Education, has developed a range of ICT-related support services for schools. PDST emphasises a whole-school approach involving the principal, an ICT co-ordinator at the school, an e-learning team to provide informal support to teachers, the teachers themselves, and other stakeholders, such as parents.

The four-step PDST approach begins with a review and the prioritisation of aims:

1. The school answers questions including: Where does the school stand at present in relation to ICT?; Where would it like to go?; and, What does it need to do to get there?
2. The development of an action plan.
3. Implementation and monitoring, including professional development for teachers.
4. Evaluation.

For each of the steps, PDST provides services and support – online, through printed materials, and face-to-face. Online courses for teachers have the advantage of being scalable. They also employ the same tools during teacher training that teachers will use in the classroom.

Sources: ITL Research (2011), *Innovative Teaching and Learning Research, 2011 Findings and Implications*; UNESCO, (2011), *UNESCO ICT Competency Framework for Teachers;* PDST (2015), "The e-learning roadmap" (accessed April 2015).

Recommendations

The review team recommends that Thailand:

- **Define the ICT competencies teachers need and provide relevant high-quality teacher preparation and professional development based on these competencies.**

Thailand should assess the current ways teachers are trained to use ICT use to determine how they could stimulate increased familiarity with ICT and increased use. This could be done by emphasising how teachers can integrate ICT into pedagogy in ways that support the learning goals set out in the basic education curriculum. The UNESCO ICT Competency Framework for Teachers provides good advice on how to design such training. ICT-enabled distance training might be a good way to ensure that teachers in rural areas also have the opportunity to participate, providing this does not replace collaborative practices within the school. In addition, teachers' reflective practices, such as action research and lesson study have huge potential, especially if shared through an online community.

This work would be informed by a thorough review of the basic education curriculum, as recommended in Chapter 3, as well as efforts to amend Thailand's teacher standards, as recommended in Chapter 5. It also aligns with the recommendations in Chapter 5 that Thailand strengthen the accreditation process for pre-service programmes to ensure they cover content in essential areas, like the basic education curriculum and the use of ICT, and establish a nationwide strategy for professional development to support the country's education reform.

- **Invest in equipment, Internet access and on-line services to support teachers' use of ICT as a pedagogical tool.**

Provision should be made for pedagogical guidance and support, online and offline, to assist teachers in their daily work. Building on the work of OBEC and the IPST to develop digital learning resources, Thailand should provide national online pedagogic services. These should include access to subject-specific online communities that 1) exchange ideas and experiences; 2) offer digital learning materials; 3) provide handbooks and guidelines for teachers wanting to learn how to use social media sites; and, 4) make suggestions for incorporating student-owned mobile phones into their teaching (UNESCO, 2012b).

Policy Issue 4: Thailand lacks adequate capacity to monitor and assess ICT use in schools

A solid evidence base is essential for informed, effective and timely policy development (Davies, 2000). In contrast, opinion-based policy relies

on the selective use of evidence (such as the results of a single survey, irrespective of quality), or on the untested views of individuals or groups. There is wide consensus on the need for effective mechanisms to gather information on the inputs, outputs and outcomes of different policy areas. At present, Thailand has limited evidence about ICT use in its education system to support the development of policies in this area.

The importance of evidence-based policy development

In order to make evidence-based policy decisions about ICT in education, Thailand needs mechanisms in place to collect reliable data. The World Bank and the UNESCO Institute for Statistics (UIS) have developed an Education Data Quality Assessment Framework (Ed-DQAF) to help countries ensure that their data-gathering practices and statistical analysis techniques are methodologically sound, their data sources are accurate and their data are timely and consistent (UIS, 2014b). Key indicators should include the conditions for using ICT (e.g. regional or grade-level differences in the number of students and teachers per computer); the age and quality of the equipment; the availability of digital learning materials; classroom Internet access and speed; teachers' competence in using ICT for teaching and learning; access to ICT competency development for teachers; technological and pedagogical support for teachers and students; and attitudes toward the use of ICT for teaching and learning. Data should take into account not just inputs, but also outputs and outcomes. Output data might include the number of hours per week a student uses ICT in school, broken down by age and subject area; the number of hours per week teachers use ICT to prepare and present their classes; or a list of typical tasks students perform using ICT. Outcome data might be statistics assessing student confidence in using ICT, skills acquired and learning outcomes.

