AI and education

Protecting the rights of learners

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SHORT SUMMARY

Safeguarding the right to education in the digital era

The rapid digitalization of education, accelerated by the COVID-19 pandemic and the development of generative artificial intelligence (Gen AI), is reshaping education and learning. New opportunities for increased access to education, personalized learning, and effective educational management have emerged. These advancements also come with challenges, including the risks of exacerbating existing inequalities, privacy and safety concerns, and emerging issues relating to ethics, governance, and equity.

As of 2024, nearly one-third of the world's population, around 2.6 billion people, still lacks Internet access, deepening the digital divide and potentially leading to an artificial intelligence (AI) divide. Vulnerable groups, including girls, rural populations, persons with disabilities, and marginalized communities, are particularly affected.

AI in education must be anchored in the right to education and safeguarded by human rights

In this era of digital technology and AI, without proper safeguards —such as strong data protection measures, ethical frameworks, transparent governance, inclusive access policies, and accountability mechanisms— the right to education and other human rights are at risk.

This report emphasizes that all efforts must prioritize a human-centred and rights-based use of digital technology to benefit all learners. It calls for urgent national and international action to ensure that technology enhances, rather than endangers, the right to education for all.

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"Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed"

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Acronyms and abbreviations

AI	Artificial intelligence
AT	Assistive technology
CADE	Convention against Discrimination in Education
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CESCR	Committee on Economic, Social and Cultural Rights
CMW	International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families
COP	Child Online Protection
CRC	Committee on the Rights of the Child
CRPD	Convention on the Rights of Persons with Disabilities
CSAM	Child sexual abuse material
CSEA	Child sexual exploitation and abuse
ECHR	European Court of Human Rights
EECEA	European Education and Culture Executive Agency
EEF	Education Endowment Foundation
EU	European Union
FCC	Federal Communications Commission
GA	General Assembly of the United Nations
GADRRRES	Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector
GAFAM	Google, Apple, Facebook (now Meta), Amazon and Microsoft
GDPR	General Data Protection Regulation
GEM Report	Global Education Monitoring Report
GWFF	Gallup and Walton Family Foundation
HAI	Stanford University Human-Centered Artificial Intelligence
HE	Higher education
HRBA	Human rights-based approach
HRW	Human Rights Watch
HTTP	hypertext transfer protocol
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICT	Information and communication technologies
IDP	Internally displaced person

IEA	International Association for the Evaluation of Educational Achievement
IEA	International Energy Agency
IITE	UNESCO Institute for Information Technologies in Education
INEE	Inter-Agency Network for Education in Emergencies
IP	intellectual property
IPCC	Intergovernmental Panel on Climate Change
IPR	intellectual property right
ISP	Internet service/access provider
ITU	International Telecommunication Union
LD	learning disability
LDCs	least developed countries
LLM	large language model
LLDC	landlocked developing country
Mbps	megabits per second
MOOC	massive open online course
OECD	Organisation for Economic Co-operation and Development
OER	open educational resources
SDG	Sustainable Development Goal
SOU	Shanghai Open University
UDHR	Universal Declaration of Human Rights
UIL	UNESCO Institute for Lifelong Learning
UIS	UNESCO Institute for Statistics
UNCRC	Convention on the Rights of the Child
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCHR	United Nations High Commissioner for Human Rights
UNHCR	Office of the United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNICRI	United Nations Interregional Crime and Justice Research Institute
UNODC	United Nations Office on Drugs and Crime
URL	Uniform Resource Locator
VLE	virtual learning environment
VSP	video service provider
WASH	water, sanitation and hygiene
WTO	World Trade Organization
W3C	World Wide Web Consortium

Introduction

> *"AI offers major opportunities for education, provided that its deployment in schools is guided by clear ethical principles. To reach its full potential, this technology must complement the human and social dimensions of learning, rather than replace them. It must become a tool at the service of teachers and pupils, with the main objective being their autonomy and well-being."*
>
> Audrey Azoulay, UNESCO Director-General

Digitalization in education is not a recent phenomenon. However, the reach of digitalization expanded with the coronavirus disease (COVID-19) pandemic, and the development of new technologies, including artificial intelligence (AI), contributed to the transformation of education system processes, including teaching, learning, management, administration, research and knowledge generation.

Innovation in teaching, learning and educational data management

The incorporation of technology into education, including AI, has introduced innovative teaching methodologies and personalized learning experiences. However, it is sometimes criticized for reducing the human element, which is vital for students' trust and motivation, given the critical social and emotional support provided by teachers. The advancements introduced by technology also facilitate the efficient gathering, analysis and utilization of educational data, enhancing education planning and the development of adequate digital educational tools. By leveraging these digital tools, education administrators can make more informed decisions. This ensures that educational institutions can operate with greater efficiency and adaptability, continuously refining the tools and methods used to address the evolving needs of students and educators and decision makers.

Evolving roles of learners and teachers

The role of learners has evolved, shifting from that of mere consumers of information to that of active creators of content. This change reflects the growing recognition that learners are not passive recipients of knowledge but central participants in knowledge creation and dissemination. In parallel, teachers are adapting pedagogical practices and strengthening their digital skills to integrate new technologies effectively. This transformation has empowered learners not only to engage more effectively with knowledge-sharing and collaboration tools, but also to generate data through their access to learning platforms and interactions with online tools, peers and teachers; These data are used for enhancing learning analytics and personalizing education.

The growing role of private actors in digital education

At the same time, these data are turning into a resource for private entities in areas such as commercialization, targeted advertising, and the training of AI systems. The digitalization of education has reinforced the role of private entities in the educational sector. Their involvement has become absolutely pivotal, particularly in the creation, development, provision, maintenance and governance of digital tools. This trend underscores the growing partnership between public education systems and private enterprises, highlighting these stakeholders' critical contributions to ensuring the accessibility and sustainability of digital education resources. Collaboration with private parties can support continuous innovation and effective functioning of educational technologies, reflecting a synergistic effort to enhance global education standards. However, the increasing impact of these private entities in education, combined with concerns surrounding data privacy and security, presents a set of challenges that must be carefully analysed. In this context, it is crucial to develop robust frameworks and policies that safeguard human rights, specifically ethical and privacy and security, to ensure that digital learning does not take place at students' or teachers' expense.

Persistent inequalities and the digital divide

Notwithstanding the numerous opportunities and long-term potential offered by the integration of digital tools into various education processes, digitalization in education also generates complex challenges, deepens existing inequalities and affects the realization of human rights - the right to education and rights beyond it (UNESCO, 2023a). For instance, as of 2024, roughly one third of people globally remain unconnected to the Internet (ITU, 2022a), the digital divide continues to pose a fundamental barrier to unlocking the potential benefits of integrating digital technology into education processes. Despite global decreases in the cost of connectivity, lack of Internet access disproportionately affects vulnerable groups. The digital divide will only be bridged once connectivity is guaranteed, access to digital devices is ensured and digital skills are imparted to everyone.

Towards inclusive and ethical governance of digital tools in education

Beyond the multi-layered digital divide, legal and policy frameworks need to adapt quickly alongside the development of new educational technology tools to ensure safe, inclusive, equitable and quality education and lifelong learning opportunities for all. This is absolutely crucial in ensuring the ethical development and deployment of AI educational tools, promoting their support of educational goals, and preventing biases and misuse.

Striking a balance: opportunities and challenges

The tension between the opportunities and challenges involved necessitates careful discernment of the balance required to fully leverage the potential of digital tools while ensuring the right to education for all.

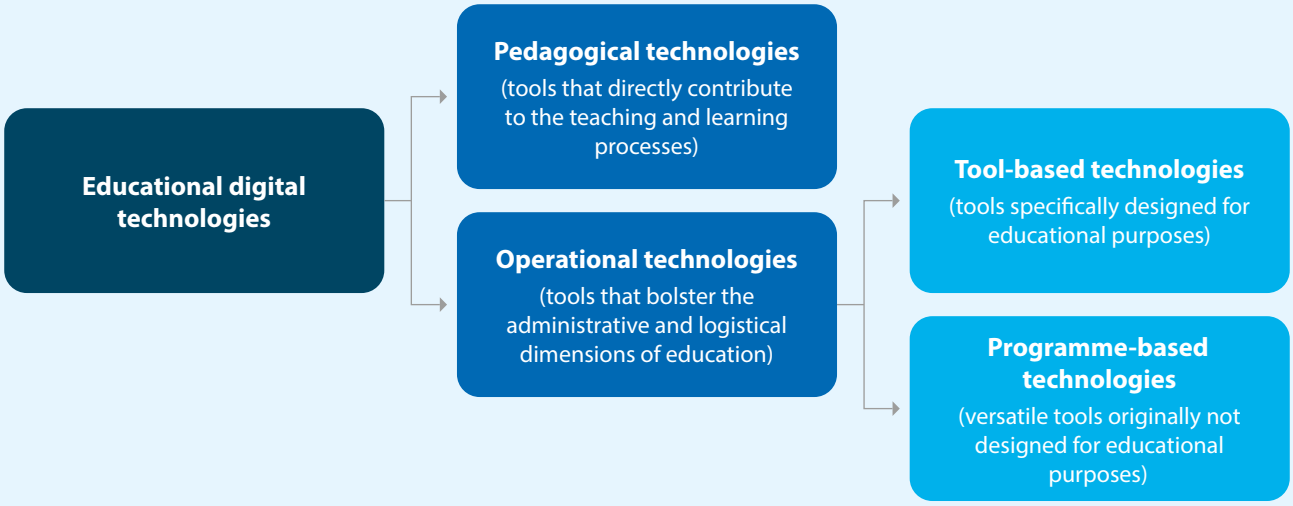
Types of educational digital technology

Digital technologies in education are very diverse and are constantly evolving. To frame the analysis that will ensue, we can categorize educational technologies as either operational technologies or pedagogical technologies (Gao et al., 2019). However, this is one of several frameworks, as numerous institutions and academics have proposed different taxonomies and typologies for classifying educational digital technologies.

Operational technologies bolster the administrative and logistical dimensions of education rather than directly engaging in the teaching process. They include tools such as email and fora for communication among educators and online data management systems for maintaining student records. While not directly involved in instructional activities, these technologies are indispensable for the efficient functioning of educational institutions, ensuring optimized management and communication.

On the other hand, **pedagogical technologies** can contribute to teaching and learning processes. They can be broadly divided into two main subcategories: tool-based technologies and programme-based technologies. **Tool-based technologies**, such as the Internet, smartboards and Microsoft Office, are versatile tools originally not designed for educational purposes, but adapted to enhance educational practices. **Programme-based technologies**, in contrast, are specifically designed for educational purposes, and some may utilize algorithms and/or artificial intelligence. These technologies are intended to take over several aspects of teachers' traditional duties, such as the delivery of instruction and personalized learning experiences, lesson planning and marking. They also include digital tools used directly by learners.

Figure 1: Categorization of educational technologies

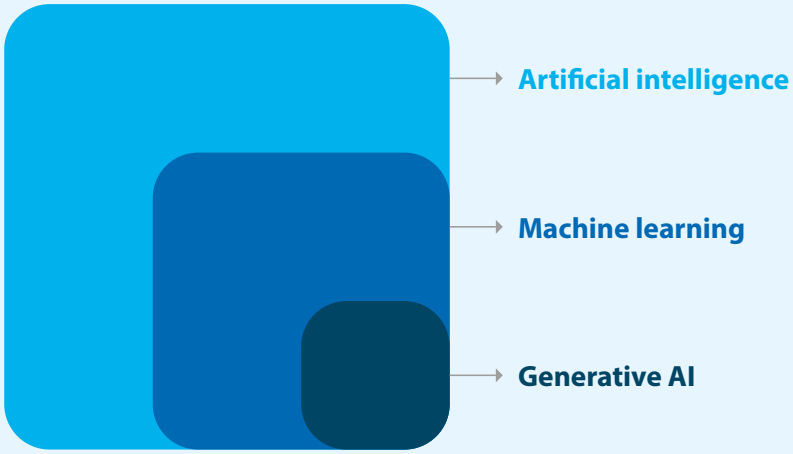


Source: Adapted from Gao et al., 2019, p. 4. Available under CC BY 3.0

In recent years, **artificial intelligence** has been progressively integrated into a diverse range of educational tools, such as those used in administrative processes, and teaching materials and processes, presenting new challenges that warrant careful consideration. AI can be defined as "information-processing technologies that integrate models and algorithms that produce a capacity to learn and to perform cognitive tasks leading to outcomes such as prediction and decision-making in material and virtual environments. AI systems are designed to operate with varying degrees of autonomy by means of knowledge modelling and representation and by exploiting data and calculating correlations" (UNESCO, 2021b). Within this broader category, the term "machine learning" refers to the process whereby AI systems can improve their performance over time by learning from data and can perform tasks without explicit instructions.

Additionally, AI educational tools may also use **generative AI**, which processes "vast data sets of natural language, code language and images to create new content in these and other data forms" (GEM Report, 2023) (such as text, images, audio and video), imitating human brain functions more closely. This growing integration of AI in education necessitates a special focus beyond the general efforts already dedicated to technology in education, particularly with regard to the skills required for its effective use, and to ensuring quality, safety, privacy and ethical standards, for example.

