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Digital citizenship in Asia-Pacific

Translating competencies for teacher innovation and student resilience

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SHORT SUMMARY

Empowering teachers, shaping digital citizens

A digitally-equipped and competent teaching force is crucial for cultivating students' digital citizenship skills. This UNESCO report, consisting of a comprehensive analysis comprising 15 countries in the Asia-Pacific region, unveils compelling evidence pertaining to what factors influence teachers' Information and Communication Technology (ICT) skills and their impact on students' digital citizenship competencies. Perhaps unsurprisingly, the findings of this report show that students are developing most of their digital citizenship competencies through self-directed learning and outside of school. Nevertheless, teachers still play an important role, particularly in coaching students to use technology safely and effectively. Thus as UNESCO reports, Digital Creativity and Innovation remains relatively underdeveloped in all participating research countries. Additionally, female students tend to benefit more from teachers' guidance and advice, especially in terms of Digital Safety and Resilience.

Support for teachers in terms of access to ICT infrastructure and training on ICT and pedagogical skills will contribute towards improving their ability to effectively guide and mentor their students, ultimately leading to better outcomes in terms of digital citizenship competencies. To achieve this, it is important for education systems to develop comprehensive and contextualized approaches to enhance digital citizenship capacities in teachers. Education policymakers and leaders are encouraged to use the 10 recommendations herein as a 'roadmap' to ensure that teachers are equipped with the necessary skills and knowledge to effectively integrate digital citizenship education into their teaching practices. This will ultimately help prepare students for the digital world and ensure their safety and well-being online.

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Digital citizenship in Asia-Pacific

Translating competencies for teacher innovation and student resilience

Foreword

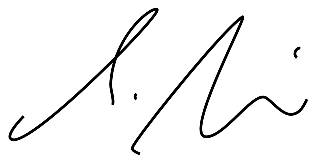
The UNESCO report *Digital Citizenship in Asia-Pacific: Translating Competencies for Teacher Innovation and Student Resilience* arrives at a critical moment, indeed as we navigate the urgent challenges and implicit opportunities brought on global society by the growth of digital technologies in education, the global shift to digital learning throughout and following the COVID-19 pandemic, and the disruptive impact of artificial intelligence (AI) that is forcing us to rethink how we teach and learn. As we move towards a more digitalized world, it is important to ensure that we use the latest 'tech' to enhance and not replace human interaction, all the while we uphold our humanitarian values in all our interactions, such as respect, empathy, and accountability. Developing our digital citizenship skills is crucial in this regard. It enables individuals to use technology more effectively, responsibly and ethically while also promoting positive online behaviour and harmonious interactions. These skills are not only important for individuals in their private lives and careers, but also for building a peaceful society and a sustainable and equitable future for everyone.

It is therefore my pleasure to introduce *Digital Citizenship in Asia-Pacific* as a truly milestone publication, one that derives from a comprehensive, five-year project to foster digital citizenship throughout the Asia-Pacific region. This publication aims to provide insights into what constitute 'requisite competencies' if teachers and students are to become responsible digital citizens, and it offers guidance on how to integrate these competencies into educational policies and practices. The analyses provide an in-depth examination of two major bodies of work by UNESCO, which have jointly engaged with 15 countries in the region: one focuses on students' digital citizenship competencies in the Asia-Pacific context; the other on developing systematic approaches towards building teachers' competencies for teaching with ICT.

The findings highlight the contextual and complex nature of the teacher-student relationship in terms of supporting digital citizenship competencies. The data suggests that most of students' development of digital citizenship competencies today is happening through self-directed learning. Teachers nonetheless remain key enablers of this learning, but their agency must be reinforced through customized approaches that take into close consideration the unique cultural and social contexts of each country. Consequently, the findings of this report have important implications for policymakers and educators in both the Asia-Pacific region and beyond.

Ten recommendations have been developed out of this report's findings to provide guidance in how governments, teachers, communities, families and youth can take shared responsibility for promoting digital citizenship education. The recommendations include the need for comprehensive digital citizenship education programmes, teacher training and support, parental involvement, and collaboration between schools and communities. Whether adopted individually or in their entirety, these recommendations can support all education stakeholders at more effectively equipping youth with the skills and knowledge they need to navigate the digital world safely and responsibly.

It is my hope that this UNESCO publication will serve as a valuable tool for policymakers, educators, and researchers to support their efforts in promoting digital citizenship education, and in their empowering students to become responsible and ethical digital citizens. May this publication inspire collective action and serve as a catalyst for meaningful change, paving the way towards a future where technology empowers us to learn, grow, and thrive together.



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Acronyms

AI	Artificial intelligence
DKAP	Digital Kids Asia-Pacific
ICT	Information and Communication Technology
ICT-CST	Information and Communication Technology Competency Standards for Teachers
ICT-CFT	Information and Communication Technology Competency Framework for Teachers
ITU	International Telecommunications Union
OECD	The Organisation for Economic Co-operation and Development
UNICEF	The United Nations Children's Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization

Executive summary

The growing influence of information and communication technologies (ICT) on people's daily lives has fundamentally altered how young people participate in society. A large part of their lives is mediated by digital technology, which provides them with new and different ways to participate in civic society and exercise their agency as digital citizens. This was further accelerated with the increased use of digital technologies in education during the COVID-19 pandemic, as governments implemented remote and online learning modalities in response to school closures. While this rapid shift introduced hundreds of millions of students from around the world to blended and digital learning, this has also heightened the need for students to draw upon a range of digital literacy and citizenship skills to be safe, effective, and responsible in the use of these technologies and to successfully participate in digital learning.

UNESCO defines digital citizenship as 'being able to find, access, use and create information effectively; engage with other users and with content in an active, critical, sensitive, and ethical manner; and navigate the online and ICT environment safely and responsibly, being aware of one's own rights' (2018). It includes five key digital citizenship domains: Digital Literacy, Digital Safety and Resilience, Digital Participation and Agency, Digital Emotional Intelligence, and Digital Creativity and Innovation.

In recognition of the importance of such digital citizenship capabilities and needs of Member States in the Asia-Pacific region, UNESCO has been implementing the 'Enhancing National Capacity to Foster Digital Citizenship in Asia-Pacific' project to support the development of evidence-based policies for fostering children's digital citizenship and promoting safe, effective, and responsible ICT use. Building from the emerging data and insights of the project, this report sought to better understand the linkages between teacher and student digital citizenship competencies, and how Member States can support teachers to effectively promote students' acquisition of digital citizenship values and skills. This report's specific objectives are therefore to:

1. Provide a contemporary synthesis of the status of digital citizenship in the Asia-Pacific region, with a particular focus on COVID-19's impact on technology use in education and the digital citizenship capacities of students and teachers to manage learning during the pandemic.
2. Analyse and compare Member States' Information and Communication Technology Competency Standards for Teachers (ICT-CST), including digital citizenship components, digital citizenship frameworks and curricula for teachers, alongside other national resources, against the Digital Kids Asia-Pacific Framework for Education.
3. Examine and compare students' digital citizenship data from Digital Kids AsiaPacific and the emerging data and insights on teachers' and students' digital citizenship from the analysis for this report.
4. Provide a systematic review of the policy and regulatory environments in each research country to reveal the current approaches undertaken by different Member States and to better understand the potential impacts of differing policy and regulatory approaches on digital citizenship development.

A three-stage research methodology was employed, including:

1. A desktop review to reveal contextual factors influencing the development and importance of digital citizenship, particularly given the rapid, global changes due to the COVID-19 pandemic.
2. A quantitative analysis of student and teacher data from the DKAP and the teacher and school readiness surveys.
3. A qualitative analysis of policies and practices associated with developing digital citizenship competencies in both students and teachers from Member States across the Asia-Pacific region.

A synthesis of the findings from the three analyses conducted in this report resulted in the following ten observations about the relationship between teachers and students in the context of digital citizenship competencies:

1. Students who learn how to use computers and the internet through self-taught methods scored higher on digital citizenship competencies in contrast to students who learned through curricular programmes and formal learning opportunities.
2. There is more variation in all DKAP domains for students within schools than between schools.
3. Female students benefit slightly more than their male counterparts from teachers' guidance and advice, particularly concerning Digital Safety and Resilience, and, after controlling for all other factors, females tend to have higher levels of safety and resilience. However, female students who taught themselves about computers and the internet and were not taught or advised by their teachers about using the internet securely, scored lower than male students in the same situation.
4. The relationship between teacher behaviours and the development of students' digital citizenship skills is highly contextualised and complex and requires the adoption of new methodological approaches to reveal more detailed findings.
5. Teacher readiness is influenced by five key factors: teacher attitude, access to infrastructure, age, competency level, and geographic context.
6. The richness of the policy framework and frequency of ICT-CST that correspond to DKAP domains in Member States appear to have an impact on students' digital citizenship skills development.
7. Member States have taken broad and different approaches when developing strategies for developing digital citizenship capacities in their teachers. This includes a homogenized approach for all teachers, irrespective of experience, a differentiated approach for in-service teachers, and, in one Member State, a differentiated approach for in- and pre-service teachers.
8. Policy provisions for Digital Creativity and Innovation are relatively underdeveloped in all countries, except for the Philippines. The notion of lower-order digital citizenship competencies that are easier to attain than more challenging, higher-order digital citizenship competencies is reflected in the hierarchical nature of ICT-CST implementation in various Member States.

Recommendations

There are ten recommendations presented regarding how to support and enhance four key factors in digital citizenship development across the Asia-Pacific region and beyond. They were informed by a commitment to knowledge creation for more sustainable futures, and an emphasis was made on more holistic, participatory approaches to developing digital citizenship aligned with a 'learning society' paradigm, where economic and social development goals can coexist.

Contextual factor	Target audience	Recommendation(s)
Policy	Policy leaders with budget responsibilities at central and local levels.	1. Implement sustained efforts to strengthen digital citizenship competencies, with particular focus on digital creativity and innovation. 2. Strengthen hybrid (blended offerings of online and face-to-face teaching and learning) and out-of-school access initiatives to remove obstacles to using computer and internet technologies for learning. 3. Adopt a holistic approach to providing equitable ICT connectivity and devices by starting at the community level, rather than focusing solely on the school level.
Teacher development	National policy-makers with budget responsibility and cross-national advisory bodies (e.g. UNESCO), as well as agencies responsible for designing and delivering professional learning programmes.	4. Mainstream digital technologies in teacher professional development programmes and build explicit connections between initial teacher education and continuing professional training. 5. Develop digital citizenship competencies for teachers, emphasizing digital creativity and innovation, awareness of global challenges, and pedagogical differences between genders. 6. Develop or enhance ICT Competency Standards and Frameworks for Teachers to include the six aspects of teacher activity and support learning across hybrid (online/offline, in-school/out-of-school) and blended spaces.
Curriculum	Policy-makers and external bodies (e.g. quasi-governmental agencies and universities) involved in curriculum development and delivery.	7. Collaborate to develop a regional common curriculum standard and criteria for digital citizenship.
Classroom practice (pedagogy)	Teachers and other stakeholders involved in matters of education provision and practice (e.g. consultants and professional learning providers)	8. Encourage students' self-regulated and peer learning through targeted programmes. 9. Promote deepened cooperation and interactions between teachers and female students of varied abilities and skill sets.
Research	Donor agencies (government and non-government), research institutions, and researchers.	10. Invest in research to better understand how teacher competencies impact relevant student outcomes.

Introduction

Background

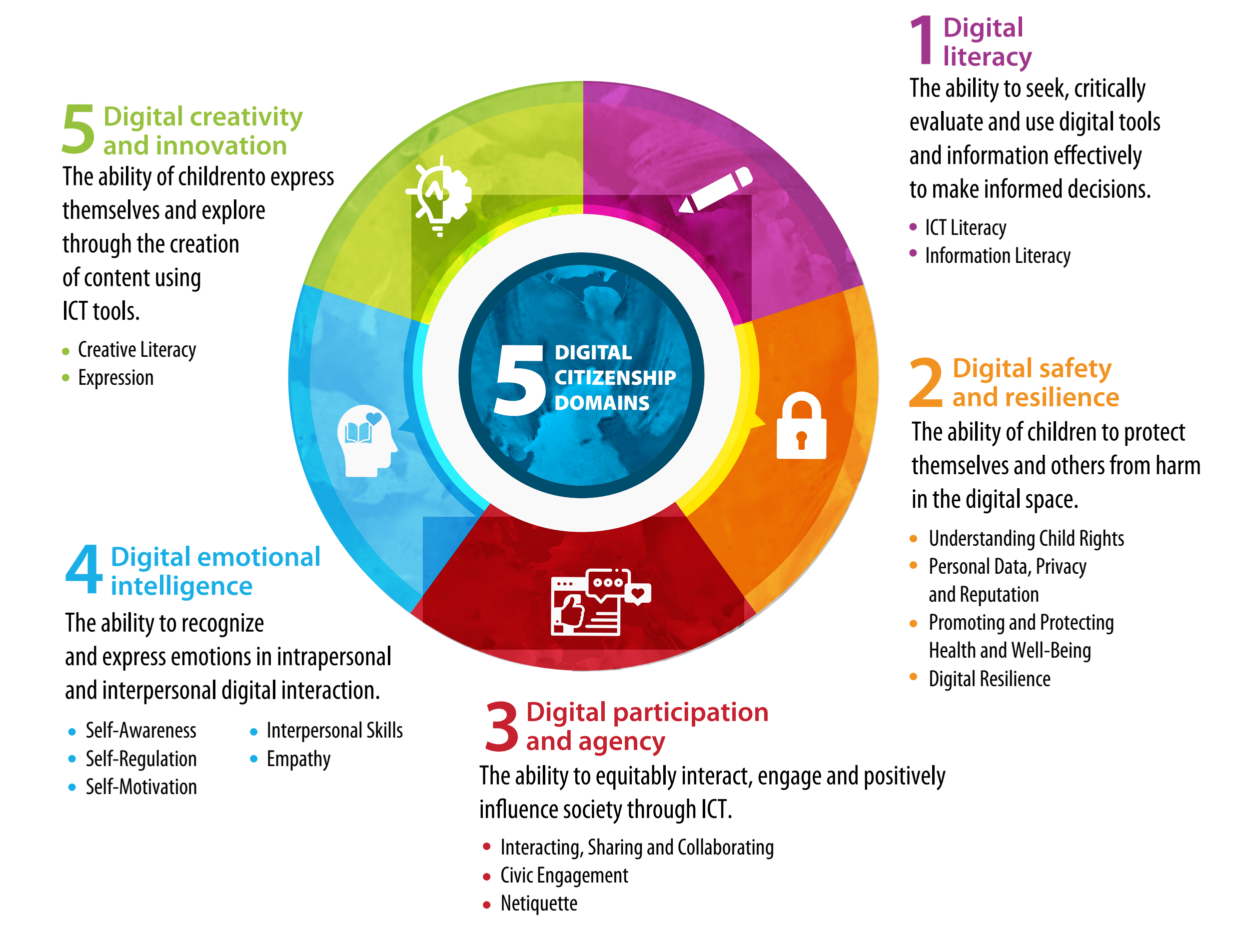
The increasing influence of information and communication technologies (ICT) has impacted the daily lives of communities and fundamentally changed the ways in which people participate in societies. Global estimates in 2018 indicated that one in three children used the internet (UNICEF, 2019) and 69 per cent of 15–24 year olds are connected online (International Telecommunications Union, 2020). This means that young people are increasingly interacting through digital technology, which provides them with ever more new and different opportunities to participate in civic society and to exercise their agency as digital citizens.

Most recently, digital technology use was accelerated in education as governments implemented remote and online learning modalities in response to the disruptions of the COVID-19 pandemic. Using educational technologies to mitigate the impact of sudden school closures, particularly for vulnerable and disadvantaged communities, and to maintain the continuity of education for all students was a hallmark of education system responses around the world. At the same time, the COVID-19 disruptions inadvertently heightened the need for students to draw upon a range of digital skills and capacities to successfully participate in education through remote and digital learning.

In relation to these trends, digital citizenship has become increasingly recognized around the world (see, for example, UNICEF, 2019). It brought the attention of governments, education leaders, teachers, and students to notions of digital citizenship together with other relevant concepts of digital literacy and digital rights.

> Digital citizenship is defined by UNESCO as:
>
> Being able to find, access, use and create information effectively; engage with other users and with content in an active, critical, sensitive, and ethical manner; and navigate the online and ICT environment safely and responsibly, being aware of one's own rights.
>
> (UNESCO, 2018)

Figure 1: Digital Kids Asia-Pacific Framework for Education



Source: UNESCO Bangkok

A Regional Project to Enhance Digital Citizenship Education in Asia-Pacific

Since 2017, UNESCO has been supporting Member States in developing evidence-based digital citizenship policies and capabilities for teachers and students to promote safe, effective, and responsible ICT use. The 'Enhancing National Capacity to Foster Digital Citizenship Education in Asia-Pacific' project, supported by the Korean Funds-in-Trust, builds the national capacity of Member States to make informed policy decisions for fostering digital citizenship in education, with special emphasis on teacher training and development. The project consists of two key components:

Component 1: Digital Kids Asia-Pacific (DKAP)

The Digital Kids Asia-Pacific (DKAP) project component aims to assist Member States in developing evidence-based policies for fostering children's digital citizenship and promoting their safe, effective, and responsible ICT use. Noting the lack of a regionally contextualized framework as well as the lack of an evidence-base for the Asia-Pacific region, the project developed and implemented research to understand students' attitudes, behaviours, and usage of ICT in educational settings. The research toolkit comprises the DKAP Framework for Education (DKAP Framework), which outlines five domains and sixteen competencies (UNESCO, 2019a) as shown in Figure 1. Aligned with the DKAP Framework, a validated research instrument was developed for education stakeholders to inform evidence-based national policies, interventions, and public information and awareness campaigns. To date, the DKAP research has been conducted among 12,471 students across nine countries in the Asia-Pacific for a regional dataset of children's digital citizenship competencies.

Component 2: Reform for competency-based teacher ICT education and training

Recognizing the important role of teachers in developing students' digital citizenship skills, UNESCO has supported six countries in implementing competency-based teacher education reforms to facilitate ICT-pedagogy integration. The main intervention focused on developing ICT Competency Standards for Teachers (ICT-CST) and related resources, which provide a comprehensive roadmap for promoting competency-based teacher ICT education programmes. This includes conducting situational analyses and ICT Teacher Readiness surveys, developing an ICT-CST contextualized for the country, integrating the developed ICT-CST into national teacher education/training curricula, and developing assessment and implementation guidelines.

Objectives

Leveraging the data and synergies between the two components above, this report seeks to strengthen the understanding of the linkages between the development of teachers' and students' digital citizenship competencies in the Asia-Pacific region.

This report's specific objectives are therefore to:

- Provide a contemporary synthesis of the status of digital citizenship in the Asia-Pacific region, with a particular focus on COVID-19's impact on technology use in education and the digital citizenship capacities of students and teachers to manage learning during the pandemic.
- Analyse and compare Member States' ICT-CSTs, including digital citizenship components, frameworks, and curricula for teachers, alongside other national resources, against the DKAP Digital Citizenship Framework.
- Examine and compare students' digital citizenship data from Digital Kids AsiaPacific and the emerging data and insights on teachers' and students' digital citizenship from the analysis arising for this report.
- Provide a systematic review of the policy and regulatory environments in each participant country to reveal the current approaches undertaken by different Member States and to better understand the potential impacts of different policy and regulatory approaches on digital citizenship development.

Methodology

A three-stage research methodology was employed for this project. It included:

1. A desktop review to reveal contextual factors influencing the development and importance of digital citizenship, particularly given the rapid global changes due to the COVID-19 pandemic.

2. A quantitative analysis of student and teacher data from the DKAP and the teacher and school readiness surveys.
3. A qualitative analysis of the policies and practices associated with developing digital citizenship competencies in both students and teachers from Member States across the Asia-Pacific region.

Structure of the report

The research in this report comprises the three different methodologies described above separately outlined within an individual chapter, as well as an overall analysis and a set of recommendations. The report's structure is as follows:

- Chapter 1: A desktop review of the development and state of digital citizenship.
- Chapter 2: A quantitative analysis of student and teacher digital competencies.
- Chapter 3: A qualitative analysis of digital citizenship-related policies and practices.
- Chapter 4: A synthesis and analysis of the findings from the preceding three chapters.
- Chapter 5: Recommendations for informing education policy, for student and teacher digital citizenship development, and for research across the Asia-Pacific region and beyond.

Chapter 1

Factors influencing digital citizenship development in the Asia-Pacific region

This chapter aims to provide an overview of the status of digital citizenship in the Asia-Pacific region, with a particular focus on COVID-19's impact on technology use in education and the digital capacities of students and teachers to manage learning in response. This desktop review analysed published reports from international organizations along with existing academic literature against four a priori themes:

- Importance of digital citizenship and the link with lifelong learning.
- Status of digital citizenship in education in the Asia-Pacific region.
- COVID-19's impact on technology use in education and the digital citizenship capacities of students and teachers to manage learning during the pandemic.
- Different perspectives and responses to digital citizenship education.

These themes were considered from a historical perspective and, importantly, through the pandemic and its impact on technology use in education and the changing nature of digital citizenship skills.

The importance of digital citizenship in a changing world

Citizens from countries around the world have become ever more reliant on digital technologies for their everyday lives (Isin and Ruppert, 2015). This increasing digitization has impacted work practices (Chandwani, et al., 2021), interactions with government institutions (Dunleavy et al., 2006; Henman 2010), and education (Ross, 2020). As a result of the exponential growth of digital technologies, education policy-makers and stakeholders have become increasingly interested in and concerned with the notion of digital citizenship. Meanwhile, researchers have identified its importance in three education-related purposes:

1. Conveying country-specific civic values and norms

   Citizenship education has provided a way for nation states to instil national, political, cultural, and religious values and norms in their citizens (Abowitz and Harnish, 2006). This can promote social cohesion and a shared national identity. Within the digital context, this can include educating citizens on safe and responsible use of digital technologies, digital rights and responsibilities, and digital etiquette.

2. Educating citizens about their rights and responsibilities

   Developing digital citizenship competencies is crucial in today's digital age, as it helps individuals understand and exercise their rights and responsibilities online. This is supported by research, as various studies have emphasized the importance of digital citizenship education in fostering civic engagement, political participation, and access to online news and social media (Boulianne, 2020; UNESCO, 2015; Astuto and Ruck, 2010; Abowitz and Harnish, 2006). With more and more government services and interactions shifting online, it is important that citizens have the skills necessary to navigate and engage with these platforms (Connolly, 2021) to effectively access and use these services.

3. Developing twenty-first century knowledge and skills for work

   Advanced digital skills are considered important for a range of work and entrepreneurship opportunities. It is seen as underpinning the enhancement of economic opportunities and income in various ways. There is a growing emphasis on digital entrepreneurship for empowering otherwise economically marginalized groups (McAdam et al., 2020), while digital skills are essential to thrive in future work contexts that are increasingly shaped by automated systems and artificial intelligence (AI) (Churchill and Cuervo, 2021), alongside the growing uncertainty of employment opportunities (Mok et al., 2021), especially for girls and women (Winarnita et al., 2020).

Taking these perspectives into consideration, digital citizenship education can be broadly framed as important for citizens to develop the competencies needed to exercise their individual and collective rights and responsibilities in an increasingly digital world.

> "Digital citizenship education is important for citizens to develop the competencies needed to exercise their individual and collective rights and responsibilities in an increasingly digital world."

Status of digital citizenship education in the Asia-Pacific region

Before the COVID-19 pandemic, various governments, organizations, and agencies had conceptualized digital citizenship to educate citizens in developing competencies to exercise individual and collective rights and responsibilities in an increasingly digital world. A policy review conducted by UNESCO Bangkok in 2016 reported on the ongoing interest of Asia-Pacific Member States in pursuing digital education projects due to increasing priorities related to ICT integration and innovation (UNESCO Bangkok, 2016). However, it also identified significant differences in policy readiness across Member States in the Asia-Pacific region to support the development of students' digital skills and to support teachers' integration of digital citizenship in their classroom practices.

Building on the policy review findings, a wide range of key organizations, field experts, researchers, private organizations, and other relevant stakeholders were engaged to map and review thirteen digital citizenship frameworks from around the world. The analysis found that, despite common ground between frameworks, contextual differences have resulted in a wide range of focuses that address different aspects of digital citizenship education. In turn, UNESCO, through the DKAP project, developed a digital citizenship framework that considered the strengths and weaknesses of existing approaches and their suitability in the Asia-Pacific context. The resulting Digital Kids Asia-Pacific Framework for Education (DKAP Framework) was developed to guide children's digital citizenship skills development 'by providing a holistic, rights-based and child-centred approach structured across five domains and sixteen competencies' (UNESCO, 2020).

The DKAP Framework distinguishes between inputs, skills, and outcomes; considers broad contextual factors, including parents, schools, ICT systems, and peers; highlights safety as a critical, individual competency; and considers the intersection between online and offline activities and the way young people navigate between the two spaces. Importantly, and in contrast to many other digital citizenship frameworks, the DKAP survey instrument that accompanies the DKAP Framework has been shown to be a useful, reliable, and valid instrument to assess all digital citizenship domains (Chaimongkol, 2021).

Impact of COVID-19 on the use of technology in education

The upheaval to daily life caused by the COVID-19 pandemic also caused widespread school closures, forcing governments to look towards technological solutions to continue education delivery. During the first wave of school lockdowns in 2020, it was reported that nearly 1.6 billion students across 192 countries (nearly 85 per cent of the global school population) were unable to attend physical school (UNESCO, 2020). In response, school systems in many high-income and middle-income countries established forms of remote and distance learning that used digital technologies to support learning continuity during lockdown periods. These rapid shifts prompted much enthusiasm among various education stakeholders that a significant tipping point in the evolution of educational technology use had been reached. It was reasoned that governments will now have to seriously consider the prospect of online education taking on a more prominent role as educational systems adjust to the post-pandemic world (Bubb and Jones, 2020).

There are several lessons that can be learned from these ongoing experiences of technology-based education enacted at scale and its relevance to digital citizenship education. Considering the current report, we draw attention to the following four issues arising from recent literature:

1. The continuously changing nature of digital technology adoption by schools, teachers, and students during COVID remote schooling.

The widespread adoption of online learning platforms and learning management systems during the pandemic saw some school systems quickly adding platforms to facilitate virtual classes. These technologies required teachers and students to develop a range of new skills and competencies to adapt – not least for effectively participating in synchronous video classrooms, designing online collaborative activities, and combining synchronous and asynchronous technology (Bond, 2020).

These emergency implementations of educational technology also pushed teachers, students, and parents to quickly develop ways of studying and teaching as best as they could through improvised innovation, with schools and families making use of commonly used social media, content-creation tools, online gaming platforms, and other informal digital technology practices adapted to support remote schooling.

However, there was a lack of readiness, knowledge, and best practices among educators to adequately respond to the shift to online learning. While the forms of remote and digital learning implemented were able to sustain education delivery to a large number of students throughout the pandemic, the OECD (2020) acknowledged that 'there are still concerns that online learning may have been a sub-optimal substitute for face-to-face instruction.' Furthermore, more sophisticated forms of technology-based and technology-related education (including digital citizenship education) had not been prioritized.

This saw a range of informal digital practices being taken up, harnessing the educational value of popular social media platforms, games, and smartphones. Prominent use cases include the rise of platforms such as TikTok as a source of informal learning content, classes being run using WhatsApp and BitMoji, as well as teachers establishing informal online professional learning communities through platforms such as WhatsApp and Twitter (Zaitun et al., 2021). All told, the COVID lockdowns raised the educational profile of social media, apps, and games, reflecting long-standing enthusiasm for school-related uses of personal digital media to support interest-driven learning and online peer communities (Ito et al., 2020; Ubaedillah et al., 2021). This confirms a body of work prior to the pandemic that thoroughly explored how 'connected learning' could be supported by non-institutional platforms and devices and the need to support the safe and effective use of these technologies (UNESCO Bangkok, 2016; Ito et al., 2020).

2. Low capacity of students and teachers to manage distance and online learning during COVID-related remote schooling.

The pandemic exposed significant digital divides across the Asia-Pacific region. In terms of access to digital technology, many education systems in low-income countries relied on low-tech, analogue teaching methods, including radio, television, and paper-based resources, which still were not able to equally reach all learners. Even within high-income countries, significant disparities were highlighted in schools' ICT resourcing and household access to adequate internet connectivity, digital devices, and technical support. As such, the pandemic revealed persistent and long-standing divides and inequalities related to digital learning, especially in terms of socio-economic status, rural/urban communities, and, in some regions, signs of newly emerging gender divides (Bozkurt et al., 2020; Drane et al., 2020; Korlat et al., 2021; Avanesian et al., 2021). Commentators in some countries have highlighted differences in the 'e-readiness' of students and teachers to engage with the 'online load' associated with these forms of digital education (Putri et. al, 2020; Bhaumik and Priyadarshini, 2020).

Rapid surveys conducted during periods of remote schooling raised issues of some students not feeling able to engage effectively with digital learning due to both their own lack of skills and/or the limited digital competencies of their teachers. Tellingly, there was no distinct pattern in how these deficiencies in student and teacher skills were apparent in different contexts and countries. Some studies placed more weight on a lack of student competence and preparedness (Almanthari et al., 2020), while others pointed to the need for greater teacher confidence and competence (Bond, 2020). Regardless of this balance, these skill-related barriers were exacerbated in developing contexts, not least by disparities in basic access to ICT resources and reliable infrastructure among poorer and/or rural communities (Tadesse and Muluye, 2020).

Alongside technical skills and resourcing, the switch to online learning during COVID also drew attention to a range of additional issues impacting the capacity for teachers and students to engage with online education. From the teachers' perspective, remote teaching was acknowledged to be a significant cause of stress for many (MacIntyre et al, 2020), while demanding new pedagogical approaches to manage students' emotional engagement and varied home-learning contexts (Novitasari et al., 2020). Conversely, students were found to be impacted by the increased stresses and anxieties related both to continuous online learning and to the lockdowns and threat of the pandemic (Harjule et al., 2021), although some studies pointed to the role of parents in mediating these stresses and to the lower stress of remote schooling when compared to not being engaged in education at all (Guimond et al., 2021).

3. Lack of systemic support and training for teachers.

Unplanned crises such as the COVID-19 pandemic have resulted in rapid changes to the nature of education and, particularly, to teachers' pedagogical practices. Remote schooling has highlighted the integral role that teachers play in supporting effective online learning (International Commission on the Futures of Education, 2020). At the same time, it also highlighted the lack of support that education systems had provided teachers. The reliance on digital technologies to facilitate teaching and learning exposed a range of challenges faced by teachers to support digital education policies and to effectively integrate their technological, pedagogical, and content knowledge (Lawrence and Harris, 2021).

Researchers have highlighted the need for ongoing teacher professional development to develop and embed skills and capacities underpinning digital citizenship education into their teaching practices (Chong and Pao, 2021; Öztürk, 2021), supporting the long-held understanding that 'the most effective professional development programs, whose goal is to increase teachers' knowledge and skills and improve their teaching practice [include] activities that are ongoing and sustained over time' (Tournaki et al., 2011, p. 300). Milenkova and Lendzhova (2021) highlighted the importance of digital citizenship skills for both teachers and students in rapid moves to online and distance learning suggesting 'digital citizenship contributes to social understanding and control, as well as the individual practices in the global pandemic trajectory' (p.14).

The rapid 'pivot' in education systems has not provided the opportunity to engage in such professional learning, exposing potential weaknesses in both teacher and therefore student online teaching and learning capacities.

Evolving needs for digital citizenship among students and teachers

The challenges amplified by the COVID-19 pandemic have reinforced an understanding that there is an ongoing need to further develop digital citizenship capacities in both students and teachers. There is a continuing shift towards blended and remote schooling around the world that is part of a broader trend in education towards more flexible modes of provision and participation, notably in terms of co-location (e.g. between teacher and student homes), timing (e.g. more emphasis being placed on asynchronous learning), and modality (e.g. allowing students to engage in ways that best suit their digital resource and home circumstances). These changes are therefore associated with several distinct areas of student digital citizenship skills.