It is also important to understand the results of previous investments and expenditures of resources. Baseline information is essential to measure the effectiveness of programmes. Indicators for target outputs and outcomes must also be clear. One might ask questions such as:

- What are the outcomes of past initiatives to improve teachers' ICT competency or provide digital learning resources?
- If prior investments in hardware, software or competency training were not as successful as expected, why was this the case and what can be done to improve future outcomes?

Questions of this kind require in-depth evaluations built on statistical evidence. Gap analyses can be conducted to determine where additional resources should be spent in order to achieve the greatest impact. In

Thailand, data gathering, evaluation and analysis are not happening on a regular basis to inform the development of policies related to the use of ICT in education.

The limited knowledge base about ICT use in Thailand

In the past, Thailand has gathered, analysed and disseminated information on the status of ICT in its education system. The Ministry of Education's Information and Communication Master Plan for Education, 2011–2013, outlines four groups of key ICT indicators to be used to monitor implementation of the plan over time:

- the number of personnel receiving ICT professional training, and statistics on teachers with access to technology at the school level for learning, e-mail, etc.
- growth of ICT infrastructure and Internet accessibility for schools
- school practices that integrate ICT in teaching
- statistics on ICT use for administrative purposes by schools (OEC, 2014).

The only official statistics regarding ICT use in Thai schools made available for this review appear in a summary of the 2011-2013 Master Plan, and relate mainly to the situation as it was in 2008. They consist of a mixture of input and output data, such as ratios of students and teachers per computer, the percentage of teachers who use their own computer, and average hours per week that teachers or lecturers use computers to support their teaching, broken down by education level (basic education, vocational education, higher education and non-formal education). The figures are not disaggregated by region, which is a problem given the disparities between large urban and small rural schools in Thailand. No chronological data showing development over time seems to be available, nor are there comparable statistics for the period after 2008. The educational data collected annually in Thailand are reportedly unsuitable for comparative purposes because the format and methods for data collection frequently change. There is no system for rechecking and developing data quality, nor is there any means to use the collected data to inform the administration of the education system (OEC, 2015). This lack of readily available data suggests a major challenge for the Thai government.

Thailand has a good record of participating in comparative international studies assessing the use of ICT in education, which can be of real help to policy makers (SEAMEO, 2010). For example, the ICT in Education in Asia study (UIS, 2014a) provides information on areas such as policies to integrate ICT in education, ICT in the national curricula, infrastructure to

support the integration of ICT in educational institutions, participation in ICT-assisted instruction, teacher preparedness, and education outcomes. This type of study could be of great use, but all the data on Thailand's practices, except information on ICT in relation to the curriculum, relied on estimates by the government or by UIS rather than solid statistics, and it is difficult to determine their accuracy and reliability.

The ICILS 2013 study also presents an important source of information. Although built on a sample of only 200 to 250 schools in Thailand, it gives a broad range of data on access, utilisation and attitudes regarding ICT use in education. But unless Thailand plans to participate in the next ICILS study scheduled for 2018, there will be no chronological data or comparative information to inform the country's policies and practices. The PISA study (OECD, 2013) also provides useful data on ICT use in Thai schools in comparison to other countries but international data cannot be a substitute for solid national data. A number of countries have developed national data-gathering mechanisms to ensure their ICT in education policies, and broader education reform efforts, are rooted in evidence (Box 6.8). Their practices could inform Thailand's work in this area.

Box 6.8. Promising cases: Systematic monitoring systems

Schools in the Netherlands are served by two public (semi-governmental) organisations. One is called Kennisnet ("knowledge net") and the other Schoolinfo. Taken together, the monitoring of ICT use by Kennisnet and Schoolinfo provide school administrators, parents and policy makers with the information needed to make informed decisions on how to further improve the Dutch school system.