Figure 2: Key concepts related to Generative AI



Source: Adapted from Gimple et al., 2023, p. 13. Available under CC BY-SA 4.0

While these represent some of the primary categories of educational digital technology, their rapid evolution makes it challenging to predict the future innovations that may further transform the educational landscape.

Adopting a human rights-based approach to digital education

Human rights were brought to the very forefront of the global stage, and nations across the world committed to promoting the respect of human rights by enshrining them in the Universal Declaration of Human Rights (1948). Subsequently, there has been a proliferation of legally binding international human rights instruments that elaborate on how to ensure that human rights are respected, protected, and exercised.

While human rights are regularly invoked and are widely recognized, the concrete entitlements for rights holders and obligations for duty bearers - which are laid out in international human rights law - are perhaps less known. Yet human rights entail legal obligations which must be incorporated into national legal frameworks and frame the elaboration of policies, plans and processes of development. As a guide for this process, the conceptual framework known as the human rights-based approach (HRBA) helps to analyse the "process of human development that is normatively based on international human rights standards" and is "operationally directed to promoting and protecting human rights" (UNSDG, n.d.). Furthermore, "it seeks to analyse inequalities which lie at the heart of development problems and redress discriminatory practices and unjust distributions of power that impede development progress and often result in groups of people being left behind" (UNSDG, n.d.).

Current provisions concerning the right to education have yet to be fully enforced. Recent global trends, norms and challenges have shed light on the need for the international human rights framework to provide greater clarity and regulation in order to support States' efforts to implement the right to education at the national level. Given this context, in 2021, UNESCO launched the **Initiative on the Evolving Right to Education**[1] to investigate how this right could be reinforced to ensure its enduring relevance in light of the new demands being placed on education and lifelong learning in the twenty-first century.

1 See more information here: https://www.unesco.org/en/right-education/evolving

This publication uses the HRBA to understand the impacts of digitalization on the right to education by specifically responding to the following **research questions**:

- What norms and standards, as currently laid out in the international human rights framework, apply to digitalization processes in education?
- What are the opportunities and challenges associated with digitalization in education, including the integration of AI?
- What considerations for national and international guidance can be elaborated to reinforce regulation in light of the evolving right to education framework?

Unpacking digital transformation in education: the 5C framework

The 5C framework offers a common reference point for governments and stakeholders to align their approaches to digital transformation in education. By addressing its interconnected dimensions, it provides a holistic tool that supports a human rights-based analysis of digital reforms. In particular, the framework helps assess whether digital transformation in education upholds the principles of availability, accessibility, acceptability and adaptability, and whether it advances ethical, safe and effective uses of technology in education in line with the right to education.

Meaningful digital transformation in education is about much more than connecting schools, delivering devices, digitizing textbooks and developing digital skills. Many countries have struggled to scale pilot projects that target one digital priority, such as devices or Internet connectivity, without coordination with the wider system or a plan for sustainable financing of such digital services (GEM Report, 2023). This trend was exacerbated during the COVID-19 pandemic, when emergency solutions (now lapsed) were put in place, sometimes through in-kind offers from partners. As a result, many education systems in different contexts find themselves with a patchwork of piecemeal solutions that are not nationally coordinated, funded or technically interoperable (UNESCO, 2024e). This report refers to the 5C framework to assess how digital transformation can be aligned with human rights obligations and the realization of the right to education.

In the face of these challenges, a group of global partners came together in September 2022 to: advance a vision for coordinated, sustainable digital transformation in education at a national scale to ensure that digital technology in education directly benefits learners; and promote progress towards inclusive, quality equitable learning, as described by the Sustainable Development Goal (SDG) 4 targets. This multi-stakeholder partnership is called the Digital Transformation Collaborative (DTC), a technology-focused subgroup of the Global Education Coalition, a broad network of organizations, including private sector, multilateral and non-profit groups, civil society, networks and associations and media partners.

Together, expert DTC partners representing international organizations, educational technology (ed-tech) and telecom companies, funds and foundations[2] created a common framework for system-wide digital transformation in education called the 5C framework (see below). The **5C framework** builds on the three Cs that were proposed at the Transforming Education Summit (TES) as the keys to digital learning: content, capacity and connectivity. This framework expands digital learning within a system perspective, unpacking the core components of system-wide digital transformation in education needed to achieve a positive impact on learners, teachers and all education stakeholders (UNESCO, 2024e). It informs the analysis in this report, linking digital transformation in education to the realization of the right to education.

2 The document was prepared by a core team of the DTC Steering Group, led by UNESCO, UNICEF and Microsoft, and including ITU, GPE, Ericsson, Google and ProFuturo. Complementary initiatives such as the ITU-UNICEF Giga initiative to connect every school to the Internet, the UNESCO-UNICEF Gateways to Public Digital Learning initiative, GPE's Tech4Ed, and the EdTech For Good initiative of UNICEF's Learning Innovation Hub have informed and inspired this common framework.

1. **Coordination and leadership:** It is critical to begin a digital transformation in education with a clear vision and policies and goals that engage all education stakeholders. This requires evidence-informed governance, monitoring and evaluation, and the regulatory frameworks that ensure that digital technology and data are used safely and deliver on learners' rights rather than encroach on them. Consistent cross-sectoral and multi-stakeholder cooperation would ensure that the benefits of transformation reach the most marginalized.

2. **Content and solutions:** Digital platforms and high-quality, accessible, curriculum-aligned content sustain a long-term vision for digital transformation in education. However, this digital transformation should not be promoted to replace teachers or reduce costs implied by the teacher workforce. Teachers should participate in the designing of these platforms and multi-modal content, which should be available in national and, where relevant, minority languages to support varied pedagogical models, opportunities for formative assessment and flexible learning pathways. Said models, opportunities and pathways should meet the needs of each learner and enhance teachers' academic freedom, empowering them to create, use, modify and leverage digital resources where they see fit. Curricula and assessment should meet the aims of education in accordance with international human rights law, meaning that they should be directed towards the full development of the human personality and the sense of human dignity, and that they should enable all persons to participate effectively in a free society in the digital age. Future-ready skills should be integrated into all levels of the curriculum; these skills would include AI competencies, information literacy, and communication and collaboration, all of which are becoming increasingly important in an age where the use of generative artificial intelligence is widespread. Moreover, content should be designed with accessibility principles in mind in order to engage learners with disabilities.

3. **Capacity and culture:** Digital transformation must be focused on humans and directed specifically towards learner-centred benefits. Investing in the digital capacities of all education stakeholders — from learners, teachers and leaders to parents, caregivers, policymakers and local communities — is key to enabling them to keep up with worldwide digitalization processes. Combined with sustained investment in the teacher workforce and commitment to the right to education for all, such investment should be anchored in equity and inclusion and be adapted to local needs. This means ensuring ongoing professional development for both in-service and emerging teachers to teach with, about and through technology, while being able to critically assess such technology. Such investment in a digitally competent and critical culture would further spur knowledge generation, innovation and democratic citizenship, including digital citizenship.

4. **Connectivity and infrastructure:** Meaningful connectivity goes far beyond Internet access. There are major global digital divides in terms of meaningful access to hardware, software, electricity and quality high-speed Internet connectivity, with many rural and lower-income communities left behind. Systems must take into account the safety and security of online and on-site learning spaces by ensuring that any software that transfers data is equipped with measures for protecting the privacy of personal data. Further, digital surveillance should not jeopardize human rights, in particular the right to education, which encompasses the aims of education, academic freedom, freedom of expression and access to information. Schools should have fit-for-purpose devices and tools that meet diverse needs and that should be accessible to all learners and education stakeholders both online and offline and on site and off site. Connectivity should be efficiently ensured in accordance with the educational needs of the different learning spaces involved, which are connected through interoperable data systems. Finally, digital education should never replace face-to-face education.

5. **Cost and sustainability:** Within the framework of States' obligation to provide public education and to regulate private involvement in education, digital transformation in education requires a well-established, sustainable and cost-effective budget. Given the high cost of digital services and the pressure on tight education budgets in many contexts, a range of funding sources and intersectoral cooperation would ensure allocation of resources across schools and regions that is optimized, affordable, equitable and impact-driven, and that delivers on the vision established by enabling a thriving education technology ecosystem to encourage, monitor and sustain growth.

Feeding into all the Cs are **data**: data that identify gaps in these five areas of digital transformation, data on which children are learning and what they were learning, and data that help to make informed decisions in order to safeguard the right to education. New data also emerge as a result of the process of digital transformation in education. As elements of learning, teaching, management and administration processes are digitalized, new digital data are produced, which could improve education decision makers' capacity to better manage, allocate and monitor resources across an education system, and their capacity to support teachers and school leaders in adapting their teaching and management practices.

The 5C framework offers an analytical lens that supports this report's human rights-based approach. By framing actions and reforms around coordination, content, capacity, connectivity and cost, it enables a systematic assessment of whether digital strategies align with the right to education. The framework underpins the analysis in the chapters that follow.

Report structure

This report comprises two main parts, with a total of 11 chapters.

- The first part explores the impact of digitalization and AI on the right to education, examining subjects including access to education (chapter 1), quality education (chapter 2), digital divides and inequalities (chapter 3), the role of non-State actors (chapter 4) and governance issues (chapter 5).
- The second part delves into digitalization's impact on human rights contributing to the fulfilment of the right to education, covering the right to privacy (chapter 6), the right to be protected from violence (chapter 7), the right to work (chapter 8), the right to information (chapter 9), cultural rights (chapter 10) and, finally, the right to be heard and the right to autonomy (chapter 11). The rights identified and developed in the second part of the report are likely to have the greatest impact on the realization of the right to education in the context of digitalization. This does not exclude implications for other human rights.

While all the content falls under the broader umbrella of the right to education, the analysis is deliberately framed in the context of other relevant rights to highlight the holistic approach needed to address digitalization in education.

In the conclusion, considerations and guidance for action are provided at both the national and international levels.

Part I

The right to education

First enshrined in article 26 of the **Universal Declaration of Human Rights (1948)**, the right to education was further elaborated in the **Convention against Discrimination in Education (1960)**, the first international legally binding instrument entirely devoted to this right. Drawing on the 1960 Convention, the **International Covenant on Economic, Social and Cultural Rights (1966)** comprehensively prescribes the right to education in its articles 13 and 14. Other instruments of international law also set out rights and obligations related to the right to education which are specific to certain groups of people; these instruments include, most notably, the **Convention on the Rights of the Child (1989)**, the **Convention on the Elimination of All Forms of Discrimination against Women (1979), the Convention on the Rights of Persons with Disabilities (2006)** and the **International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (1990)**. The rights and obligations related to the right to education, which is a fundamental human right, apply to all kinds of education, including digital education. How they apply specifically will be analysed in each section below.

Besides legally binding instruments, soft law instruments at the international level also offer some guidance. The earliest reference to terminology that falls under the umbrella of digital technology in education can be found in the **Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4 (UNESCO, 2015a)**. Underpinned by the right to education, it calls on States to develop quality distance learning in tertiary education to improve access (paragraph 45), and to "provide distance learning, ICT training, access to appropriate technology and necessary infrastructure to facilitate a learning environment at home and in conflict zones and remote areas" (paragraph 57). In 2015, the same year that the Incheon Declaration was adopted, the **Qingdao Declaration** (UNESCO, 2015b), on information and communication technologies (ICT) in education, was adopted to leverage ICT to achieve the SDGs. The signatories to the Qingdao Declaration committed to "ensur[ing] that all girls and boys have access to connected digital devices and a relevant and responsive digital learning environment by 2030" (paragraph 5). Building on these earlier commitments, the Beijing Consensus on Artificial Intelligence and Education (UNESCCO, 2019a) further emphasizes the transformative role of emerging technologies to advance inclusive and equitable quality education.

The **Rewired Global Declaration on Connectivity for Education (2021)** draws on lessons from the COVID-19 pandemic and proposes new norms and interpretations to guide national and international efforts so that connected technologies reach all learners and are centred on principles of justice, equity and respect for human rights. It states that "for connectivity to truly equalize educational opportunity, it needs to enable anytime, anywhere Internet access for individual students and teachers" (paragraph 1(a)). It recognizes that "technology supplements, expands, and enriches high-quality, formal and in-person education, rather than replac[ing] it", specifying that "with rare exception, compulsory schooling should require attendance at a physical school" (paragraph 1(d)).

Part I of this report is dedicated to right to education components that are particularly relevant when considering the digitalization process, and that are not otherwise covered under the other human rights identified in this report.

Chapter 1

Digitalization and access to education

The right to education requires that education be accessible (CESCR, 1999), but what does this imply for the digital environment? Digital technologies have expanded access to learning opportunities and have even proven essential to ensuring education continuity in times of emergencies and protracted crises. Digital tools allow learners to access a wide range of online resources, to learn at their convenience and to access a wide choice of learning techniques; they are, in some cases, more economical than paper-based materials (Haleem et al., 2022; Sabatini et al., 2022).