It is beginning to be acknowledged that remote schooling has had a pronounced impact on students' social, emotional, and academic well-being (Duckworth et al., 2021). As such, online remote schooling raised the importance of emotional and empathetic aspects of digital citizenship, being an extension of what Ribble (2015) termed **'digital health and wellness'** aspects. This includes the skills required for students to effectively manage and regulate technology use, while avoiding the stresses associated with technology overuse and enforced isolation (Stringer, 2020; Jackman et al., 2021). It also involves skills to engage with the shift from in-person to online mental health tools and support (OECD, 2021; Prihatiningsih et al., 2021). Another important factor is the role played by parents and teachers in supporting students' positive attitudes towards digital learning, notably students' self-regulation and intrinsic motivation to engage in isolated online study for sustained periods of time. This has led to calls for increased teacher training/education and parental support in building these skills in students (OECD, 2020), especially given the lack of direct face-to-face social interaction in comparison to what students are accustomed to when learning with technology in classroom contexts.

The shift to online schooling also broadened the significance of students' **digital communication** skills, especially in terms of the skills required to engage in video classes and collaborate through online platforms and other modes of remote digital interaction that usually do not feature in technology use in face-to-face classrooms. This also raises concerns over the varying capacity of young people to make effective use of digital modes of communication, such as video calls, text messaging, social media, and online games, to maintain social connections with their classmates and peers (Nguyen et al., 2020; Literat, 2021).

Rapid adoption of new software, apps, and platforms has been a cause for concern regarding **digital safety and data privacy**. For example, the Singapore Ministry of Education needed to temporarily suspend use of a particular learning platform due to privacy and safety issues (Baharudin, 2020). Such incidents highlight a shift in the 'safety' aspects of digital citizenship. Here, the onus falls primarily on school authorities and parents – rather than students – to manage the privacy implications of the rapid adoption of online learning tools and what might be the risks of 'innovation under pressure' (Newlands et al., 2020). These issues are complicated by the origins and ownership of these large platforms, many of which are owned by Western-based corporations and developed for business (rather than educational) uses.

The turn to remote schooling also highlighted differences in students' and teachers' **media and information literacy (MIL)**, much of which relate to broader inequalities in digital technology resourcing and support previously mentioned. Students' remote schooling experiences have been undoubtedly shaped by differences in their media and information literacy, such as varying levels of ability to select information sources according to their homes' internet connectivity (Majid et al., 2020). Tellingly, some research found differences in media and information literacy to be most associated with students' social backgrounds, regardless of the school attended. For example, using data from international technology and information literacy surveys from over forty-five countries, (van de Werfhorst et al., 2022) found that students' skills were influenced primarily by their socioeconomic and migration backgrounds, rather than by disparities in their school ICT environments.

The next chapter of this report provides a quantitative analysis of the state of actual ongoing efforts to develop citizens who are equipped with the appropriate knowledge, skills, and attitudes to be active and responsible members of their society. The quantitative and qualitative analysis parts of this report that follow draw on a range of data, much of which was collected before the COVID-19 pandemic. As such, any discussions of report findings need to acknowledge the current context of a region still coping with the possibility of lockdowns and bouts of remote schooling, while looking towards 'post-pandemic' education.

Chapter 2

Quantitative analysis of student and teacher digital competencies

This section of the report aims to reveal what is known about students' digital citizenship in relation to contextual factors, including geography, school type, gender, and levels of digital access and use. It analyses the relationship between teachers' digital skills and students' digital citizenship skill development. Additionally, the analysis also aims to reveal what data tells us about teachers' digital citizenship skill development in terms of five contextual factors, including geography, school type, teacher digital organisation and administration, teacher digital competence, and teacher gender.

Following the former section, this quantitative analysis aims to provide readers with a deeper sense of the approaches to teacher and student digital citizenship development that have led to the current response to the COVID-19 pandemic by different Member States across the Asia-Pacific region.

Methodology

The quantitative analysis explored the roles that teachers played in the development of students' digital citizenship competencies in two ways: first, by examining to what extent these skills vary within and between schools, and second, by exploring how teachers' practices are linked to the development of these skills. The analysis also acknowledged that differences in context can influence digital citizenship skills and hence accounted for them when analysing this relationship between teachers and students.

Statistical tests were conducted to identify differences between independent and non-independent groups, including Kruskal–Wallis, Wilcoxon, and Friedman tests. The analysis also included the estimation of two-level hierarchical models with students nested within schools and fixed effects for each country. More information about the statistical analysis is provided in Annex 1.

Data

The quantitative analysis was conducted on two existing data sources: 1) the survey data from the DKAP project, and 2) the teacher and school readiness survey data from the ICT-CST project. The main components of these datasets are outlined below.

1. DKAP dataset

The DKAP dataset consists of data collected through the DKAP Survey of 12,471 students from 230 schools across nine countries (Bangladesh, Bhutan, Fiji, Indonesia, Lao PDR, the Philippines, Thailand, Viet Nam, and the Republic of Korea) from 2018 to 2020.

The dataset collected information on five digital citizenship competency domains: Digital Literacy, Digital Safety and Resilience, Digital Participation and Agency, Digital Emotional Intelligence, and Digital Creativity and Innovation (see Annex 1). In general, the survey in each country was conducted among 15-year-olds with representation according to urban/rural, private/public, and other relevant factors, according to the DKAP Research Manual. Minor adjustments to the sample size were made according to the country's contexts.

The scales for each domain examined were generated using the items described in the supplemental material (Annex 1), following the DKAP Research Manual recommendations, and suggested in the codebooks for the teacher and school readiness survey data. The items in these scales asked students to self-report the extent to which they agreed/disagreed with a set of statements on a scale of 1 to 5. All self-reporting scales were internally consistent and had adequate reliability scores. Table 1 shows the sample size for each country in the DKAP dataset.

Table 1: DKAP survey data sample size for each country

Country	Number of students
Bangladesh	1,055
Bhutan	2,381
Fiji	1,239
Indonesia	1,257
Lao PDR	1,292
Philippines	1,186
Republic of Korea	1,784
Thailand	1,216
Viet Nam	1,061
Total	**12,471**

2. ICT-CST dataset

The ICT-CST dataset consisted of data collected from teacher ICT readiness surveys collected by UNESCO as part of its engagement with project countries from 2018 to 2020. The dataset comprised surveys of 4,572 teachers from 73 provinces or equivalent geographical divisions across five countries: Kyrgyzstan, Lao PDR, Mongolia, Myanmar, and Nepal. Table 2 shows the number of teachers from each country who completed a survey.

Table 2: Teacher readiness survey data sample size for each country

Country	Number of teachers
Kyrgyzstan	279
Lao PDR	304
Mongolia	1,917
Myanmar	1,635
Nepal	437
Total	**4,572**

The teacher readiness data includes three scales to measure each of the ICT competency domains for teachers. The scales are based on teachers' self-reported competency levels for a set of ICT-related tasks. These scales also had adequate reliability (internal consistency) scores.

Table 3 presents the available data for each country according to the two datasets. In general, there was minimal overlapping countries between the two datasets, except for Bhutan, Lao PDR, and the Philippines. Due to the minimal overlaps, the analysis focused on developing insights and inferences into the digital citizenship competencies for students and ICT competency readiness for teachers in the different countries. It also provided the foundations for the qualitative analysis in the following section.

Table 3: Quantitative data available for each country

Country	DKAP		Teacher and school readiness survey		
	Student	School	Teacher	School	National
Bangladesh	x	x			
Bhutan	x	x	x	x	
Fiji	x				
Indonesia	x	x			
Kyrgyzstan			x		x
Lao PDR	x	x	x		x
Mongolia			x	x	x
Myanmar			x		
Nepal			x		
Philippines	x	x	x (dated version)		
Republic of Korea	x				
Thailand	x	x			
Uzbekistan					
Viet Nam	x	x			

Findings

Students' digital citizenship skills

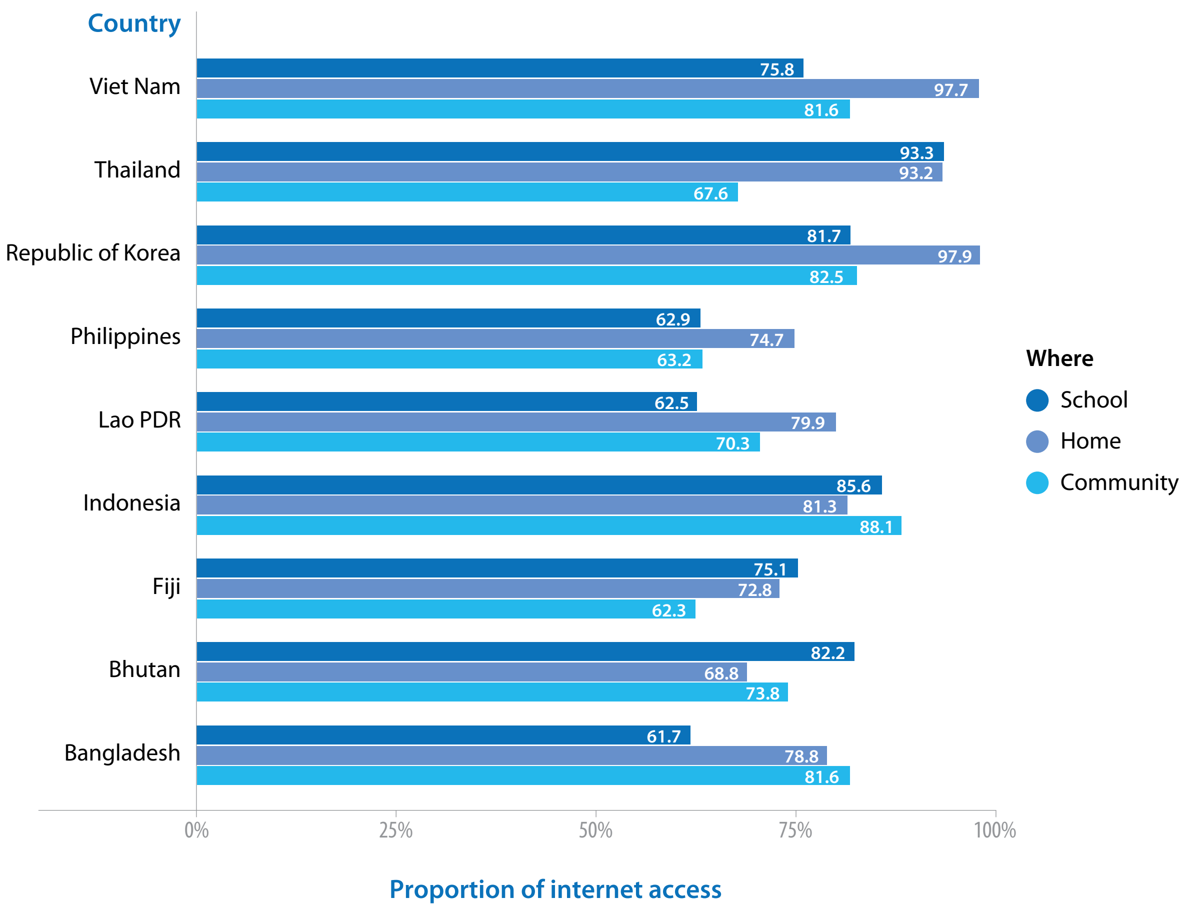
Internet connectivity at home and school

In terms of internet access, Figure 2 shows that a high proportion of students in each country reported having access to an internet connection at home. In Bangladesh, the Republic of Korea, Thailand, and Viet Nam, over 90 per cent of students had home internet access. In Fiji, Indonesia, Lao PDR, and the Philippines, over 70 per cent of students reported the same, while 68.8 per cent of students in Bhutan did so.

In general, fewer students reported having internet access at school than at home. However, in Bhutan, Indonesia, Fiji, and Thailand, more students reported having more internet access at school. In all the other countries, between 64 per cent and 82.7 per cent of students had access at school.

Students who reported having internet access in their community also varied across countries. In Indonesia, 85.6 per cent of students reported so, while only 64.5 per cent of students in Lao PDR did. In Bangladesh, the Philippines, the Republic of Korea, and Viet Nam, this number was around 80 per cent.

Figure 2: Proportion of students reporting to have access to the internet at home, at school, and in the community



A further analysis presented below reveals that access to digital devices at home and at school is significantly associated with positive effects on students' scores in all five domains when controlling for other factors.[1]

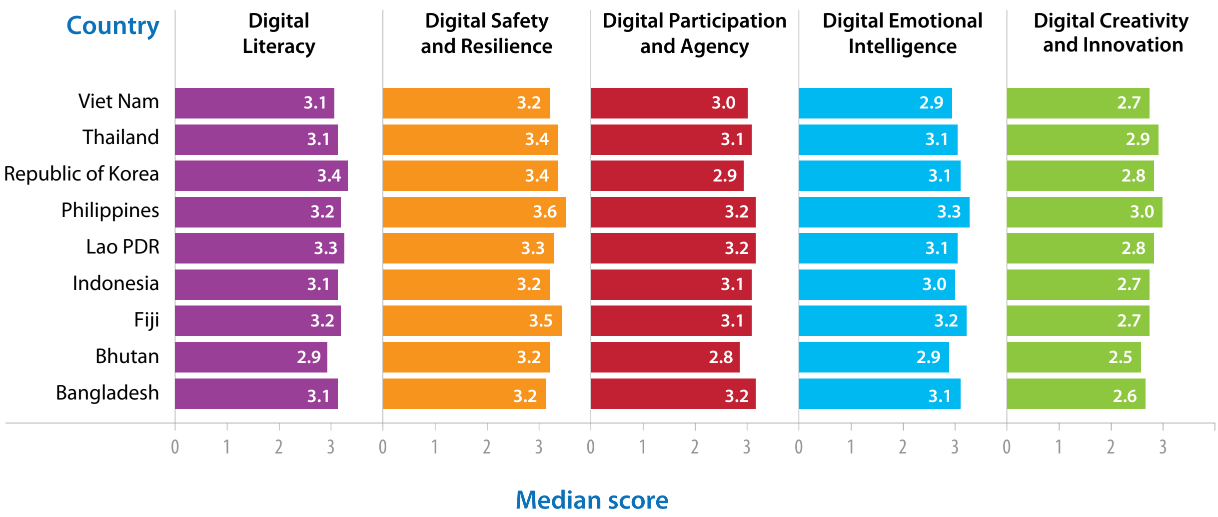
Differences across domains and countries

The DKAP dataset analysis examined the relationship between the five digital citizenship domains of the DKAP Framework and its potential relationship to teachers' actions. The study also looked at potential differences in subgroups based on country, location, gender, and device access. It aimed to understand the impact of these factors on digital citizenship and to inform strategies for promoting digital citizenship education.

The data analysis revealed significant differences across countries in the distribution of students' digital citizenship skills in all domains. There was greater variation in terms of the highest-rated domain among the countries and the range of median level scores across the domains. For example, Digital Safety and Resilience was the highest performing domain in all participant countries, while Digital Creativity and Innovation was the lowest. Digital Literacy was the second- or third-highest performing domain, followed by Digital Participation and Agency and Digital Emotional Intelligence, although there was much more variation between countries in these last two.

The high performance of all countries in Digital Safety and Resilience relative to other domains suggests that this is a foundational competency preceding the other competencies or that there is a heavier focus on the development of this competency. Meanwhile, Digital Creativity and Innovation has been less developed among students. Figure 3 shows the average scores across countries and by domain. A possible explanation for the lack of clear patterns may reflect the different emphasis that each country places on developing these competencies in its standards and policies, which is discussed later in this report.

Figure 3: Median students' scores in each of the digital citizenship domains by country

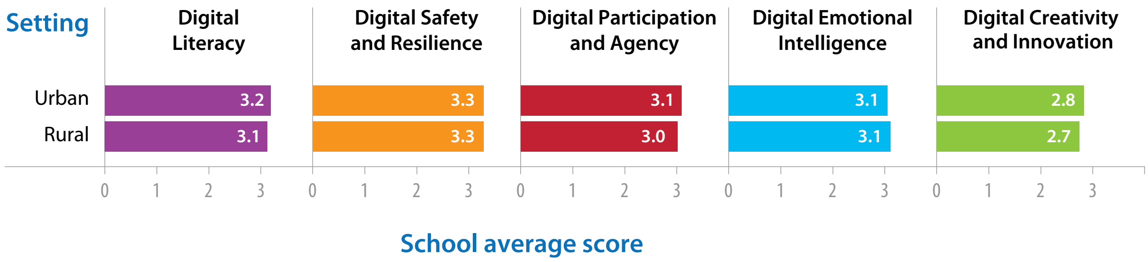


1 https://unesdoc.unesco.org/ark:/48223/pf0000367985, p.23.

Differences between urban and rural settings

In general, students from urban schools reported higher competencies in all five domains than those from rural schools. However, there were some differences across countries for each domain. For example, Bangladesh did not show any significant difference between students from urban and rural schools in any domain except for Digital Safety and Resilience.[2] It is important to highlight that an analysis by rural/urban location could not be conducted for three countries (Lao PDR, Thailand, and Fiji) as the number of participating schools in the sample was too small. Based on the remaining countries, Figure 4 shows no meaningful difference in the distribution of school average scores across the digital citizenship competencies between urban and rural school settings. This seems counterintuitive to various reports and general conceptions regarding the digital divides between urban and rural populations. Thus, we attempted to dig deeper to understand this lack of differences in the section below.

Figure 4: Distribution of the school average score across digital citizenship domains by school setting



Variation in school average digital citizenship skills

A hierarchical linear model with students nested within schools was used to examine the extent to which the variability in students' digital citizenship skills can be attributed to differences between students within schools and to differences between schools. In other words, we sought to understand what proportion of the differences in scores can be attributed to differences in school composition, policies, and practices, but also other factors such as a country's school policy and cultural environment where the schools are located. The detailed estimation results are presented in Annex 1.

The analysis found that most of the variation in digital citizenship skills across domains can be attributed to differences between students/within schools, while differences between schools accounted for only a small proportion, as shown in Figure 5. There are multiple possible interpretations and implications for this finding:

1. The majority of learning of digital citizenship competencies may be taking place outside of schools, with students learning more about how to use computers and the internet on their own instead. Policies that promote learning at school are likely to increase the proportion of the variation in digital citizenship that can be attributed to schools.
2. Schools may currently be providing very similar learning opportunities regarding digital citizenship competencies, so there are few differences across schools. For example, it may be possible that all the participant countries provide similar levels of access to digital devices in their schools. Policies that are applied unevenly (e.g. training teachers only at a few schools or

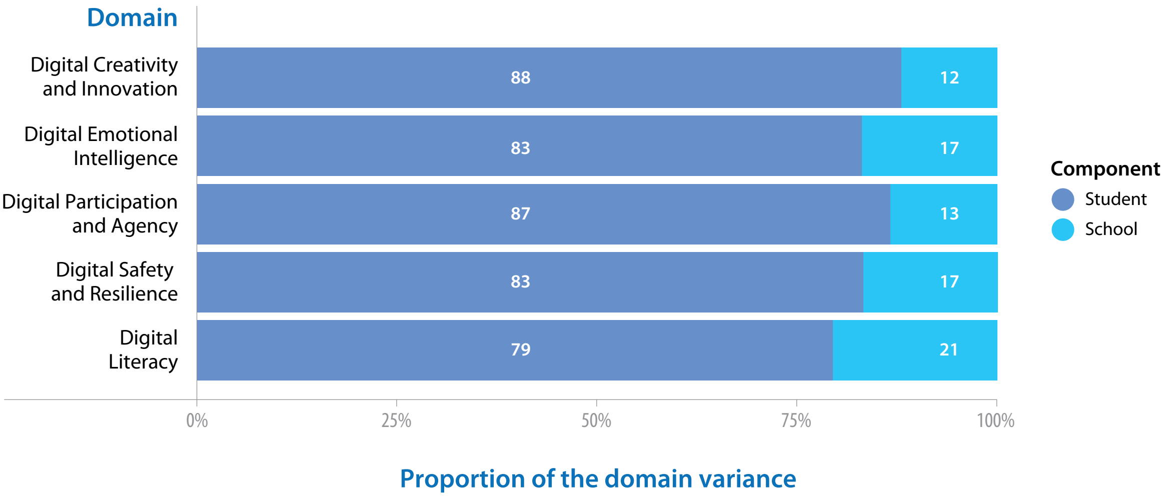
2 https://unesdoc.unesco.org/ark:/48223/pf0000367985, p.28.

delivering free devices only to some schools) are also likely to draw attention to differences between schools for variation in digital citizenship skills.

3. The nature of digital citizenship competency development may be linked to the specific experiences that students have outside school, so policies that only target school interventions may generate a small change in the differences between students' digital skills.

Furthermore, the analysis showed that more frequent computer use and improved access to digital devices at home result in higher skills across all domains, even after accounting for different factors. This finding suggests that education policies should holistically consider how digital literacies are supported inside and outside school settings.

Figure 5: Proportion of the variability in digital skills in each domain that can be attributed to differences between students and schools



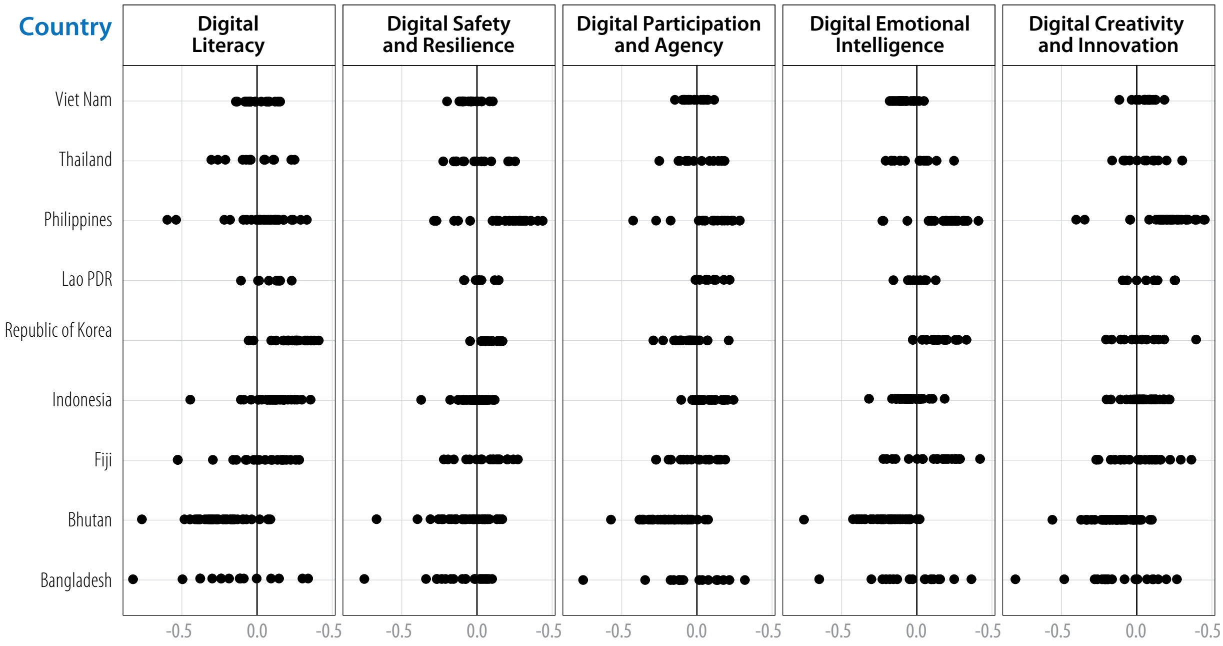
The hierarchical model also allowed for an analysis of how the average score of students' digital skills from particular schools varied among countries. Figure 6 presents the predicted school averages for each digital citizenship domain and country. This analysis shows a prediction of how schools perform on average, for reasons both in and outside their control, and so it is not an indication of school quality but rather differences between schools (due to a combination of various factors).

According to the model, overall, schools within a country will perform similarly across domains. For example, if schools in a particular country generally perform above average in Digital Literacy, they will also perform above average in other domains. This can be seen in the Republic of Korea, where schools tend to perform above the average across all domains (except for Digital Participation and Agency). The finding implies that school average performance in digital citizenship competencies may be closely linked to overarching country-level policies and priorities that have had a trickle-down effect on school practices.

Furthermore, Figure 6 shows that school average digital skills were more unequal in some countries than in others. In Bangladesh, the difference between the highest and lowest school average scores in Digital Literacy is 1.17 standard deviations (from -0.83 to 0.34 standard deviations). But in Viet Nam, the difference between the highest and lowest school average scores in Digital Literacy is only 0.31 standard deviations (from -0.14 to 0.17 standard deviations).

These results are similar across domains. The implication is that countries that tend to have a dispersed school average in one domain also tend to have a dispersed school average in the others. The reasons for different levels of inequality across countries are likely to be due to complex socio-political and cultural processes that are unique to each country. A first step, however, is to identify the countries that are successful in tackling inequality and understand how their policies contribute to this, as we attempt to do later in this report.

Figure 6: Variation in the school average digital citizenship skills across domains and countries[3]



Teachers' practices in supporting students' ICT use

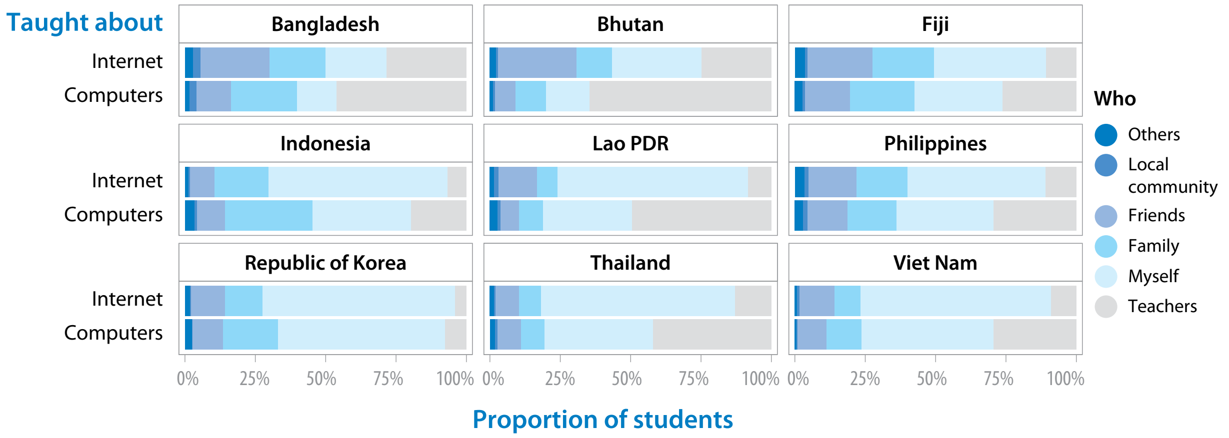
There are four ways in which the DKAP survey questions helped identify how teachers may influence students' digital skills: whether they taught the student the most about how to use computers, whether they taught the student the most about how to use the internet, the frequency with which teachers suggested ways to use the internet safely to the student, and the frequency with which teachers encouraged the student to explore or learn things on the internet. This section analyses how teachers' actions differed across countries (as reported by their students) and how student digital citizenship skills are associated with these practices.

As seen in Figure 7, there was variation across the countries in terms of the influence of teachers in teaching students how to use computers and the internet. For example, in Bhutan, Fiji, the Philippines, and Thailand, students indicated that teachers taught them the most about computer use. In Indonesia and the Republic of Korea, the percentage was much smaller.

3 Note: Each of the dots in the plot represents a school. If the dot is above zero (black line), it means that such a school performed better than average, while if the dot is below zero, it means that the school performed lower than the average for all schools in the participating country. Extra caution should be exercised when interpreting the results for Indonesia, which tends to have fewer students per schools in the sample and hence predicted school averages that are very close to the mean for all countries.

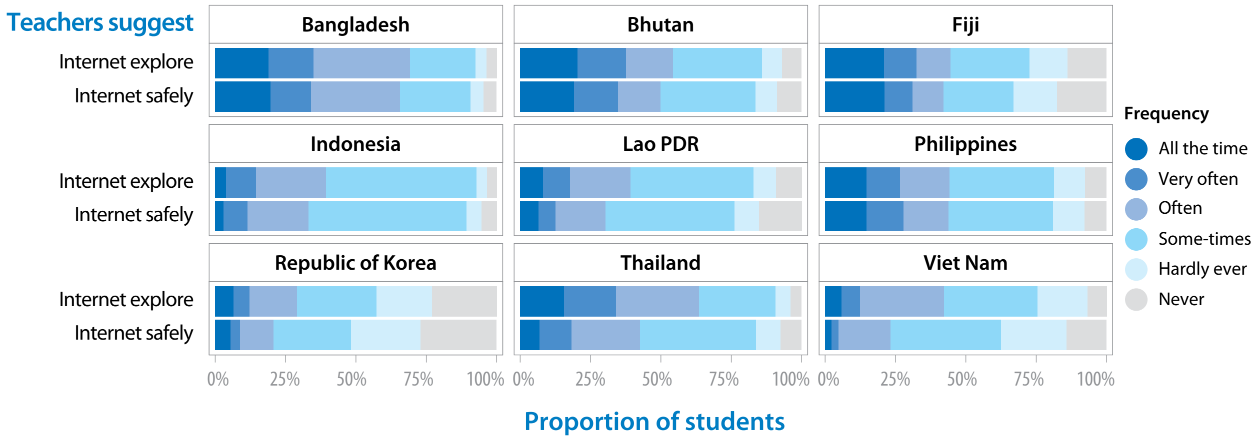
When it came to learning about the internet, students were less likely to turn to teachers. Across all the countries, students reported that their teachers were more influential in teaching them about computers, but less so when it came to using the internet. This suggests that learning about the internet happens much more outside of school contexts. In Fiji, while 50.3 per cent of students reported that teachers taught them how to use computers, only 8.5 per cent of them reported the same about internet use. It is noticeable that in most countries (except Bhutan and the Philippines), students were more likely to report that they taught themselves 'the most' about how to use the internet (and, to a lesser extent, computers). The role of family and friends varied across all countries.

Figure 7: Proportion of students according to who taught them 'the most' about how to use computers and the internet for each country



Across the countries, there were also differences in the frequency with which teachers suggested ways to use the internet. Figure 8 shows that, overall, students perceived that their teachers suggested ways to use the internet safely slightly less often than they encouraged them to explore or learn things on the internet. For example, while only 4.8 per cent of students in Bangladesh reported that their teachers never suggested ways to use the internet safely, 27.1 per cent of students in the Republic of Korea report the same. In turn, 3.6 per cent and 23 per cent of students in Bangladesh and the Republic of Korea, respectively, reported that their teachers never encouraged them to explore or learn things on the internet.