Kennisnet's mission is to ensure that educational institutions avail themselves of the opportunities offered by ICT. The organisation monitors how Dutch schools develop in four areas essential to effective ICT use in education. This model is based on studies showing that investments in infrastructure did not lead Dutch teachers to alter their teaching practices or use ICT tools to impact student learning. The four areas are:

- **vision**: the school's objectives; the role of the teachers, pupils, and administration; the content to be taught; and the ethos of the school
- **expertise**: technical skills, and the ability to combine them with pedagogical techniques in order to present subject matter effectively
- **digital learning materials**: all digital educational content that is used in the school
- **ICT infrastructure**: the availability and quality of computers, networks and Internet connections.

Box 6.8. Promising cases: Systematic monitoring systems *(cont.)*

The four basic elements apply equally to a single school or the whole country. Schoolinfo helps individual schools make the best use of their resources in a transparent and accountable way by providing an online system for gathering and sharing information. The data assembled include the number of students, exam results, the use of ICT, student and parent satisfaction, characteristics of teaching teams, schools' financial situation, partnerships and school plans. Its guiding principle is to use existing data wherever possible in order to eliminate repetitive surveys of schools (thus reducing workload). The system is currently used in 88% of primary schools and 95% of secondary schools in the Netherlands.

In Norway, the Centre for ICT in Education has developed a longitudinal study called *Monitor* that annually charts the digital skills of students in Grade 7 and 9, and in upper secondary level 2. It covers attitudes toward ICT, use of ICT, selection and development of teaching strategies, and learning outcomes. The study highlights links between the use of digital tools and learning outcomes for students. It also provides additional information to teachers, schools, local governments, guardians and authorities regarding the use of ICT and digital teaching resources in schools.

Source: ten Brummelhuis and van Amerongen (2010) *Four in Balance Monitor 2010: ICT at Dutch Schools*; Norwegian Centre for ICT in Education, (2010), *Information and Communication Technology (ICT) in Norwegian Education.*

Recommendations

The review team recommends that Thailand:

- **Puts in place a centralised system for periodic (annual or biannual) collection and publication of statistics, fed by school-level data regarding infrastructure, equipment, training and use of ICT.**

Ideally this would involve a central database system, such as the one employed in Norway, so that schools do not have to correspond with various ministries or national agencies separately. The system should be available for relevant ministries and government agencies to use for planning and policy-making purposes. Data should reflect not only resources put into schools, but also outputs and ultimately outcomes.

The statistics should provide an overview of the situation in specific regions of the country. Special attention should be paid to the size of the schools, since there are indications that smaller schools have less Internet

access. Special attention should also be paid to geographical differences, taking into account the risks of a digital divide between rural and urban areas. In order for Thailand to measure and monitor progress, the statistics should be comparable over time. The quality of the data should be ensured, for example, by using the World Bank / UIS Education Data Quality Assessment Framework, and it must be accessible to both government agencies and the general public. There should be an agreement between the Ministry of Education and its main and subordinate offices (OBEC, OVEC, OHEC, OEC and the Office of Permanent Secretary) on what data to collect and on the definitions of concepts employed. This would facilitate the use of data and co-operation between agencies.

- **Complement the gathering of statistics with evaluations (qualitative data) and continued participation in international surveys to enable a deeper understanding of the issues at hand and a comparative perspective on how Thailand is progressing.**

The Ministry of Education should organise evaluations of policies and programmes to support the use of ICT in education and use them to inform evidence-based policy making. They should be conducted by individuals – whether within or outside the government – with qualitative research expertise. Although not essential, there is an argument for procuring the services of external researchers such as university faculty or private research organisations to ensure evaluations are impartial. International organisations such as UNESCO can provide relevant ICT in Education indicators and the required capacity building to ensure that they are used to inform policy-making and practice. Efforts should be made to develop broad research strategies, encompassing the evaluation of different policies and programmes, to align efforts and ensure schools are not overburdened by the demands of the research.