Despite their potential to reach a wide range of learners, digital technologies also pose significant barriers that can considerably hinder access to education. These barriers arise where, for example, there is a lack of digital pedagogical tools and devices and of Internet connectivity and affordability. As part of the analysis regarding access, this section will also address access to digital education in emergencies and protracted crises. The broader context, which encompasses learning processes, educational content, the role of teachers, overcoming psychological barriers and ensuring physical and mental well-being in the digital learning environment, presents additional challenges and obstacles, will be examined in chapter 2, on quality.

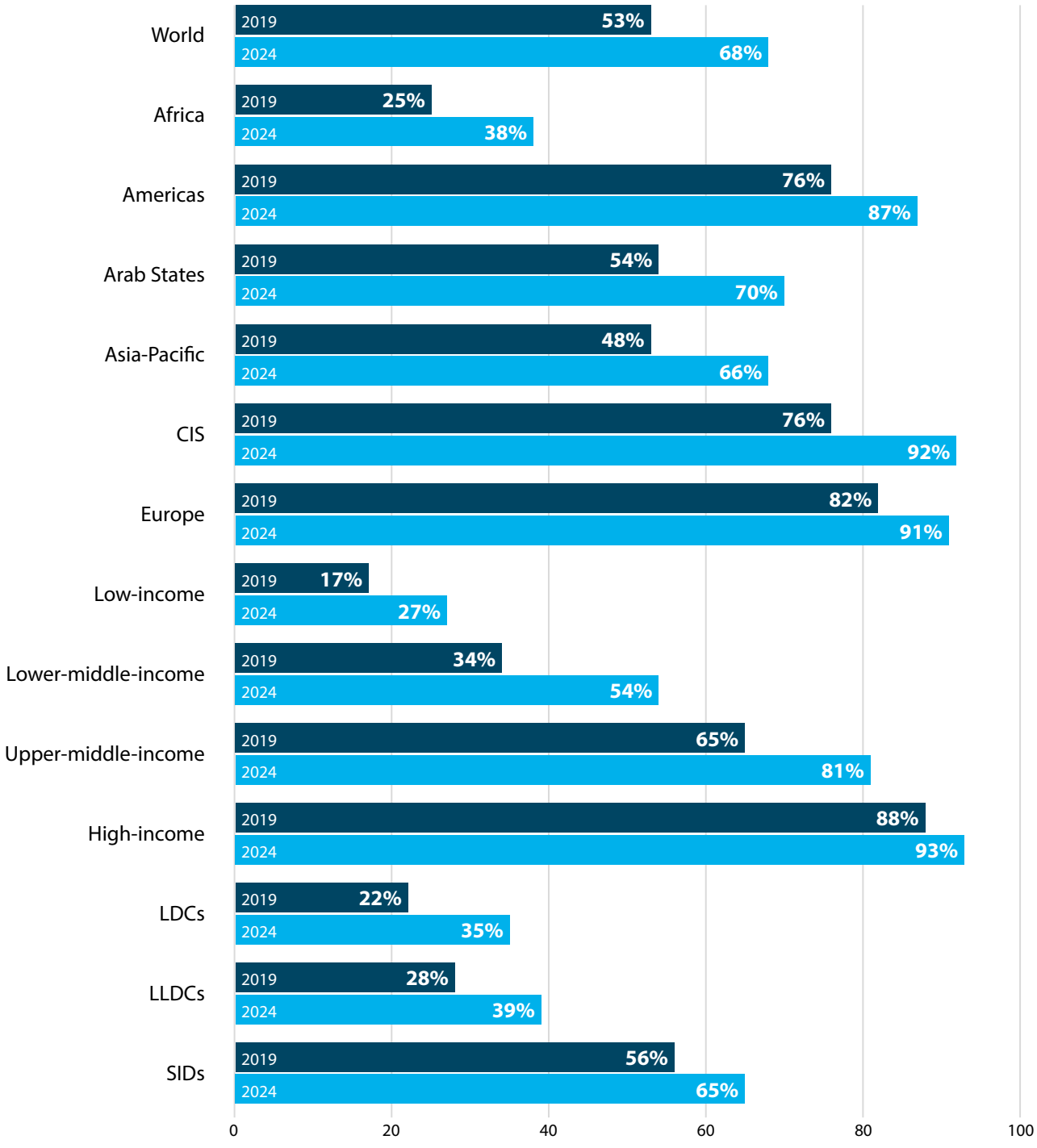
1.1 The Internet as a foundational challenge for education

The Rewired Declaration notes that "technical and material access to connectivity remain[s] woefully insufficient with approximately two out of every three children and youth having no Internet access at home". Yet education is becoming more and more dependent on connectivity, and without Internet, there is a risk that the right to education, especially in the case of vulnerable groups, cannot be enjoyed.

The **percentage of the population using the Internet has grown exponentially in recent decades**. In 2005, 1 billion people (16% of the population) were using the Internet; in 2022, that number increased fivefold, **with 5.5 billion people (68% of the population)** using the Internet (ITU, 2022b; ITU, 2024b). However, there remain substantial differences between Internet usage across regions: 40% in Africa, 64% in Asia-Pacific States, and 70% in Arab States, but between 80% and 90% in the Americas, Europe and the Commonwealth of Independent States (ITU, 2022b). In addition, there are also substantial differences in education levels around the world, with only **40% of primary, 50% of lower secondary and 65% of upper secondary schools in secondary education that are connected to the Internet (GEM Report, 2023)**. This metric ranges from just over 30% in least developed countries (LDCs) to almost all schools in Europe and North America. Giga, a global initiative launched by the International Telecommunication Union (ITU) and the United Nations Children's Fund (UNICEF), is one example of a global multi-agency and multi-stakeholder collaboration intended to address the issue of school connectivity (Broadband Commission, 2020a). It is also necessary to note that without electricity, Internet access is impossible. In 2021, 770 million people, almost 9% of the global population, still lacked access to electricity (GEM Report, 2023).

Figure 3: Internet use per region

Percentage of individuals using the Internet by region, 2019 and 2024



Source: ITU, Measuring digital development: Facts and Figures 2024.
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As learning opportunities expand beyond school, access to the **Internet at home is now a prerequisite for digitalization in education**. Lack of connectivity at home has created the effect of the "homework gap" – an expression used to refer to school-age children lacking the necessary connectivity to complete schoolwork at home (Broadband Commission, 2020b). Indeed, 2.2 billion individuals under the age of 25 years lack Internet access at home (UNICEF and ITU, 2020). This puts students at a substantial disadvantage;

this is particularly the case for students who come from poorer households in rural areas, as they suffer the most from the digital divide at home (Broadband Commission, 2019; Broadband Commission, 2021). Furthermore, as the coronavirus disease (COVID-19) pandemic revealed, ensuring access to connectivity at home is essential for learning continuity in times of crisis. According to the Responses to Educational Disruption Survey, during the pandemic, in Burkina Faso, Ethiopia and Kenya, a proper Internet connection was not available for most students, causing significant disruptions to their education (UNESCO and IEA, 2022).

Beyond the differences in Internet access, there are also **stark variances in average broadband network speeds across the globe**. Notwithstanding the increase in global broadband speed (the average broadband speed increased from 7.40 to 34.79 Mbps between 2017 and 2022), there are differences in average broadband network speeds across the globe. Western Europe, North America, the Baltics and Asia (excluding the Near East) dominate the upper speed bands, while Eastern Europe, the Caribbean, South and Central America, the Near East, sub-Saharan Africa and North Africa have the slowest network speeds (Cable.co.uk, 2022).

High-speed Internet access requires a substantial financial investment (from States and/or the private sector) in the physical infrastructure needed to operate the networks for such access. Beyond this fiscal factor, politics and geography also play crucial roles: the size of a country and the accessibility of its terrain affect the feasibility and cost of laying down the infrastructure needed, for example. As will be discussed in section 3 of this chapter, the private sector often fills this gap.

Box 1: Food for thought

A right to connectivity in education?

It has been argued that the introduction of digital technologies in education should be discussed within the framework of the universal right to public, free, quality education and of States' commitments, pursuant to both international human rights law and SDG 4, in that regard.

In 2022, the Special Rapporteur on the right to education called for the "introduction and/ or enhancement of digital education for all" (A/HRC/50/32, para. 96 (b)).

In 2023, the Special Rapporteur recognized that the right to education encompasses digital skills and Internet access, as they represent essential tools for realizing this right (A/HRC/53/27, para. 96).

Then in 2024, the Special Rapporteur called for action to urgently close all digital divides in education by addressing access, including Internet connectivity and device availability, instructional design and pedagogies (A/79/520, paras. 82-86).

See more:

- A/HRC/50/32
- A/HRC/53/27
- A/79/520

Addressing connectivity is therefore an important step towards ensuring access to educational platforms and materials in all contexts. Ensuring that the infrastructure necessary for Internet access exists in all areas, including remote and rural areas, is essential.

Affordability is also key to accessibility: Internet connectivity must be inexpensive so that cost does not constitute a barrier to access. In both developing and developed nations, those who do not use the Internet are disproportionately poor, among other factors (Antonio and Tuffley, 2014). Policy and regulations that foster low-cost connectivity technologies are one way of improving connectivity; this includes "establishing public/private partnerships to enable zero-rated data connectivity, especially for rural areas and Internet traffic related to online education" (UNESCO, 2022a). **Zero-rated data connectivity** not only means that accessing, using, and downloading content from some websites will be free of

charge, but also that the Internet data traffic consumed by accessing these websites will be excluded from charges and monthly data caps. This requires the telecom sector and other concerned agencies to create a list of websites to be automatically exempted from "billing" (European Commission, 2017, as cited in UNESCO, 2022a). Therefore, policies like zero-rated data connectivity can play a vital role in ensuring that digitalization in education benefits all learners, not just those who can afford high-speed Internet.

1.2 Access to digital infrastructure and devices

Access to digital tools is fundamental for digitalization processes in education. It is particularly necessary in crises such as the COVID-19 pandemic, during which most countries shifted to some form of distance learning solution. The introduction of these tools (including mobile devices, smartboards, tablets, laptops, simulations, dynamic visualizations and virtual laboratories) has changed the way in which education is delivered (Haleem et al., 2022). However, more needs to be done to expand access to devices both at school and at home.

Giga is a joint UNICEF and ITU initiative aimed at connecting all the world's schools to the Internet. A 2021 report on 17 countries it had mapped (Connecting the Dots) found that approximately 86,000 schools remained unconnected. That represents 11% of the total schools in those countries. **Moreover, that lack of connectivity affects 25.8 million students and teachers (Giga, 2021)**. At home, access to a computer also varies: **globally, in 2019, 47.1% of households were estimated to have a computer**; in developed countries the percentage was close to 80%, while in developing countries, it was only 36.1% (Statista, 2023a). Ultimately, a crucial barrier to digitalization in education is the **cost of digital devices**. According to ITU data (ITU, 2022a), the high cost of equipment and services is a significant barrier to accessing the Internet. In 49 countries, survey data (ITU, 2022a) indicate that many households consider the cost of equipment and service too high. Specifically, 50% of survey respondents in seven countries mentioned the high cost of both equipment and service as a barrier to Internet access. Indeed, in low-income economies, Internet access remains limited because of the high cost of equipment and connection. At most, only 10% of people can afford a benchmark broadband basket, which should not exceed 2% of their monthly income. Consequently, the proportion of Internet users in low-income regions barely reached 40% in 2021.

Measures to subsidize the cost of digital devices, or even offer them free of charge to learners, prioritizing those who are most vulnerable and disadvantaged, can address challenges with regard to access. For example, Uruguay became the first country to implement the One Laptop Per Child programme nationwide between 2007 and 2009, while also connecting all schools to the Internet (GEM Report, 2023). As a result, two thirds of 6 to 13 years olds from the poorest households had access to a computer exclusively through the programme (GEM Report, 2023). In a 2024 report, the United Nations High Commissioner for Human Rights called for "universal access to digital devices and reliable and affordable electricity and telephone services, and reliable, open, safe and affordable access to the Internet for students, families, communities and educational institutions" (UNHCHR, 2024, para. 104 (b)). The High Commissioner also called for businesses to "assess how the price of digital devices and infrastructure affects the access and rights of young people and explore options to reduce barriers limiting access for those most in need" (Ibid., para. 105 (a)). Furthermore, as noted in the Rewired Declaration, "user interfaces and functionality should also be optimized for use on mobile phones, in addition to laptop and desktop computers, due to the growing ubiquity of Internet-connected mobile devices" (para. 2(a)). As ITU data reveal, approximately 73% of individuals worldwide own a mobile phone (ITU, 2022b). While progress has been made in expanding connectivity and access to devices, affordability and inequality remain major barriers, requiring targeted subsidies and a rights-based approach to ensure that no learner is excluded.

In line with this, the 5C framework identifies "connectivity and infrastructure" as a foundational pillar, which focuses on the availability, reliability and accessibility of electricity, Internet access hardware and

devices, digital software and services, and the design of learning spaces, ensuring that all schools are equipped with the necessary resources to facilitate digital learning (UNESCO, 2024e). Significant efforts have been made to integrate educational technology into schools; these efforts have involved both top-down approaches (initiated by governments and ministries of education) and bottom-up approaches (initiated by schools) (UNESCO, 2022c). Principle 2 of the Rewired Declaration determines that States should "**expand investments in free and high-quality digital education content**". Beyond the use of technological devices, there is a need to ensure "high-quality educational content and interactions that facilitate learning and development". What constitutes quality in the context of digitalization in education will be discussed in section 2 of this chapter.