Figure 8: Proportion of students according to the frequency with which their teachers suggested safe internet use or encouraged using the internet to explore or learn new things



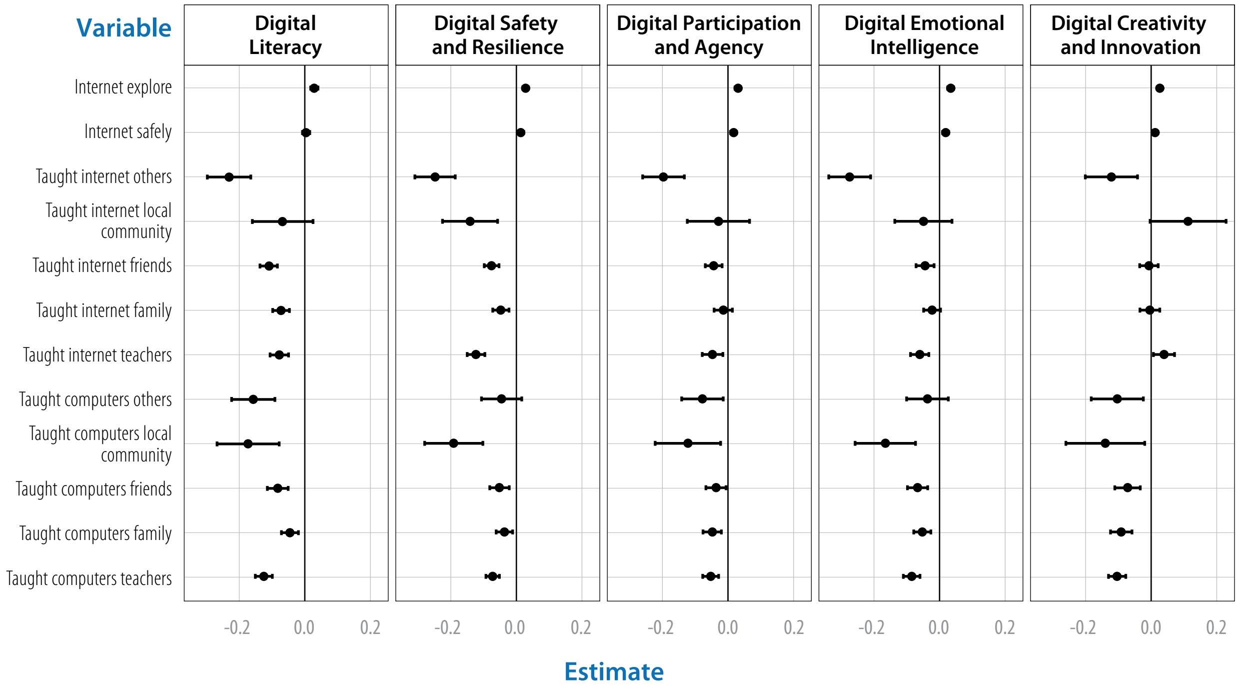
Relation between teachers' practices and digital citizenship skills

The findings from the analyses above reflect differences between countries' cultures, geographies, policy environments, and all other country-specific factors that influence student digital citizenship skills. In this section, we aim to account for these differences by focusing on how digital skills are related to teacher behaviours, regardless of country differences.

Figure 9 shows the relationship between the level of student digital citizenship skills in each domain and different teacher behaviours (teaching students the most about how to use the internet or computers, suggesting ways to use the internet safely, and encouraging students to explore and learn things from the internet). As shown, students who reported that their teachers suggested ways to use the internet safely or encouraged them to explore or learn things on the internet more often have a higher level of digital skills across all domains than students who reported their teachers never encouraged them to do so.

Students who indicated that their family, friends, local community, or others taught them the most about computers or the internet showed lower digital citizenship skills. However, students who taught themselves the most about how to use computers or the internet tended to have higher average levels of digital citizenship skills across domains than those students whose teachers taught them the most. This may reflect the fact that students who taught themselves were likely to have access to more resources and support outside of schools than students who mostly received help from their teachers.

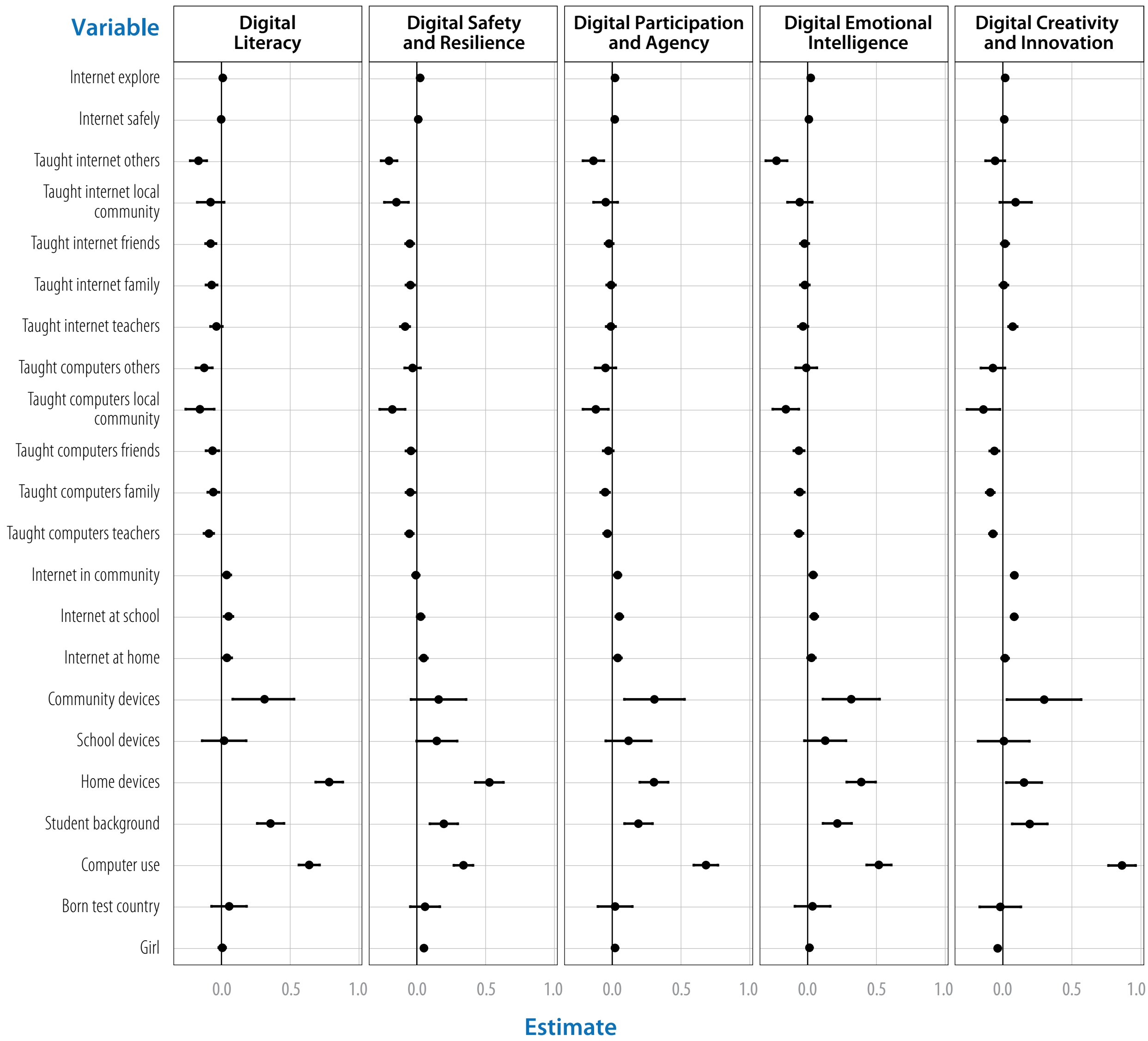
Figure 9: Estimated parameters and 95% confidence interval for the models estimating relationships between teacher behaviours and student digital skills across domains[4]



4 Confidence intervals allowed us to communicate how certain we are about our results. In our figures, confidence intervals are represented by bars from a lower to an upper band. The wider these bars are, the more uncertain we are about the value we are reporting, and if the bars are wide enough to cross zero, it means that we are not confident enough to claim that an effect or a difference exists beyond our data. 95% confidence is a standard used in social sciences as an acceptable level of certainty. The model also includes fixed effects by country that are not shown for conciseness.

Following the analysis of the relationship between teacher behaviours and student skills across domains, the next step of the analysis was to account for those potential differences in student and school characteristics that may have affected the results in Figure 9. Figure 10 shows how teachers' behaviours and students' digital skills were linked, after considering differences in student and school characteristics.

Figure 10: Estimated parameters and 95% confidence intervals for the models estimating the relationship between teacher behaviours and student digital skills across domains including student, school, and community characteristics[5]



5 The models include an intercept and fixed country effects that are not shown for conciseness. Table 19 describes the control variables in the model.

Even after considering differences across countries and in students' backgrounds and resource access and usage, those students who were taught the most about how to use computers by their teachers scored lower, on average, than their peers who taught themselves. Similarly, those whose teachers taught them the most about internet use have lower scores in Digital Safety and Resilience than those who taught themselves. Interestingly, after accounting for differences in other characteristics, students who were taught the most about internet use by their teachers have higher average levels of Digital Creativity and Innovation than those who taught themselves. There are also positive relationships between digital skills across domains and the frequency with which teachers suggested ways to use the internet safely and encouraged them to explore or learn things on the internet, after accounting for other influential factors.

Examining differential relationships between digital citizenship skills and teacher behaviours for female students

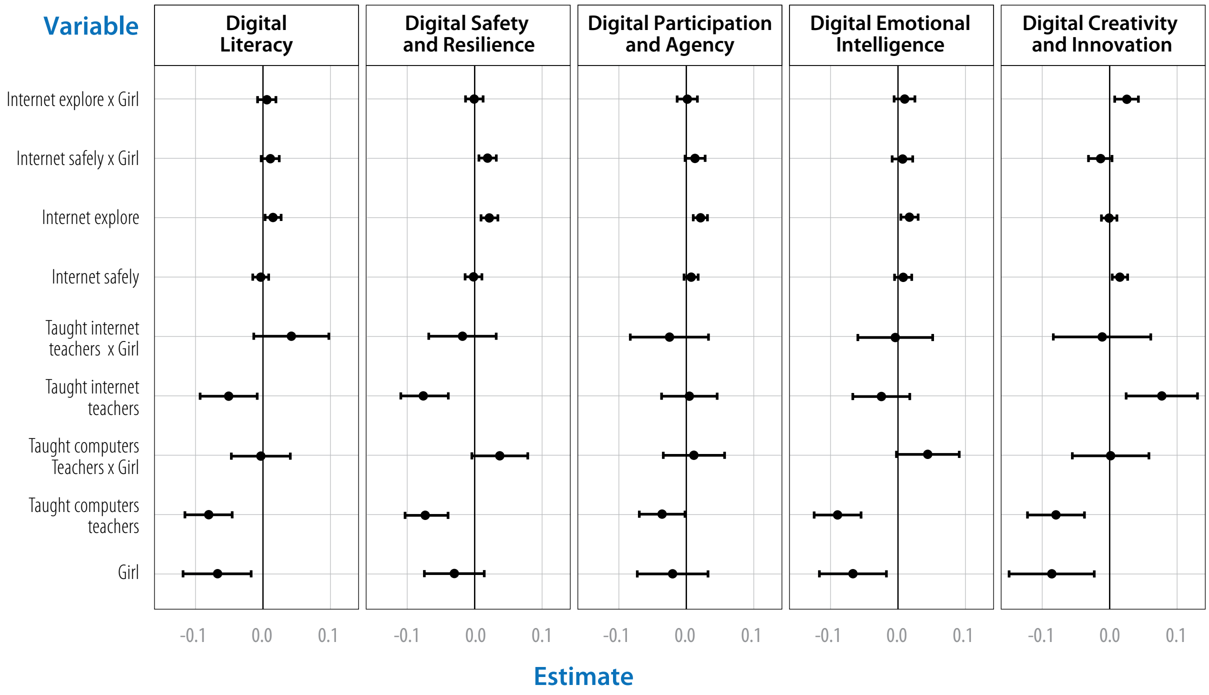
In terms of differences in competencies between genders, after controlling for all other characteristics, female students tended to have slightly higher levels of Digital Safety and Resilience and Digital Participation and Agency than male students, but lower levels of Digital Creativity and Innovation. However, these differences are small, and the analysis did not find any meaningful differences. A more detailed analysis of gender differences is presented in Annex 1.

The analysis of the relationship between teacher behaviour and digital citizenship skills was grounded in the assumption that the relationships between teacher behaviours and digital skills are the same for male and female students. This section explores the potential for these effects to be different using the models in Figure 11. Although the models include all the characteristics discussed in the previous section, this figure focuses on the new terms that we have added.[6]

This time, the parameter estimated for female students indicated that, after accounting for differences in other characteristics, female students who taught themselves how to use computers and the internet and whose teachers never suggested ways of using the internet securely or encouraged them to learn about and explore the internet, scored lower than male students in the same situation.

6 The variables that are named 'variable x Girl' (e.g. Internet explore x Girl) measure a change in the effect of the variable for girls. The final sign of the effect depends on the original sign of the effect of that variable, but in general, if the bar for 'variable x Girl' is to the right of zero, the effect of variable is more positive for girls, and if it is to the left of zero, the effect of variable is more negative for girls. If the original effect of variable is negative, as is the case of being taught about how to use the internet by teachers (in this case, 'variable' is 'Taught internet teachers'), a bar to the right of zero for 'variable x Girl' (Taught internet teachers x Girl) indicates a weaker effect for girls, while a bar to the left of zero would indicate a stronger negative effect for girls. If the original effect of variable is positive, as is the case for the frequency with which teachers encourage the students to explore or learn things on the internet ('Internet explore') a bar to the right of zero for 'variable x Girl' ('Internet explore x Girl') indicates a stronger effect of variable for girls, while a bar to the left of zero would indicate a weaker effect for girls. If the bar for 'variable x Girl' crosses zero (as is the case for 'Internet explore x Girl') it indicates that the effect of variable is the same for boys and girls. The models also include all the parameters shown in Figure 10, an intercept and fixed country effects that are not shown for conciseness. Table 19 describes the control variables in the model.

Figure 11: Estimated parameters and 95% confidence intervals for the effects of gender and teacher behaviours on student digital skills across domains[7]



Overall, the relationships between teacher behaviours and digital citizenship skills for female students were nuanced and complex. The analysis seemed to show that differences were specific to each domain and interaction with teachers. In general, positive relationships were stronger and negative relationships were weaker for female students than for male students. For example, Figure 11 shows that when comparing female students whose teachers taught them the most about computer use with female students who taught themselves, the differences in skills for digital emotional intelligence are narrower than when comparing males (i.e. the negative relationship is less strong for female students than for male students).

In contrast, the positive relationship between Digital Safety and Resilience and the frequency with which teachers suggested ways to use the internet safely is stronger for female students, as is the positive relationship between the frequency with which teachers encouraged students to learn and explore on the internet and creativity and innovation scores.

Teachers' ICT competency and readiness

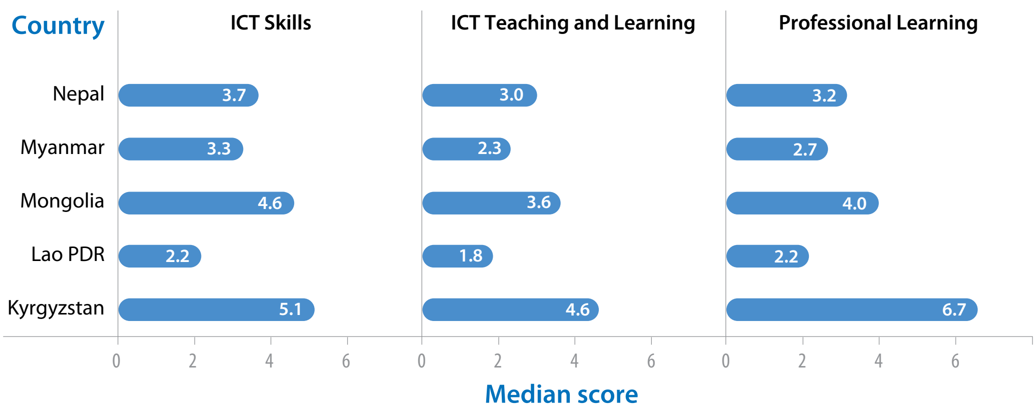
In addition to the teacher-related findings from the DKAP dataset, further in-depth analysis of teacher ICT skills was conducted based on the data collected from UNESCO's Teacher Readiness surveys that covered three domains of self-reported teacher competencies: 1) general ICT skills, 2) ICT skills for teaching and learning, and 3) professional learning. For each of these three domains, teachers reported their perceived level of competency in ICT-supported tasks on a scale from 1 to 7, with 1 being the least competent and 7 being the most competent.

7 See above.

Differences in teacher ICT competency across countries

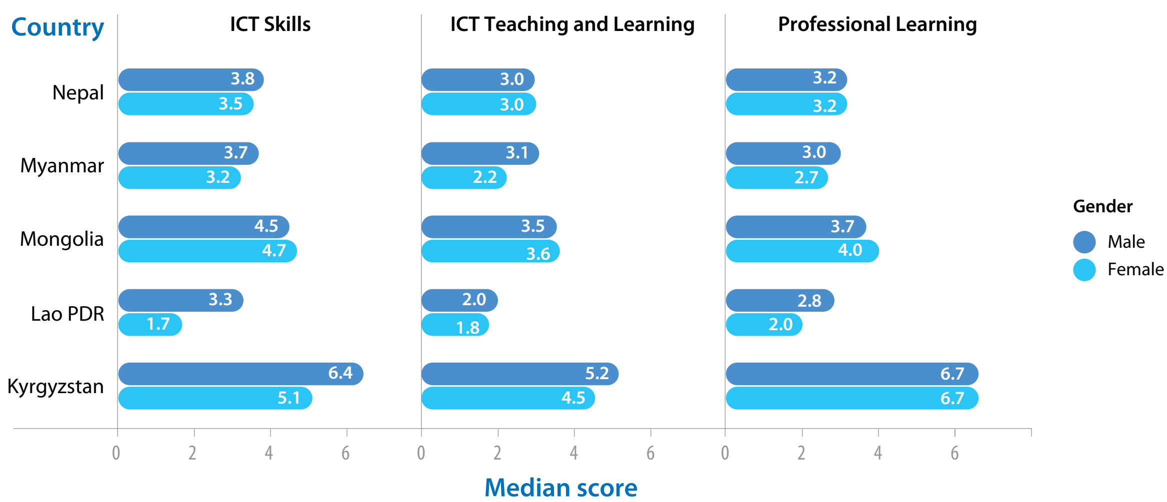
The distributions of ICT competency by country are shown in Figure 12, revealing significant differences between teachers' competency across domains within each country. By comparison, teachers in Mongolia and Kyrgyzstan repeatedly reported the highest levels of self-perceived competency across all domains, while teachers from Lao PDR continually reported the lowest levels across all three domains. The analysis consistently revealed that teachers reported significantly higher levels for general ICT skills and professional learning than for ICT teaching and learning.

Figure 12: Median of teachers' perceived competency in ICT domains across countries



In terms of gender, overall, there were no significant differences found between female and male teachers' level of ICT competency across the three domains as show in Figure 13. However, there were differences observed in specific countries, such as Lao PDR and Kyrgyzstan.

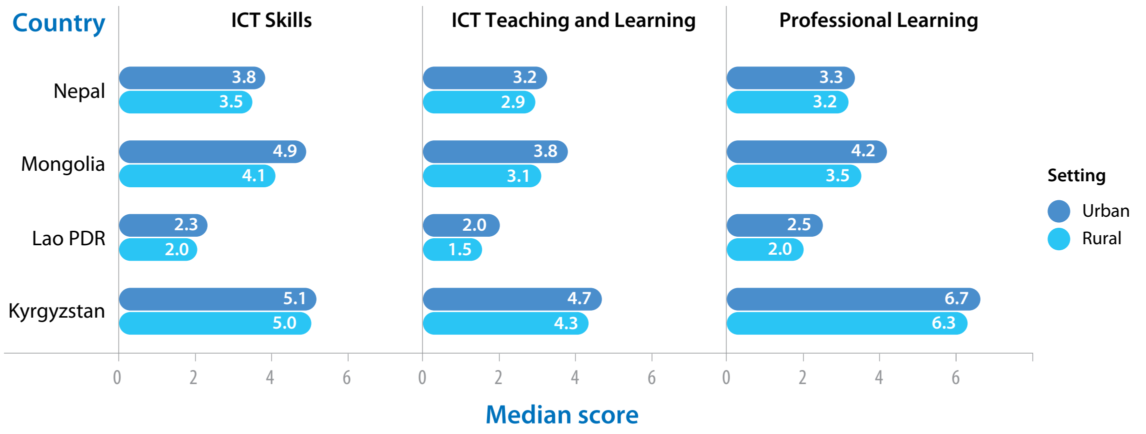
Figure 13: Median of teachers' perceived competency across ICT domains by gender and country



Differences between urban and rural contexts

The analysis of teacher ICT competency found that those from urban regions reported higher levels of ICT competency across the three domains than those from rural regions. The difference was consistent across all four countries. The distributions of ICT competency are shown in Figure 14.

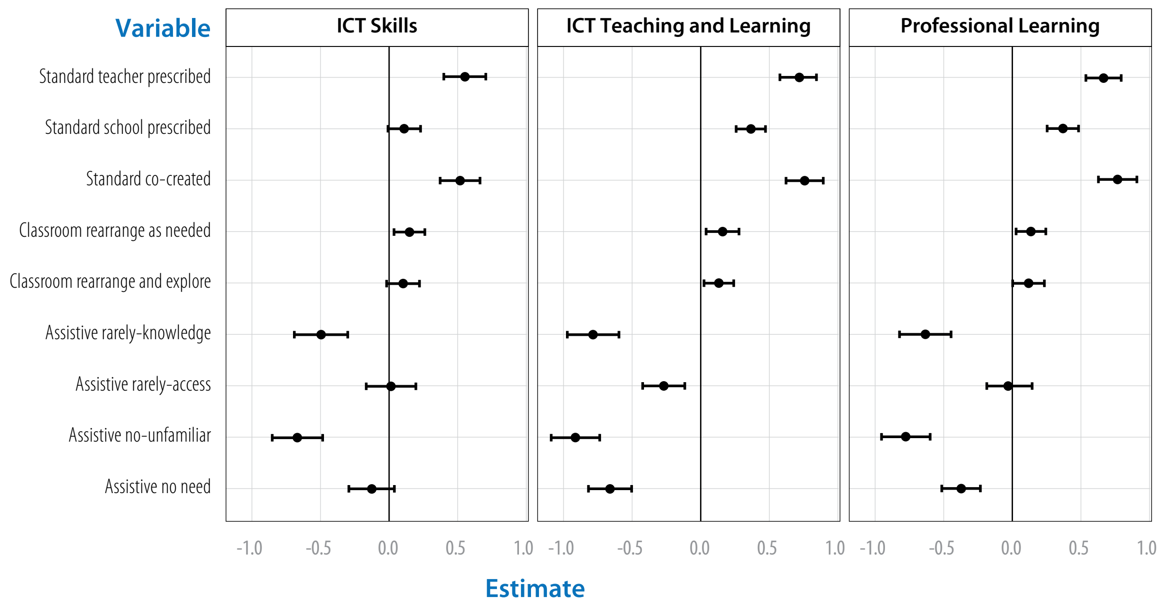
Figure 14: Distribution of different ICT domains between teachers from rural and urban regions by country



Understanding teacher ICT competency

This section focused on understanding the relationship between teachers' reported levels of confidence in their ICT competency and their organization and administration tasks (creating standard operating rules, setting up the classroom, and using assistive technologies). The analysis consisted of three steps. First, identifying the relationships; second, exploring if they persist even after considering other teacher characteristics; and third, exploring if there are any differential effects by gender. All the analyses accounted for differences between countries, which implies that they provided information about the existence of these relationships over and above socio-cultural and policy differences between countries.

Figure 15: Estimated parameters and 95% confidence intervals for the relationship between organization and administration dimensions and teachers' digital skills across domains[8]



8 The model also includes fixed effects by country that are not shown for conciseness.

Relationships between teachers' ICT skills and dimensions of organization and administration

The Teacher Readiness survey examined three dimensions of teachers' organization and administration with regards to ICT:

- Standard operating rules: Does your class have standard operating procedures/routines and rules of conduct whenever ICT is used?
- Classroom setting: Do you rearrange your classroom setting based on the nature of the activity and ICT used?
- Assistive technologies: If you teach students with various types of disabilities, do you use assistive technologies or various digital tools to support their learning?

Figure 15 shows the 95% confidence intervals for a model that estimates the relationship between teachers' reported levels of competency in each ICT skill domain and the different dimensions of organization and administration. Meanwhile, Figure 15 shows how teachers in each country approached the administration and organization tasks. A deeper analysis of the three dimensions is detailed below.

Teachers and standard operating procedures/routines

Teachers with higher levels of competency were more likely to use standard operating procedures/routines and rules of conduct when using ICT and were especially more likely to use co-created standards or standards created by themselves, as seen in Figure 15. Those who created or co-created their standards also had higher levels of competency than those who adopted school-prescribed standards. These findings suggest a relationship between teachers' ICT competency and their ability to make more effective use of technology in the classroom, including the use of standard operating procedures and rules of conduct.

However, Figure 16 shows a large variation in how teachers approach these tasks. For example, in Nepal, only 22 per cent of the teachers reported that they used school-prescribed standard operating procedures/routines and rules of conduct in their ICT use, while the same was true for 67 per cent of teachers in Lao PDR and 45 per cent of teachers in Kyrgyzstan. Distinctively, almost half of the teachers in Nepal set their own ICT standard operating procedures/routines and rules of conduct, which is not often the case in other countries. In contrast, only 9 per cent of teachers in Lao PDR and 11 per cent in Myanmar do so.

The analysis also found that a significant portion of teachers do not use any standard operating procedures and/or rules of conduct in their ICT use. In every country, over 10 per cent of the teachers reported not using any at all, and in Myanmar, it reached 41 per cent.

Teachers and classroom management

ICT competency in the classroom could lead to more engaging classroom configurations for activities. Teachers with higher levels of competency across ICT domains were more likely to rearrange their classrooms as needed, according to the nature of the activity and ICT used (see Figure 15). Similarly, teachers who rearranged their classrooms and those who rearranged and explored alternative venues according to the activity or ICT used, reported higher average competency for ICT in teaching and learning, compared with those who always used a row configuration, although this is not the case in other ICT domains.

Nevertheless, over a quarter of teachers from all countries kept row configurations, regardless of their activities. This proportion was particularly high in Nepal, at 47 per cent. Conversely, over 20 per cent of teachers in all countries rearranged or relocated their classrooms according to their activities. This was particularly high in Mongolia, where 53 per cent of teachers reported using this strategy.

Teachers and assistive technology

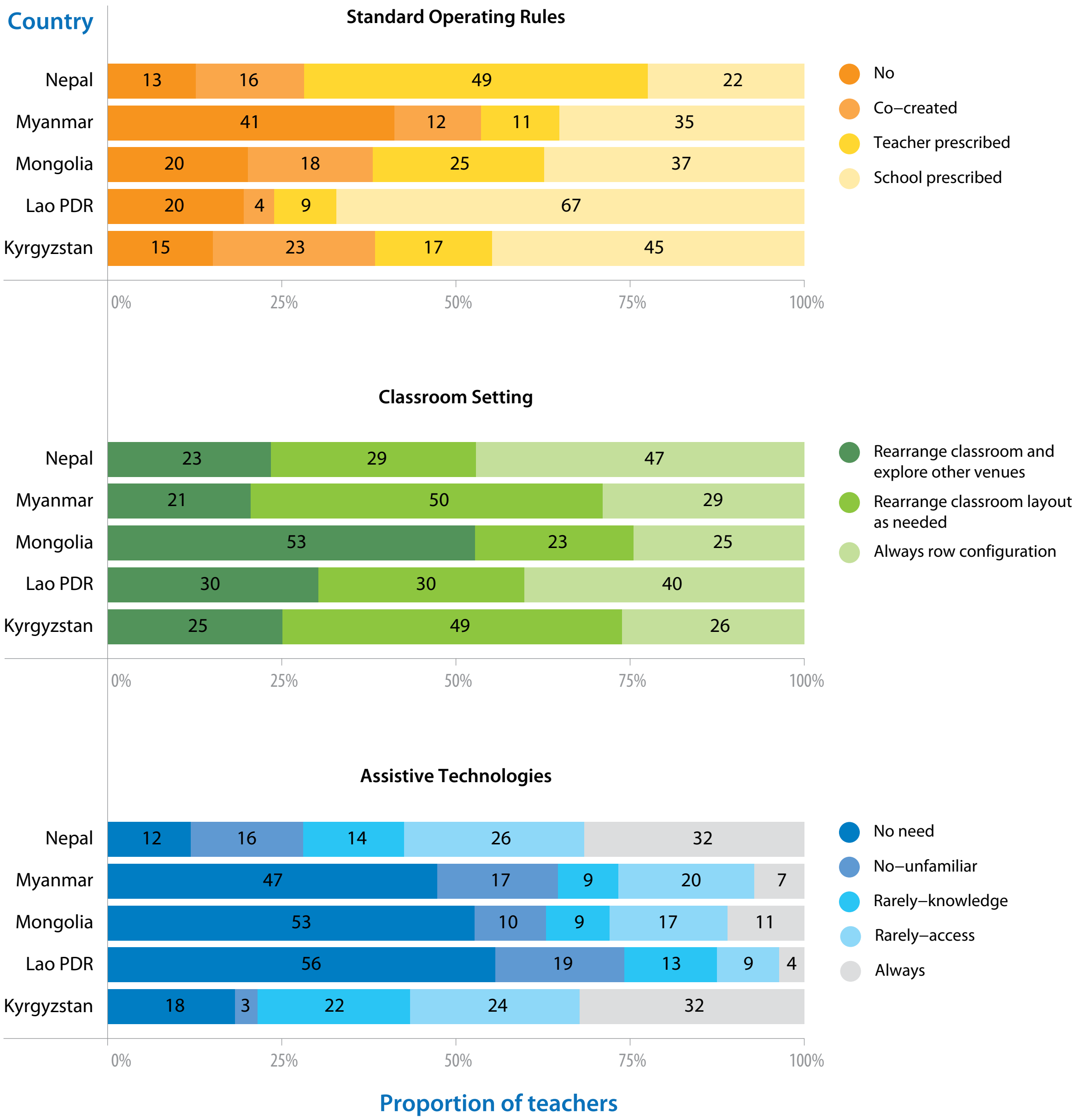
The analysis found a link between teachers always using assistive technologies and higher average levels of competency across ICT domains. There was a clear difference when compared with teachers who rarely used assistive technologies or had a lack of knowledge. However, there are nuances, such as when considering other characteristics. For example, teachers who reported lack of access as a reason they did not use assistive technologies, did not report any difference in average ICT competence compared with teachers who always used them.

The average ICT competency of teachers who did not use or rarely used assistive technology because of their lack of knowledge was significantly lower than for those who always used these technologies. In other words, teachers with higher levels of reported ICT competency were more likely to use assistive technologies to support the needs of students with disabilities. The findings were consistent across the three domains. For example, ICT competency levels for teaching and learning were also lower on average for teachers who did not use assistive technologies because they had no access, compared with teachers who always used them. The same relationships held for the use of assistive technologies after considering other teacher and school characteristics.

It is important to keep in mind that teachers' use of assistive technologies is likely to be influenced by school characteristics, such as better infrastructure. If this is the case, the higher competency level for teachers who always used assistive technologies reflects the relationship with infrastructure instead of with the use of assistive technologies.

When looking at the proportion of teachers who used assistive technologies by country, almost half of the teachers in Myanmar, Mongolia, and Lao PDR reported that they did not consider it necessary to use assistive technologies in their classrooms. Only around one-third of teachers in Nepal and Kyrgyzstan stated that they always used assistive technology in their classrooms. These were, nonetheless, the countries that reported the highest proportion of teachers always using assistive technology. Both access to devices and knowledge about how to use them were obstacles to adoption. In all countries, except Lao PDR, over 15 per cent of teachers reported access as an obstacle to their adoption of assistive technologies. Additionally, in Lao PDR and Nepal, 32 per cent and 30 per cent of teachers, respectively, reported that they 'rarely or never' used these technologies because they did not have enough knowledge.