At the same time, Thailand should continue its commendable participation in international comparative studies regarding the use of ICT in education. These studies can yield important information about the country's own practices, as well as international practices Thailand could explore and adapt. To make the most out of these studies, it should make every effort to provide reliable and timely data to the study organisers to ensure the results present an accurate picture of the practices that are being implemented in the country.

These recommendations align with the advice in Chapter 1 that Thailand work to increase its capacity for evidence-informed policy development.

Policy Issue 5: Thailand lacks a coherent framework for its significant investments in ICT

Successful policies are coherent, meaning that they are aligned to support the attainment of shared objectives. Insufficient coherence can lead to inefficient use of resources, as well as conflicts among stakeholders over goals. Thailand has made significant investments in hardware, infrastructure, software and "people-ware" in the past, but these have been based on a series of fragmented strategies and initiatives. Thailand needs a coherent national strategy for ICT in education that will improve students' competencies and prepare them for today's society and labour market. This strategy could be articulated within a broader long-term vision for education in Thailand, as described in Chapter 1.

Why coherence is important for ICT policies in education

Policy coherence encompasses a number of aspects, including systemic coherence, chronological coherence, vertical coherence and cross-organisational coherence.

- Systemic coherence means co-ordinating the actions of various parties. If different parties spend time and resources on activities which pull in different directions, this can lessen the impact of their efforts. Systemic coherence may be compromised, for example, if a country allocates significant resources to in-service training for teachers but not to infrastructure or learning materials. In such a case, skilled teachers may be unable to use their knowledge to its full potential.
- Another aspect of coherence is chronology. For example, large investments in hardware and infrastructure, but not in teacher training, may leave the equipment underutilised or standing idle while once teachers do receive training, the equipment may have deteriorated or become obsolete.
- Vertical coherence refers to the alignment of stakeholder initiatives at different levels. For example, if schools wish to allow students to use their smart phones in class, but the Ministry of Education has prohibited this, policies lack vertical coherence.
- Finally, cross-organisational coherence refers to the need for a common vision and strategy across organisations, as in the case of public-private partnerships.

Current technology policies in education

Thailand is committed to modernising its education system, which will involve further integrating ICT into pedagogy, ensuring Thai students acquire the ICT competencies they need, and using ICT to support educational administration. In 2015, the Ministry of Education proposed five general and seven specific policies to further the country's education reform efforts. These included policies related to ICT, including the expansion of the Smart Classroom programme, which would equip schools with Internet access and laptops or desk computers, and the use of ICT for efficient resource-management and data gathering (Ministry of Education, 2015). Such policies need to be aligned with a new coherent strategy for ICT in education.

In developing this strategy, Thailand should learn the lessons of previous initiatives. It should examine in detail, for instance, the impact of the policies and programmes in the Information and Communication Master Plan for Education, 2011–2013 as well as the One Tablet Per Child initiative. These were intended to provide a pathway toward continuous development in the area of ICT in education but their implementation seems to have been unbalanced, with too great a focus on investments in hardware and digital learning materials to be used offline and lower priority given to essential elements, such as Internet access in classrooms and professional learning for teachers. Inefficiencies have been apparent in multiple areas: networks, hardware, software and people-ware (OEC, 2015). Thailand has also lacked a long-term, integrated approach across government agencies. As a result, schools have not been able to make full use of their ICT resources, diminishing the effectiveness of teaching and learning.

Thailand would benefit from ensuring that its strategy emphasises continuity with previous strategies and programmes and, as recommended above, makes use of solid data on infrastructure (networks and hardware), digital learning materials and competencies as well as findings from international research on effective ICT programmes in other countries. Change will take time and often requires longitudinal studies in order to detect differences in student performance due to the intervention of technology. Research suggests it takes at least three years, and up to five or eight years, for stable results to be apparent (Owen et al., 2005; Silvernail and Gritter, 2007).