Ensuring access to educational content, including open educational resources (OER), provides individuals with the opportunity to learn to complement formal in-school learning, and from a lifelong learning approach, it opens up a world of information, training and knowledge for people of all ages. The movement for **OERs** coincided with the adoption of the UNESCO Recommendation on Open Educational Resources (OER) (2019), which defines OER as "**learning, teaching and research materials in any format and medium that reside in the public domain** or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others" (para. 1). The aim is to enhance "access to, and effective use of high quality educational and research materials and programmes of study" (para. 5). One way of enhancing access is through publicly sanctioned digital learning platforms and content. For example, in India, the digital platform DIKSHA, an initiative of the National Council for Educational Research and Training (Ministry of Education of India), offers engaging learning material, relevant to the prescribed school curriculum, to teachers, students and parents.

Box 2: Useful resources

Digital education platforms

These examples have been selected to highlight the commitment of UNESCO and other United Nations agencies to advancing quality education through digital tools.

Global Learning House

In the context of the COVID-19 pandemic, UNESCO's Global Education Coalition launched the Global Learning House. The Global Learning House aims to mobilize international solidarity and innovative solutions in order to support learning, especially for the most disadvantaged learners. More specifically, it aims to provide supplemental educational resources and instruction, at no cost, for remedial programmes that mitigate COVID-19 pandemic-induced learning losses.

See more: Global Learning House

The Learning Passport

The Learning Passport, delivered by UNICEF and powered by Microsoft Community Training, is a mobile platform with online and offline functionalities. It enables continuous access to quality education. It is highly flexible and adaptable, allowing countries to easily and quickly adopt it as its national learning management system or use it to complement existing digital learning platforms.

See more: The Learning Passport

Gateways to Public Digital Learning Platforms

At the United Nations' Transforming Education Summit in 2022, UNESCO and UNICEF joined forces to launch Gateways to Public Digital Learning. This is a global initiative aimed at working with governments and partners on establishing digital education as a public good through high-quality, inclusive national digital learning platforms and content. Additionally, it aims to promote knowledge exchange among countries to ensure that all children have access to quality digital education.

See more: Gateways to Public Digital Learning Platforms

While, because of the COVID-19 pandemic, considerable progress was made with the integration of digital tools in educational settings, that momentum has been lost and there has even been a reversion (United Nations, 2022). Open-access platforms offering diverse and quality content need to be supported. Not only do they have considerable potential for learners, teachers, caregivers and other education stakeholders, but they also represent education as a public good. Nevertheless, **public digital learning platforms should never be used to justify divestment from, or ceasing investment in, in-person schooling**. Instead, governments should favour "a process of turning digital environments into hubs and centres that enrich learning in ways that complement, improve, and extend the vital work that happens in brick-and-mortar education institutions" (United Nations, 2022, p. 3). The Special Rapporteur on the right to education (2024, para. 3) has reiterated that digitalization in education should not replace on-site schooling. Education is a collective and social endeavour, and schools are venues in which children socialize and learn to live together.

In the development of regulations on digital infrastructure and devices, it is equally important to take into account their ecological impact, ensuring that expansion in access does not come at the expense of environmental sustainability. The **environmental impact of digitalization processes cannot and must not be ignored**. According to a 2023 report of the Intergovernmental Panel on Climate Change (IPCC), global surface temperature will rise on account of human causes if we continue along the current path. Additionally, by 2030, the electricity consumption of data centres, needed to train and deploy AI models, will be equivalent to Japan's total consumption (IEA, 2025). There is an urgent need to reduce greenhouse gas emissions considerably. When developing policies for digitalization in education, which involves expanding the availability and accessibility of digital tools, **policymakers need to minimize negative impacts, in terms of raw materials, energy requirements and waste** (UNESCO, 2022a). They also need to consider liberalizing energy markets, by means such as "decoupling grids, allowing independent renewable power producers, and minimizing or eliminating duties and taxes on renewable energy products" (Broadband Commission, 2022, p. 49). Tech companies that are involved in education also have an important role to play in reducing and eliminating their greenhouse gas emissions (UNESCO, 2022a). On the other hand, digitalization of education can also help in reducing waste, as digital pedagogical content can be environmentally cleaner than paper-based materials that require regular updating (Haleem et al., 2022).

In conclusion, guaranteeing access to digital content and platforms must go hand in hand with preserving in-person schooling and minimizing the ecological footprint of digital tools, so that technology enriches education without undermining its social or environmental foundations.

1.3 Education in emergencies and protracted crises

Where crisis strikes, individuals' lives and education are severely and oftentimes irreversibly affected. It is estimated that 127 million primary and secondary school-age children and young people living in crisis-affected countries were out of school in 2019 (INEE, 2020), and that fewer than 1 out of 3 refugees are enrolled in secondary education (INEE and Save the Children, 2021). Conflict-type crises include those caused by external factors (e.g., brought on by war, embargoes, and blockades) and internal factors (e.g., brought on by strikes, sabotage, and terrorist attacks) (Shaluf and Said, 2003). Crisis affects individuals differently. The impact on children, for example, differs across various age ranges: very young children are susceptible to health and developmental problems, and school-age children and adolescents are susceptible to early marriage and pregnancy, recruitment into the military or armed groups, and labour exploitation (Nicolai, Hine and Wales, 2015). Climate change is also affecting human movement: as at 2024, natural hazards and extreme weather had displaced 45.8 million people (Internal Displacement Monitoring Centre, 2025). Those living in the context of emergencies and protracted crises — whether due to conflict, violence, disasters or pandemics — are particularly at risk of being left out of school or having their education disrupted (UNESCO, 2020d).

In crises, education provides a lifeline for children and adults alike. The provision of education in emergencies and protracted crises has the ability to mitigate the psychosocial impact of armed conflicts and natural hazards by providing a sense of normalcy, stability, structure and hope for the future, while also offering much-needed safe spaces (GA, 2010; Nicolai, Hine and Wales, 2015). **Under the right conditions, digital technologies in education can help** in overcoming the challenges facing vulnerable groups by facilitating access to education through innovative combinations (both low-tech and high-tech digital modalities) that allow timely and effective learning (UNESCO, 2022; UNHCR, 2021). In response to emergencies and protracted crises, crisis-sensitive planning must prioritize equity by addressing the digital divide and ensuring that inclusive, gender-responsive learning solutions are implemented (UNESCO, 2020a).

According to a 2021 report by the Office of the United Nations High Commissioner for Refugees (UNHCR), the **use of radio and television is particularly popular** where Internet connectivity is not guaranteed, especially in low- and lower-middle-income contexts. Such modalities, when accompanied by supportive measures (such as teachers engaging with students in their communities) can prove very beneficial. However, even these channels do not reach all areas, and when they do, the relevance of the programmes can be limited where households are made up of children of different ages. The same report notes that **online and offline platforms** are also an effective means of **education and that they allow for personalized learning resources in the user's own language, as well as offering the flexibility to learn at the user's own pace**. Yet, across the world, such modalities remain largely out of reach because of connectivity issues (see also above section). Initiatives such as the SolarSPELL offline digital libraries used in South Sudan during the COVID-19 pandemic (Farrell et al., 2024) show that curricula can be effectively adapted in digital form, even offline, in emergencies and protracted crises in order to ensure the continuity of education. Similarly, a report by the University of Cambridge and the Centre for Lebanese Studies, in partnership with the UNRWA, has recommended actions for rebuilding the education system in Gaza, including the adoption of new modalities for learning and the use of appropriate technologies that can be adapted to support learners who have missed out on education (University of Cambridge et al., 2024).

Nevertheless, when there is strong collaboration between government, technical partners and United Nations agencies, nationally aligned education content can support both the continuity of learning and classroom instruction (UNHCR, 2021). Finally, **social media channels have allowed not only access to education and learning, but also meaningful engagement**. In addition to the delivery of lessons and teacher training, social media platforms also permit instant messaging and the formation of support groups. Such modalities depend on connectivity and access to digital devices.

A multimodal approach is also needed to adapt to specific contexts and cater to those from disadvantaged backgrounds who have limited technological access. According to a survey, during the COVID-19 pandemic, radio and television were more commonly deployed by governments in low-income countries, while online platforms were most popular in high-income, lower-middle, and upper-middle income countries (UIS et al., 2021). As will be discussed in later sections, it is important to pay attention to intersectionality and the challenges of the digital divide, which exacerbated inequalities during the COVID-19 pandemic.

However, as noted by the United Nations' Special Rapporteur on the right to education, "remote education in a context of emergency is fundamentally different from a typical use of technology. On such occasions, teachers, educators and policymakers have little or no time to adjust" (Special Rapporteur on the right to education, 2022, para. 45). In this connection, ensuring **education resilience strategies which include crisis-sensitive educational planning is essential**. This involves: identifying and analysing the risks that conflict and disasters pose to education, in order to inform the development of education policies and plans; and adopting mitigation measures (UNESCO, 2020d). Cross-sectoral policy harmonization (for example, between education, disaster-risk reduction and climate change policies) can help in enhancing synergies and effectiveness. Teachers, learners and schools must be

ready and equipped to face emergencies, which requires reviewing current distance and open learning programmes and resources to improve their delivery and accessibility (UNESCO, 2020a). Furthermore, in several contexts, learners are experiencing compounded emergencies and crises, which adds another level of complexity. Addressing this reality in education planning can ensure a more targeted and accurate response.

Guidance on how to cater for education in emergencies can be found in Save the Children's Education in Emergencies Toolkit, the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES) Comprehensive School Safety Framework and the Global Education Cluster Toolkit. An important component of the planning phase is **defining beneficiaries and target groups, which directly affects the elaboration and design of plans, policies and programmes**. "The measures that can be taken to help students recover from learning losses will depend on various factors: the target groups (students in formal vs non-formal settings), the level of learning outcomes (missed vs lost learning), the organization of teaching and learning (flexibility, time of learning, etc.), and content and pedagogy (condensed curricula, adapted teaching)" (UNESCO, 2021c, p. 3). Regarding the latter, understanding whether education takes place in centres (collective and teacher-led education) or at home (self-directed education) and what types of programme are needed (regular, accelerated, catch-up, remedial or bridging) are also important factors (Save the Children, 2017). While these aspects are general to education in emergencies and protracted crises, they must also be taken into account in the design and use of digital technologies in this context to ensure targeted and effective use. Crisis planning needs to involve coordinating with teachers and communities to find effective remote learning strategies, and communicating with all stakeholders to share ideas, provide motivation and convey crucial information (UNESCO, 2020a).

In such circumstances, quality, equitable and inclusive education is crucial to the creation of a sustainable infrastructure that helps to ensure the success of other interventions (such as those related to water and health), as well as the economic growth, peace and stability of countries in recovery (Nicolai, Hine and Wales, 2015).

Some considerations with regard to international and national guidance

- Access to digital education requires access to digital devices, the Internet and educational digital content, both in schools and at home, and it must take into account local contexts.
- Removing barriers to access, especially for the most vulnerable, can include subsidies, free-of-charge digital devices, maintaining quality public digital learning platforms and offering zero-rated data connectivity for education purposes.
- The integration of digital technologies in education should neither aim for nor result in a reduction of investment or lack of investment in public education systems.
- Modernizing digital public infrastructure (including improving connectivity, updating hardware, and establishing modern education management information systems) will make it possible to fully leverage technology for education management.
- Ensure systematic follow-up maintenance of digital devices, particularly in the context of education in emergencies and proacted crises, to prevent the abandonment of tools on account of the unavailability of repair services or spare parts, and to reduce the need for repeated reinvestment in new equipment.
- Digitalization processes must minimize environmental impacts, as there is an urgent need to reduce greenhouse gas emissions.
- Under the right conditions, digital technologies can provide timely and effective learning in emergency contexts and protracted crises, as long as they adapt to the local context and adopt a multimodal approach.

Considerations for guidance

- Guarantee equitable, affordable, and sustainable access to both Internet connectivity and digital devices, including ongoing maintenance and repair services.
- Adapt education strategies to the specific contexts and needs of disadvantaged groups by utilizing a combination of low-tech and high-tech modalities, including radio and television, to provide education in low-connectivity areas in the context of emergencies and protracted crises.
- Ensure that crisis-sensitive planning prioritizes equity by addressing the digital divide and implementing inclusive, gender-responsive learning solutions.
- Minimize the negative ecological impact in terms of the use of raw materials, energy and water consumption and waste reduction in the context of the digitalization of education.

Chapter 2

Digitalization and quality education

As a dynamic concept, quality of education evolves with time and is affected by social, economic and environmental context (UNESCO, 2005). The UNESCO Convention against Discrimination in Education (1960) first introduced the notion of quality education by stipulating that education refers to "all types and levels of education, and includes access to education, the standard and quality of education, and the conditions under which it is given" (article 1, paragraph 2). In the context of digitalization in education, this section explores its impact on learning processes, the need to adapt curricula for digital skills and citizenship, the evolving role of teachers, and the implications for learners' well-being.