Figure 16: **Proportion of teachers according to their approach to three different organization and administration tasks (creating standard operating rules, setting the classroom, and using assistive technologies) by country**



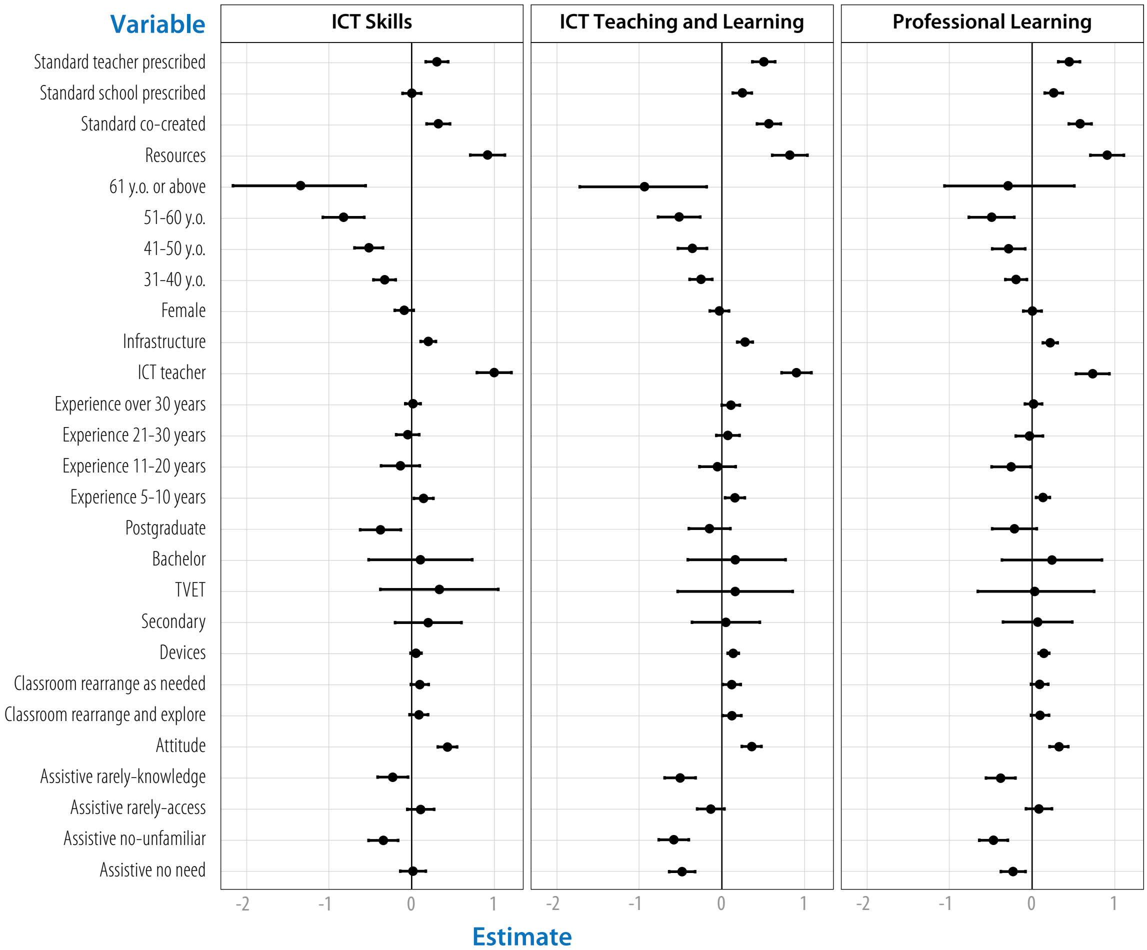
Factors affecting teachers' ICT skills

Based on the data and variables collected, Figure 17 shows a comprehensive analysis conducted to identify teacher characteristics that affected ICT skills according to the three categories. While the analyses aimed to include as many variables as possible, questions regarding school setting (urban/rural), school type (public/private), policy environment, and grade levels taught were not included as they had not been collected in all countries or had very high levels of missing data across all countries. These variables were excluded from the analysis to include as many participant countries as possible. A full list of variables included in the estimated models is in Table 20.

The most notable findings were:

- Across all ICT skill domains, teachers who reported a better general attitude to ICT in education, higher levels of infrastructure, and a more diverse use of digital resources reported higher average levels of competency after accounting for other characteristics.
- Teachers with five to ten years of experience also reported higher average ICT competency levels across domains than those with less than five years of experience.
- Teachers who used digital devices with more frequency also reported higher average competency levels in both the 'ICT for teaching and learning' and 'professional learning' domains, after considering other teacher and school characteristics.
- Younger teachers (30 years old or younger) reported higher ICT competency levels than older teachers (older than 31 years) across all domains, even after considering other factors such as education and experience.
- Interestingly, no relationship was found between the reported average ICT competency levels and sex and education level.

Figure 17: Estimated parameters and 95% confidence intervals for the models estimating the relationship between organization and administration dimensions and teachers' digital skills across domains including other teacher characteristics[9]

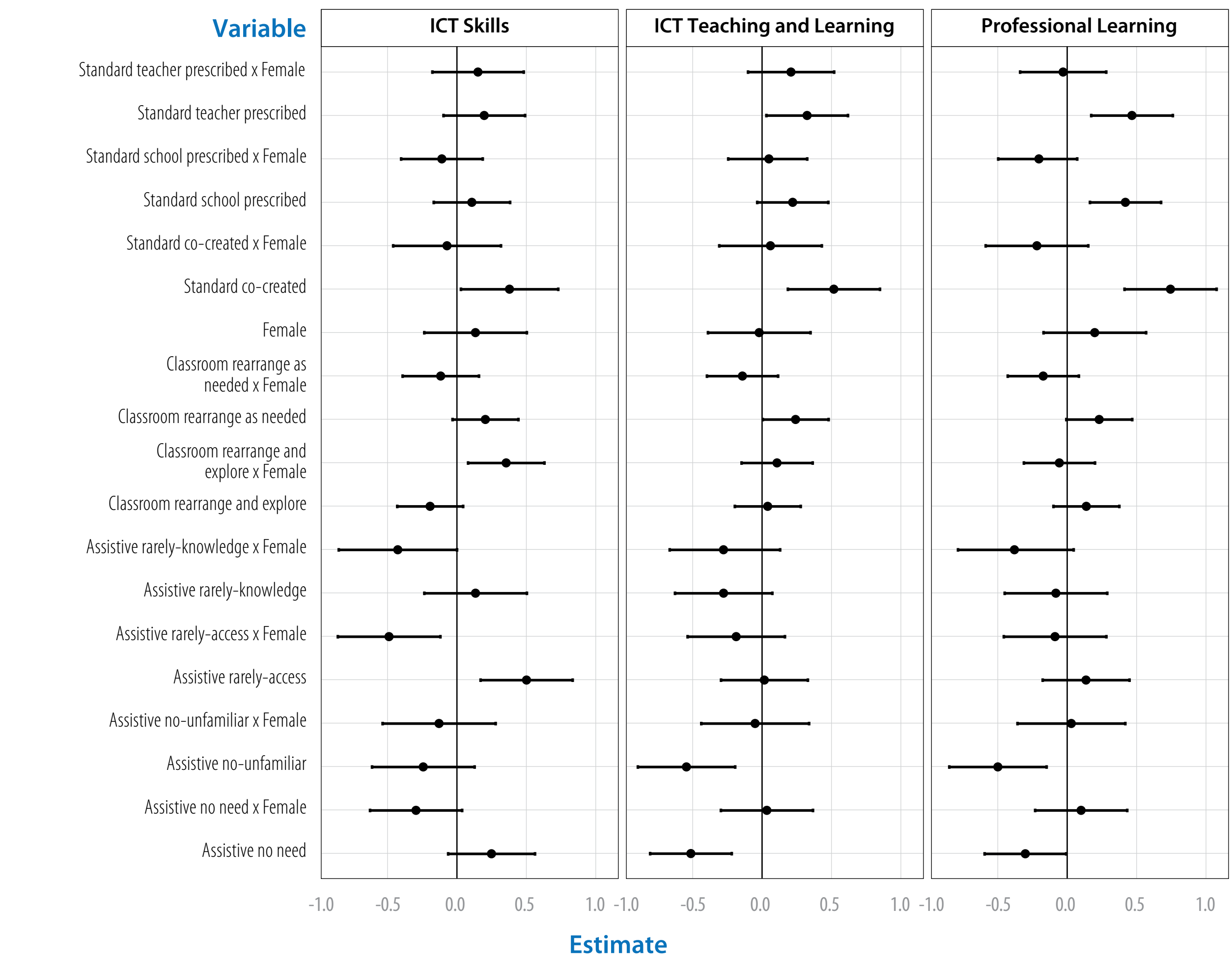


9 The models include an intercept and fixed country effects that are not shown for conciseness. Table 19 describes the control variables in the model.

Gender differences

The analysis showed that after accounting for other teacher and school characteristics, there was a relationship between teacher ICT competency level, organization and administration strategies, and gender. As shown in Figure 18, after accounting for other teacher and school characteristics, there is a slight difference in average levels of ICT skills competency between female and male teachers who rearranged classroom layouts as needed, and sometimes explored other venues. While female teachers who rearranged classrooms and explored other venues reported higher average levels for ICT skills than teachers who did not, male teachers who did the same reported lower average competency levels for ICT skills.

Figure 18: Estimated parameters and 95% confidence intervals for the relationship between gender and organization and administration dimensions and teachers' digital skills across domains



The analysis in this section showed that there was a relationship between teachers' organization and administration strategies and their reported competency levels across ICT skill domains. This relationship persisted even after comparing teachers who were similar in other characteristics, such as their attitudes towards ICT, education level and experience, teaching in similar schools, and broader cultural and policy contexts.

The reasons why teachers with different ICT competency levels adopted different strategies and whether these specific strategies had a favourable effect on students' learning experiences cannot be uncovered with the available survey data. It is also unclear if different organization and administration strategies enabled ICT competency development or if ICT competency allowed teachers to adopt different strategies. However, the DKAP data analysis showed a link between teacher behaviours and students' digital citizenship skills. This opens the possibility of a link between students' and teachers' ICT skills via teachers' behaviours and strategies. That is, teachers' ICT skills influenced the strategies and behaviours they used to engage with students, and those strategies and behaviours influenced students' digital citizenship skills. These questions require further research.

Experimental Matching Exercise: Combining student and teacher data

Bhutan, Lao PDR, and the Philippines were the only countries that participated in both DKAP and ICT-CST surveys, providing an opportunity to try to analyse for a more comprehensive picture of students' digital citizenship competencies and teachers' ICT competency standards.

However, there were a few limitations, as the DKAP data from Lao PDR only included students from nine different schools, which is a sample too small to provide reliable and generalizable conclusions about the relationship between teacher and student ICT skills. The ICT-CST data from the Philippines was collected in 2015 and thus was not suitable due to the significant time difference with the DKAP data. Therefore, Bhutan was selected for this matching exercise.

Bhutan's conditional average teacher ICT skills as reported in the ICT-CST data were matched to the DKAP student data for Bhutan using three steps, described in Annex 2. The matched data were used to study the relationship between teachers' ICT skills and students' digital citizenship skills across domains.

The steps to match the ICT-CST Teacher Readiness data with the DKAP data for Bhutan were:

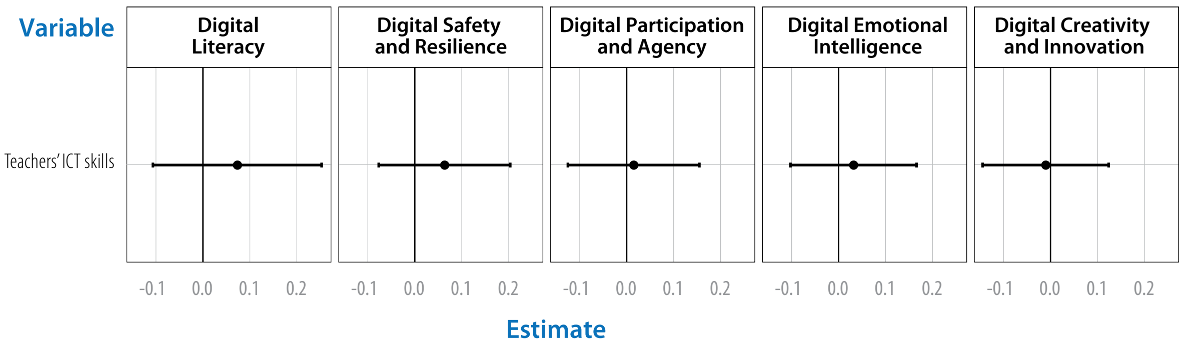
1. Searching for school characteristics that were recorded in both datasets. The common variables were province, location (urban or rural), level (Higher Secondary School, Middle Secondary School, or Lower Secondary School), and internet type (wired or wireless). Variables in both datasets were relabelled, if necessary, to ensure that they had the same categories.
2. A scale was constructed according to the frequency of twenty-four different ICT-related tasks to measure teachers' self-reported level of ICT skills. This scale was regressed on the school characteristics in Step 1. Different model specifications were attempted and compared for best fit using adjusted R-square and the AIC. The model with the best fit had the ICT skills scale as a dependent variable and province and school level as independent variables. This model is presented in Annex 2.
3. The model from the Step 2 was used to predict the teachers' average skills for twenty-four schools for which province and school level information was provided (of the forty-five schools participating in the DKAP study).

This procedure produced an estimate of the teachers' expected ICT skills, given school province and level, for the schools that participated in the DKAP study. This estimate was then used to replicate the analysis above using the questions related to teachers' roles in learning about internet and computer use and their advice.

No significant relationship was found between teachers' ICT skills and students' digital citizenship skills, as presented in Figure 19. This is unlikely to reflect the processes that were taking place in the classrooms, as the DKAP data analysis showed that teachers' behaviours were indeed linked to students' digital citizenship skills. In turn, this finding is probably the result of a poor match between the two datasets (DKAP and teacher readiness surveys) to predict ICT skills for and the digital citizenship skills of the students in the DKAP database, as we cannot assume that the teachers who participated in the teacher readiness survey taught any of the students in the DKAP survey. Annex 1 includes an explanation of the disadvantages of this matching attempt and of alternative matching options for this kind of analysis.

This attempt to connect the DKAP and ICT-CST surveys to understand the relationship between teacher and student ICT skills takes as much advantage as possible of the available data. Despite its limitations, it could have provided a better indication of the relationship of interest if there were a larger overlap in the availability of variables in the two studies and if the characteristics of the participating schools were available for more schools.

Figure 19: Estimated parameters and 95% confidence intervals for a Bhutan model predicting students' digital citizenship skills using teachers' ICT skills for each domain



Chapter 3

Qualitative mapping of digital citizenship in teacher and student policies

This qualitative analysis aims to reveal the policy and ICT competency standards that support the development of teacher digital citizenship skills and the extent to which DKAP domains are evident in policy and guidance documents for both teachers and students.

Methodology

A qualitative review and analysis of seven Member States' digital citizenship policies and ICT-CST data was undertaken using a priori categories drawn from the DKAP Framework's five digital citizenship domains. Coding was undertaken by two members of the research team, with each independently coding a sample from each country. Inter-rater reliability was determined using Cohen's kappa and indicated substantial reliability (k = 0.74). Where differences in coding were detected, team members discussed them until an agreement was reached. The senior member of the research team then coded the remaining data.

Data

The data sources for this analysis included:

- ICT-CST data from seven Member States: Bhutan, Kyrgyzstan, Mongolia, Myanmar, Nepal, the Philippines, and Uzbekistan.
- Twenty-one policy and guidance documents, including education sector plans, ICT in education master plans, and student curricula detailed in Annex 3.

Findings

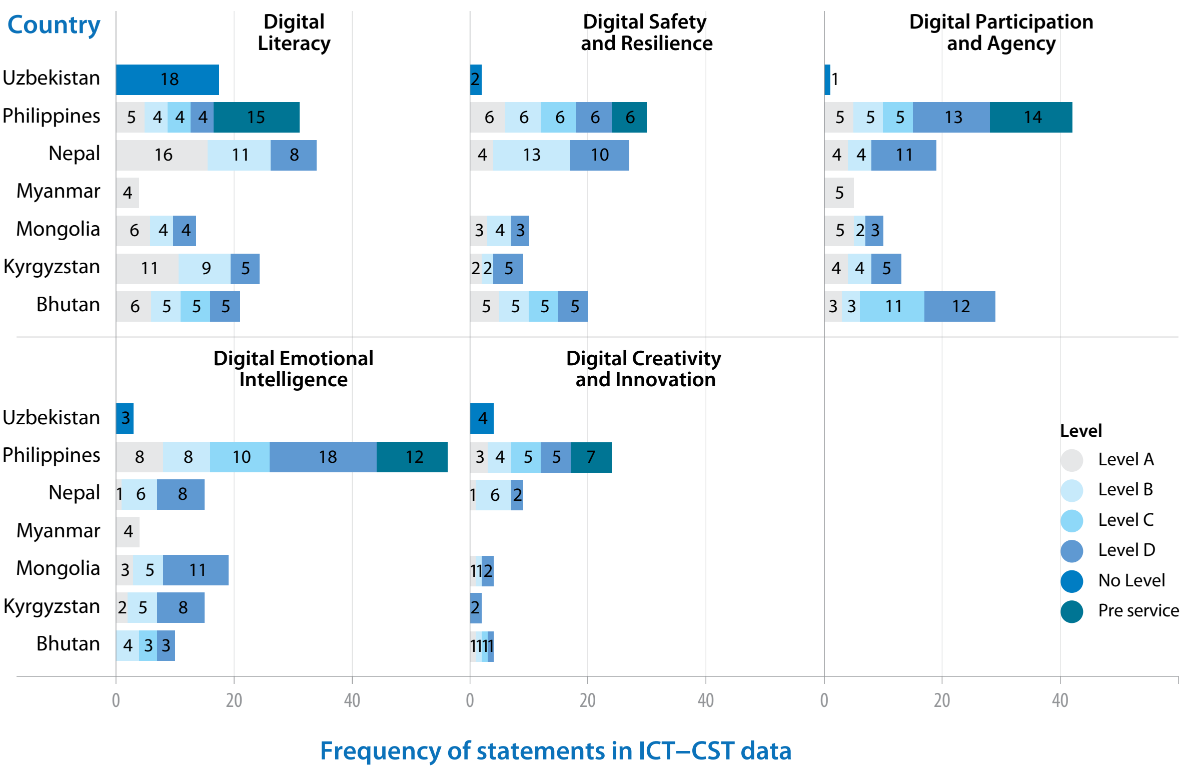
Overview of digital citizenship standards and policies

The ICT competency standards for teachers in the seven Member States were developed between 2016–2022 with the support of UNESCO. The standards largely referenced UNESCO's ICT Competency Framework for Teachers (ICT-CFT), which is a tool to guide pre-service and in-service teacher training on digital technology use. The ICT-CFT launched its Version 3 in 2018 and predated the DKAP Framework, so it is natural that the frameworks do not necessarily align. However, it is interesting to understand to what extent the competencies of the DKAP Framework are covered within the resulting teacher competency standards, especially considering that teachers still have a large impact on student digital competencies, particularly in lesser developed contexts.

The results in Figure 20 show the frequency of indicators in the ICT-CST documentation that relate to the DKAP Framework domains. It also reveals the way in which the DKAP domains have been covered in the UNESCO ICT-CST implementation in various Member States had been designed to be hierarchical. This aligns with research based on Bloom's Digital Taxonomy (Goranova, 2019; Wedlock and Growe, 2017) which introduces the notion of lower-order digital citizenship competencies that are easier to attain and more challenging higher-order ones.

For example, as teachers develop their digital proficiency, the indicators move from a focus on Digital Literacy, which covers the acquisition of digital skills, to the application of those skills in domains such as Digital Creativity and Innovation. While this is a general trend evident in the data, exceptions were revealed through our analysis. For example, there were relatively high levels of Digital Creativity and Innovation indicators for pre-service teachers in the Philippines (n = 7) and for proficient in-service teachers in Nepal (n = 6). This suggests that there are various contexts where certain domains are expected to be developed by less proficient teachers, suggesting the relative importance of these domains in different education systems. Additional, detailed analyses of individual Member States can also be found in Annex 3.

Figure 20: Summary of the frequency of ICT-CST that correspond to DKAP domains in Member States[10]



10 Please note that due to the different delineations of teacher levels by various Member States, this figure has adopted a generic nomenclature of Level A to Level D to compare frequencies from least to most experienced teachers in different Member States.

The extent to which the topic of digital citizenship and its competencies are covered in policy documents can suggest the awareness in education systems and how their policy environments support digital citizenship education. Figure 21 shows that the distribution of DKAP domains in key policy documents across Member States varies substantially in both the number of policy documents that mention topics relevant to digital citizenship as well as the number of DKAP domains evident in each policy.

A great deal of variation was found in the frequency with which DKAP domains were included within documents guiding both student and teacher digital citizenship development, as outlined in Table 4. For example, DKAP domains for students in Nepal were mentioned infrequently in key policy and guidance documents, particularly when compared to some other Member States, such as the Philippines. DKAP domains for teachers also varied substantially between Member States with Bhutan recording relatively low frequencies and Myanmar providing relatively high frequencies. Examples of rich policy frameworks providing opportunities for the development of digital citizenship competencies for teachers and students were particularly evident in Myanmar and the Philippines.

Figure 21: Summary of DKAP domains in policy documents of Member States

Country	Digital Literacy		Digital Safety and Resilience		Digital Participation and Agency		Digital Emotional Intelligence		Digital Creativity and Innovation	
	Students	Teachers	Students	Teachers	Students	Teachers	Students	Teachers	Students	Teachers
Uzbekistan	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered
Philippines	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered
Nepal	Covered	Covered	Not Covered	Covered	Not Covered	Covered	Not Covered	Covered	Covered	Covered
Myanmar	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered
Mongolia	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Not Covered	Not Covered
Kyrgyzstan	Covered	Covered	Covered	Covered	Covered	Covered	Not Covered	Not Covered	Covered	Covered
Bhutan	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Covered	Not Covered

Variations in DKAP domains across countries

It is interesting to note that all Member States, except for Bhutan, had an equal or higher frequency of DKAP domains in key policy and guidance documents for teachers compared with those for students. This suggests that current policy and guidance documents do more to enhance teacher digital citizenship development than student digital citizenship development. However, it should be noted that while these findings provide some deeper insights into the development of digital citizenship education in different Member States, these perspectives resulted from analyses of a relatively limited number of key policy and guidance documents for each Member State.

Table 4: Coverage of DKAP domains in documents guiding student and teacher digital citizenship development

	Bhutan		Kyrgyzstan		Mongolia		Myanmar		Nepal		Philippines		Uzbekistan	
Domain	S	T	S	T	S	T	S	T	S	T	S	T	S	T
Digital Literacy	2/4	2/4	2/3	1/3	1/3	1/3	1/3	3/3	1/3	3/3	2/3	3/3	2/2	2/2
Digital Safety and Resilience	2/4	1/4	1/3	1/3	2/3	2/3	2/3	2/3	0/3	1/3	3/3	3/3	1/2	1/2
Digital Emotional Intelligence	2/4	2/4	0/3	0/3	1/3	1/3	2/3	2/3	0/3	2/3	2/3	2/3	1/2	1/2
Digital Participation and Agency	2/4	1/4	1/3	3/3	2/3	2/3	1/3	3/3	0/3	1/3	2/3	2/3	1/2	2/2
Digital Creativity and innovation	1/4	0/4	1/3	1/3	0/3	0/3	2/3	3/3	1/3	1/3	3/3	2/3	1/2	1/2
Total	9/20	6/20	5/15	6/15	6/15	6/15	8/15	13/15	2/15	8/15	12/15	12/15	6/10	7/10
Percentage	45	30	33.3	40	40	40	53.3	86.6	13.3	53.3	80	80	60	70

Note: S = students; T = teachers

The qualitative mapping of the ICT-CST and policy frameworks of seven Member States revealed the following key findings:

- Digital competency development is important for multiple stakeholders beyond just teachers and students. In Bhutan, the policies covered digital skills for learning support staff, educational leaders, library staff, laboratory assistants, and parents. This provides a comprehensive platform to enable broad understanding and development of digital citizenship competency while engaging a wider range of stakeholders.
- The approach taken by Member States varies from a multifaceted approach that distinguishes between standards for teachers with different levels of experience to more homogenized approaches. A comparison of the ICT-CST in the different countries suggests that there are three approaches that Member States have taken when developing strategies for developing digital citizenship capacities in their teachers:
    - A homogenized approach in which all teachers, irrespective of experience, are expected to develop the same digital citizenship competencies (for example, see the approach taken by Uzbekistan and Myanmar). This approach aims to ensure that all teachers achieve a base level of digital competency by only providing ICT-CST indicators without differentiating by levels. Sometimes, the ICT-CST focused only on a specific group of either in-service or pre-service teachers. For example, Uzbekistan's homogenized approach mainly covered Digital Literacy competencies as outlined in the DKAP Framework and was only for in-service teachers. Meanwhile, Myanmar reflected a similar approach towards a single level of ICT-CST indicators that covered various DKAP domains for pre-service rather than in-service teachers.

  - A differentiated approach that requires in-service teachers with different experience levels to develop different digital citizenship skills. This suggests that Member States may consider digital citizenship skills to be hierarchical in nature (for example, see the approaches taken by Nepal, Mongolia, Kyrgyzstan, and Bhutan in Annex 3). It shows that once there is broad scale evidence of pre- and in-service teachers achieving a universal level of competence, further refinement is made to expand the breadth and depth of digital citizenship developmental opportunities for teachers.
  - A differentiated approach that requires both in-service and pre-service teachers to develop digital citizenship skills, irrespective of experience levels, suggesting an integrated approach where all digital citizenship domains are considered important for all teachers (for example, see the approach taken by the Philippines, where numerous indicators of DKAP domains were evident at all levels, from basic to distinguished, and for both pre-service and in-service teachers.)
- Policy provisions for Digital Creativity and Innovation are relatively underdeveloped in all countries, except for the Philippines.

Further details on both policy and ICT-CST data for all seven Member States can be found in Annex 3, together with more detailed analysis of each individual Member State.

Chapter 4

Synthesis of key findings and observations at student and teacher levels

Synthesizing the findings from the three parts of this research allowed us to make the following observations about the relationship between teachers and students in the context of digital citizenship skills:

1. **Students who reported learning how to use computers and the internet through self-learning scored higher in digital citizenship competencies.** Taking into account differences across countries and in students' background, usage, and access to resources, those students who stated they were taught the most by teachers on how to use computers scored lower, on average, than their peers who taught themselves. Similarly, those who reported that teachers taught them the most about how to use the internet had lower scores in Digital Emotional Intelligence, Digital Literacy, and Digital Safety and Resilience than those who taught themselves.

   The data analysed in this report suggests that a large part of digital citizenship competency development occurs beyond the four walls of a school classroom. This brings into question where, when, and with whom students learn and develop their digital citizenship competencies. Thus, the effectiveness of policies and interventions may be improved through focusing on strengthening self-learning and out-of-school approaches.

   However, it is also important to acknowledge that the data in this report did not allow for in-depth and independent triangulation of digital citizenship competency development in individual students. Future investigations are required and are likely to reveal more nuanced understandings of what works, when, and why.

2. **Most of the variation in students' digital citizenship skills can be attributed to disparities between students within schools, whereas differences between schools accounted for only a small proportion.** In other words, this implies that the differences between students are more significant than differences between schools when explaining the variation in students' levels of digital citizenship skills. A possible explanation for this finding is that digital citizenship skill development may regularly occur in contexts outside of formal schooling, particularly among students who are self-driven and supported by adequate access to ICT devices and internet connectivity outside of school. In particular, Digital Creativity and Innovation showed the greatest variance associated with students (88 per cent), while variance in Digital Literacy was most influenced by differences between

schools (21 per cent).

3. **Female students benefited slightly more than their male counterparts from teachers' guidance and advice on ICT, particularly concerning Digital Safety and Resilience.** When comparing the differences between female students who reported that they learned about computer and internet use the most from others with those who taught themselves, the differences in Digital Safety and Resilience and Digital Emotional Intelligence are narrower than when comparing male students. In other words, in the same situation of self-driven ICT learning, female students scored lower than male students in these two domains. It is important to note that these findings are likely to be shaped by specific interactions with teachers, together with other contextual factors.
4. **The influence of teachers' behaviours on students' digital citizenship skills was evident but highly contextualized and complex.** There is emerging evidence from the DKAP data showing a link between teachers' behaviours and students' digital citizenship skills. This requires further research to provide a clearer picture of how teachers' organization and administration strategies and their ICT competency levels affect the development of students' digital citizenship skills. New emerging methodological approaches (for example, see the Quantitative Ethnographic methodology adopted by Phillips et al., 2021) offer opportunities for future explorations of such relationships.
5. **Teacher ICT readiness is influenced by five key factors: attitude to ICT, access to infrastructure, age, competency level, and geographic context.** In particular, the key findings were:
   - Across all ICT skill domains, teachers who reported a better general attitude to ICT in education, higher levels of infrastructure, and a more diverse use of digital resources reported higher average levels of competency, after accounting for other characteristics.
   - Younger teachers (30 years old or younger) reported higher ICT competency levels than older teachers across all domains, even after considering other factors, such as education and experience.
   - Teachers with different ICT competency levels adopt different organization and administrative strategies.
   - Teachers from urban regions reported higher ICT competency levels across domains than teachers from rural regions.

   The specific impact of each of these factors, in combination with one another, is not clearly understood. Further explorations of the connections between factors influencing teacher ICT readiness are required to better understand their impact on their ICT competency development.
6. **The richness of policy frameworks in terms of frequency and coverage of the DKAP domains within ICT competency standards for teachers seems to correlate with students' digital citizenship skills.** The qualitative analysis of policy documents and ICT-CST in the Philippines revealed high levels of guidance and support for teachers. Meanwhile, it is the only country to have consistently strong student representation across all DKAP domains, with all medians being 3.0 or higher. In contrast, other Member States with fewer examples of ICT-CST and supporting policy documentation, such as Bhutan, have substantially lower

levels of student digital citizenship skills.

7. **There are three different approaches that Member States have taken when developing ICT competency standards for teachers:**

    a. A homogenized approach in which a core set of competencies is expected of all teachers (pre-service and in-service), irrespective of experience (for example, see the approaches taken by Uzbekistan and Myanmar).

    b. A differentiated approach that distinguishes expected competencies between pre-service and in-service teachers, with more coverage of specific digital citizenship domains at certain levels of experience. This suggests that Member States may consider digital citizenship skills to be hierarchical in nature (for example, see the approaches taken by Nepal, Mongolia, Kyrgyzstan, and Bhutan).

    c. A differentiated approach that requires both in-service and pre-service teachers to develop all digital citizenship domains, irrespective of experience levels, suggesting an integrated approach where all digital citizenship domains are considered important for all teachers (for example, see the approach taken by the Philippines).

8. **Policy provisions for Digital Creativity and Innovation are relatively underdeveloped in all countries, except for the Philippines.** Considering research based on Bloom's Digital Taxonomy (Goranova, 2019; Wedlock and Growe, 2017), there is a notion of lower-order digital citizenship competencies that are easier to attain and more challenging, higher-order competencies. This seems to be reflected in the hierarchical nature of the ICT-CST implementation in various Member States. The findings paint a mixed picture, where Digital Literacy and Digital Safety and Resilience are sufficient, but Digital Creativity and Innovation is lacking. It is clear that fostering digital citizenship skills – especially creativity and innovation – will require attention in new pedagogical roles and new approaches to teacher education, supported by evidence-based policy.

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Chapter 5

Recommendations

Based on the five digital citizenship domains described in the DKAP Framework, the analysis in this report focused on understanding students' digital citizenship competencies in the Asia-Pacific region and the various contexts and factors in which they are developed. Particular focus was placed on how teachers' actions can support the development of these competencies. Secondly, the analysis of teachers' ICT competencies sought to understand if and how teaching policies supported the development of digital citizenship competencies.

Against this background, the following recommendations begin to delineate a comprehensive and systemic approach to educational transformation, from holistic policies that acknowledge a changed information landscape that extends beyond the school walls to nuanced teacher professional development informed by rigorous research.

Ten recommendations are made to support and enhance four key contextual factors associated with digital citizenship development across the Asia-Pacific region and beyond. The recommendations are underpinned by the principle of a commitment to knowledge creation for more sustainable futures through more holistic, participatory approaches to developing digital citizenship aligned with a 'learning society' paradigm, where economic and social development goals can coexist.

The recommendations are matched to specific stakeholder groups, identifying specific actions that could be undertaken to achieve impact. However, given the differences between the Asia-Pacific countries involved in the DKAP study, it is paramount to consider the nature of governance structures and existing curriculum policies in countries before implementing a recommendation.