Recommendation

The review team recommends that Thailand:

- **Develop a coherent national strategy to further integrate ICT into pedagogy, ensure equity of Internet access for Thai students across the country improve students' ICT competencies, and use ICT to support educational administration.**

At a minimum, this strategy should encompass four elements:

- A vision shared by all stakeholders of how ICT will be used in the Thai basic education system over the course of five years to improve student ICT proficiency and transversal skills.
- An inventory of existing digital learning materials, focusing in particular on subject areas and grade levels that are under-supplied, combined with a schedule and operational plan to address gaps (including through the use of OER).
- A map of teacher competencies and competency gaps, focusing in particular on regional differences and the needs of teachers and administrators in small schools, combined with a timetable and plan of action.
- A description of existing ICT infrastructure (Internet access and digital devices per school) together with a plan on how to reach agreed targets in time. This plan needs to take into consideration the age and condition of existing equipment, and the inventories and connectivity in different regions (especially urban vs. rural areas). Targets should be formulated in terms of number of students and teachers per computer, the number of computers connected to the Internet and the bandwidth capacity per student.

The strategy should have clear annual milestones with regard to digital learning materials, competency development and infrastructure so that progress can be measured every one or two years. The responsibilities of different stakeholders on the national, regional and local levels should be made clear and a strong leadership role should be defined. Adequate financial and human resources should be made available, including funds for the maintenance and replacement of older equipment. Targets, resources, and responsibilities should be co-ordinated. If the annual or biannual follow-up indicates that targets have not been met, the reasons for these shortfalls should be the object of thorough discussion, and the targets, resources or responsibilities should be adjusted as required.

This strategy would be informed by a thorough review of the basic education curriculum, as recommended in chapter three of this report, and would be an essential component of a new long-term vision for education in Thailand, as described in Chapter 1.

Conclusions

This chapter has analysed Thailand's use of ICT in education. Over the years, Thailand has made significant investments in hardware, software, people and infrastructure to support the use of ICT in its education system. It has also developed and adopted a basic education curriculum in which ICT is taught as a separate subject and also as a competency across subjects. Despite this, the ICILS 2013 study found that Thai students' proficiency in ICT was low. This chapter has identified a number of reasons for this.

Thailand's schools lack a stable, responsive and countrywide ICT infrastructure, encompassing devices, connectivity and maintenance. Teachers and students require better quality digital learning materials, which are an essential to increasing the use of ICT to improve the quality of education. Teachers need the confidence and capacity to use ICT and digital learning materials effectively; their competencies and attitudes with respect to ICT use have a real impact on student performance. Accordingly, investments in teacher education, both pre-service and in-service, are vital. Mechanisms for gathering, developing and disseminating information are needed to continually strengthen the development of evidence-based ICT policies, as well as Thai schools' ability to use ICT to facilitate students learning.

As a priority, Thailand should create a coherent national strategy to enhance the use of ICT in education. This strategy should be informed by a review of the country's basic education curriculum and it should form part of a broader long-term vision for education in Thailand (see Chapters 1 and 3). The strategy should focus first on the essential role of the teacher by identifying the ICT competencies teachers need and developing relevant and effective professional development to address them. It should emphasise how teachers can integrate ICT into pedagogy in ways that support the learning goals set out in a new basic education curriculum. This work would form part of a holistic plan to build the capacities of teachers and school principals to drive forward Thailand's education reform (see Chapter 5). Expanding and improving Internet access in all regions of the country would also be particularly important, not only to increase ICT use but also improve equity across the education system.

Notes

1. An independent assessment of the OTPC programme by Chulalongkorn University has not been made publicly available (Intellectual Repository: http://cuir.car.chula.ac.th/handle/123456789/43482).
2. These repositories can be found at http://www.eun.org/teaching/resources (Schoolnet), http://materialeplatform.emu.dk/materialer/index.jsp (Materialplatformen), www.khanacademy.org/ (Khan Academy) and www.ck12.org (CK-12 Foundation).
3. E-mail from Mr Srinutanpong, Director, Public Sector Programme, Microsoft Thailand.
4. Partners in Learning, Thailand Infographic. E-mail from Mr Srinutanpong, Director, Public Sector Programme, Microsoft Thailand.
5. E-mail from Ms Langkhapin, Education Manager, Intel Thailand.

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