2.1 Learning processes

In their most basic form, technologies such as radios, mobile phones and computers are a means through which information, knowledge and educational resources are delivered to learners. However, beyond this, **digitalization processes have allowed for innovative practices** in actual education content and educational experience. Pedagogical technologies include an array of traditional and innovative methods, or a combination of thereof, including blended learning tools, online teaching, e-learning, individualized and personal learning, flipped classes and experiential teaching techniques (using gamification, simulations, role modelling and so on) (Paul, 2021, Álvarez-García et al., 2020).

Some argue that such **technology can allow for greater interaction and can enhance learner engagement** (GEM Report, 2023). It also provides means of involving stakeholders in the delivery of educational content by permitting experts (academics and professionals) to deliver talks, engage in discussions, organize simulations and so forth. Digital game-based learning, which uses principles of play as an effective tool for teaching a variety of subjects, such as mathematics, science and humanities and even social-emotional skills (Chatterjee Singh et al., 2020), can also make learning more enjoyable (Haleem et al., 2022).

In terms of more practical aspects, in a digital context, educational content can be updated and corrected immediately (reducing the costs entailed by reprinting paper-based material). Furthermore, digital technologies permit the delivery of classes and teaching sessions online to groups or individual learners, which, as discussed in the previous section, can expand access and permit the continuity of learning in times of crisis. That said, digital learning also presents challenges - capturing children's attention is harder, and reduced interpersonal interaction can affect motivation and outcomes. Digital tools should not be seen as a simple fix or an excuse for divestment, as effective education depends on more than just access.

Building on these developments, emerging technologies such as AI are increasingly shaping how learning is designed and delivered. **AI-driven tools are, furthermore, offering new pathways for learning**. These involve tools such as "intelligent tutoring systems, dialogue-based tutoring systems, exploratory learning environments, automatic writing evaluation, learning network orchestrators, chatbots and dedicated AI to support learners with disabilities" (Council of Europe, 2022a, p. 19). However, despite the expansion in their use, there is little evidence to justify their wide use in classrooms (Council of Europe, 2022a).

Generative AI and, more specifically, AI chatbots, exemplified by models such as ChatGPT, present significant challenges to cognitive development, particularly in educational contexts. This phenomenon, referred to as "AI-chatbot-induced cognitive atrophy (AICICA)", highlights the risks associated with overreliance on AI for information retrieval and problem-solving (Dergaa et al., 2024). The core concern is that extensive dependence on these technologies may directly lead to detrimental cognitive effects, counteracting educational objectives and hindering individual development.

Overreliance on AI chatbots poses a risk to educational quality by diminishing learners' motivation and memory retention. Indeed, a 2024 study conducted by Abbas et al. examined ChatGPT use among university students in Pakistan through two linked studies, first surveying 165 students, then conducting a three-wave, time-lagged survey of 494 students, to explore its academic and cognitive impacts. It founds that students who frequently used ChatGPT were more likely to engage in procrastination, have lower academic performance and be subject to greater memory loss than those who rarely used ChatGPT (Abbas et al., 2024). This dependency impairs critical thinking, as it hinders the development of essential skills in analysis and evaluation. Furthermore, because of AI's lack of true understanding, the information provided can sometimes be inaccurate, potentially leading to the dissemination of misleading content. The instant answers supplied by generative AI promote superficial engagement with subjects, adversely affecting long-term memory formation. Additionally, reduced human interaction - an element crucial to effective learning and memory -coupled with the effortless nature of AI-assisted learning, can demotivate students from engaging in independent problem-solving (Bai, Liu and Su, 2023).

More recently, a study conducted by the Massachusetts Institute of Technology (MIT) (Kos'myna et al., 2025), published in June 2025, investigated the cognitive effects of using large language models (LLMs) such as ChatGPT in educational essay writing. Participants were divided into three groups: LLM, search engine and brain-only, and had to complete three essay-writing tasks. In a fourth session, some participants switched conditions: LLM users wrote without tools, and brain-only users wrote with LLMs. Using electroencephalography to measure brain activity, along with natural language processing analysis and interviews, the study found that reliance on LLMs significantly reduced cognitive engagement. Brain-only participants showed the strongest neural connectivity, while LLM users had the weakest. Essay content from LLM users was more uniform and less memorable, and participants reported lower ownership of their work.

Indeed, the use of adaptive AI in education may limit learners' chance to develop essential life skills such as resourcefulness, self-efficacy, self-regulation, metacognition, critical thinking and independent thought, all of which are crucial for personal development. The long-term impact on students' civic and educational outcomes remains uncertain (UNESCO, 2021a). This situation is particularly alarming in educational settings, where the foundational development of cognitive abilities is crucial. To mitigate these risks, it is imperative to adopt a balanced approach in integrating AI technologies, ensuring that they complement rather than replace traditional cognitive development practices. Further research and policy frameworks are needed to address the long-term cognitive impacts of generative AI, promoting sustainable and holistic educational strategies that preserve and enhance human cognitive abilities.

Digital technologies have also led to the increased **collection, storage, sharing and analysis of data, which have generated a rise in learning analytics and education data mining**. Both of these fields have similar traits in that they exploit machine learning for educational research, but they also have distinct features, as learning analytics "is focused on the processes influencing learning, at the individual and social levels, whereas [education data mining] is focused on knowledge discovery from all educational data sources produced by individuals and groups of individuals supported by institutional frameworks" (Lemay et al., 2021, p. 1). As noted by the Special Rapporteur on the right to education, learning analytics, as well as education data mining, used with due respect for the privacy of students and communities, "can provide insights for educators and learners to improve teaching and learning" (Special Rapporteur on the right to education, 2022, paras. 5 and 100). Furthermore, the Special Rapporteur (2024, para. 91) calls for national policies to incorporate AI in a way that enhances learning outcomes

without threatening to replace human educators. For example, data on the following can be obtained: the frequency with which and length of time for which learners engage with online content. Educational content can then be tailored to the individual needs of learners (Klement et al., 2017). **Technologies can also be used to support formative assessments** providing "longitudinal and real-time feedback on students' learning and progress, allowing learners to receive immediate feedback and participate in exercises adapted to their ability level" (UNESCO UIS et al., 2022, p. 21). However, the collection of such data does have repercussions in terms of the right to privacy (see chapter 3), the right to be heard and the right to autonomy (see chapter 8).

While there is very little guidance at the international level, the UNESCO Recommendation on the Ethics of Artificial Intelligence (2021) does alert States that "AI should support the learning process without reducing cognitive abilities" (paragraph 104). The Special Rapporteur on the right to education has cautioned that "learning requires social interaction, particularly when it concerns young children" (Special Rapporteur, 2022, para. 75) and noted that personal connections are essential to the development of emotional and social abilities. In addition, educational settings are spaces where other services are provided, such as food, health and protection against violence. Furthermore, the Special Rapporteur warns that face-to-face learning should never be replaced by distance learning, as this threatens the realization of the right to education, including quality teaching (Special Rapporteur, 2022, see also the section on 'Physical and mental well-being in the digital learning environment').

In conclusion, digitalization has opened new pathways for delivering and enriching learning, from interactive pedagogies and updated content to adaptive AI-driven tools. Yet the evidence underscores that effective learning depends on more than access to technology: it requires meaningful engagement, human interaction, and the safeguarding of cognitive and social development. Integrating digital tools in ways that complement rather than replace traditional pedagogical practices is therefore essential to ensuring that digitalization contributes positively to learning processes and to the realization of the right to education.

2.2 The need to adapt curricula for the digital age: functional and critical digital skills and digital citizenship

Without digital skills, digital pedagogical tools and platforms are of no use. For example, according to available information, around 25% of students in a number of Latin American countries (Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Peru, Uruguay) have access to ICT infrastructure but do not use it (OECD, 2020a). "**Inadequate digital skills and competencies rank as the single greatest barrier to technology use for education, and this regardless of a country's development status**" (Rewired Declaration, 2022, p. 4). These barriers are also particularly prevalent among the most vulnerable, as will be further discussed in chapter 3. As noted in the recently adopted Recommendation on the Ethics of Artificial Intelligence (2021), "**living in digitalizing societies requires new educational practices, ethical reflection, critical thinking, responsible design practices and new skills, given the implications for the labour market, employability and civic participation**" (paragraph 3(a)).

For many years, literacy has been defined as the capacity to read and write. The Convention on the Rights of the Child requires States Parties to encourage international cooperation with a view to the elimination of "ignorance and illiteracy" (article 28, para. 3). The Convention on the Elimination of All Forms of Discrimination against Women provides for men and women to have the same opportunities to access functional literacy programmes (article 10, para. (e)). UNESCO's Right to Education Handbook highlights that "literacy and numeracy are vital to the realization of the right to education because they are foundational for the acquisition of other skills, without which the continuation of education is impossible" (UNESCO, 2019d, p. 115). In the twenty-first century, the concept of literacy now needs to encompass **digital literacy skills**, which, according to General Comment No. 25 of the Committee on the Rights of the Child, must be "taught in schools, as **part of basic education curricula**, from the preschool level

and throughout all school years, and that such pedagogies are assessed on the basis of their results" (para. 104). Introducing digital skills into school curricula helps "children build resilience and develop critical thinking to engage in a harmonious way with technology, allowing them to maximize the opportunities of connectivity onward" (Broadband Commission, 2020a, p. 26).

Digital literacy does not just mean functional skills and technical know-how as to the safe use of a wide range of digital tools and resources **(functional digital literacy). It also encompasses critical digital literacy**, namely the ability to understand the politics of digital society and the digital economy, and to recognize the motivations of actors in digital spaces and the way that technologies exert a profound influence on people (UNESCO, 2018).

With the growth of the AI industry affecting education and the whole of society, AI ethics skills are also now required (UNESCO Recommendation on the Ethics of AI, para. 102). However, by 2022, only 15 countries had successfully integrated AI learning objectives into their national curricula, underscoring a significant gap in global education systems' preparedness to equip students with critical AI skills (UNESCO 2024a). The integration of AI competencies is essential not only for developing students' functional and critical digital skills, but also for fostering informed and responsible digital citizenship. Students must be empowered to understand, critically evaluate and meaningfully engage with AI technologies, addressing both their potential benefits and ethical challenges (UNESCO, 2024a). UNESCO's *AI Competency Framework for Students* emphasizes the urgent need to prepare students as responsible co-creators of AI, ensuring that they possess the knowledge and skills needed to navigate an AI-driven world, while contributing to sustainable and inclusive digital futures (UNESCO, 2024a).

Box 3: Useful resources

Global initiatives supporting digital skills

Global Skills Academy

The Global Skills Academy was launched by UNESCO in 2020 as a key initiative under the umbrella of the Global Education Coalition. Its main objective is to equip 1 million young people with digital and job-ready skills by 2029, and it has a special focus on marginalized learners.

See more: Global Skills Academy

Digital Skills Toolkit

The Digital Skills Toolkit was launched by the ITU and UNDP in 2024. It offers a practical framework designed to help governments, policymakers and education planners assess, plan and implement digital skills strategies and policies at all levels of education.

See more: Digital Skills Toolkit

UNESCO Media and Information Literacy Alliance

The Media and Information Literacy (MIL) Alliance was launched by UNESCO in 2013 as a global "network of networks" committed to building international cooperation for MIL development.

See more: UNESCO Media and Information Literacy Alliance

AI Competency Framework for Students

The UNESCO AI Competency Framework for Students defines knowledge, skills, and values students must master in the age of AI.

See more: AI Competency Framework for Students

Curricula should also offer "guidance on how to find trusted sources of information and to identify misinformation and other forms of biased or false content" (CRC General Comment No. 25, paragraph 104), and build awareness of digital footprints and reputation (Rewired Declaration, Principle 3(d)). The High Commissioner for Human Rights (UNHCHR, 2024) has similarly recommended that digital, media and information literacy should be embedded in formal education curricula to empower young people with the skills, knowledge and critical thinking needed to safely and effectively navigate digital spaces (paras 60-64); it should also be promoted outside the formal education system (para. 104 (c)).

Beyond formal education, a lifelong learning perspective is also required, ensuring that **people of all ages have access to learning opportunities** to build digital skills is paramount for those who lack formal education. The Recommendation on the Ethics of Artificial Intelligence (2021) recommends that States should promote public understanding of AI and data through inclusive and accessible education, civic engagement, media and information literacy and ethics training. This requires collaboration among governments, intergovernmental organizations, civil society, academia, the media and the private sector, taking into account linguistic, social and cultural diversity to support informed public participation.

Moreover, to ensure responsibility in the digital environment, in addition to being critically digitally literate, **individuals must also engage as digital citizens**, capable of understanding the principles governing the digital environment, the societal impact of technologies, and their role in knowledge creation and democratic participation. Digital citizenship involves the ability to access, analyse, create and use digital content ethically, critically and creatively (UNESCO, 2020b).

To sum-up, digitalization drives the need to develop a wide range of skills. These covers different roles and responsibilities, from digital learner to digital citizen. It spans a wide range of skills including, digital and AI skills, digital and media literacy as well as critical thinking and communication skills. As emphasized in the "content and solutions" pillar of the 5C framework (UNESCO, 2024e), curricula and assessment should meet the aims of education in accordance with international human rights law and should enable all persons to participate effectively in a free society in the digital age.