Policy

Target audience	Action(s)
Policy leaders with budget responsibilities at central and local levels.	1. Implement sustained efforts to strengthen digital citizenship competencies, with particular focus on digital creativity and innovation. 2. Strengthen hybrid (blended offerings of online and face-to-face teaching and learning) and out-of-school access initiatives to remove obstacles to using computer and internet technologies for learning. 3. Adopt a holistic approach to providing equitable ICT connectivity and devices by starting at the community level, rather than focusing solely on the school level.

1. Implement sustained efforts to strengthen digital citizenship competencies, with particular focus on digital creativity and innovation.

The DKAP research data shows that some domains in particular require ongoing attention. The findings from Bangladesh, Fiji, the Republic of Korea, and Viet Nam found that students were least confident about their competencies in Digital Creativity and Innovation when compared with other domains (UNESCO, 2019b). In Indonesia, Lao PDR, and the Philippines, it revealed that while students in all three countries were digitally literate and emotionally intelligent in their ICT use, further work is required to enhance their capacities to participate more fully in digital relationships and, importantly, 'create content that is useful and relevant to others' (UNESCO, 2021, p. xix).

McGillivray et al. (2016) support the call for Digital Creativity and Innovation as a key domain in developing digital citizenship skills and capacities, highlighting the importance of 'Do-It Yourself (DIY) cultures, digital making and creative citizenship as they relate to the lives of young people' (p. 725) as this can position students 'not as simply consumers of pre-constructed messages but as people who are shaping, sharing, reframing, and remixing media content in ways which might not have been previously imagined' (Jenkins et al., 2013, p. 2). This suggests that there are questions for those shaping the future directions of education systems in Member States to address findings such as this and to provide additional opportunities for students to develop such digital citizenship skills.

2. Strengthen hybrid (blended offerings of online and face-to-face teaching and learning) and out-of-school access initiatives to remove obstacles to using computer and internet technologies for learning.

The findings suggest that students who are self-driven and are supported by adequate access to ICT devices and infrastructure (including electricity and internet) outside of school develop the most in terms of digital citizenship competencies. Thus, there is a need for a more holistic policy approach that goes beyond supporting individual schools and considers that students are developing their digital citizenship competencies across different learning spaces, including school, home, and their broader community.

Policies that exclusively target school interventions may have the unintended consequence of increasing existing divides among students' digital citizenship competencies between schools. Moreover, school-level interventions that do not consider broader contextual factors are likely to be less effective, since most of the differences in these digital citizenship skills arise from factors outside a school's control. More effective interventions may involve providing financial support and adult education programmes targeting families who cannot or choose not to buy or use technologies for learning. Such initiatives can improve parental and sibling engagement and strengthen home-school links.

3. Adopt a holistic approach to providing equitable ICT connectivity and devices by starting at the community level, rather than focusing solely on the school level.

Lack of access to digital devices presents a significant challenge to the development of digital citizenship skills (UNESCO, 2019a). While access is increasing in many Member States, this is still an ongoing challenge in public education. Thus, bridging gaps in access to quality infrastructure and connectivity are necessary prerequisites for enhancing children's digital citizenship development in all DKAP domains.

Community-level access to digital devices and connectivity showed a positive relationship with digital citizenship skills. These contexts include the home, where family links and access to technology are associated with positive outcomes. This may be because developing these skills for young people is a deeply social affair, which relies on established and ephemeral networks through which they learn, seek help, and receive advice (UNESCO, 2019a). Overall, community-level initiatives to increase access to technology and teach digital citizenship could be a highly effective way to support students' learning and development, while also engaging and empowering community members to play an active role in supporting these efforts.

Teacher development

Target audience	Action(s)
National policy-makers with budget responsibility and cross-national advisory bodies (e.g. UNESCO), as well as agencies responsible for designing and delivering professional learning programmes.	4. Mainstream digital technologies in teacher professional development programmes and build explicit connections between initial teacher education and continuing professional training. 5. Develop digital citizenship competencies for teachers, emphasizing on digital creativity and innovation, awareness of global challenges, and pedagogical differences between genders. 6. Develop or enhance ICT Competency Standards and Frameworks for Teachers to include the six aspects of teacher activity and support learning across hybrid (online/offline, in-school/out-of-school) and blended spaces.

4. Mainstream digital technologies in teacher professional development programmes and build explicit connections between initial teacher education and continuing professional training.

The importance of teacher professional development (coupled with adequate ICT infrastructure) for educators remains high. The analysis suggested that benefits are particularly visible in public schools, where teachers reported higher levels of ICT competency than teachers from private schools. Therefore, governments should sustain their efforts in teacher professional development while providing focused attention on supporting teachers as they transition from pre-service to in-service teaching. This should include developing a nuanced set of criteria for digital proficiency and different learning pathways depending on career level. Ideally, this more nuanced approach to professional learning could be informed by the relevant research. This recommendation should be read in conjunction with other recommendations that outline how specific teaching strategies and behaviours at different career stages influence the development of digital skills among students.

5. Develop digital citizenship competencies for teachers, emphasizing digital creativity and innovation, awareness of global challenges, and pedagogical differences between genders.

In addition to the need for ongoing digital citizenship development among students, developing digital citizenship knowledge and skills in teachers also requires continuous attention.
For example, Choi et al. (2018) examined the factors that influenced the different levels of teacher digital citizenship. They found that internet self-efficacy was strongly correlated with digital citizenship, suggesting Member States need to ensure equitable access to devices

and opportunities for educators to develop their knowledge and skills when using internet-based resources. Findings from Richardson et al. (2021) indicated that K–12 teachers can also enhance digital citizenship skills through considered and well-designed professional learning opportunities, indicating that countries with such developmental pathways in place may be advantageously positioned to develop such skills among their teachers.

The DKAP Framework can provide the overarching structure for developing digital citizenship competencies that are focused on socially and environmentally sustainable solutions. This can be done by recalibrating teacher professional development around addressing the challenges of a post-pandemic world and enhancing students' digital creativity and innovation. Programmes could be co-developed alongside experts and stakeholders through scenario-based approaches (e.g. one scenario where online interactions co-exist with traditional face-to-face education or one where infrastructure limitations, caused by environmental degradation, have become endemic and intractable).

Lastly, the findings from the DKAP research showed the different needs between males and females and the impact of teachers in developing their digital citizenship competencies. Teacher ICT development programmes should ensure a strengthened focus on how to diversify pedagogical use and ICT support across genders. This recommendation is linked to the one on pedagogical differences within the classroom practice category.

6. Develop or enhance ICT Competency Standards and Frameworks for Teachers to include the six aspects of teacher activity and support learning across hybrid (online/offline, in-school/out-of-school) and blended spaces.

It is recommended that all professional learning programmes be recalibrated to comprehensively cover content on how best to create new learning spaces effectively and safely, considering the benefits of digital technologies, while not losing sight of the importance of physical interactions. For example, if referencing the UNESCO ICT Competency Framework, a national teacher framework could be extended to encompass an explicit focus on combining ICT skills with innovations in pedagogy and curriculum. In addition to the current six aspects of teacher activity (understanding the ICT role in education, curriculum and assessment, pedagogy, ICT, organization and administration, and professional development), an area ripe for exploration is the ability to support digital creativity and learning across multiple 'learning spaces'. There is strong evidence that self-regulated and technology-enhanced learning occurs in multiple digitized spaces and physical settings. Children and teachers are increasingly using unconventional platforms, such as social media, games, and messaging apps, for their educational purposes.

Curriculum

Target audience	Action
Policy-makers and external bodies (e.g. quasi-governmental agencies and universities) involved in curriculum development and delivery.	7. Collaborate to develop a regional common curriculum standard and criteria for digital citizenship.

7. Collaborate to develop a regional common curriculum standard and criteria for digital citizenship.

The analysis showed that there are similarities between Asia-Pacific countries when it comes to the current level of their students' digital citizenship competencies and the various gaps that need to be addressed. A common curriculum standard that can be shared and referred to by all countries could enhance cooperation and strengthen digital citizenship skills among students within the Asia-Pacific region. Meanwhile, it is important that such standards are flexible enough to allow for localization to country-specific policy contexts. Furthermore, countries should expand their understanding of the term 'curriculum' to consider the increasingly hybrid nature of learning and include forms of technology-based activities that occur across home, community, and school settings.

The purpose of a common curricular framework, based on a shared set of criteria and learning outcomes, is to foster stronger expectations and create better support mechanisms across education systems. Revising and extending the curriculum will ensure that the hybrid out-of-school dimension described earlier is not an 'added extra' to the core business of schools, but an essential asset for the development of digital skills, which can shape the work of a school on multiple levels, including support for effective behaviour strategies and extra-curricular activities.

A shared set of curriculum standards would also increase the visibility and profile of digital citizenship skills across the board, supporting teachers and households (families and students) to implement more pragmatic and goal-oriented strategies for learning (i.e. based on clear assessment criteria and shared, consensual expectations). It is important that the curriculum is not framed as disconnected from the lives of students and their learning experiences outside school.

Classroom practice (pedagogy)

Target audience	Action
Teachers and other stakeholders involved in matters of educational provision and practice (e.g. consultants and professional learning providers).	8. Encourage students' self-regulated and peer learning through targeted programmes. 9. Promote deepened cooperation and interactions between teachers and female students of varied abilities and skill sets.

8. Encourage students' self-regulated and peer learning through targeted programmes.

A large body of education research suggests that teachers are no longer the sole providers of knowledge and skills and that other stakeholders, such as peers, can play an instrumental role in students' education.

It is recommended that educators make systematic efforts to engage students and their peers in building digital citizenship knowledge and skills. In practice, this means encouraging peer-learning, cooperative learning, and enhanced self-regulation among students of all genders and abilities.

There is, of course, a direct relationship between the professional learning recommendation proposed earlier and this more specific recommendation aimed at practitioners. This separate set of points invites educators to constantly reflect upon and improve their practice, taking advantage of the extensive advice and expertise accumulated by international educational research. For example, this can be done through supporting and motivating more experienced peers to teach other students. These strengthened peer relationships may also help young people develop stronger peer support networks to address online risks, as well as their awareness of and ability to navigate the digital landscape.

9. Promote deepened cooperation and interactions between teachers and female students of varied abilities and skill sets.

It is important to highlight how teachers will continue to play important roles in building digital literacy for all students, particularly female students. Teachers play an important role in modelling effective self-regulated practices that can help alleviate some gender inequalities in relation to digital citizenship. Pedagogical strategies aimed at female students should reinforce existing positive relationships, while also encouraging more creativity outside the classroom. The analysis suggested that, overall, there were slight differences between female and male students in their digital citizenship skills. Two meaningful points of distinction concerned Digital Safety and Resilience on the one side, with female students reporting slightly higher levels compared to male students, and Digital Creativity and Innovation on the other, where female students reported slightly lower levels. These differences are likely to be shaped by specific interactions with teachers and other contextual factors but suggest a gender-specific dynamic that warrants further attention. For example, female students may turn to their teachers for advice about safety and resilience but are less confident and creative around technology when such advice is not forthcoming.

Research

Target audience	Action
Donor agencies (government and non-government), research institutions, and researchers.	10. Invest in research to better understand how teacher competencies impact relevant student outcomes.

10. Invest in research to better understand how teacher competencies impact relevant student outcomes.

There is a need for funding and support to conduct systematic research on how teachers' behaviours and strategies translate into increased student digital citizenship skills. As part of their comprehensive review of seventy-eight academic articles exploring digital citizenship, Richardson et al. (2021) highlighted several shortcomings in previous investigations of digital citizenship education, including a lack of focus on K–12 educators, a lack of empirical and experimental studies, and a paucity of studies quantitatively measuring digital citizenship. The resulting limited understanding of digital citizenship poses challenges that have been brought into sharp focus by the COVID-19 pandemic and highlights the importance of digital citizenship education in a changing world.

While the DKAP data analysis revealed a link between teachers' ICT competencies and their impact on improving relevant student outcomes, a deeper investigation of a causal relationship will require more robust and experimental methodological approaches. It is recommended that new research should consider granular differences (e.g. relationships between individual teachers and students or clear identifying data for classrooms and schools).

Ideally, a quantitative study would collect data from teachers and students simultaneously, identifying the teachers who teach each student. If this is not possible, identifiers for the institutions to which both students and teachers belong would maximize the chances of matching students and teachers and finding a relationship. Quantitative designs can be integrated with qualitative interviews and workshops to clarify relationships and model best practices for professional development.

Some other important considerations for future studies include:

- Observational and longitudinal studies to shed light on how various teaching practices differentially impact student skills.
- Contextual variation across countries is an important variable that may influence research findings across the countries in the Asia-Pacific region.
- Quantitative approaches can rely on indicators for behaviours, strategies, and outcomes selected from DKAP and ICT-CST, which could be further refined through additional efforts towards scale development and evaluation.
- Student voices are critical in gaining an in-depth understanding of how their skills develop over time. Research using student voices should be promoted as it can provide new insights rarely captured in this region. The findings of these studies would have relevance for learners not only from this region but also beyond it.

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Annexes

Annex 1: Supplementary quantitative material

DKAP Scales: students

The question for these scales was: How much do you agree with the following statements? Disagree a lot:1; Disagree a little:2; Agree a little:3; Agree a lot:4.

Table 5: Scales measuring digital citizenship skills in each of the domains of the DKAP Framework

Domain	Question Number	Survey Question
Digital Literacy	A1	I can edit electronic resources (e.g. text, graphics, audio, videos).
	A2	I use social media platform (e.g. Facebook, Instagram, Snapchat, LINE, We Chat) to share ideas, participate in discussions, and collaborate with others.
	A3	I can set up a safe computing environment (e.g. remove computer viruses, install security programs/antivirus).
	A4	I can transfer photos, music, and video files saved on my computer into other digital devices (e.g. mobile phone, tablet PC).
	A5	I use computer software (e.g. Microsoft Word, Microsoft PowerPoint, Google Docs) to complete learning tasks at school.
	A6	I know how to use the latest digital devices.
	A7	I use digital devices in order to search for information and application I need.
	A8	I use digital devices for learning at home.
	A9	I use digital devices for my personal interest (e.g. games, chatting, shopping, searching for information).
	A10	I assess the relevance of the digital information to complete learning tasks at school.
	A11	I can separate reliable from unreliable information when searching for digital information.
	A12	I search for and find information to complete learning tasks on the Internet.
	A13	I know I need to report the source of information when using information attained from online.
	A14	If I find wrong information on the internet, I can correct it.

Domain	Question Number	Survey Question
Digital Safety and Resilience	B1	I understand I should show respect to the others on the internet.
	B2	I understand I should protect the privacy and security of the others.
	B5	I try to avoid threatening other people's personal information when using digital information.
	B6	I try to avoid infringing other people' intellectual property rights (e.g. software copyrights, portrait rights) when searching for and using digital information.
	B7	I try to protect my personal information from others online.
	B8	I know which information I should and should not share on the internet.
	B9	I find myself using on digital devices for longer periods of time than intended.
	B10	I use digital devices to relieve myself from stress (e.g. listening to music, watching movies, social networking services [SNS]).
	B11	I feel anxious if I have not checked for messages or switched on digital devices for some time.
	B12	I can modify privacy setting to keep myself safe/away from unwanted contacts (e.g. spam texts, emails).
	B13	I try to avoid clicking on information that look weird or suspicious.
	B14	I can ask the person to stop sending unwanted disturbing messages or emails.
Digital Participation and Agency	C1	I use the Internet to talk to people from places or backgrounds different from mine.
	C2	I use the Internet to share something I am good at or I know well.
	C3	I can share my knowledge online to anyone if it is helpful to him/her.
	C4	I make a new friendship online.
	C5	I post news on social issues online (e.g. Facebook, Instagram, blog).
	C6	I use the Internet to make a solution on my school problems.
	C7	I use the Internet to make a solution on my town/community problems.
	C8	I get involved online in social issues.
	C9	If I disagree with people online, I watch my language so that it doesn't come across a mean.
	C10	I am careful to make sure that the pictures I post or send will not embarrass other people or get them into trouble.
	C11	My favourite online places are where people are respectful toward each other.
	C12	I do not add to arguments and insulting interactions that happen on the internet.

Domain	Question Number	Survey Question
Digital Emotional Intelligence	D1	I am aware of my feelings that I experience in my interactions online.
	D2	I express myself in a way that makes a good impression on others when I write a post or comments on SNS (e.g. Facebook, Instagram).
	D3	I am aware of the meaning of non-verbal messages (e.g. smiley face, emoji) that I send to other people on the internet.
	D4	I express my feelings freely on the Internet using online communications.
	D5	I manage my feelings when I talk with other people on the internet.
	D6	Even though I get distracted during online classes or activities, I can easily go back to my work again.
	D7	I stick on my goals when I use the internet to do assignment at home.
	D8	I am motivated by the good results that my group can get from the projects that we do online.
	D9	Even though I face challenges while using digital devices, I solve the problem without giving up.
	D10	When I use digital devices or software (e.g. programs, applications) for the first time, I expect I am able to do well.
	D11	I communicate comfortably with people who have different backgrounds, appearances, and opinions on the internet.
	D12	I help other people feel better when they are not feeling well on the internet (e.g. when they read negative comments or see awful pictures of themselves posted by others).
	D13	I know how to resolve the conflicts that arise when I interact with people from diverse backgrounds on the internet.
	D14	When I meet friends online, I easily empathize with their emotions.
	D15	When I talk with friends on the internet, I understand their perspectives even if I disagree.
	D16	When I meet friends on the internet, I easily recognize what they want to talk about.

Domain	Question Number	Survey Question
Digital Creativity and Innovation	E1	I make changes to the digital contents (e.g. photos, videos, music, text, etc.) that others have produced.
	E2	I remix existing digital contents by using digital media software (e.g. programs, applications).
	E3	I create presentation slides to support my ideas or opinions.
	E4	I create something new from existing digital contents.
	E5	I express my ideas through selecting, organizing, and sharing existing digital materials.
	E6	I use the internet to try out different ways of expressing myself.
	E7	I express my personality online.
	E8	I show a better version of myself online.
	E9	I express who I want to be online.
	E10	There are certain things I express about myself more freely online than offline.
	E11	When I'm online, I present myself how I want others to view me.

Statistical tests for DKAP survey data

Table 6: Statistical tests for the analysis of differences and correlations for digital citizenship domains across countries

What was tested	Domain	Test name	df	Statistic	p-value
Differences across countries	Digital Literacy	Kruskal-Wallis test	8	1050.76859	1.64E-221
	Digital Safety and Resilience	Wilcoxon test	8	855.402425	2.34E-179
	Digital Participation and Agency	Kruskal-Wallis test	8	708.947829	8.48E-148
	Digital Emotional Intelligence	Kruskal-Wallis test	8	1044.21805	4.25E-220
	Digital Creativity and Innovation	Spearman correlation-based test	8	565.197562	7.06E-117

What was tested	Domain	Test name	df	Statistic	p-value
Gender differences	Digital Literacy	Spearman correlation-based test		18181277	4.83E-06
	Digital Safety and Resilience	Spearman correlation-based test		16949395	4.01E-27
	Digital Participation and Agency	Spearman correlation-based test		17728492	7.07E-12
	Digital Emotional Intelligence	Spearman correlation-based test		18377813.5	0.0003
	Digital Creativity and Innovation	Spearman correlation-based test		19408842.5	0.1074
Teacher taught the most about computers	Digital Literacy	Wilcoxon test	5	663.065097	4.75E-141
	Digital Safety and Resilience	Wilcoxon test	5	394.462694	4.63E-83
	Digital Participation and Agency	Wilcoxon test	5	92.9115832	1.64E-18
	Digital Emotional Intelligence	Kruskal-Wallis test	5	309.019118	1.15E-64
	Digital Creativity and Innovation	Wilcoxon test	5	135.924648	1.31E-27
Teacher taught the most about the internet	Digital Literacy	Kruskal-Wallis test	5	527.971868	7.30E-112
	Digital Safety and Resilience	Kruskal-Wallis test	5	441.643701	3.12E-93
	Digital Participation and Agency	Spearman correlation-based test	5	127.00912	1.03E-25
	Digital Emotional Intelligence	Spearman correlation-based test	5	207.697653	6.40E-43
	Digital Creativity and Innovation	Spearman correlation-based test	5	68.7578466	1.86E-13

What was tested	Domain	Test name	df	Statistic	p-value
Teacher safety	Digital Literacy	Spearman correlation-based test		0.00395284	0.660
	Digital Safety and Resilience	Spearman correlation-based test		0.05007429	2.51E-08
	Digital Participation and Agency	Spearman correlation-based test		0.10176919	7.58E-30
	Digital Emotional Intelligence	Wilcoxon test		0.07623501	2.05E-17
	Digital Creativity and Innovation	Wilcoxon test		0.04636104	2.48E-07
Teacher explore	Digital Literacy	Wilcoxon test		0.04737675	1.33E-07
	Digital Safety and Resilience	Kruskal-Wallis test		0.08688885	3.45E-22
	Digital Participation and Agency	Wilcoxon test		0.1250941	2.25E-44
	Digital Emotional Intelligence	Kruskal-Wallis test		0.09628474	6.72E-27
	Digital Creativity and Innovation	Kruskal-Wallis test		0.06744983	5.75E-14
Usage	Digital Literacy	Spearman correlation-based test		0.25601972	5.79E-183
	Digital Safety and Resilience	Spearman correlation-based test		0.20567963	2.17E-117
	Digital Participation and Agency	Spearman correlation-based test		0.25384918	8.33E-180
	Digital Emotional Intelligence	Spearman correlation-based test		0.18538029	2.42E-95
	Digital Creativity and Innovation	Spearman correlation-based test		0.21665281	2.43E-130

What was tested	Domain	Test name	df	Statistic	p-value
Home device access	Digital Literacy	Spearman correlation-based test		0.30483136	3.80E-266
	Digital Safety and Resilience	Wilcoxon test		0.23678911	2.55E-158
	Digital Participation and Agency	Wilcoxon test		0.11216984	3.58E-36
	Digital Emotional Intelligence	Wilcoxon test		0.18614459	1.59E-97
	Digital Creativity and Innovation	Kruskal-Wallis test		0.08097382	1.41E-19
School device access	Digital Literacy	Wilcoxon test		0.1620588	4.43E-74
	Digital Safety and Resilience	Kruskal-Wallis test		0.13476421	1.38E-51
	Digital Participation and Agency	Kruskal-Wallis test		0.10811883	1.02E-33
	Digital Emotional Intelligence	Spearman correlation-based test		0.11106277	1.70E-35
	Digital Creativity and Innovation	Spearman correlation-based test		0.09658806	3.23E-27
Community device access	Digital Literacy	Spearman correlation-based test		0.13109367	7.54E-49
	Digital Safety and Resilience	Spearman correlation-based test		0.06629421	1.32E-13
	Digital Participation and Agency	Spearman correlation-based test		0.0774446	5.00E-18
	Digital Emotional Intelligence	Spearman correlation-based test		0.09860868	2.78E-28
	Digital Creativity and Innovation	Wilcoxon test		0.06707406	6.79E-14

What was tested	Domain	Test name	df	Statistic	p-value
Home internet access	Digital Literacy	Wilcoxon test		8190840.5	3.04E-100
	Digital Safety and Resilience	Wilcoxon test		9009978.5	2.61E-57
	Digital Participation and Agency	Kruskal-Wallis test		9597781	6.94E-34
	Digital Emotional Intelligence	Wilcoxon test		9289217.5	2.57E-45
	Digital Creativity and Innovation	Kruskal-Wallis test		9651317.5	4.72E-32
School internet access	Digital Literacy	Kruskal-Wallis test		11878825	7.61E-32
	Digital Safety and Resilience	Spearman correlation-based test		12484660	2.90E-16
	Digital Participation and Agency	Spearman correlation-based test		12270070.5	3.70E-21
	Digital Emotional Intelligence	Spearman correlation-based test		12391056	2.76E-18
	Digital Creativity and Innovation	Spearman correlation-based test		12053451	8.50E-27
Community internet access	Digital Literacy	Spearman correlation-based test		12603583	6.82E-32
	Digital Safety and Resilience	Spearman correlation-based test		14192783	0.00852492
	Digital Participation and Agency	Wilcoxon test		12951644	1.67E-22
	Digital Emotional Intelligence	Wilcoxon test		13072753.5	1.33E-19
	Digital Creativity and Innovation	Wilcoxon test		12813625	5.08E-26

Table 7: Friedman tests of the differences between digital skills domains within each country

Country	df	Statistic	p-value
Bangladesh	4	937.74	1.1E-201
Bhutan	4	2630.82	0.0E+00
Fiji	4	1111.42	2.5E-239
Indonesia	4	2009.46	0.0E+00
Lao PDR	4	1067.57	8.1E-230
Philippines	4	1158.92	1.3E-249
Republic of Korea	4	2109.69	0.0E+00
Thailand	4	933.31	1.0E-200
Viet Nam	4	1492.22	6.9E-322

Table 8: Description of the independent variables included in the models estimated using DKAP data

Variable	Description
Bhutan	Fixed country effect for Bhutan. Reference: Bangladesh.
Fiji	Fixed country effect for Fiji. Reference: Bangladesh.
Indonesia	Fixed country effect for Indonesia. Reference: Bangladesh.
Lao PDR	Fixed country effect for Lao PDR. Reference: Bangladesh.
Philippines	Fixed country effect for Philippines. Reference: Bangladesh.
Republic of Korea	Fixed country effect for Republic of Korea. Reference: Bangladesh.
Thailand	Fixed country effect for Thailand. Reference: Bangladesh.
Viet Nam	Fixed country effect for Viet Nam. Reference: Bangladesh.
Born test country	Student was born in the test country. Reference: Born in other country.
Computer use	Indicator combining G13 - computer use for school, G14 - computer use for personal study, G15 - computer use for leisure and G16 - computer use for socializing.
Girl	Student is a girl. Reference: Boy.
Student background	Indicator combining H2 - mother's education, H3 - father's education and the possession of H4_1 - Car, H4_2 - Television and H4_3 - Bathrooms with a bathtub or shower.
Community devices	Indicator combining the availability of Desktop computer, Laptop Smartphone, Tablet PC (e.g. iPad, Galaxy Tab) and Printer in the community - G6.
Home devices	Indicator combining the availability of Desktop computer, Laptop Smartphone, Tablet PC (e.g. iPad, Galaxy Tab) and Printer at home - G4.
School devices	Indicator combining the availability of Desktop computer, Laptop Smartphone, Tablet PC (e.g. iPad, Galaxy Tab) and Printer at school - G5.

Variable	Description
Internet at home	Indicator combining the availability of wired or wireless internet at home - G7.
Internet at school	Indicator combining the availability of wired or wireless internet at school - G8.
Internet in community	Indicator combining the availability of wired or wireless internet in the community - G9.
Taught computers Family	Family taught the student most about how to use computers. Reference: The student taught themselves the most about how to use computers.
Taught computers Friends	Friends taught the student most about how to use computers. Reference: The student taught themselves the most about how to use computers.
Taught computers Local community	The local community taught the student most about how to use computers. Reference: The student taught themselves the most about how to use computers.
Taught computers Others	Others taught the student most about how to use computers. Reference: The student taught themselves the most about how to use computers.
Taught computers Teachers	Teachers taught the student most about how to use computers. Reference: The student taught themselves the most about how to use computers.
Taught internet Family	Family taught the student most about how to use the internet. Reference: The student taught themselves the most about how to use the internet.
Taught internet Friends	Friends taught the student most about how to use the internet. Reference: The student taught themselves the most about how to use the internet.
Taught internet Local community	The local community taught the student most about how to use the internet. Reference: The student taught themselves the most about how to use the internet.
Taught internet Others	Others taught the student most about how to use the internet. Reference: The student taught themselves the most about how to use the internet.
Taught internet Teachers	Teachers taught the student most about how to use the internet. Reference: The student taught themselves the most about how to use the internet.
Internet explore	Frequency with which teachers encourage the student to explore or learn things on the internet.
Internet safely	Frequency with which teachers suggest ways to use the internet safely.

Data manipulation notes for DKAP survey data

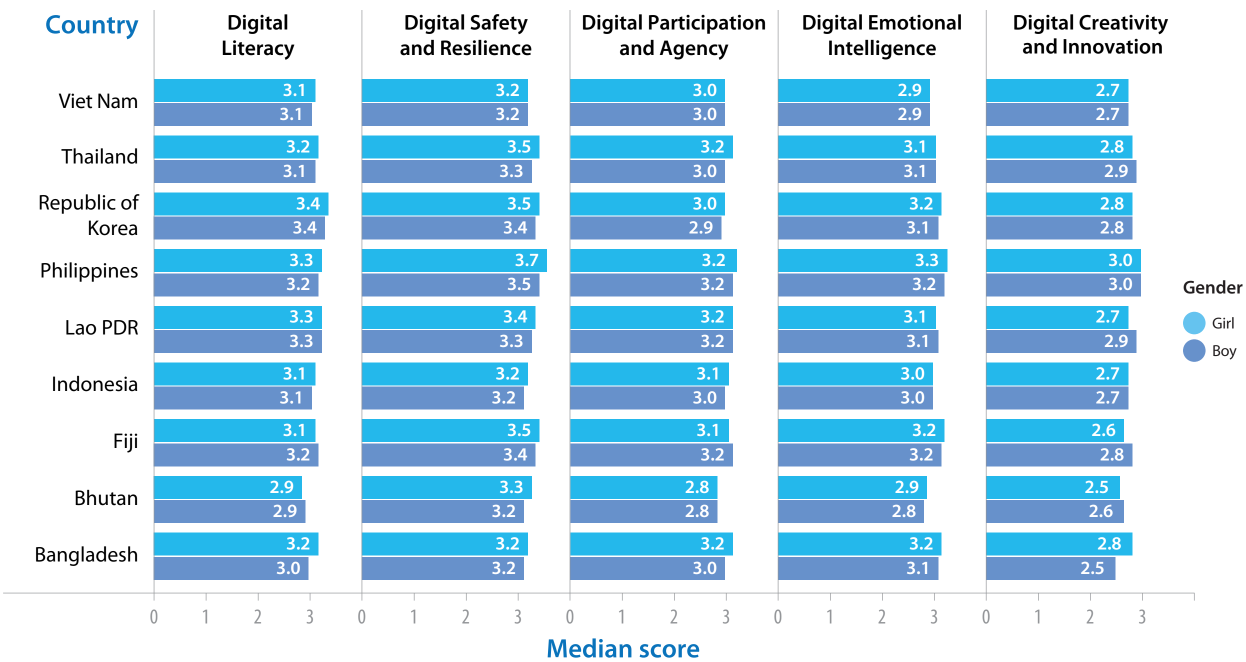
While all other participant countries included questions on who taught students the most about how to use computers and the internet with single-answer options, Bhutan offered multiple-answer options. For estimation purposes, the first answer was selected as the final answer for the students who selected multiple options (9 per cent and 8 per cent of the students who answered the questions about computers and the internet, respectively). This implies that all those students who selected their teachers as the person who taught them the most about computers or the internet (57 per cent and 20 per cent of students, respectively) either as a unique selection or as part of their multiple choices were coded as if they selected their teachers as who taught them the most about computers and the internet.

Differences in digital skills based on gender

In contrast to the literature on self-assessment of digital skills, which often found that women and girls tended to rate their skills lower than men and boys do (Hargittai and Shafer, 2006; Sonck et al., 2012), data from four countries studied in previous investigations indicated that, except in a few instances, girls overall had significantly higher scores for all five domains. This is possibly due to the survey measuring cognitive, socio-emotional, and behavioural aspects of children, beyond just digital skills.[11]

Due to the large sample size (which allowed us to detect very small differences between groups), data analysis revealed statistically significant gender differences for all digital citizenship domains; however, the magnitude of gender differences was only meaningful for Digital Safety and Resilience, with females reporting a median level of 3.42, in contrast to the 3.33 reported for males. Figure 22 shows the distribution of digital citizenship skills by gender and country.

Figure 22: Distribution of skill level in each of the digital citizenship domains by gender and country



11 https://unesdoc.unesco.org/ark:/48223/pf0000367985, p.27.