2.3 The role of teachers

Recognizing that digital tools must not replace in-person education, the Rewired Declaration notes that along with schools and educational institutions, "teachers and educators [...] should remain the primary interface of education" (Principle 1(d)). At the international level, there are two instruments that focus on teachers: the UNESCO/ILO Recommendation concerning the Status of Teachers (1966) and the UNESCO Recommendation concerning the Status of Higher-Education Teaching Personnel (1997). While they provide a solid framework for teacher training, qualifications, conditions and rights, they do not specifically address the issues related to the use of digital technologies in education.

Notwithstanding the potential role of digital technologies in education, **ultimately their establishment and uptake and the ability to make effective use of them depends not only on access to and the quality of resources, but also on the availability of teacher training**. The COVID-19 pandemic made apparent that, for some teachers, the shift to remote learning was quite a frustrating experience due to the lack of digital skills and the need to adapt pedagogies from an in-person context (UIS et al., 2021). Without a good level of teacher training, teachers cannot be expected to overcome the obstacles that prevent them from using digital tools in teaching and learning activities. Providing digital training for teachers and strengthening their digital competencies, as well as enabling them to adapt digital technology use in their teaching and in supporting of students, are measures necessary to ensuring the effective integration of digital educational tools (UNHCHR, 2024, para. 65). This focus on strengthening teachers' skills and mindsets is echoed in the 5C framework, which identifies "capacity and culture" as a key pillar (UNESCO, 2024e). This pillar underscores that capacity-building must go beyond technical training to include cultivating growth mindsets, fostering innovation, and ensuring that teachers can safely and effectively navigate and shape digital education.

Already in 2015, with the Qingdao Declaration, States committed to "rethinking the role of teachers and reforming their preparation and professional development" (UNESOC, 2015b, para. 10). In the aftermath of the pandemic, the need to give teachers digital-skills training has become even more apparent. Because of the strong correlation between the standard of educators' skills and their ability to use and integrate digital tools in their classroom environment, **teacher training is pivotal in creating and optimizing the opportunities for teachers to use digital tools in teaching, learning**

and research activities (OECD, 2016). Instead of isolated units of technological skills, teacher training should adopt a more holistic and integrated approach in order to avoid a disconnect between this specific training and the rest of the teacher programme (Falloon, 2020). Any training should not only seek to guarantee users' ability to use digital tools, but also aim to help users to understand how to integrate these tools effectively in teaching and learning activities (Broadband Commission, 2020b).

As digital tools evolve, AI-driven applications are increasingly becoming part of teachers' working environment. Several teaching tasks, including content creation and administrative tasks, could be alleviated by leveraging AI-based tools. A recent trial conducted by the Education Endowment Foundation (EEF) in the United Kingdom of Great Britain and Northern Ireland found that teachers using ChatGPT, with a structured guide, reduced lesson planning time by 31% without compromising lesson quality (EEF, 2024). Furthermore, digital tools can be leveraged by all education personnel – including psychologists and counsellors – to reduce the administrative burden, thereby enabling them to provide enhanced support to students.

Box 4: Useful resources

Teacher material and training

Open Education Resources under the UNESCO ICT Competency Framework for Teachers

UNESCO and partner countries have created a hub which contained a collection of Open Education Resources which are aligned with the UNESCO ICT Competency Framework for Teachers and are intended to improve the teaching experience through the use of information and communication technology.

See more: UNESCO ICT Competency Framework for Teachers

Global Teacher Campus

The Global Teacher Campus is a flagship program of UNESCO's Global Education Coalition which offers digital capacities training and professional development opportunities.

See more here: Global Teacher Campus

AI Competency Framework for Teachers

The UNESCO AI Competency Framework for Teachers defines knowledge, skills, and values teachers must master in the age of AI.

See more here: AI Competency Framework for Teachers

Pre-service and continuous professional development should cover digital competences. The authors of *From Learning Recovery to Education Transformation* recognize that teachers "need in-depth and regular training to use digital tools and methods to adapt instruction to optimize the learning of each student. Obtaining an understanding of how technology, pedagogy and content knowledge intersect can gradually underpin transformation of classroom teaching practices" (OECD et al., 2022, p. 35). Pre-service training should also include supervised field teaching experience, induction and mentoring by expert classroom teachers (OECD et al., 2022). Platforms should also give teachers the opportunity to collaborate (Rewired Declaration, Principle 2(b)).

However, efforts to empower teachers must also address how rigid instructional models, such as scripted curricula, can undermine teachers' autonomy and effective pedagogy. Scripted curricula are distributed in fixed form, without allowing teachers to adapt content to learners' needs, limiting flexibility in instruction. The 2021 Global Education Monitoring (GEM) Report noted concerns over scripted curricula[3], stating that they "are viewed as constraining teacher and student intellectual

3 The term "scripted curricula" refers to highly structured lesson plans designed to standardize teaching and reduce variability in classroom delivery (GEM Report, 2021).

participation in the classroom" and that an "analysis of the Bridge International model has found that it uses scripted lessons, GPS technology and automation to create a market for its schools and reduce teacher autonomy". As recommended by the Rewired Declaration (Principle 2(b)) and the Broadband Commission (2020b), teachers should be given the freedom to tailor content for their students or make their own. Ensuring educational autonomy and individual empowerment is essential for teachers.

According to the fourth round of the Survey on National Education Responses to COVID-19 School Closures (OECD et al., 2022, p.31), which covered 93 countries, over 80% of the countries surveyed reported having implemented professional development activities for teachers on the effective use of technologies at the primary to upper-secondary levels in the school year 2020/21. Similarly, around 80% of countries planned to maintain or develop in-service digital skills training for primary to upper-secondary teachers, while 67–71% reported similar plans for pre-service training (OECD et al., 2022). **A failure to formulate comprehensive and holistic policies and strategies that aim to develop training programmes creates gaps in the digital skills of all users, impeding the integration of technology in the educational environment** (OECD, 2016).

Box 5: Useful resources

Country example

School of Computational Thinking and Artificial Intelligence (EPCIA) (OECD, 2023d)

In Spain, the Ministry of Education, Vocational Training and Sports, in partnership with regional educational authorities, has established the School of Computational Thinking and Artificial Intelligence (EPCIA). This project aims to explore the integration of artificial intelligence in educational settings. The school provides open educational resources, teacher training programmes, and a monitoring system to track the development and implementation of educational strategies. Additionally, in collaboration with a university, the school conducts research focused on the impact of artificial intelligence on student learning and pedagogical practices.

See more: EPCIA

The role of teachers is pivotal in the digital transformation of education, particularly with the growing integration of AI technologies. Teachers are increasingly seen as central actors, not only in facilitating student learning but also in guiding the ethical and effective use of AI in educational settings. However, since 2022, only seven countries have developed AI frameworks or training programmes for teachers, underscoring the urgent need for global action (UNESCO, 2024b).

AI in education allows for increased personalized learning experiences, offering teachers the ability to provide real-time feedback despite having large classes (European Commission et al., 2023). Real-time feedback helps to identify individual students' weaknesses and strengths, which in turn can help teachers to adjust teaching strategies and help students achieve educational outcomes more effectively (European Commission et al., 2023). Concretely, AI can be used to analyse data, grade work and provide feedback while teachers focus on providing personalized support. AI can also help teachers to create their teaching material; however, a teacher will always be required to verify the results produced by AI to ensure that the quality remains high (European Commission et al., 2023). AI can also be used in teacher training to "provide quick examples of pieces of text and adapt them to a given age level so the teacher can practice grading or correcting assessments for that target group of students" (European Commission et al., 2023, p.7). The integration of AI in education has primarily focused on student-facing applications, often replacing certain teaching functions. However, there is growing interest in the potential of teacher-facing AI tools to support and enhance teaching, rather than replace it. **These AI systems can help teachers by automating tasks such as assessment, plagiarism detection and administrative duties, thereby freeing up time for more personalized student support**. Nonetheless, it is essential to highlight

that AI lacks human qualities, such as empathy and contextual understanding, which are fundamental to effective teaching. Teachers play an irreplaceable role not only in delivering knowledge, but also in inspiring, mentoring and supporting students in ways that machines cannot replicate. While AI systems are increasingly capable of automating routine teaching tasks such as grading, monitoring and managing online forums, there is concern that their growing presence may diminish the perceived need for human teachers, potentially undermining their vital social role in the learning process (UNESCO, 2021a). Educational systems must therefore be careful to frame AI as a tool for assisting - not replacing - teachers, whose presence remains central to meaningful and quality learning (International Task Force on Teachers for Education, 2030, forthcoming).

Finally, external barriers can have an impact on the use of digital tools by teachers. Providing ongoing technical support for teachers to overcome technical issues (such as those related to Internet-connection stability and managing incidents) is also important to ensuring a sustainable digital educational environment (based on Ertmer et al., 2012; UNESCO, 2022c). Indeed, one of the primary obstacles to the integration of technology into teachers' professional practice is insufficient access to a stable Internet connection, which significantly impairs their capacity to effectively leverage digital tools for education. More than half of the teachers surveyed in a UNESCO T4 survey, an online survey of more than 20 000 teachers in 165 countries, indicated that **inadequate online access has significantly hindered the ability of schools to deliver quality education** (GEM Report, 2023). In numerous schools, particularly in low- and middle-income countries, the potential for digital learning is constrained by unreliable Internet connections and outdated technological infrastructure. This challenge is exacerbated by the lack of adequate technical support, which is essential for teachers to be able to resolve these issues and fully harness available resources for educational purposes (GEM Report, 2023). Beyond these infrastructural and technical barriers, the rapid emergence of new technologies such as AI is also reshaping teachers' professional environments, raising questions not only about access but also about how best to integrate these tools into pedagogical practices.

The integration of AI in education has primarily focused on student-facing applications, often replacing certain teaching functions. However, there is growing interest in the potential of teacher-facing AI tools to support and enhance teaching rather than replace it. Indeed, teachers remain central to the education process and should be equipped to benefit from AI technologies in ways that strengthen their roles and pedagogical impact. These **AI systems can help teachers by automating tasks such as assessment, plagiarism detection, and administrative duties**, thereby freeing up time for more personalized student support. According to a 2025 Gallup and Walton Family Foundation report, 32% of primary and secondary teachers in the United States of America use AI tools on a weekly basis, resulting in an average time savings of 5.9 hours per week, equivalent to approximately six additional weeks of instructional time over the course of a school year (GWFF, 2025).

Despite this, there is concern that as AI takes over more tasks, the perceived need for human teachers could diminish, undermining their essential social role in the learning process, as pointed out by the UNESCO publication *AI and Education: Guidance for Policy-Makers* (UNESCO, 2021a). It anticipates that **the role of teachers will evolve with the increasing availability of AI in classrooms**, requiring educators to develop new skills and competencies to work effectively alongside AI. Indeed, an OECD Teaching and Learning International Survey (TALIS) conducted in 2018 showed that younger teachers were more familiar with new technologies (OECD, 2020b). Moreover, AI-driven tools such as teaching assistants could assist in managing online forums, providing specialist knowledge and tracking student progress, thereby enhancing, rather than replacing, teachers' role. AI should be seen as a tool that can amplify – not replace – teachers' role, allowing educators to focus more on creative, interpersonal and value-driven aspects of teaching.

While AI systems are being developed to automate certain teaching tasks, such as grading and monitoring, **the complete replacement of teachers by machines is not expected in the near future**, according to *AI and Education: Guidance for Policy-Makers* (UNESCO, 2021a). These AI tools aim to alleviate

the more routine tasks, enabling teachers to focus on essential human aspects of education, including empathy and personal interaction. However, the publication argues that as **AI technologies continue to evolve and take on more of these duties, the traditional role of teachers may transform**. This shift underscores the importance of: ensuring that policymakers, with the participation of teachers, students, parents and caregivers, proactively address how AI will reshape teaching roles; and ensuring that educators are equipped to thrive in AI-enhanced learning environments.

The importance of **using AI to empower teaching and teachers** is emphasized in the Beijing Consensus on Artificial Intelligence and Education (UNESCO, 2019a). The document underscores that, while AI offers opportunities to assist educators with their responsibilities, **human interaction and collaboration between teachers and learners must remain central to education**. Teachers cannot be replaced by machines, and their rights and working conditions must be safeguarded. There is also consensus regarding the need for a dynamic review of teachers' roles and competencies, strengthening teacher-training institutions, and developing capacity-building programmes to prepare educators for AI-rich educational environments.

To sum-up, teachers' role is central to the effective integration of digital technologies, including AI, in education. Several measures can empower teachers including pre and in-service teachers training and access to infrastructure and internet. Preserving and promoting teachers' role in leveraging AI is another important area of policy intention.

2.4 Overcoming mental barriers

Digitalization processes in education are impeded not only by a lack of functional and critical digital literacy and training, but also by psychological barriers, which are more generally referred to as second-order barriers (Durff and Carter, 2019). Learners and educators may experience **difficulties in internalizing the use of digital tools**, which is also a significant impediment to the integration of digital tools in education. There can be a general **fear of adoption of, false perceptions of and scepticism about technology** (Broadband Commission, 2020b).