We also explored whether there were gender differences related to access to the internet and electronic devices at home, at school, and in the community, as well as their frequency of use. Figure 23 shows no meaningful differences in access to electronic devices between boys and girls at home, at school, or in their communities.

Figure 23: Distribution of student access to electronic devices at home, at school, and in the community by gender

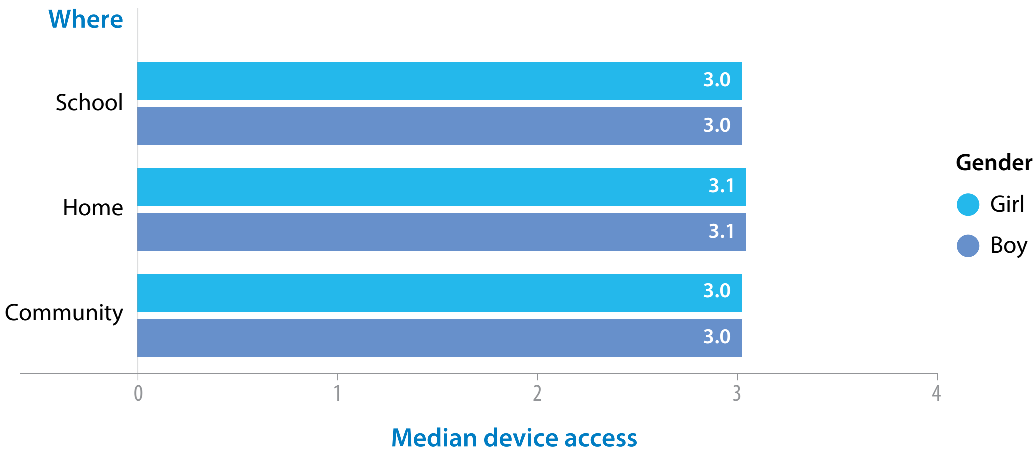


Figure 24 shows that girls were more likely to report having internet access at school (77.9 per cent) than boys (75.2 per cent). Other differences shown in the figure are not statistically significant.

Figure 24: Proportion of students reporting to have internet access at home, at school, and in the community by gender

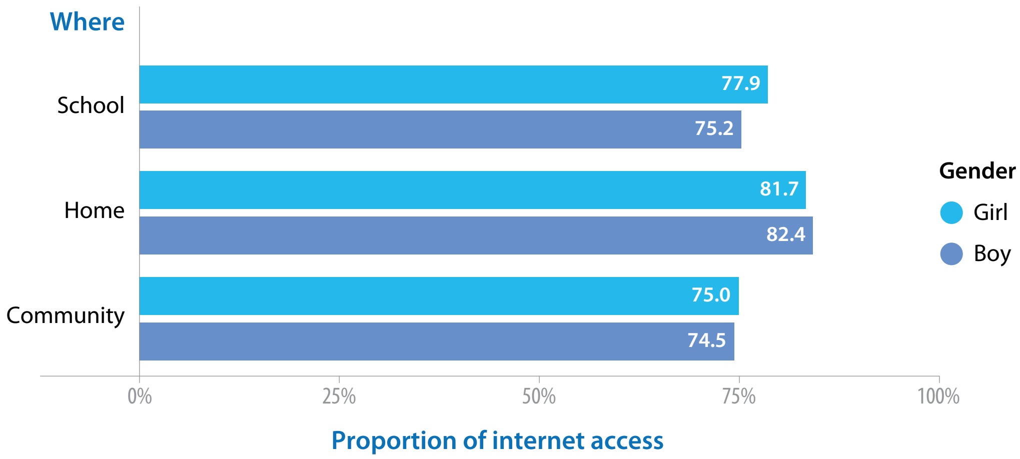
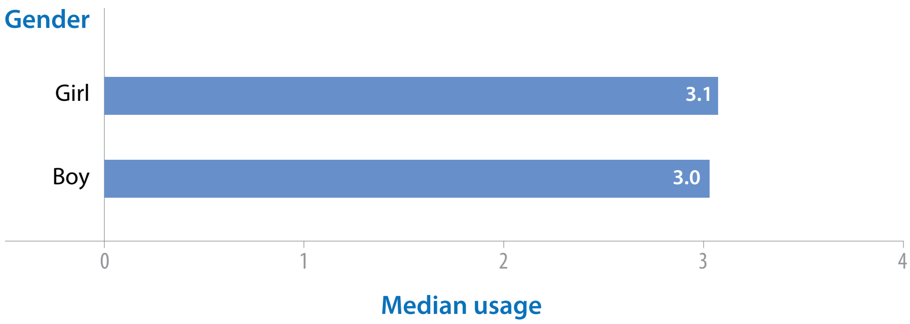


Figure 25 also shows no meaningful differences in reported usage between boys and girls, as the median score for girls is 3.1 and for boys is 3.

Figure 25: Distribution of the student computer usage by gender



Gender differences conditional on school setting

Overall, there were no substantial gender differences across domains, including when analysing gender differences conditional on the school setting, as shown in Table 9.

Table 9: Median score in digital citizenship domains for boys and girls attending schools in urban and rural settings

Domain	Rural		Urban	
	Boys	Girls	Boys	Girls
Digital Literacy	3.1	3.1	3.2	3.2
Digital Safety and Resilience	3.2	3.3	3.3	3.3
Digital Participation and Agency	3.0	3.1	3.0	3.1
Digital Emotional Intelligence	3.1	3.1	3.1	3.1
Digital Creativity and Innovation	2.7	2.7	2.8	2.8

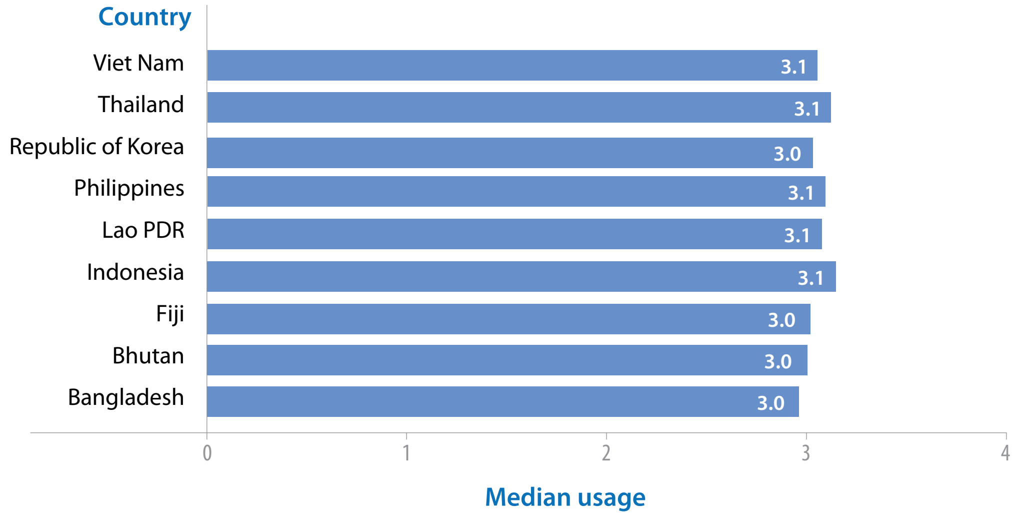
Further analysis presented below showed that, after controlling for all other characteristics, female students tended to have slightly higher levels of Digital Safety and Resilience and Digital Participation and Agency than males, but conversely lower levels of Digital Creativity and Innovation. It also showed no major gender differences in the relationship between interactions with teachers and digital citizenship skills, with some exceptions for specific domains.

Differences in usage and access

The DKAP survey asked students about how often they used computers or the internet for school study, for personal purposes, for leisure, and for socializing with friends. This was compiled into an indicator of usage. The survey also asked students about their access to digital devices (desktop computer, laptop, smartphone, tablet PC, and printer) and to the internet at home, at school, and in the community, responses to which were compiled into three different indicators of access (home, school, and community). These indicators do not have units and hence are only useful for comparisons between subgroups and countries, but they should not be interpreted on their own.

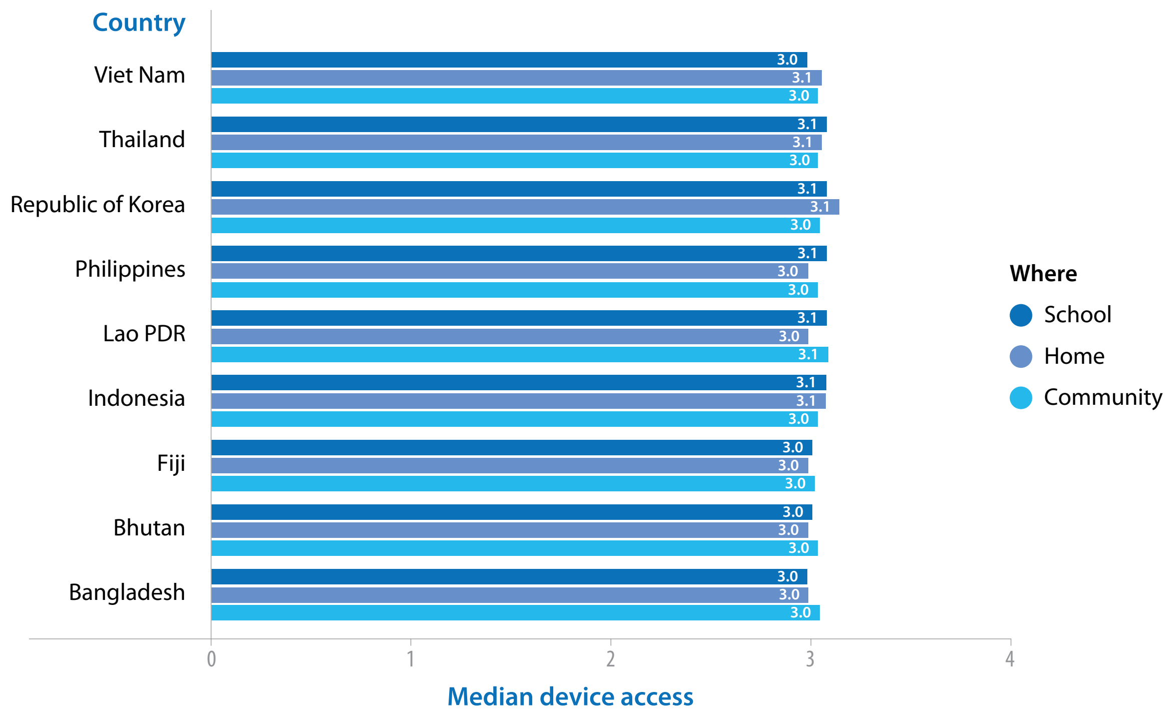
As an aggregate, students from across all the countries had similar levels of computer use. As Figure 26 shows, students across the participant countries reported similar usage levels (median score of 3 for the Republic of Korea, Fiji, Bhutan, and Bangladesh, and a median of 3.1 for Indonesia, Lao PDR, the Philippines, Thailand, and Viet Nam).

Figure 26: Distribution of the student computer usage indicator for each country



In terms of electronic device access, although there is an odd-shaped distribution (Figure 27), comparing their medians shows no substantial differences across the countries. The Republic of Korea has a slightly higher level of access at home (median 3.1) than other countries (median 3 for all of them), and Fiji has a slightly higher level of access at school and in the community (median 3.1, while the median for all other countries is 3 in both indicators).

Figure 27: Distribution of the indicator of student access to electronic devices at home, school, and in the community for each country



Finally, there were positive relationships between all domains and variables, including socioeconomic background (student background), using computers for different purposes (computer use), the availability of electronic devices at home (home devices), and internet at school. The availability of electronic devices and internet in the community (community devices) had a positive relationship with digital citizen skills in all domains except Digital Safety and Resilience. Similarly, the availability of internet at home was positively linked to all domains except Digital Creativity and Innovation. Interestingly, no relationship was found between any of the domains and the availability of electronic devices at school (school devices) and being born in the test country (born test country). However, there was little difference in these variables. That is, most schools had similar levels of availability of electronic devices, and most of the students were born in the test country.

Table 10: Estimation results for the hierarchical models using DKAP data with Digital Literacy as dependent variable

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	2.993	0.042	***	2.979	0.042	***	-3.655	0.380	***	-3.641	0.380	***
Bhutan	-0.126	0.051	**	-0.113	0.047	**	-0.110	0.038	**	-0.114	0.039	**
Fiji	0.127	0.058	**	0.116	0.053	**	0.085	0.044		0.080	0.044	
Indonesia	0.183	0.052	***	0.142	0.048	**	-0.010	0.040		-0.013	0.040	
Lao PDR	0.219	0.074	**	0.205	0.067	**	0.139	0.055	**	0.134	0.055	**
Philippines	0.188	0.055	***	0.168	0.050	***	0.105	0.041	**	0.100	0.042	**
Republic of Korea	0.327	0.059	***	0.289	0.054	***	0.117	0.045	**	0.113	0.045	**
Thailand	0.073	0.064		0.025	0.059		-0.104	0.049	**	-0.110	0.049	**
Viet Nam	0.108	0.060		0.073	0.055		-0.040	0.045		-0.045	0.045	
Girl							0.014	0.009		-0.069	0.026	**
Born test country							0.063	0.061		0.060	0.061	
Computer use							0.649	0.037	***	0.654	0.037	***
Student background							0.368	0.051	***	0.369	0.051	***
Home devices							0.794	0.051	***	0.793	0.051	***
School devices							0.024	0.078		0.036	0.078	
Community devices							0.321	0.108	**	0.316	0.108	**
Internet at home							0.047	0.012	***	0.048	0.012	***
Internet at school							0.063	0.011	***	0.064	0.011	***
Internet in community							0.044	0.011	***	0.045	0.011	***
Taught computers Teachers				-0.123	0.013	***	-0.084	0.012	***	-0.081	0.018	***
Taught computers Family				-0.044	0.015	**	-0.053	0.014	***	-0.038	0.021	
Taught computers Friends				-0.080	0.017	***	-0.059	0.016	***	-0.043	0.022	
Taught computers Local community				-0.170	0.049	***	-0.147	0.047	**	-0.143	0.067	**

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Taught computers Others				-0.155	0.034	***	-0.117	0.032	***	-0.084	0.049	
Taught computers Teachers x Girl										-0.002	0.023	
Taught computers Family x Girl										-0.023	0.028	
Taught computers Friends x Girl										-0.028	0.031	
Taught computers Local community x Girl										-0.007	0.094	
Taught computers Others x Girl										-0.061	0.065	
Taught internet Teachers				-0.076	0.015	***	-0.027	0.015		-0.049	0.021	**
Taught internet Family				-0.069	0.014	***	-0.062	0.014	***	-0.081	0.021	***
Taught internet Friends				-0.108	0.013	***	-0.072	0.013	***	-0.110	0.018	***
Taught internet Local community				-0.066	0.047		-0.069	0.045		-0.063	0.075	
Taught internet Others				-0.229	0.034	***	-0.153	0.032	***	-0.151	0.047	**
Taught internet Teachers x Girl										0.043	0.028	
Taught internet Family x Girl										0.031	0.027	
Taught internet Friends x Girl										0.071	0.025	**
Taught internet Local community x Girl										-0.009	0.093	
Taught internet Others x Girl										-0.013	0.065	
Internet safely				0.008	0.004	**	0.005	0.004		-0.002	0.005	
Internet explore				0.033	0.004	***	0.020	0.004	***	0.017	0.005	**
Internet safely x Girl										0.013	0.007	
Internet explore x Girl										0.007	0.007	
School-level variance	0.031			0.025			0.015			0.016		
Student-level variance	0.195			0.187			0.170			0.169		
Deviance	13105.994			12656.686			11554.345			11529.217		
AIC	13127.994			12702.686			11620.345			11619.217		
Number of Students	10525			10525			10525			10525		
Number of Schools	230			230			230			230		

***p<0.001, **p<0.05, *p<0.01

Table 11: Estimation results for the hierarchical models using DKAP data with Digital Safety and Resilience as dependent variable

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	3.115	0.034	***	3.055	0.034	***	-1.329	0.348	***	-1.285	0.348	***
Bhutan	0.049	0.041		0.052	0.037		0.051	0.031		0.046	0.032	
Fiji	0.213	0.047	***	0.203	0.042	***	0.177	0.035	***	0.171	0.036	***
Indonesia	0.136	0.041	***	0.102	0.038	**	0.000	0.033		-0.005	0.033	
Lao PDR	0.183	0.059	**	0.169	0.052	**	0.116	0.044	**	0.109	0.044	**
Philippines	0.367	0.044	***	0.349	0.040	***	0.300	0.034	***	0.293	0.034	***
Republic of Korea	0.284	0.047	***	0.264	0.043	***	0.141	0.036	***	0.134	0.036	***
Thailand	0.193	0.052	***	0.150	0.046	**	0.056	0.040		0.048	0.040	
Viet Nam	0.143	0.048	**	0.121	0.043	**	0.042	0.037		0.035	0.037	
Girl							0.058	0.008	***	-0.029	0.023	
Born test country							0.068	0.056		0.068	0.056	
Computer use							0.347	0.034	***	0.350	0.034	***
Student background							0.205	0.047	***	0.208	0.047	***
Home devices							0.538	0.047	***	0.534	0.047	***
School devices							0.153	0.072	**	0.158	0.071	**
Community devices							0.165	0.099		0.160	0.099	
Internet at home							0.063	0.011	***	0.064	0.011	***
Internet at school							0.038	0.010	***	0.039	0.010	***
Internet in community							0.001	0.010		0.001	0.010	
Taught computers Teachers				-0.070	0.011	***	-0.050	0.011	***	-0.072	0.016	***
Taught computers Family				-0.035	0.013	**	-0.044	0.013	***	-0.043	0.020	**
Taught computers Friends				-0.050	0.015	***	-0.035	0.014	**	-0.030	0.021	
Taught computers Local community				-0.191	0.044	***	-0.169	0.043	***	-0.163	0.062	**
Taught computers Others				-0.043	0.030		-0.017	0.030		-0.072	0.045	
Taught computers Teachers x Girl										0.039	0.021	
Taught computers Family x Girl										-0.001	0.026	
Taught computers Friends x Girl										-0.013	0.029	
Taught computers Local community x Girl										-0.016	0.086	
Taught computers Others x Girl										0.092	0.059	

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Taught internet Teachers				-0.120	0.014	***	-0.085	0.013	***	-0.074	0.019	***
Taught internet Family				-0.044	0.013	***	-0.038	0.013	**	-0.048	0.019	**
Taught internet Friends				-0.076	0.012	***	-0.048	0.012	***	-0.045	0.017	**
Taught internet Local community				-0.140	0.042	***	-0.142	0.041	***	-0.094	0.068	
Taught internet Others				-0.247	0.030	***	-0.197	0.030	***	-0.122	0.044	**
Taught internet Teachers x Girl										-0.017	0.026	
Taught internet Family x Girl										0.015	0.025	
Taught internet Friends x Girl										-0.005	0.023	
Taught internet Local community x Girl										-0.077	0.085	
Taught internet Others x Girl										-0.139	0.059	**
Internet safely				0.015	0.003	***	0.012	0.003	***	0.000	0.005	
Internet explore				0.030	0.003	***	0.023	0.003	***	0.023	0.005	***
Internet safely x Girl										0.021	0.007	**
Internet explore x Girl										0.001	0.007	
School-level variance	0.019			0.015			0.009			0.010		
Student-level variance	0.156			0.150			0.143			0.142		
Deviance	10741.023			10292.517			9689.796			9656.917		
AIC	10763.023			10338.517			9755.796			9746.917		
Number of Students	10525			10525			10525			10525		
Number of Schools	230			230			230			230		

***p<0.001, **p<0.05, *p<0.01

Table 12: Estimation results for the hierarchical models using DKAP data with Digital Participation and Agency as dependent variable

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	3.006	0.033	***	2.878	0.036	***	-2.090	0.387	***	-2.059	0.387	***
Bhutan	-0.168	0.039	***	-0.161	0.038	***	-0.180	0.034	***	-0.181	0.034	***
Fiji	0.019	0.045		0.031	0.043		-0.001	0.039		-0.003	0.039	
Indonesia	0.129	0.040	**	0.131	0.039	***	-0.017	0.036		-0.019	0.036	
Lao PDR	0.118	0.056	**	0.133	0.054	**	0.052	0.048		0.049	0.048	
Philippines	0.168	0.043	***	0.170	0.041	***	0.099	0.037	**	0.097	0.037	**
Republic of Korea	-0.022	0.045		0.003	0.044		-0.121	0.040	**	-0.123	0.040	**
Thailand	0.040	0.050		0.024	0.048		-0.102	0.043	**	-0.106	0.044	**
Viet Nam	-0.002	0.046		0.009	0.045		-0.088	0.040	**	-0.090	0.040	**
Girl							0.022	0.009	**	-0.018	0.026	
Born test country							0.020	0.062		0.020	0.062	
Computer use							0.692	0.038	***	0.692	0.038	***
Student background							0.192	0.052	***	0.194	0.052	***
Home devices							0.308	0.052	***	0.305	0.052	***
School devices							0.122	0.080		0.124	0.080	
Community devices							0.309	0.110	**	0.306	0.110	**
Internet at home							0.042	0.012	***	0.042	0.012	***
Internet at school							0.057	0.011	***	0.057	0.011	***
Internet in community							0.045	0.011	***	0.045	0.011	***
Taught computers Teachers				-0.052	0.013	***	-0.026	0.012	**	-0.034	0.018	
Taught computers Family				-0.048	0.015	***	-0.054	0.014	***	-0.052	0.022	**
Taught computers Friends				-0.036	0.017	**	-0.024	0.016		-0.020	0.023	
Taught computers Local community				-0.123	0.050	**	-0.115	0.048	**	-0.097	0.069	
Taught computers Others				-0.077	0.034	**	-0.049	0.033		-0.061	0.050	
Taught computers Teachers x Girl										0.013	0.023	
Taught computers Family x Girl										-0.003	0.028	
Taught computers Friends x Girl										-0.009	0.032	
Taught computers Local community x Girl										-0.038	0.096	
Taught computers Others x Girl										0.016	0.066	

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Taught internet Teachers				-0.046	0.015	**	-0.008	0.015		0.005	0.021	
Taught internet Family				-0.014	0.014		-0.007	0.014		0.008	0.022	
Taught internet Friends				-0.042	0.013	**	-0.017	0.013		-0.006	0.019	
Taught internet Local community				-0.027	0.047		-0.040	0.046		-0.007	0.076	
Taught internet Others				-0.194	0.034	***	-0.134	0.033	***	-0.080	0.049	
Taught internet Teachers x Girl										-0.022	0.029	
Taught internet Family x Girl										-0.026	0.028	
Taught internet Friends x Girl										-0.020	0.025	
Taught internet Local community x Girl										-0.053	0.095	
Taught internet Others x Girl										-0.104	0.066	
Internet safely				0.018	0.004	***	0.015	0.004	***	0.007	0.005	
Internet explore				0.032	0.004	***	0.022	0.004	***	0.021	0.005	***
Internet safely x Girl										0.013	0.007	
Internet explore x Girl										0.001	0.007	
School-level variance	0.017			0.015			0.011			0.011		
Student-level variance	0.194			0.189			0.177			0.177		
Deviance	12949.224			12665.096			11948.260			11937.757		
AIC	12971.224			12711.096			12014.260			12027.757		
Number of Students	10525			10525			10525			10525		
Number of Schools	230			230			230			230		

***p<0.001, **p<0.05, *p<0.01

Table 13: Estimation results for the hierarchical models using DKAP data with Digital Emotional Intelligence as dependent variable

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	3.052	0.034	***	2.953	0.036	***	-1.909	0.379	***	-1.891	0.379	***
Bhutan	-0.199	0.040	***	-0.188	0.038	***	-0.196	0.034	***	-0.201	0.034	***
Fiji	0.107	0.046	**	0.109	0.043	**	0.086	0.039	**	0.080	0.039	**
Indonesia	0.008	0.041		-0.006	0.039		-0.126	0.036	***	-0.129	0.036	***
Lao PDR	0.008	0.058		0.016	0.054		-0.049	0.048		-0.055	0.048	
Philippines	0.221	0.044	***	0.215	0.041	***	0.160	0.037	***	0.155	0.037	***
Republic of Korea	0.171	0.046	***	0.174	0.044	***	0.057	0.040		0.051	0.040	
Thailand	-0.013	0.051		-0.039	0.048		-0.140	0.043	**	-0.147	0.044	***
Viet Nam	-0.097	0.047	**	-0.099	0.045	**	-0.180	0.040	***	-0.186	0.040	***
Girl							0.015	0.009		-0.065	0.026	**
Born test country							0.037	0.061		0.035	0.061	
Computer use							0.522	0.037	***	0.524	0.037	***
Student background							0.217	0.051	***	0.218	0.051	***
Home devices							0.395	0.051	***	0.395	0.051	***
School devices							0.132	0.078		0.140	0.078	
Community devices							0.319	0.108	**	0.317	0.108	**
Internet at home							0.031	0.012	**	0.032	0.012	**
Internet at school							0.048	0.011	***	0.048	0.011	***
Internet in community							0.042	0.011	***	0.042	0.011	***
Taught computers Teachers				-0.089	0.012	***	-0.064	0.012	***	-0.090	0.018	***
Taught computers Family				-0.052	0.014	***	-0.057	0.014	***	-0.058	0.021	**
Taught computers Friends				-0.067	0.016	***	-0.054	0.016	***	-0.058	0.022	**
Taught computers Local community				-0.167	0.048	***	-0.156	0.047	***	-0.139	0.067	**
Taught computers Others				-0.037	0.033		-0.011	0.032		-0.031	0.049	
Taught computers Teachers x Girl										0.046	0.023	**
Taught computers Family x Girl										0.003	0.028	
Taught computers Friends x Girl										0.007	0.031	
Taught computers Local community x Girl										-0.031	0.094	
Taught computers Others x Girl										0.039	0.065	

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Taught internet Teachers				-0.060	0.015	***	-0.027	0.015		-0.023	0.021	
Taught internet Family				-0.021	0.014		-0.015	0.014		-0.017	0.021	
Taught internet Friends				-0.046	0.013	***	-0.022	0.013		-0.032	0.018	
Taught internet Local community				-0.048	0.046		-0.055	0.045		-0.098	0.075	
Taught internet Others				-0.275	0.033	***	-0.221	0.032	***	-0.233	0.047	***
Taught internet Teachers x Girl										-0.004	0.028	
Taught internet Family x Girl										0.003	0.027	
Taught internet Friends x Girl										0.021	0.025	
Taught internet Local community x Girl										0.066	0.093	
Taught internet Others x Girl										0.024	0.065	
Internet safely				0.016	0.004	***	0.014	0.004	***	0.010	0.005	
Internet explore				0.034	0.004	***	0.025	0.004	***	0.020	0.005	***
Internet safely x Girl										0.007	0.007	
Internet explore x Girl										0.009	0.007	
School-level variance	0.018			0.015			0.011			0.011		
Student-level variance	0.184			0.178			0.169			0.169		
Deviance	12451.389			12064.293			11491.795			11474.817		
AIC	12473.389			12110.293			11557.795			11564.817		
Number of Students	10525			10525			10525			10525		
Number of Schools	230			230			230			230		

***p<0.001, **p<0.05, *p<0.01

Table 14: Estimation results for the hierarchical models using DKAP data with Digital Creativity and Innovation as dependent variable

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	2.589	0.039	***	2.513	0.043	***	-2.094	0.479	***	-2.093	0.479	***
Bhutan	-0.048	0.046		-0.035	0.046		-0.063	0.043		-0.062	0.043	
Fiji	0.117	0.053	**	0.129	0.052	**	0.097	0.049	**	0.097	0.049	**
Indonesia	0.140	0.047	**	0.151	0.047	**	-0.012	0.045		-0.011	0.045	
Lao PDR	0.202	0.065	**	0.223	0.064	***	0.142	0.060	**	0.143	0.060	**
Philippines	0.372	0.050	***	0.378	0.049	***	0.305	0.047	***	0.305	0.047	***
Republic of Korea	0.180	0.053	***	0.194	0.053	***	0.083	0.050		0.084	0.050	
Thailand	0.210	0.059	***	0.203	0.058	***	0.068	0.055		0.067	0.055	
Viet Nam	0.158	0.054	**	0.167	0.054	**	0.064	0.050		0.065	0.050	
Girl							-0.042	0.011	***	-0.084	0.032	**
Born test country							-0.023	0.077		-0.029	0.077	
Computer use							0.867	0.047	***	0.867	0.047	***
Student background							0.194	0.064	**	0.194	0.064	**
Home devices							0.155	0.065	**	0.157	0.065	**
School devices							0.008	0.099		0.017	0.099	
Community devices							0.302	0.137	**	0.299	0.137	**
Internet at home							0.016	0.015		0.016	0.015	
Internet at school							0.080	0.014	***	0.081	0.014	***
Internet in community							0.080	0.013	***	0.080	0.013	***
Taught computers Teachers				-0.106	0.015	***	-0.076	0.015	***	-0.077	0.022	***
Taught computers Family				-0.093	0.018	***	-0.094	0.017	***	-0.078	0.027	**
Taught computers Friends				-0.073	0.020	***	-0.065	0.020	**	-0.067	0.028	**
Taught computers Local community				-0.140	0.061	**	-0.144	0.059	**	-0.193	0.085	**
Taught computers Others				-0.103	0.042	**	-0.074	0.041		-0.016	0.062	
Taught computers Teachers x Girl										0.004	0.029	
Taught computers Family x Girl										-0.026	0.035	
Taught computers Friends x Girl										0.008	0.040	
Taught computers Local community x Girl										0.098	0.119	
Taught computers Others x Girl										-0.100	0.082	

	Country Fixed Effects			Teacher Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Taught internet Teachers				0.039	0.019	**	0.072	0.018	***	0.076	0.026	**
Taught internet Family				-0.004	0.018		0.004	0.017		-0.008	0.027	
Taught internet Friends				-0.007	0.017		0.013	0.016		0.001	0.023	
Taught internet Local community				0.111	0.058		0.093	0.057		0.070	0.094	
Taught internet Others				-0.122	0.042	**	-0.061	0.041		-0.097	0.060	
Taught internet Teachers x Girl										-0.010	0.035	
Taught internet Family x Girl										0.020	0.035	
Taught internet Friends x Girl										0.023	0.031	
Taught internet Local community x Girl										0.032	0.118	
Taught internet Others x Girl										0.057	0.082	
Internet safely				0.011	0.005	**	0.008	0.005		0.016	0.007	**
Internet explore				0.026	0.005	***	0.014	0.005	**	0.001	0.007	
Internet safely x Girl										-0.015	0.009	
Internet explore x Girl										0.024	0.009	**
School-level variance	0.022			0.021			0.018			0.018		
Student-level variance	0.291			0.287			0.271			0.271		
Deviance	17212.795			17058.741			16444.308			16432.814		
AIC	17234.795			17104.741			16510.308			16522.814		
Number of Students	10525			10525			10525			10525		
Number of Schools	230			230			230			230		

***p<0.001, **p<0.05, *p<0.01

ICT-CST Scales

The question for these scales was: How do you rate your level of competency in the following ICT-supported tasks? (Please tick the appropriate box per item, 7 being most competent and 1 being least competent).

Table 15: Scales that measured teacher ICT competency levels in the ICT-CST Framework

Scale	Question Number	Survey Question
ICT Skills	Q30A	Use a word processor (e.g. MS Word, OpenOffice Writer).
	Q30B	Produce presentation slides (e.g. MS PowerPoint, OpenOffice Impress).
	Q30C	Use a spreadsheet (e.g. MS Excel, OpenOffice Calc).
	Q30D	Store and organize files into folders.
	Q30F	Read, write, and send emails.
	Q30G	Use chat applications and other social media applications.
	Q30H	Search for and access educational resources and tools online.
	Q30I	Evaluate the credibility of information on the web.
	Q30J	Evaluate the relevance of a digital application or content for a learning activity.
	Q30K	Download/install programs and software.
	Q30L	Use videoconferencing applications (e.g. Skype, FB video chat, Google Hangouts, WebEx, etc.).
	Q30M	Use collaborative online applications and folders (e.g. Google Drive, Dropbox).
	Q30N	Edit digital photographs or other graphics.
	Q30O	Create audio-visual materials (e-books, digital stories, videos, animation, etc.).
	Q30P	Learn new ICT applications and tools on your own.

Scale	Question Number	Survey Question
ICT for Teaching and Learning	Q31A	Incorporate multimedia elements (e.g. video, animation, or simulation) to support learning of concepts.
	Q31B	Conduct student practice drills through digital tools.
	Q31C	Use digital tools/games to engage student participation.
	Q31D	Engage students to share opinions through online polls, surveys, forums, blogs, and other social media.
	Q31E	Engage external experts via electronic means (emails, forums, videoconference, etc.).
	Q31F	Guide students in conducting online research.
	Q31G	Integrate ICT into teaching strategies that stimulate students' critical thinking, problem-solving skills, and creativity.
	Q31H	Organize collaborative activities/projects among students using various ICT tools.
	Q31I	Use online assessment strategies and tools (e.g. quizzes, online submission of assignments/outputs, digital portfolios).
	Q31J	Conduct peer or self-evaluation among students using online forms.
	Q31K	Discuss with students their online rights, safety, privacy, and ethical behaviour.
	Q31L	Use appropriate social networking sites for teaching purposes.
	Q31M	Use a variety of ICT applications/tools to communicate with parents, caregivers/ guardians, and peers.
Professional Learning	Q36A	Access educational websites to stay up-to-date and enhance my skills.
	Q36B	Enrol in webinars and/or online courses.
	Q36C	Reflect on my own teaching practices.
	Q36D	Share ICT in education trends with peers and colleagues in your school.
	Q36E	Engage in a virtual community of practice with teachers from different schools.
	Q36F	Coach/mentor peers and colleagues on ICT in education practices.

Bhutan constructed a scale of the frequency (from never to every day) with which teachers executed 24 different tasks employing ICT. In turn, other participant countries asked their teachers to rate their level of competency (from Least Competent:1 to Most Competent:7) in 35 ICT-supported tasks, 16 general tasks, 13 for teaching and learning, and 6 for professional learning.

Statistical tests for ICT-CST survey data

Table 16: Statistical tests for differences across ICT domains

What was tested	Domain	Test name	df	Statistic	p-value
Differences across countries	ICT Skills	Kruskal-Wallis test	4	1289.94	5.04E-278
	ICT Teaching and Learning	Kruskal-Wallis test	4	1231.31	2.59E-265
	Professional Learning	Kruskal-Wallis test	4	1480.16	2.861E-319
Gender differences	ICT Skills	Wilcoxon test		1546373.00	0.310
	ICT Teaching and Learning	Wilcoxon test		1557720.00	0.177
	Professional Learning	Wilcoxon test		1513982.50	0.954
Rural/Urban differences	ICT Skills	Wilcoxon test		730024.00	3.37E-24
	ICT Teaching and Learning	Wilcoxon test		744199.00	2.33E-21
	Professional Learning	Wilcoxon test		756824.50	5.08E-19
Public/Private differences	ICT Skills	Wilcoxon test		367661.50	2.67E-30
	ICT Teaching and Learning	Wilcoxon test		427398.50	6.09E-15
	Professional Learning	Wilcoxon test		357711.00	1.75E-33

Table 17: Friedman tests of the differences between ICT domains within each country

Country	df	Statistic	p-value
Mongolia	2	1456.87	4.41E-317
Kyrgyzstan	2	167.25	4.81E-37
Lao PDR	2	46.78	6.94E-11
Myanmar	2	1082.79	7.52E-236
Nepal	2	62.20	3.12E-14

Table 18: Chi-square tests for difference between countries in each Organization and Administration dimension

Dimension	Statistic	p-value
Standard operating rules	583.69	3.22E-117
Classroom setting	468.60	3.82E-96
Assistive technologies	564.93	6.18E-110

ICT skill differences across provinces

Figure 28 illustrates the variations in ICT competencies across countries. There were no discernible differences across the countries; however, there were differences in teachers' ICT competencies within countries. For example, in Kyrgyzstan, teacher competency in using ICT for teaching and learning was more variable than the other two competencies. Whereas, in Lao PDR, the variation in teachers' ICT Skills and ICT for professional learning was larger than in ICT for teaching and learning.

Figure 28: Distribution of the province mean ICT competencies within countries

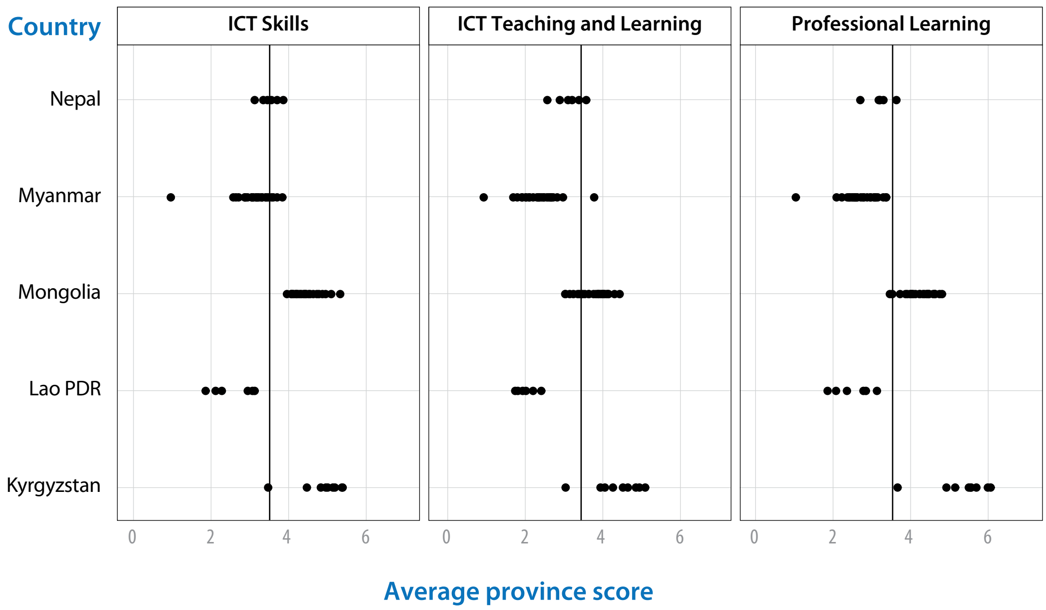


Table 19: Description of the independent variables included in the models estimated using ICT-CST survey data

Variable	Description
Lao PDR	Fixed country effect for Lao PDR. Reference: Kyrgyzstan
Mongolia	Fixed country effect for Mongolia. Reference: Kyrgyzstan
Myanmar	Fixed country effect for Myanmar. Reference: Kyrgyzstan
Nepal	Fixed country effect for Nepal. Reference: Kyrgyzstan
Assistive Rarely-access	Frequency of use of assistive technologies: 'rarely, as I do not have sufficient access to these technologies'. Reference: Always - Q35
Assistive Rarely-knowledge	Frequency of use of assistive technologies: 'rarely, as I do not have sufficient knowledge of these technologies'. Reference: Always - Q35
Assistive No-unfamiliar	Frequency of use of assistive technologies: 'No, I am not familiar with what assistive technologies are'. Reference: Always - Q35
Assistive No need	Frequency of use of assistive technologies: 'No, I do not teach any students with disabilities'. Reference: Always - Q35
Classroom Rearrange as needed	Classroom setting according to the nature of the activity and ICT used: 'My classes rearrange the classroom layout, depending on the activity or as needed'. Reference: Always row configuration - Q34
Classroom Rearrange and explore	Classroom setting according to the nature of the activity and ICT used: 'We rearrange the classroom layout, as needed, and sometimes explore other venues (outdoors or other places) as well'. Reference: Always row configuration - Q34
Standard School prescribed	Type of standard operating procedures/routines and rules of conduct when ICT is used: 'prescribed by the school'. Reference: No standard- Q33
Standard Teacher prescribed	Type of standard operating procedures/routines and rules of conduct when ICT is used: 'I provided the routines and rules'. Reference: No standard- Q33
Standard Co-created	Type of standard operating procedures/routines and rules of conduct when ICT is used: 'my students and I developed the routines and rules together'. Reference: No standard - Q33
31–40 y.o.	Age range: 31–40 years old. Reference: 30 and under - Q5
41–50 y.o.	Age range: 41–50 years old. Reference: 30 and under - Q5
51–60 y.o.	Age range: 51–60 years old. Reference: 30 and under - Q5
61 y.o. or above	Age range: 61 years old or above. Reference: 30 and under - Q5
TVET	Highest degree earned: Technical and Vocational Education and Training. Reference: other - Q8A
Bachelor	Highest degree earned: Bachelor's degree. Reference: other - Q8A
Secondary	Highest degree earned: Secondary education. Reference: other - Q8A
Postgraduate	Highest degree earned: Postgraduate education. Reference: other - Q8A
Experience 5-10 years	Number of years in teaching: 5-10 years. Reference: 4 years and under - Q6

Variable	Description
Experience 11-20 years	Number of years in teaching: 11-20 years. Reference: 4 years and under - Q7
Experience 21-30 years	Number of years in teaching: 21-30 years. Reference: 4 years and under - Q8
Experience over 30 years	Number of years in teaching: over 30 years. Reference: 4 years and under - Q9
Female	Sex: Female. Reference: Male - Q4
ICT teacher	ICT is the primary teaching area for the teacher - Q10A
Attitude	Score for general attitude on ICT education - Q12A-Q12G
Infrastructure	Score for school ICT infrastructure - Q13A to Q13K
Devices	Score for frequency of use of devices for classroom teaching - Q15A - Q15H
Resources	Score for use of digital resources for classroom teaching - Q16A - Q16I

Table 20: Estimation results for the hierarchical models using ICT-CST Teacher readiness data with ICT Skills as dependent variable

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	4.935	0.139	***	4.723	0.153	***	2.386	0.273	***	2.233	0.312	***
Lao PDR	-2.320	0.195	***	-2.073	0.189	***	-1.722	0.182	***	-1.733	0.182	***
Mongolia	0.165	0.155		0.195	0.151		0.328	0.131	**	0.333	0.131	**
Myanmar	-1.935	0.155	***	-1.769	0.150	***	-1.556	0.129	***	-1.536	0.129	***
Nepal	-1.379	0.191	***	-1.446	0.184	***	-1.264	0.152	***	-1.258	0.152	***
Assistive Rarely-access				0.015	0.086		0.114	0.079		0.500	0.166	**
Assistive Rarely-knowledge				-0.493	0.098	***	-0.210	0.090	**	0.131	0.191	
Assistive No-unfamiliar				-0.664	0.095	***	-0.338	0.088	***	-0.244	0.185	
Assistive No need				-0.127	0.080		0.024	0.075		0.251	0.155	
Assistive Rarely-access x Female										-0.493	0.187	**
Assistive Rarely-knowledge x Female										-0.425	0.214	**
Assistive No-unfamiliar x Female										-0.126	0.206	
Assistive No need x Female										-0.298	0.171	
Classroom Rearrange as needed				0.148	0.059	**	0.096	0.054		0.202	0.122	

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Classroom Rearrange and explore				0.106	0.061		0.092	0.056		-0.192	0.122	
Classroom Rearrange as needed x Female										-0.114	0.135	
Classroom Rearrange and explore x Female										0.353	0.136	**
Standard School prescribed				0.115	0.061		0.009	0.057		0.104	0.136	
Standard Teacher prescribed				0.552	0.073	***	0.312	0.069	***	0.194	0.150	
Standard Co-created				0.520	0.077	***	0.326	0.072	***	0.379	0.178	**
Standard School prescribed x Female										-0.112	0.147	
Standard Teacher prescribed x Female										0.147	0.164	
Standard Co-created x Female										-0.071	0.192	
31-40 y.o.							-0.322	0.069	***	-0.319	0.069	***
41-50 y.o.							-0.520	0.093	***	-0.521	0.093	***
51-60 y.o.							-0.818	0.135	***	-0.806	0.135	***
61 y.o. or above							-1.334	0.408	**	-1.325	0.407	**
TVET							0.338	0.362		0.285	0.361	
Bachelor							0.106	0.310		0.155	0.310	
Secondary							0.198	0.211		0.173	0.210	
Postgraduate							-0.369	0.131	**	-0.363	0.131	**
Experience 11-20 years							-0.125	0.116		-0.133	0.116	
Experience 21-30 years							-0.037	0.070		-0.047	0.070	
Experience 5-10 years							0.148	0.057	**	0.149	0.057	**
Experience over 30 years							0.016	0.047		0.019	0.047	
Female							-0.084	0.058		0.136	0.192	
ICT teacher							0.986	0.101	***	1.007	0.101	***
Attitude							0.440	0.057	***	0.434	0.057	***
Infrastructure							0.202	0.045	***	0.199	0.045	***
Devices							0.060	0.033		0.061	0.033	

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Resources							0.915	0.104	***	0.934	0.104	***
Province-level variance	0.072			0.062			0.030			0.030		
Teacher-level variance	1.967			1.860			1.560			1.549		
Deviance	12540.323			12338.539			11694.210			11670.564		
AIC	12554.323			12370.539			11762.210			11756.564		
Number of teachers	3549			3549			3549			3549		
Number of provinces	71			71			71			71		

***p<0.001, **p<0.05, *p<0.01

Table 21: Estimation results for the hierarchical models using ICT-CST Teacher readiness data with ICT Teaching and Learning as dependent variable

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	4.442	0.135	***	4.225	0.142	***	1.807	0.262	***	1.823	0.300	***
Lao PDR	-2.321	0.190	***	-1.887	0.174	***	-1.780	0.179	***	-1.774	0.179	***
Mongolia	-0.179	0.151		0.020	0.140		0.139	0.130		0.139	0.130	
Myanmar	-2.153	0.151	***	-1.764	0.139	***	-1.542	0.127	***	-1.536	0.127	***
Nepal	-1.369	0.186	***	-1.427	0.170	***	-1.189	0.151	***	-1.195	0.152	***
Assistive Rarely-access				-0.257	0.081	**	-0.143	0.076		0.008	0.159	
Assistive Rarely-knowledge				-0.777	0.091	***	-0.511	0.086	***	-0.285	0.183	
Assistive No-unfamiliar				-0.905	0.089	***	-0.590	0.085	***	-0.550	0.177	**
Assistive No need				-0.650	0.075	***	-0.485	0.071	***	-0.519	0.148	***
Assistive Rarely-access x Female										-0.192	0.179	
Assistive Rarely-knowledge x Female										-0.282	0.205	
Assistive No-unfamiliar x Female										-0.055	0.198	
Assistive No need x Female										0.029	0.164	
Classroom Rearrange as needed				0.167	0.056	**	0.112	0.052	**	0.234	0.117	**

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Classroom Rearrange and explore				0.144	0.057	**	0.112	0.054	**	0.027	0.117	
Classroom Rearrange as needed x Female										-0.143	0.129	
Classroom Rearrange and explore x Female										0.099	0.130	
Standard School prescribed				0.373	0.057	***	0.246	0.055	***	0.214	0.130	
Standard Teacher prescribed				0.726	0.069	***	0.485	0.066	***	0.317	0.144	**
Standard Co-created				0.762	0.073	***	0.560	0.069	***	0.510	0.170	**
Standard School prescribed x Female										0.037	0.141	
Standard Teacher prescribed x Female										0.205	0.157	
Standard Co-created x Female										0.052	0.184	
31-40 y.o.							-0.265	0.066	***	-0.267	0.066	***
41-50 y.o.							-0.360	0.089	***	-0.363	0.089	***
51-60 y.o.							-0.524	0.129	***	-0.522	0.129	***
61 y.o. or above							-0.943	0.390	**	-0.928	0.390	**
TVET							0.153	0.346		0.121	0.346	
Bachelor							0.154	0.297		0.185	0.297	
Secondary							0.032	0.202		0.014	0.202	
Postgraduate							-0.163	0.125		-0.155	0.125	
Experience 11-20 years							-0.057	0.111		-0.056	0.111	
Experience 21-30 years							0.062	0.067		0.058	0.067	
Experience 5-10 years							0.148	0.055	**	0.149	0.055	**
Experience over 30 years							0.096	0.045	**	0.099	0.045	**
Female							-0.036	0.055		-0.026	0.184	
ICT teacher							0.877	0.097	***	0.888	0.097	***
Attitude							0.357	0.055	***	0.355	0.055	***
Infrastructure							0.267	0.043	***	0.265	0.043	***

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Devices							0.124	0.031	***	0.125	0.031	***
Resources							0.806	0.099	***	0.813	0.099	***
Province-level variance	0.070			0.052			0.032			0.033		
Teacher-level variance	1.800			1.635			1.425			1.421		
Deviance	12229.574			11880.100			11378.425			11369.558		
AIC	12243.574			11912.100			11446.425			11455.558		
Number of teachers	3549			3549			3549			3549		
Number of provinces	71			71			71			71		

***p<0.001, **p<0.05, *p<0.01

Table 22: Estimation results for the hierarchical models using ICT-CST Teacher readiness data with Professional Learning as dependent variable

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Intercept	5.619	0.139	***	5.312	0.147	***	2.995	0.273	***	2.846	0.311	***
Lao PDR	-3.081	0.196	***	-2.756	0.182	***	-2.589	0.199	***	-2.582	0.199	***
Mongolia	-1.022	0.156	***	-0.913	0.146	***	-0.761	0.146	***	-0.762	0.146	***
Myanmar	-3.123	0.156	***	-2.837	0.145	***	-2.555	0.144	***	-2.557	0.144	***
Nepal	-2.469	0.193	***	-2.527	0.178	***	-2.264	0.173	***	-2.274	0.174	***
Assistive Rarely-access				-0.022	0.082		0.070	0.078		0.142	0.162	
Assistive Rarely-knowledge				-0.631	0.093	***	-0.377	0.088	***	-0.079	0.186	
Assistive No-unfamiliar				-0.772	0.090	***	-0.472	0.086	***	-0.499	0.180	**
Assistive No need				-0.370	0.077	***	-0.219	0.073	**	-0.304	0.151	**
Assistive Rarely-access x Female										-0.089	0.183	
Assistive Rarely-knowledge x Female										-0.374	0.209	
Assistive No-unfamiliar x Female										0.029	0.201	
Assistive No need x Female										0.098	0.167	

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Classroom Rearrange as needed				0.140	0.057	**	0.081	0.053		0.229	0.119	
Classroom Rearrange and explore				0.122	0.058	**	0.093	0.055		0.135	0.119	
Classroom Rearrange as needed x Female										-0.173	0.132	
Classroom Rearrange and explore x Female										-0.054	0.132	
Standard School prescribed				0.370	0.058	***	0.249	0.056	***	0.422	0.133	**
Standard Teacher prescribed				0.670	0.070	***	0.439	0.067	***	0.467	0.146	**
Standard Co-created				0.766	0.074	***	0.564	0.070	***	0.740	0.173	***
Standard School prescribed x Female										-0.206	0.143	
Standard Teacher prescribed x Female										-0.030	0.160	
Standard Co-created x Female										-0.217	0.187	
31-40 y.o.							-0.198	0.068	**	-0.199	0.068	**
41-50 y.o.							-0.283	0.091	**	-0.287	0.091	**
51-60 y.o.							-0.489	0.132	***	-0.491	0.132	***
61 y.o. or above							-0.288	0.397		-0.276	0.397	
TVET							0.035	0.352		-0.006	0.352	
Bachelor							0.240	0.302		0.279	0.302	
Secondary							0.070	0.205		0.042	0.205	
Postgraduate							-0.217	0.128		-0.200	0.128	
Experience 11-20 years							-0.260	0.113	**	-0.254	0.113	**
Experience 21-30 years							-0.030	0.069		-0.025	0.069	
Experience 5-10 years							0.115	0.056	**	0.115	0.056	**
Experience over 30 years							0.027	0.046		0.031	0.046	
Female							-0.007	0.056		0.197	0.187	
ICT teacher							0.732	0.099	***	0.734	0.099	***

	Country Fixed Effects			Organisation Variables			Model with Controls			Model with Interactions		
	Estimate	Standard error		Estimate	Standard error		Estimate	Standard error		Estimate	Standard error	
Attitude							0.320	0.056	***	0.321	0.056	***
Infrastructure							0.218	0.044	***	0.217	0.044	***
Devices							0.138	0.032	***	0.137	0.032	***
Resources							0.895	0.101	***	0.895	0.101	***
Province-level variance	0.077			0.059			0.053			0.053		
Teacher-level variance	1.839			1.692			1.474			1.468		
Deviance	12307.693			12004.612			11516.520			11503.012		
AIC	12321.693			12036.612			11584.520			11589.012		
Number of teachers	3549			3549			3549			3549		
Number of provinces	71			71			71			71		

***p<0.001, **p<0.05, *p<0.01

Relationship between teacher ICT competency and their organization and administration tasks

This section focused on understanding the relationship between teachers' reported levels of confidence in ICT competency and their organization and administration tasks (creating standard operating rules, setting the classroom, and using assistive technologies). The analysis consisted of three steps. First, exploring the existence of such a relationship; second, exploring if it persists even after considering other teacher characteristics; and third, exploring if there are any differential effects by gender. All the analyses accounted for differences between countries, which implies that they provide information about the existence of these relationships over and above socio-cultural and policy differences between countries.

While the analyses aimed to include as many variables as possible, questions regarding the school setting (urban/rural), school type (public/private), policy environment, and grade levels taught were not included as they had not been collected in all countries or had very high levels of missing data across all countries. These variables were excluded from the analysis to include as many participant countries as possible. A full list of variables included in the estimated models is shown in Table 19.

Figure 29 shows the 95 per cent confidence intervals for a model that estimates the relationship between teachers' reported level of competency in each of the ICT skill domains and the different dimensions of organization and administration. As shown, the reported level of competency is related to organization and administration strategies used, and these relationships are similar across ICT skill domains.

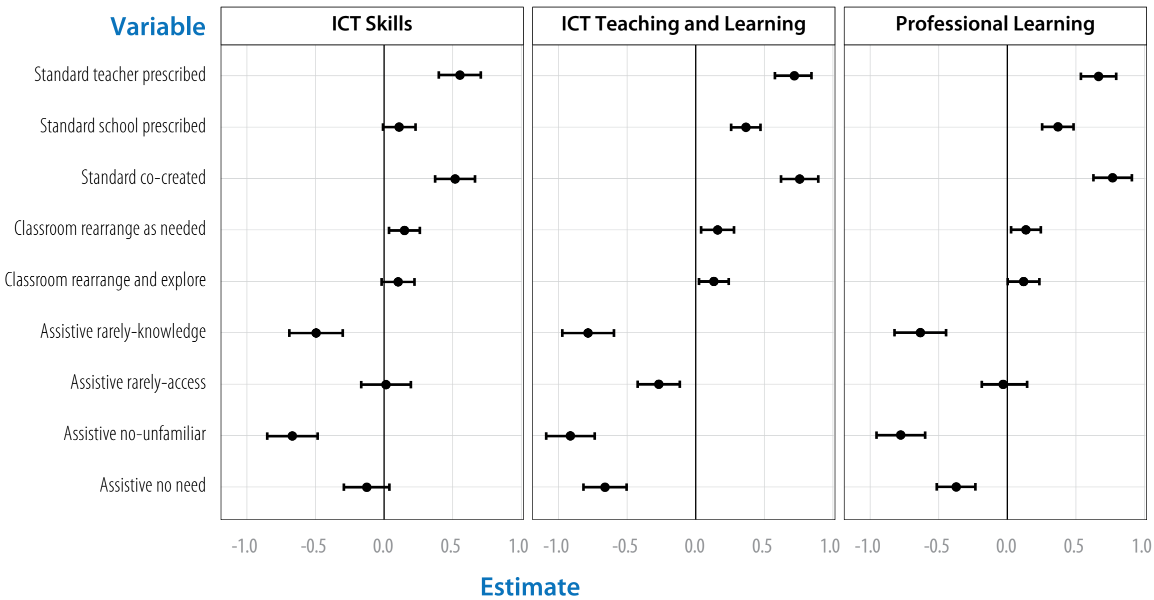
Teachers with higher levels of competency were more likely to use standard operating procedures/routines and rules of conduct when using ICT and were, especially, more likely to use self- or co-created standards.

They were also more likely to rearrange their classrooms as needed and to explore other venues according to the nature of the activity and ICT used (see Figure 18).

Finally, teachers with higher levels of reported ICT competency were more likely to always use assistive technologies or digital tools to support the needs of students with disabilities. In other words, the average ICT competency of teachers who did not or rarely used assistive technology because of their lack of knowledge was significantly lower than that of teachers who always used these technologies. This finding was consistent across domains. ICT for teaching and learning competency levels were also lower on average for teachers who did not use assistive technologies because they could not access them, in comparison to teachers who always used them.

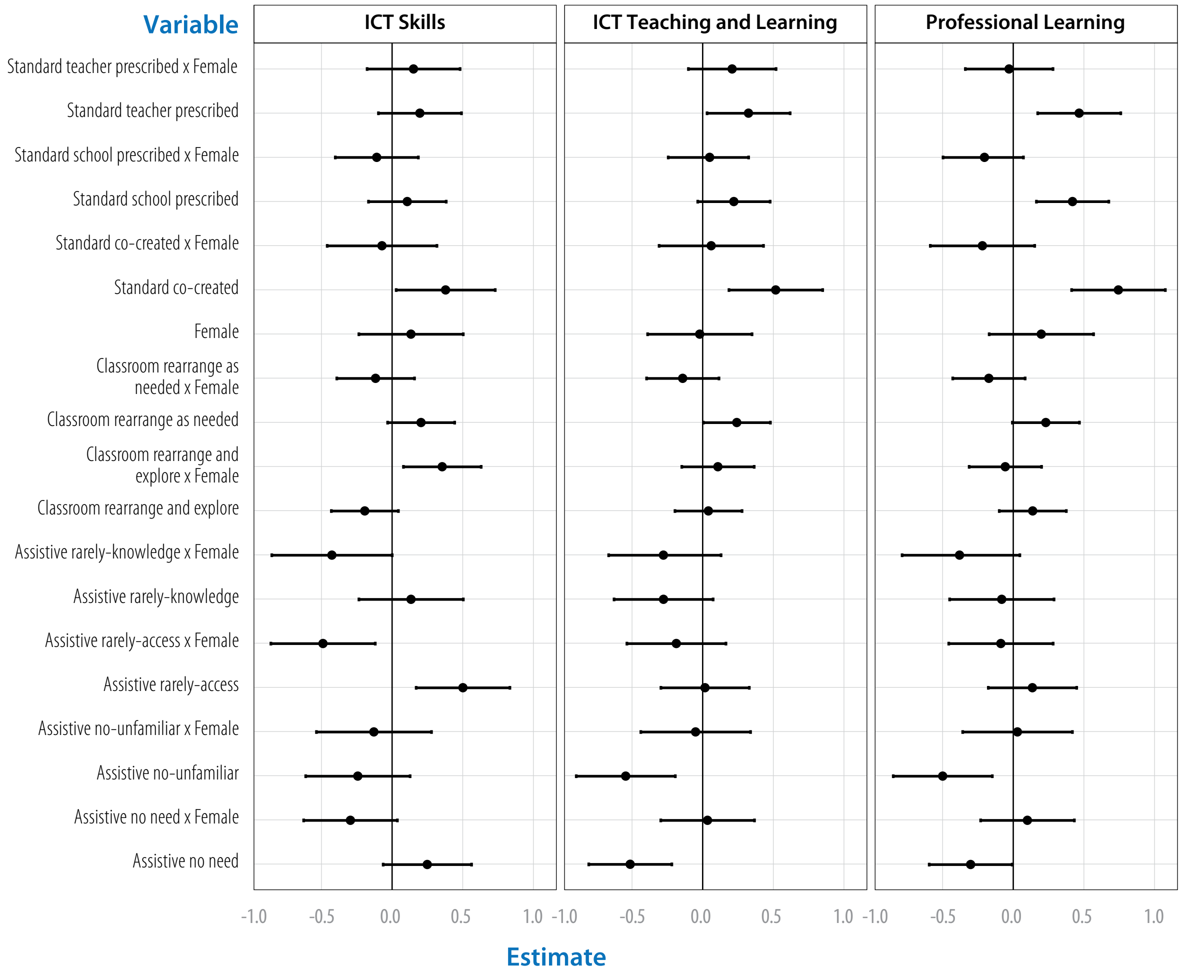
The relationships discussed above reflect the influence of many other potential teacher and school characteristics. For example, it is likely that teachers who always used assistive technologies taught in schools with better infrastructure than those who did not. If this is the case, the higher competency level for teachers who always used assistive technologies reflects the relationship with infrastructure instead of with the use of assistive technologies. Additional analysis was conducted to assess this possibility in the section below.

Figure 29: Estimated parameters and 95% confidence intervals for the relationship between organization and administration dimensions and teachers' digital skills across domains[12]



12 The model also includes fixed effects by country that are not shown for conciseness.

Figure 30: Estimated parameters and 95% confidence intervals for the relationship between gender and organization and administration dimensions and teachers' digital skills across domains[13]



The analysis in this section showed that there was a relationship between teachers' organization and administration strategies and their reported competency levels across ICT skill domains. This relationship persisted even after comparing teachers who were similar in other characteristics, such as their attitudes towards ICT, education level and experience, and who taught in similar schools and broader cultural and policy contexts.

The reasons why teachers with different ICT competency levels adopt different strategies and whether these specific strategies have a favourable effect on students' learning experiences cannot be uncovered with the available survey data. It is also unclear on the direction of the relationship, whether different organization and administration strategies enable the development of ICT competency or whether ICT competency allows teachers to adopt different strategies. However, considering that the DKAP data analysis in the previous section showed a link between teacher behaviours and student digital citizenship skills, this opens the possibility for further research on how teachers' ICT skills influence the strategies and behaviours they use to engage with students and how those strategies and behaviours influence students' digital citizenship skills.

13 The models also include all the parameters shown in Figure 29 above, an intercept and fixed country effects that are not shown for conciseness. Table 19 describes the control variables in the model.

Annex 2: Additional information about the matching procedure for Bhutan data

Initially, a synthetic control approach to match DKAP and ICT-CST data was proposed. The feasibility of this procedure depended on the ability to identify at least one or preferably a group of schools that participated in both the DKAP and ICT-CST studies.

This was not possible for two reasons. First, the teacher ICT-CST data did not identify the schools to which teachers belonged (i.e. the dataset did not have school IDs). An attempt was made to identify schools from the answer patterns to questions related to schools (i.e. type, location, level, province, existence of an ICT school policy, availability of network technology, email, teaching materials, and e-libraries). Nonetheless, there were as many unique combinations of answers as there were teachers in the dataset (1,045), which meant that this approach was not successful[14]. Second, the school names that were identified in the ICT-CST data were not found in the list from the DKAP data. This prevented any further triangulation between datasets.

Ideally, future attempts at understanding this relationship will be based on data collected simultaneously from students and teachers, linking students to teachers and the schools to which both belong. Additionally, as with the current DKAP and ICT-CST studies, the data collection effort will not be limited to the use of validated instruments to measure their ICT skills, but also to gathering information about the available infrastructure, access to resources, and student, teacher, and school background characteristics.

The procedure used to match DKAP and ICT-CST data is far from ideal, is context-specific, and relies on non-testable assumptions. First, it is assumed that the model predicts the average teacher ICT skills for each school with the same accuracy in both datasets. It is not possible to test this assumption because it would require records of teachers' ICT skills in the DKAP data. Second, it is assumed that teacher skills are homogeneous across schools within the same province and level. This is unlikely to be the case, given the large variability in the answers from the ICT-CST teacher data. Finally, it is assumed that the analysis is generalizable for the whole country. However, it was only possible to match 53 per cent of the schools and 47 per cent (of 2,381) of the students in the DKAP data. It is unlikely that this restricted sample is representative of the whole Bhutanese student population.

14 According to official figures, there were a total of 698 schools, institutes, and centres in 2019 in Bhutan, of which 529 were school education.