Given their prominent role in education, for students and learners to internalize the use of digital tools, teachers must be willing to do so as well. There is precisely a great deal of research addressing the specific barriers that teachers face. Often, educators **lack the time to invest in becoming acquainted with new forms of digital tools**, and some may be unwilling to use these (Ertmer et al., 2012). Attitudes towards technology, which can be both positive or negative, can influence whether teachers use technology in the classroom (Durff and Carter, 2019). Durff and Carter also refer to **sociocultural barriers**, which include "whether specific hardware or software was required by administrators, the status quo or 'how we have always done it,' and whether the use of technology was valued for educational purposes" (2019, p. 248). Pedagogical barriers, which consist of pedagogical beliefs as to how teaching should be or whether the classroom should be teacher-centric (i.e., a teacher imparts knowledge to students) or student-centric (i.e., students are active participants in their learning process), can also have an impact on the use of digital technologies (Durff and Carter, 2019).

Where there are such barriers, simply increasing access to digital devices and platforms is not enough to transform educators' pedagogical practices, especially when their integration is "not accompanied by a corresponding shift in teachers' pedagogical beliefs" (Ertmer et al., 2012). Research suggests that some strategies can be applied to overcome barriers. One way to reduce educators' reluctance is to provide them with ideas about how students can assist them with technology (Ertmer et al., 2012). For example, in the 2012 study carried out by Ertmer et al., which examined how teachers' pedagogical beliefs translated into classroom technology practices, several interviewed teachers reported that their **students taught them new ways to incorporate technology** into their work and to troubleshoot technology problems. Another way to improve uptake of technology tools is to encourage educators to **engage in learning**

"continually, collaboratively, and on the job" to help them find solutions to common problems and crucial challenges where they work (Darling-Hammond et al, 2009, p. 2).

Administrators also have a role to play in positively influencing the uptake of digital tools in schools and education institutions. In addition to more generally training and supporting teachers as noted in the previous section, they can provide **professional development opportunities, allowing for flexibility in lesson design, enabling teachers to take online courses, encouraging mentor relationships and providing technical support without imposing specific digital tools** (Durff and Carter, 2019).

Ultimately, overcoming these barriers requires not only access to technology but also sustained support, collaboration, and a shift in pedagogical beliefs to ensure meaningful digital integration in education.

2.5 Physical and mental well-being in the digital learning environment

The integration of digital tools, including AI, into education has ushered in significant transformations in learning environments, offering innovative solutions for personalized education and improved access to resources. However, **these advancements have also given rise to important considerations regarding the physical and mental well-being of learners** in such environments (GEM Report, 2023).

Physically, as demonstrated by the COVID-19 pandemic and highlighted in the 2023 GEM Report (GEM Report, 2023), **the increased use of digital platforms often results in extended screen time, which has been associated with various health problems**. Learners frequently report eye strain, headaches and musculoskeletal discomfort, especially in non-ergonomic settings. Additionally, **the sedentary nature of digital learning reduces opportunities for physical movement**, which traditionally forms an integral part of in-person schooling. The shift from physical to digital spaces has, in some cases, contributed to unhealthy weight gain among students, highlighting the importance of balancing screen-based learning with activities that promote physical health (UNESCO, 2023a).

Indeed, a review of 89 studies conducted across various countries and regions indicates that all age groups experienced a rise in screen time, with primary-school children seeing the largest daily increase (1 hour and 23 minutes), followed by adults (58 minutes), adolescents (55 minutes) and children under 5 years (35 minutes) (Trott et al., 2022, as cited in GEM Report, 2023). These increases had adverse effects on diet, including self-regulation of eating, as well as on sleep, mental health and eye health. Another research project also suggests that younger children need a measure of boredom in order to learn to address frustration and to control their impulses; yet increased screen time overly stimulates children and hinders imagination and motivation (UNICEF, 2022). McArthur et al. (2021) found that increased time spent using a screen (from one to more than three hours) had a **negative impact on behavioural outcomes for preschool children**; the researchers attributed this to the fact that children's developmental learning capacity is shaped by the experiences they encounter in early childhood. In their research, they also refer to the negative impact on the development and growth of children's brains and their language skills.

As highlighted in the 2023 GEM Report, the immersive nature of digital learning environments can significantly affect mental well-being. **Learners, particularly young students, may experience increased feelings of isolation and disconnection, as face-to-face interaction is often replaced by engagement with screens** (GEM Report, 2023). Digital tools, while enhancing learning opportunities, can inadvertently reduce opportunities for peer socialization and emotional support, which are critical components of holistic educational experiences. This shift can lead to **heightened levels of stress, anxiety and feelings of alienation** (UNESCO, 2023a). Furthermore, the widespread use of AI-driven educational tools, which provide real-time performance feedback, may place additional pressure on learners to consistently meet high standards. Digital platforms also present challenges with regard to ensuring safe and secure learning environments, as students may be exposed to inappropriate content

when engaging with online resources without the traditional oversight provided in school settings. However, some schools have introduced online counselling services and mental health chats that are particularly valuable in low-access or emergency settings. One example is Australia's Be You initiative, which offers digital mental-health resources and consultation services to schools, supporting both students and educators (Be You, n.d.).

Additionally, **the use of generative AI systems that mimic human interactions (such as chatbots) in the context of education may have significant, yet largely unknown, psychological effects on children**, as stressed by UNESCO's Guidance for Generative AI in Education and Research (UNESCO, 2023b). Indeed, these systems, designed to engage learners in seemingly human-like conversations, could influence cognitive development and emotional well-being in ways that we do not yet fully understand. Concerns are emerging about how these interactions might affect children's ability to develop critical thinking and empathy, as well as their social skills. Furthermore, there is **increasing concern about the potential influence of AI systems which may subtly manipulate children** (Special Rapporteur on the right to education, 2024). This raises important ethical concerns regarding the appropriate role of AI in education and child development.

School systems must therefore **"monitor, address and prioritize learners' and educators' mental health and psychosocial wellbeing" by collaborating across fields**, including education, child protection, health and nutrition (OECD et al., 2022, p. 4). This comprehensive approach will help to mitigate the negative impact that digital tools could have on children and young people. In addition, **regulations or guidelines for the use of digital technology** could be introduced by, for example, suggesting that students take regular breaks from screen time and limiting the use of digital technology to a number of defined hours according to the age group (GEM Report, 2023). **Providing parents and caregivers with guidelines** for managing children's use of digital technology outside school can also ensure healthy habits which will have positive repercussions in the educational environment. The role of parents and caregivers in education is extremely important, but it becomes absolutely critical when it comes to issues of AI, especially in order to protect children who are not yet capable of giving free and informed consent.

Some considerations with regard to international and national guidance

- Digital tools such as AI, gamification and blended learning foster personalized, interactive experiences but may also risk overreliance, reducing critical thinking and cognitive development.
- Both functional and critical digital literacy are vital for students to be able to navigate and participate effectively in the digital world.
- Effective integration of technology into education depends on comprehensive teacher training (including training related to functional digital skills and ethical and inclusive use of technology) and ongoing support.
- Increased screen time affects physical and mental health, requiring balanced use of digital tools.
- Teachers' roles are evolving with AI educational tools, requiring new digital competencies. Meanwhile, there are also concerns about the potential devaluation of the teaching profession.
- Stronger policies are needed to ensure that, rather than replacing them, AI in education empowers educators, thus maintaining human interaction in learning.

Considerations for guidance

- Prioritize teacher training in digital tools and ensure continuous support for technological adaptation.
- Implement guidelines to manage screen time and promote physical and mental health in digital learning environments.
- Promote and conduct research to ensure more effective and safe ways of integrating technology into education.
- Embed both functional and critical digital literacy into curricula to prepare students for active, responsible digital citizenship.
- Integrate AI into education without diminishing traditional cognitive skills or human interaction.

Chapter 3

Digital divides and inequalities

Guaranteed by the **International Bill of Human Rights** (the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights) and other human rights treaties, the right to non-discrimination and to equality is paramount when considering the digitalization in education.

More precisely, the **Convention against Discrimination in Education** explicitly states that discrimination in education includes:

- Depriving any person of access to education;
- Providing education of inferior quality;
- Establishing or maintaining segregated educational systems or institutions, unless they are gender-segregated, for linguistic or religious groups, non-exclusionary, of the same quality as comparable institutions, and conform to minimum education standards;
- Inflicting undignified conditions.

As digitalization becomes an integral part of education, the digital divide increasingly intersects with educational access and outcomes. The digital divide refers to the disparities in access to technology and in digital skills, leading to disparities in participation in the digital realm (European Commission, 2022). In the **Qingdao Declaration** of 2015, Member States committed to ensuring "that all girls and boys have access to connected digital devices and a relevant and responsive digital learning environment by 2030, irrespective of their disabilities, social or economic status, or geographic location" (UNESCO, 2015b).

In 2024, the United Nations High Commissioner for Human Rights highlighted significant barriers to digital education and the widening digital divide faced by young people. He emphasized that unequal access to technology, the Internet, and reliable infrastructure limits many young people's ability to benefit from digital education. Rural, remote and impoverished areas, as well as marginalized groups, such as those constituted by young women, persons with disabilities and Indigenous youth, are particularly affected by these disparities. Furthermore, the cost of digital devices and Internet services remains a significant obstacle, especially in low-income countries, where Internet access is scarce. The digital divide deepens educational inequalities and threatens young people's long-term prospects, affecting their ability to fully participate in society and exercise their human rights online. The High Commissioner called on States to take immediate and comprehensive action to bridge these gaps, ensuring universal and equitable access to digital education and the infrastructure necessary to support it.

The digital divide in education poses a risk of exacerbating educational inequalities. Digitalization in education thus entails a pressing need to ensure the concrete and effective realization of the right to non-discrimination and equality in education. If digitalization is bringing education into a new era, the right to non-discrimination and equality is key to leaving no one behind, one of the central principles of the 2030 Agenda for Sustainable Development.

For instance, recent reports indicate that North America and China are likely to gain the most from advancements in AI, while developing regions in Africa, Latin America and Asia are expected to see more modest gains (UNICEF and Ministry for Foreign Affairs of Finland, 2021).

This chapter discusses the challenges related to the right to non-discrimination and equality when considering digitalization in education. The chapter will explore some of the main manifestations of the digital divide, such as the socioeconomic divide (section 3.1), the geographic divide (section 3.2), the gender divide (section 3.3), the disabilities divide (section 3.4), and the generational divide (section 3.5).

3.1 Socioeconomic divide

According to the joint UNICEF-ITU report *How Many Children and Young People Have Internet Access at Home?* (2020), approximately 2.2 billion children and young people under the age of 25 years — accounting for two thirds of this demographic — do not have access to the Internet at home. This lack of connectivity significantly limits their ability to engage with online educational resources and participate fully in digital learning opportunities (UNICEF and ITU, 2020).

Low-income families are often provided fewer, or lower quality, governmental and other services, such as education (HRW, 2021). **There is a growing need for functional and critical digital literacy, especially among younger people from "socioeconomically less privileged parental homes", who are particularly disadvantaged, because of lower computer- and information-related skills** (Zinn, 2021, p. 8). The digital divide also extends to the types of devices used and the nature of learning activities, both of which are further shaped by cultural and social contexts. The aforementioned factors are largely dependent on sociodemographic characteristics (Goin Kono and Taylor, 2021; Gonzales, Calarco and Lynch, 2020; Pearce and Rice, 2013).

Barriers to successful digitalization of learning in the post-pandemic context disproportionately affect individuals from disadvantaged backgrounds. There is concern about broadening the social divide, which results in an online learning penalty, as well. According to the concept of online penalty, underresourced and vulnerable (i.e., from minority or otherwise marginalized backgrounds) students may not benefit from virtual learning initiatives equitably, especially without conducive resources or quiet, parent-supported learning spaces (DeMartino and Weiser, 2021; Ciuffetelli Parker and Conversano, 2021).

Though the "bring your own device" (BYOD) approach is used by certain educational establishments, it can make it difficult to guarantee equity among learners and often exacerbates existing inequalities, as there is an inevitable, omnipresent digital divide between the resourced and underresourced (OECD, 2016; Zinn, 2021). On the other hand, some initiatives have tried to bridge this divide (see box 7).

Box 6: Useful resources

National initiative

"1 Device for 1 Student" (Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT), n.d.)

This programme is implemented by the Japanese Ministry of Education, Culture, Sports, Science and Technology. With an initial budget of 461 billion yen, supplemented by an additional 231.8 billion in 2019 and 229.2 billion in 2020, the programme ensures that each student has access to a personal device. This initiative promotes individualized learning and tailored instruction, accommodating students' unique educational needs and levels of understanding. Moreover, it enhances students' exposure to diverse perspectives and fosters critical skills, such as information editing, helping to close the digital divide by providing equal access to technology and learning resources.

See more: "1 Device for 1 Student" Initiative

3.2 Geographic divide

Discussions of the geographic divide often focus on differences between countries, overlooking significant disparities within countries – particularly between rural and urban areas, which can be equally stark.