Table 23: **Estimation results for Bhutan Teacher ICT Skills predictive model**

Dependent variable:	
Teacher ICT Skills	
Province – Base: Bumthang	
Chhukha	-0.115
	(0.238)
Dagana	0.351
	(0.292)
Gasa	-0.118
	(0.346)
Gelephu Thromde	1.248**
	(0.542)
Haa	0.039
	(0.434)
Lhuentse	0.248
	(0.214)
Mongar	0.171
	(0.220)
Paro	0.744**
	(0.350)
Pema Gatshel	0.244
	(0.373)
Phuntsholing Thromde	0.602
	(0.749)
Punakha	-0.092
	(0.252)
Samdrup Jongkhar	0.500**
	(0.236)
Samtse	0.133
	(0.207)
Sarpang	0.169
	(0.221)
Thimphu Thromde	-0.148
	(0.253)
Trashi Yangtse	-0.053
	(0.242)
Trashigang	0.238
	(0.241)
Trongsa	0.021
	(0.355)
Tsirang	0.223
	(0.239)
Wangdue Phodrang	1.017***
	(0.344)
Zhemgang	-0.027
	(0.260)
School level – Base: ECR	
HSS	0.624*
	(0.366)
LSS	0.452
	(0.361)
MSS	0.729**
	(0.360)
PS	0.581
	(0.370)
Intercept	3.488***
	(0.395)
Observations	1,045
R^2	0.044
Adjusted R^2	0.021
Residual Std. Error	1.257 df = 1019
F Statistic	1.889*** df = 25; 1019
Note: *p<0.1; **p<0.05; ***p<0.01	
Source: ICT-CST Bhutan Data	

Annex 3: Supplementary qualitative material

Bhutan

As illustrated in Table 24, the policy environment in Bhutan provides a clear, integrated suite of policies designed to guide and develop educators' skills and knowledge in relation to all DKAP domains. Importantly, educator development is scaffolded and supported at different career stages. Digital citizenship development for students is well-documented in key policy documents, particularly in the Bhutan INC-NNC Framework (ICT curriculum framework), which provides detailed developmental guidelines for all DKAP domains.

The ICT in Education Master Plan (iSherig2), through the iAble programme, prioritizes teacher digital citizenship development, with particular focus on Digital Emotional Intelligence and Digital Participation and Agency. While these are very valuable contributions, iSherig2 also provides consideration beyond teachers to include learning support staff, educational leaders, library staff, laboratory assistants, and parents. It therefore provides a comprehensive platform to enable broad understanding and development of digital citizenship competencies across the Bhutanese population.

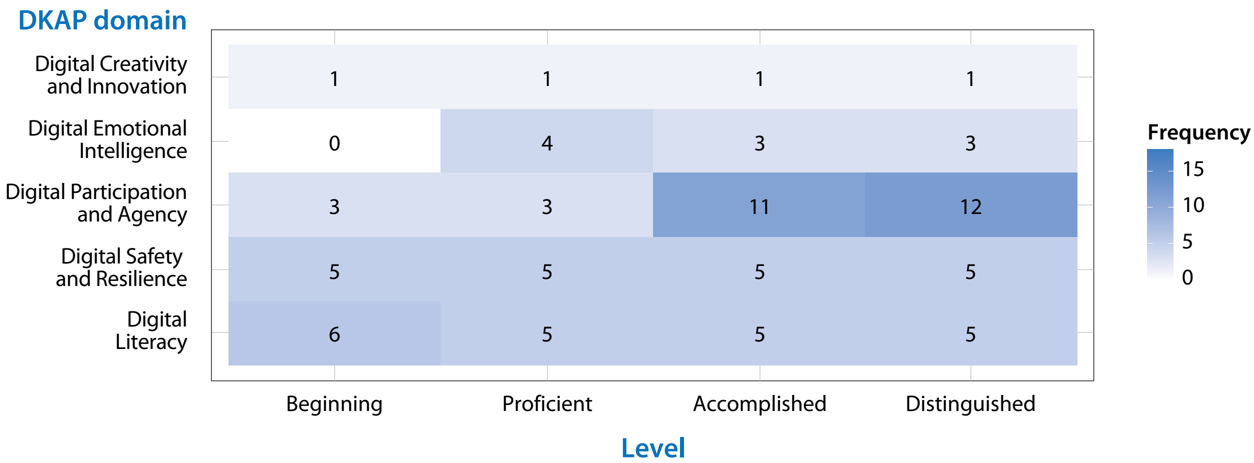
Table 24: Frequency in policy statements for DKAP domains – Bhutan

Country	Bhutan							
Key policy documents	1. Bhutan ICT Master Plan (iSherig 2). 2. Bhutan Professional Standards for Teachers (BPST) which incorporates ICT-CST for pre- and in-service teachers. 3. Bhutan Education Blueprint. 4. Bhutan INC-NNC Framework (ICT curriculum framework),							
	Students				Teachers			
Key Policy Document	1 Bhutan ICT Master Plan (iSherig 2)	2 Bhutan Professional Standards for Teachers (BPST) which incorporates ICT-CST for pre- and in-service teachers	3 Bhutan Education Blueprint	4 Bhutan INC-NNC Framework (ICT curriculum framework)	1 Bhutan ICT Master Plan (iSherig 2)	2 Bhutan Professional Standards for Teachers (BPST) which incorporates ICT-CST for pre- and in-service teachers	3 Bhutan Education Blueprint	4 Bhutan INC-NNC Framework (ICT curriculum framework)

	Students				Teachers			
Digital Literacy		n/a	n/a				n/a	n/a
Digital Safety and Resilience		n/a	n/a		n/a			n/a
Digital Emotional Intelligence	n/a	n/a			n/a		n/a	n/a
Digital Participation and Agency		n/a	n/a		n/a		n/a	n/a
Digital Creativity and Innovation	n/a	n/a	n/a		n/a	n/a	n/a	n/a

Figure 31 demonstrates that three DKAP domains (Digital Literacy, Digital Safety and Resilience, and Digital Participation and Agency) were strongly represented at all stages of teacher development, with Digital Participation and Agency being particularly prevalent for accomplished and distinguished teachers. Digital Emotional Intelligence was indicated in the ICT-CST for more experienced teachers but was absent for beginning teachers. Digital Creativity and Innovation was least prevalent of all DKAP domains in the Bhutan ICT-CST.

Figure 31: Frequency of ICT-CST for DKAP domains – Bhutan



Kyrgyzstan

The Kyrgyzstan ICT-CST provides a continuum that gives developmental scaffolding for the development of educators' skills and knowledge in relation to all DKAP domains. It is noteworthy that the policy 'Digital Kyrgyzstan 2019–2023 Digital Transformation Concept (Draft)' is particularly comprehensive and provides substantial coverage of the DKAP domains. Similar to Mongolia, many policies in Kyrgyzstan are national development and strategy documents rather than being focused educational policies. These national development and strategy documents provide a broad, active citizenry lens through which digital citizenship domains can be interpreted by education systems and teachers. This requires educators to go beyond the scope of policy documents that often guide teacher practices and therefore provide barriers to the development of digital citizenship competencies, as they must synthesize multiple policy documents that are each framed with a slightly different emphasis.

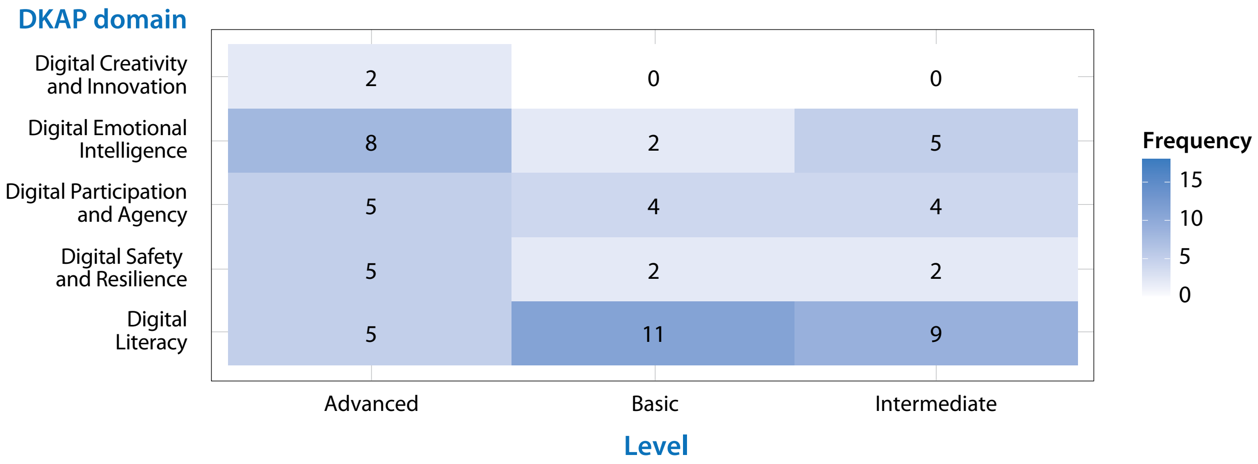
The policy and guidance documents, detailed in Table 25, provide particularly rich guidance for teachers in relation to Digital Participation and Agency, while also providing strong guidance for students' Digital Literacy development. All the DKAP domains are addressed in policy documentation, except for Digital Emotional Intelligence. Despite no references being made to this domain, there are numerous indicators for Digital Emotional Intelligence in the ICT-CST for Kyrgyzstan.

As evidenced in Figure 32, three DKAP domains (Digital Literacy, Digital Safety and Resilience, and Digital Participation and Agency) were generally well-distributed across the three stages of teacher development. Digital Literacy is particularly prevalent for beginning and intermediate teachers, and Digital Emotional Intelligence is particularly notable for advanced teachers, providing a promising sign of potential for strong digital citizenship growth. Digital Creativity and Innovation is the least prevalent of all DKAP domains in the Kyrgyzstan ICT-CST.

Table 25: Frequency of policy statements for DKAP domains – Kyrgyzstan

Country	Kyrgyzstan					
Key policy documents	1. Digital Kyrgyzstan 2019–2023 Digital Transformation Concept (Draft) 2. National Development Strategy of the Kyrgyz Republic 2018–2040 3. UNDP Digital Skills Report					
	Students			**Teachers**		
Key Policy Document	1 Digital Kyrgyzstan 2019–2023 Digital Transformation Concept (Draft)	2 National Development Strategy of the Kyrgyz Republic 2018–2040	3 UNDP Digital Skills Report	1 Digital Kyrgyzstan 2019–2023 Digital Transformation Concept (Draft)	2 National Development Strategy of the Kyrgyz Republic 2018–2040	3 UNDP Digital Skills Report
Digital Literacy		n/a			n/a	n/a
Digital Safety and Resilience		n/a	n/a		n/a	n/a
Digital Emotional Intelligence	n/a	n/a	n/a	n/a	n/a	n/a
Digital Participation and Agency		n/a	n/a			
Digital Creativity and Innovation		n/a	n/a		n/a	n/a

Figure 32: **Frequency of ICT-CST for DKAP domains – Kyrgyzstan**



Mongolia

The Mongolian ICT-CST provides guidance for teachers to develop skills and knowledge in all DKAP domains, irrespective of expertise or experience levels. Additionally, associated policies detailed in Table 26 provide support for developing knowledge and skills in all DKAP domains, except for Digital Creativity and Innovation. In particular, the Mongolian State Policy on the Development of ICT provides comprehensive policy statements for both teachers and students in relation to Digital Literacy, Digital Safety and Resilience, Digital Emotional Intelligence, and Digital Participation and Agency.

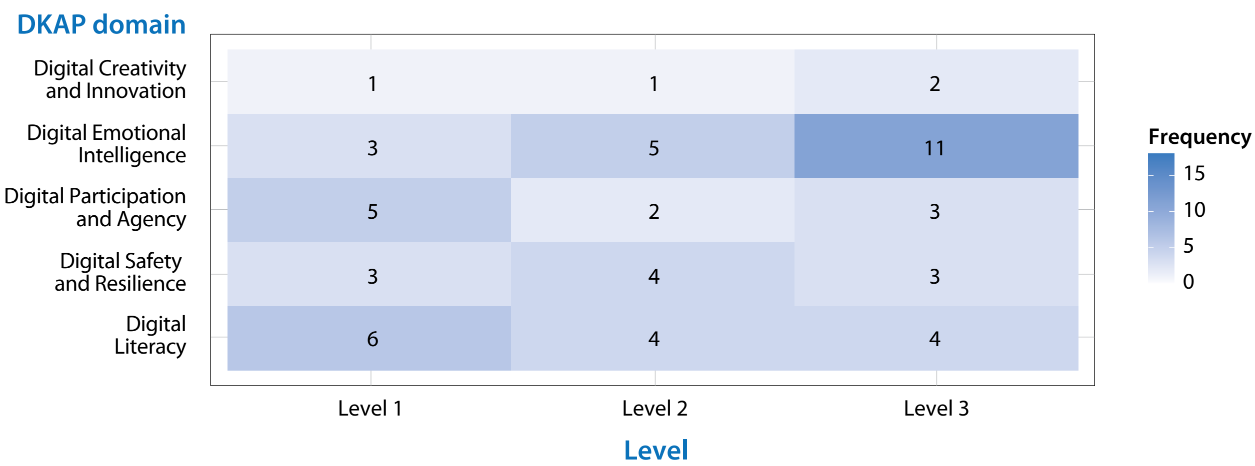
The limited references to Digital Creativity and Innovation mirror the possible way in which this DKAP domain may be considered a higher order competency than other domains, such as Digital Literacy.

Despite this challenge, Mongolia appears well-placed from a standards and policy perspective to deliver effective digital citizenship education through knowledgeable educators at all career stages. All five DKAP domains are generally well-represented in the Mongolian ICT-CST with substantial indicators for Digital Emotional Intelligence being particularly noteworthy in Figure 33. Echoing many other Member States' ICT-CST, indicators for Digital Creativity and Innovation were notably lower than for other domains. Overall, the distribution of indicators for all domains is generally even across the three levels of educators.

Table 26: Frequency of policy statements for DKAP domains – Mongolia

Country	Mongolia					
Key policy documents	1. Mongolian State Policy on the development of ICT 2. Education sector mid-term development plan 2021–2030 3. Towards Mongolia's long-term development policy vision 2050					
	Students			Teachers		
Key Policy Document	1 Mongolian State Policy on the development of ICT	2 Education sector mid-term development plan 2021–2030	3 Towards Mongolia's long-term development policy vision 2050	1 Mongolian State Policy on the development of ICT	2 Education sector mid-term development plan 2021–2030	3 Towards Mongolia's long-term development policy vision 2050
	Students			Teachers		
Digital Literacy		n/a	n/a			
Digital Safety and Resilience		n/a			n/a	
Digital Emotional Intelligence		n/a	n/a		n/a	n/a
Digital Participation and Agency		n/a			n/a	
Digital Creativity and Innovation	n/a	n/a	n/a	n/a	n/a	n/a

Figure 33: Frequency of ICT-CST for DKAP domains – Mongolia



Myanmar

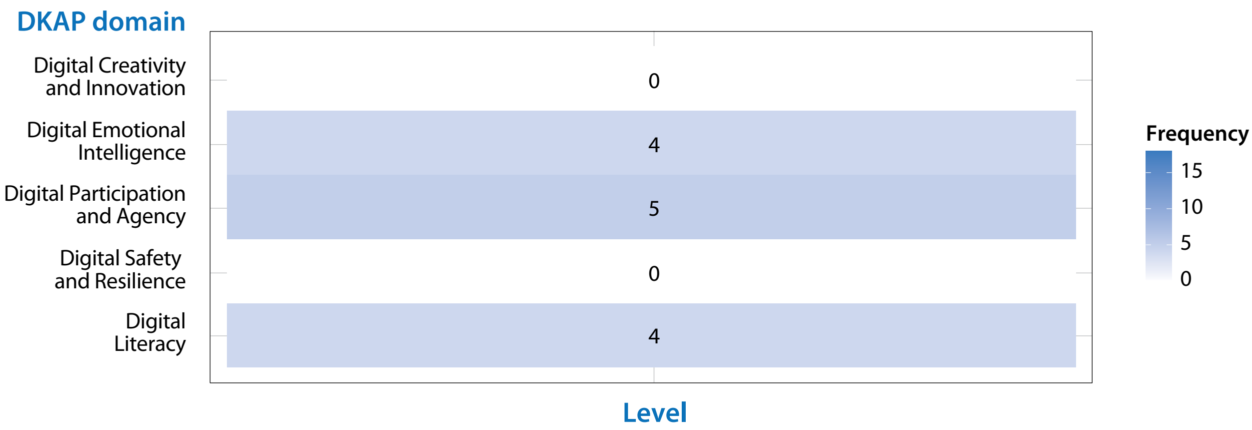
Table 27 reveals a range of policy documents that provide a comprehensive series of indicators for teachers in all DKAP domains, including Digital Creativity and Innovation, which sets Myanmar apart from other Member States. Additionally, the Myanmar ICT-CST detailed in Figure 34 provides a base for new teachers to develop their skills and knowledge in relation to all DKAP domains – particularly in relation to Digital Literacy, Digital Participation and Agency, and Digital Emotional Intelligence.

Three DKAP domains are featured in the Myanmar ICT-CST with higher frequencies of indicators (Digital Literacy, Digital Participation and Agency, and Digital Emotional Intelligence). As is the case with several other Member States' ICT-CST, indicators for Digital Creativity and Innovation were notably absent, as were indicators for Digital Safety and Resilience. Given these standards were developed for new teachers, it is possible to surmise that these DKAP domains were considered more challenging for teachers with less classroom experience to develop. While there are consistent frequencies across these three DKAP domains, the totals, when compared to other Member States, are relatively low, suggesting further enhancement of these standards may be possible in both overall frequency but also in terms of creating a developmental continuum, as evidenced in other Member States, such as the Philippines.

Table 27: Frequency of policy statements for DKAP domains – Myanmar

Country	**Myanmar**					
Key policy documents	TCSF (Teacher Competency Standards Framework) Myanmar Education Degree College Syllabus (ICT) National Education Strategic Plan (NESP) 2016–2021					
	Students			**Teachers**		
Key Policy Document	1 TCSF (Teacher Competency Standards Framework)	2 Myanmar Education Degree College Syllabus (ICT)	3 National Education Strategic Plan (NESP) 2016–2021	1 TCSF (Teacher Competency Standards Framework)	2 Myanmar Education Degree College Syllabus (ICT)	3 National Education Strategic Plan (NESP) 2016–2021
Digital Literacy	n/a	n/a				
Digital Safety and Resilience			n/a			n/a
Digital Emotional Intelligence			n/a			n/a
Digital Participation and Agency	n/a	n/a				
Digital Creativity and Innovation		n/a				

Figure 34: Frequency of ICT-CST for DKAP domains – Myanmar



Nepal

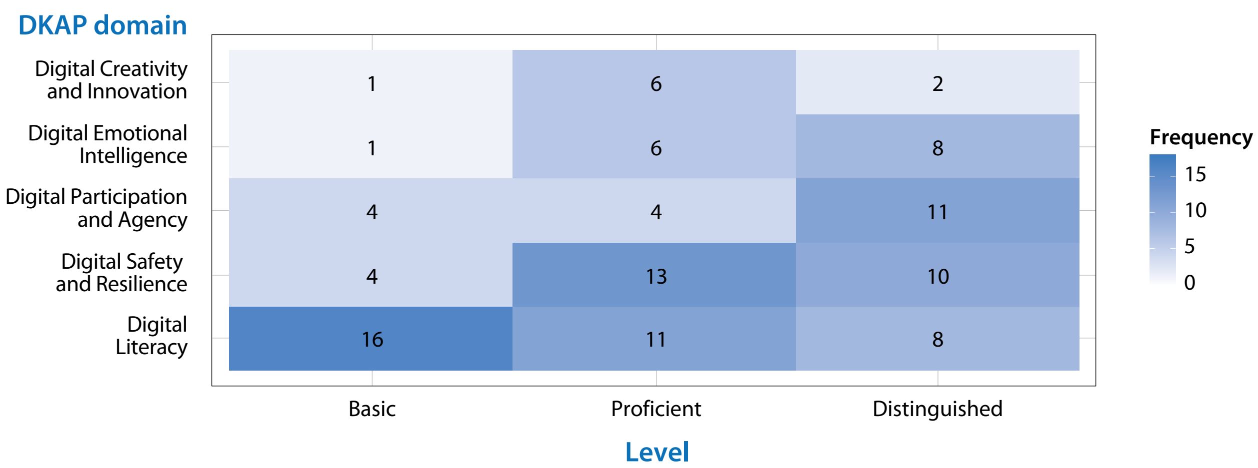
The Nepali policy documentation detailed in Table 28 reveals more guidance for teachers to develop digital citizenship skills in all DKAP domains than is evident for students with reference only to Digital Literacy and Digital Creativity and Innovation evident in one document. The limited references to Digital Creativity and Innovation for both teachers and students mirror the limited way other Member States have provided for this domain. However, when compared to some other Member States, such as Myanmar, the relatively high number of indicators in the ICT-CST illustrated in Figure 35, particularly for more experienced educators, provides a suitable structure for educator development. Nepal's training curriculum and elements of the school sector development plan – particularly Digital Creativity and Innovation – appear well-placed from a standards and policy perspective to deliver effective digital citizenship education through well-informed educators at all career stages; however, further development in other domains may enhance digital citizenship development for both teachers and students.

The ICT-CST provides substantial indicators for all five DKAP domains distributed across the three levels of educators. However, the higher levels of indicators for more experienced teachers in the Digital Participation and Agency, Digital Emotional Intelligence, and Digital Creativity and Innovation domains suggest a notion of a hierarchy of digital citizenship capacities. The strategic approach taken by the Nepali government provides opportunities for all teachers to develop strong capacities in relation to Digital Literacy and Digital Safety and Resilience, with teachers with higher proficiency levels being encouraged to further develop their creative and innovative capacities.

Table 28: **Frequency of policy statements for DKAP domains – Nepal**

Country	Nepal					
Key policy documents	1. Training Curriculum on ICT in Education 2. ICT in Education Master Plan, 2020 3. School sector development plan 2016–2023					
	Students			Teachers		
Key Policy Document	1 Training Curriculum on ICT in Education	2 ICT in Education Master Plan, 2020	3 School sector development plan 2016–2023	1 Training Curriculum on ICT in Education	2 ICT in Education Master Plan, 2020	3 School sector development plan 2016–2023
Digital Literacy	n/a		n/a			
Digital Safety and Resilience	n/a	n/a	n/a		n/a	n/a
Digital Emotional Intelligence	n/a	n/a	n/a		n/a	
Digital Participation and Agency	n/a	n/a	n/a		n/a	n/a
Digital Creativity and Innovation	n/a	n/a		n/a	n/a	

Figure 35: **Frequency of ICT-CST for DKAP domains – Nepal**



The Philippines

The extensive and comprehensive policy environment in the Philippines outlined in Table 29 provides students and teachers with extensive opportunities to develop digital citizenship knowledge and skills in all DKAP domains. In particular, the SEAMEO-INNOTECH eCitizenship[15] resources provide a broad suite of resources to enable teachers to engage students in discussions and activities associated with all DKAP domains.

Similarly, the ICT-CST indicators illustrated in Figure 36 demonstrate a comprehensive series of indicators for all DKAP domains for pre-service and all levels of in-service teachers. Notably, all teacher levels were not only represented in all DKAP domains but also in all DKAP sub-domains. The very high numbers of indicators for pre-service teachers in Digital Literacy, Digital Emotional Intelligence, and Digital Participation and Agency provide very strong digital citizenship foundations. While all in-service teachers are expected to engage with all DKAP domains, more experienced teachers are provided with more indicators for Digital Participation and Agency and Digital Emotional Intelligence than those with less experience, suggesting these domains may require additional skills and capacities to be developed over time. This rich policy and standards environment provides teachers and students with a wide variety of detailed and varied resources through which digital citizenship skills and knowledge can be built.

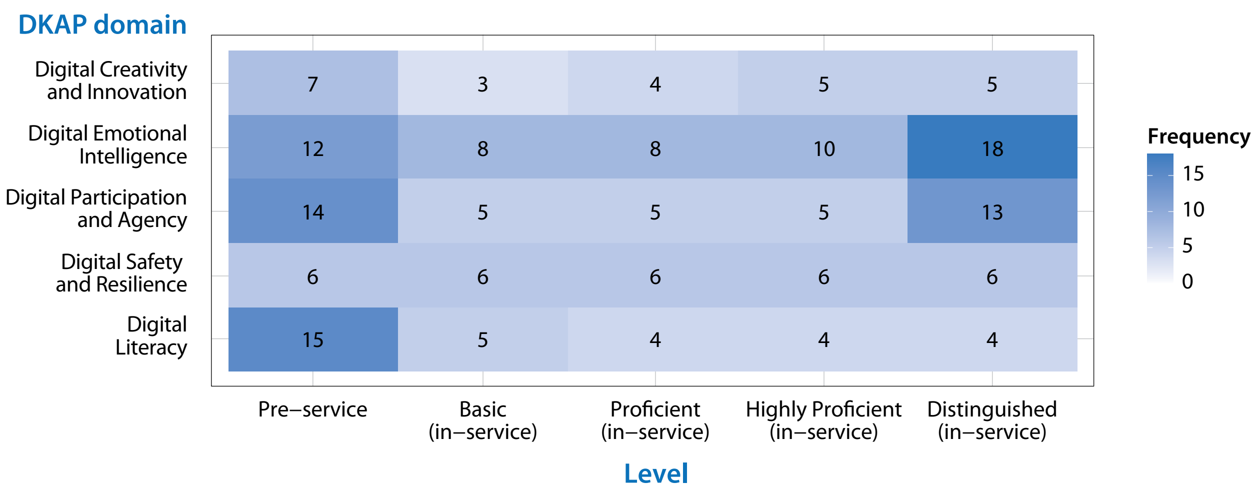
Table 29: Frequency of policy statements for DKAP domains – Philippines

Country	Philippines					
Key policy documents	Philippine Development Plan 2017–2022 Guidelines on the implementation of flexible learning SEAMEO-INNOTECH eCitizenship resources					
	Students			**Teachers**		
Key Policy Document	1 Philippine Development Plan 2017–2022	2 Guidelines on the implementation of flexible learning	3 SEAMEO-INNOTECH eCitizenship resources	1 Philippine Development Plan 2017–2022	2 Guidelines on the implementation of flexible learning	3 SEAMEO-INNOTECH eCitizenship resources

15 While these resources were not developed by the Philippine government, these materials support the teaching of Learning Strand 6 of the new ALS K to 12 Curriculum of Digital Citizenship and have been endorsed by the Philippine Commission on Higher Education for inclusion in its portal as a resource for more than 2,000 teacher education institutions and are therefore considered an important, nationally implemented resource.

	Students			Teachers		
Digital Literacy	n/a					
Digital Safety and Resilience						
Digital Emotional Intelligence		n/a			n/a	
Digital Participation and Agency		n/a			n/a	
Digital Creativity and Innovation				n/a		

Figure 36: Frequency of ICT-CST for DKAP domains – Philippines



Uzbekistan

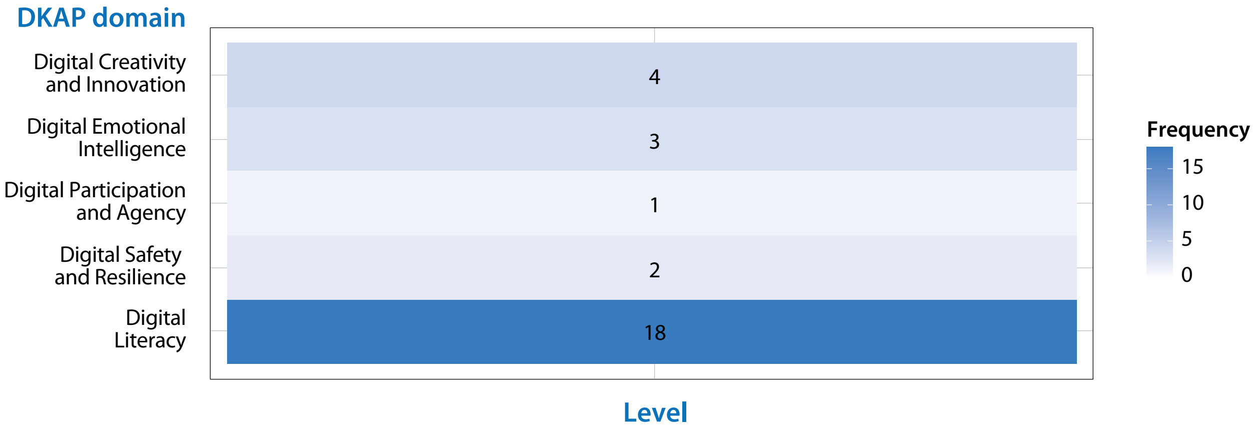
The policy environment guiding the development of digital citizenship capacities in Uzbekistan is limited to a few key documents, as illustrated in Table 30. While the Education Sector Plan of Uzbekistan (2019–2023) is comprehensive, the focus on digital citizenship is restricted to Digital Literacy. In contrast, the thirteen Uzbekistan Teacher ICT Competency Training Module Guidelines provide more comprehensive coverage of all DKAP domains while maintaining a focus on digital literacy skills for both teachers and students.

The focus on Digital Literacy is also reflected in the ICT-CST as shown in Figure 37. Notably, the Uzbekistan ICT-CST only provides one set of indicators for all teachers, in contrast to the differentiated approach used by most other Member States. This homogenized approach and focus on Digital Literacy suggests that an initial approach is to ensure all teachers reach a base level of DKAP capacities. It is likely that once broad-scale evidence of teachers achieving this level is established, further refinement to expand the breadth and depth of digital citizenship development opportunities for teachers may be beneficial in the future.

Table 30: Frequency of policy statements for DKAP domains – Uzbekistan

Country	Uzbekistan			
Key policy documents	1. Education Sector Plan of Uzbekistan 2019–2023 2. Uzbekistan Teacher ICT Competency Training Module Guidelines			
	Students		Teachers	
Key Policy Document	1 Education Sector Plan of Uzbekistan 2019–2023	2 Uzbekistan Teacher ICT Competency Training Module Guidelines	1 Education Sector Plan of Uzbekistan 2019–2023	2 Uzbekistan Teacher ICT Competency Training Module Guidelines
Digital Literacy				
Digital Safety and Resilience	n/a		n/a	
Digital Emotional Intelligence	n/a		n/a	
Digital Participation and Agency	n/a			
Digital Creativity and Innovation	n/a		n/a	

Figure 37: Frequency of ICT-CST for DKAP domains – Uzbekistan



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United Nations
Educational, Scientific
and Cultural Organization

Digital citizenship in Asia-Pacific

Translating competencies for teacher innovation and student resilience

A digitally-equipped and competent teaching force is crucial for cultivating students' digital citizenship skills. This UNESCO report, consisting of a comprehensive analysis comprising 15 countries in the Asia-Pacific region, unveils compelling evidence pertaining to what factors influence teachers' Information and Communication Technology (ICT) skills and their impact on students' digital citizenship competencies. Perhaps unsurprisingly, the findings of this report show that students are developing most of their digital citizenship competencies through self-directed learning and outside of school. Nevertheless, teachers still play an important role, particularly in coaching students to use technology safely and effectively. Thus as UNESCO reports, Digital Creativity and Innovation remains relatively underdeveloped in all participating research countries. Additionally, female students tend to benefit more from teachers' guidance and advice, especially in terms of Digital Safety and Resilience.

Support for teachers in terms of access to ICT infrastructure and training on ICT and pedagogical skills will contribute towards improving their ability to effectively guide and mentor their students, ultimately leading to better outcomes in terms of digital citizenship competencies. To achieve this, it is important for education systems to develop comprehensive and contextualized approaches to enhance digital citizenship capacities in teachers. Education policymakers and leaders are encouraged to use the 10 recommendations herein as a 'roadmap' to ensure that teachers are equipped with the necessary skills and knowledge to effectively integrate digital citizenship education into their teaching practices. This will ultimately help prepare students for the digital world and ensure their safety and well-being online.

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4 QUALITY EDUCATION

Sustainable Development Goals