Digitalization in education highlights the inequality that exists between countries. This inequality is the result of different factors. Beyond inequality in Internet access, the gap between the global North and the global South is attributed to inequality in access to technological tools (computers and/or other digital hardware) and electricity, intricately linked to other inequalities, including income disparity, differences in levels of education, and the digital gender gap (Ancheta-Arrabal et al, 2021). Thus, the higher a State's inequality rates, the more difficult it is to implement digitalization strategies and projects that cover the entire population or the most vulnerable (Ancheta-Arrabal, Pulido-Montes and Carvajal-Mardones, 2021; Lorente, Ancheta-Arrabal and Pulido-Montes, 2020, p. 6). Access to the Internet, to computers and/or other digital hardware and to electricity, and variations in the levels of Internet connectivity speeds create a widening divide between the most advanced and most vulnerable economies in terms of access to these elements (Lorente, Ancheta-Arrabal and Pulido-Montes, 2020, p. 6). For instance, there is a marked gap in terms of access to electricity between sub-Saharan Africa and South Asia on the one hand and the rest of the world on the other hand. In sub-Saharan Africa, roughly 70% of primary schools have no access to electricity, while in South Asia, roughly 50% of primary schools have no access to electricity (Lorente, Ancheta-Arrabal and Pulido-Montes, 2020). Similar differences are noted in terms of access to hardware and the Internet (Lorente, Ancheta-Arrabal and Pulido-Montes, 2020).

Box 7: Useful resources

National initiative

Connect American Fund

In the United States of America, the Federal Communications Commission (FCC) is running a project to improve broadband service in rural areas. Aimed at closing the rural digital divide, this project provides funding to different Internet service providers, over a 10-year period, to expand broadband to unserved rural households and businesses (FCC, 2019).

See more: Connect American Fund

Innovative Digital Schools and Rurality

In 2020, the French Government expanded its efforts to reduce the digital divide in rural schools through the Innovative Digital Schools and Rurality (ENIR) project, providing €15 million in funding to equip 3,433 schools in rural areas with digital tools. (French Ministry of National Education and Youth, n.d.)

See more: Écoles Numériques Innovantes et Ruralité

Digital Ambassadors Programme

Rwanda took significant steps to bridge the geographical digital divide through the Digital Ambassadors Programme (Rwandan Ministry of ICT and Innovation, n.d.). Launched in 2017 and running until 2024, this initiative recruited Digital Ambassadors from among young social innovators and deployed them to communities throughout the country. These ambassadors directly trained citizens in remote and underserved areas, empowering them to access digital tools and online services.

See more: Digital Ambassadors Programme

In terms of the geographic digital divide, it is also true that differences can be found within each nation, since **the infrastructure of the Internet is not equally distributed: there are large differences in the levels of connectivity between rural and urban areas**. **In 2020, the ITU noted that the global percentage of Internet users in urban areas was almost twice as high as in rural areas (globally, 76% of individuals in urban areas used the Internet in 2020, compared to 39% in rural areas) (ITU, 2021, p. 6)**. While the gap in Europe is slight (87% urban, compared to 80% rural), the gaps are fairly wide in the Americas (83% versus 60%), developing countries (72% versus 34%),

LDCs (47% versus 13%) and landlocked developing countries (LLDCs) (63% versus 18%) (ITU, 2021, p. 6). The urban–rural gap in Internet use is also reflected in digital skills, with 34% of urban adults able to find, download, install, and configure software, compared to only 25% of rural adults (UNESCO, 2023b).

3.3 Gender divide

The right to education for women and girls is firmly established in international law. Article 10 of the Convention on the Elimination of All Forms of Discrimination against Women requires States to take all necessary measures to eliminate discrimination and ensure equal educational opportunities for women. Additionally, Sustainable Development Goal 5 (SDG 5) emphasizes the importance of achieving gender equality and empowering all women and girls — an objective that is particularly relevant in the digital era. One key challenge to achieving this goal is the **digital gender divide**, which refers to "gender differences in resources and capabilities to access and effectively utilize information and communication technologies (ICT) within and between countries, regions, sectors and socio-economic groups" (UNECE, 2025).

The global gender digital divide remains a pressing challenge, with 259 million fewer women than men online in 2022 (ITU, 2022b). Despite some progress, significant disparities persist, and women continue to be disproportionately offline in many countries. Generally, regions with higher Internet usage also demonstrate stronger gender parity. In the Americas, the Commonwealth of Independent States and Europe, gender parity has been achieved, effectively closing the gender digital divide. The Asia and Pacific region and the Arab States have shown improvement, with gender gaps of 6% and 10% respectively, between the percentage of men and women using the Internet. In contrast, progress in Africa has stagnated over the past three years, with an 11% gap in Internet use between men and women (ITU, 2022b). **Despite a significant increase in Internet usage during the COVID-19 pandemic — rising from 4.1 billion to 4.9 billion users, or from 54% to 63% of the global population — approximately 2.9 billion people remain unconnected (ITU, 2021). Notably, 96% of these individuals live in developing countries, with the majority being women and girls (ITU, 2021).**

The discrimination that girls and women experience in their daily lives (in terms of employment, literacy and income) is mirrored in the inequalities in ICT and Internet usage in both developing and developed countries (Antonio and Tuffley, 2014; Ono and Zavodny, 2007). Several factors limit women's access to and use of ICT tools, including gaps in technical and scientific education and broader educational opportunities. Additional barriers, such as limited free time, language constraints, societal norms that favour men and various socioeconomic and institutional challenges, continue to restrict women's full participation in the digital sphere (Antonio and Tuffley, 2014; Gill et al, 2010). To comprehensively understand the gender digital divide, we will first examine the socioeconomic factors contributing to it, followed by an analysis of the digital skills gap.

Socioeconomic factors

Addressing the socioeconomic factors contributing to the gender digital divide requires a multifaceted approach, particularly when considering access and affordability. One potential solution is for policymakers and technology firms to collaborate in making Internet access more affordable and accessible, particularly via mobile phones (Heavey, 2013). In many cases, **women lack financial autonomy or access to sufficient income to purchase digital devices or pay for Internet services**. In some countries, legal barriers, such as restrictions on property ownership or access to credit, further limit women's financial agency (Antonio and Tuffley, 2014; World Bank, 2009). The intersection of these financial constraints with the gender digital divide is evident.

However, affordability alone is insufficient, as women face numerous cultural barriers. In some contexts, **women may be restricted from leaving their homes to access the Internet (for instance, in public**

spaces such as Internet cafés) because of religious or cultural constraints. A survey conducted among girls and their parents in Ethiopia, India, Jordan, Kenya, Nigeria, Rwanda and the United Republic of Tanzania revealed that parents tended to believe that girls required more protection than boys from potential online distractions and temptations (GEM Report, 2024a).

In addition, time poverty remains a significant barrier. **Women, burdened by family responsibilities and household chores, often lack the free time needed to pursue education or develop digital skills** (Antonio and Tuffley, 2014). Research in India highlights that even when women have access to technology at home, they are often only allowed to use it after completing household tasks or when male family members are not using it (Bhushan, 2008). This unequal distribution of time for digital engagement is further compounded by the fact that **women, on average, spend more time on unpaid and paid labour compared to men**, leaving little room for education or skill-building activities (Sánchez Galvis, 2010).

According to ITU data, in Japan in 2022, men's Internet access exceeded that of women by 5%. In order to reduce the gender gap in access to education, it is not enough to distribute technological tools to women or their households; it must be taken into account that the patterns of appropriation and use of technology are different between men and women, and that these differences can be much greater if combined with other sociodemographic variables such as geography, marital status and parental status.

Digital skills gap

The digital skills gender gap remains a serious and persistent challenge worldwide, hindering women's participation in the digital economy. Women are 25% less likely than men to know how to use digital technologies for basic purposes, and four times less likely to possess advanced skills such as computer programming (UNESCO, 2019b). This gap is deeply rooted in cultural stereotypes that depict technology as a male domain, further discouraging women and girls from pursuing technology-related education and careers. Additionally, **self-perception regarding female capability plays a significant role, as girls and women often tend to underestimate their capacities in this field, leading to a lack of confidence and reluctance to engage in technology-related opportunities**.

The gender digital divide is evident across various digital skills, with the gap becoming more pronounced in certain areas.

In an effort to bridge the digital skills gap, the World Bank Group, in partnership with the Equals Partnership and GSMA, launched a digital skills initiative targeting women and girls (World Bank, 2021). It aims to test different delivery models of digital literacy, including online and in-person training, mentorship and access to digital tools. Pilots in Nigeria, Rwanda and Uganda will focus on empowering women in marginalized communities, providing tools for digital inclusion and economic empowerment. Lessons from the pilots will inform future interventions designed to close the gender digital divide. Following the completion of the pilot testing, a report was published presenting key findings and recommending the promotion of Internet access to facilitate digital learning, as well as the development of a robust evidence base to support the scaling of digital skills programmes (World Bank et al., 2022).

Box 8: Useful resources

Global SDG Indicators Database

According to the Global SDG Indicators Database, a study of 50 countries and territories shows that only 6.5% of males and 3.2% of females can write a computer program using a specialized programming language (UNESCO, 2023b). The disparity is particularly stark in countries such as Belgium, Hungary and Switzerland, where fewer than 2 women for every 10 men possess this skill. However, in Albania, Malaysia and the State of Palestine, the gender gap is much narrower, with 9 women for every 10 men able to program.

Addressing the digital skills gender gap requires sustained and gender-responsive approaches to education (GEM Report, 2024a). This includes updating curricula and teacher training to challenge gender stereotypes, engaging parents to shift social norms and ensuring that all learners, regardless of gender, gain key digital skills such as staying safe online (GEM Report, 2024a). Furthermore, integrating digital skills into curricula in a manner that empowers both girls and boys equally is essential. This can be achieved by promoting diverse role models, providing gender-sensitive learning materials and addressing confidence gaps through classroom practice. It calls for the establishment of laws and standards to protect the well-being and privacy of learners and teachers; it also calls for independent bodies to assess educational tech for gender bias or harmful impacts (GEM Report, 2024a).

Bridging the gender digital divide requires more than access to devices; it demands tackling socioeconomic barriers, cultural norms, and persistent digital skills gaps. A holistic and gender-responsive approach is essential to ensure that digitalization advances both gender equality and the right to education.

3.4 Disabilities divide

The Convention on the Rights of Persons with Disabilities guarantees the right to education for persons with disabilities (article 24). SDG 4 focuses on education, with target 4.5 stating "[…] ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities […]" (United Nations SDGs, n.d.). Globally, 16% of the population (approximately 1 billion people) lives with a disability (World Health Organization, 2023). A report by UNICEF highlights that children with disabilities are 49% more likely to have never attended school, often due to inaccessible infrastructure, lack of trained teachers, and absence of inclusive policies (UNICEF, 2024b). To bridge this gap, it is essential to close the digital divide and ensure that technology serves as a truly inclusive tool for education. While technology is often seen as a universally accessible solution, discriminatory barriers can limit its potential (Kent, 2015). With the global proportion of persons with disabilities increasing because of aging and environmental factors, inclusive virtual learning and accessible e-learning must be a top priority for educational institutions (World Health Organization, 2011).

The development of digital education for students with disabilities faces multiple challenges. Indeed, digital education is often not adapted for learners with disabilities in terms of accessibility and cost (UNHCHR, 2024, para 17). **Equitable access to the necessary hardware and Internet connectivity remains a significant barrier**, with many students lacking access to these essential tools. It is imperative that the financial burden of acquiring and using digital technologies does not disproportionately fall on students with disabilities and their families. Learners **with disabilities may also face significant barriers in accessing digital learning because of physical, sensory and cognitive impairment** (GEM Report, 2024b). Such barriers can arise from difficulties related to geographical distance, mobility challenges, sensory impairment (vision, hearing) and cognitive or learning disabilities (GEM Report, 2024b). Additionally, there is a pressing need to provide students with adequate training in the use of digital tools specifically designed for their needs (UNESCO, 2022f). Furthermore, **teaching personnel often lack the necessary training to effectively use these technologies and ensure the meaningful inclusion of students with disabilities in the learning process** (UNESCO, 2022f).

The development of personalized tools powered by artificial intelligence offers promising opportunities to help learners with disabilities in accessing education. Moreover, it is critical to ensure that these tools do not contribute to further social exclusion of students with disabilities. The educational experience for disabled learners must always include meaningful interaction within a social context, particularly with teachers, to foster both learning and inclusion.

The use of assistive technologies plays a pivotal role in reducing the digital divide for learners with disabilities. Tools such as screen readers, speech recognition or sign recognition software, and alternative

input devices are essential to ensuring that these learners can access educational content on an equal footing with their peers. In its *Guidelines for ICT in Education Policies and Masterplans* (UNESCO, 2022a), UNESCO emphasizes the pressing need for the digital inclusion of persons with disabilities, urging policymakers to **integrate inclusive strategies throughout the planning and implementation of ICT in education**. The Guidelines call for close **collaboration with representative organizations to identify and address access barriers, paying particular attention to the empowerment of women and girls with disabilities**, who face compounded discrimination. UNESCO further advocates for inclusive legislation and policy frameworks that ensure the participation of persons with disabilities in digital and distance learning. The adoption of educational frameworks aimed at making education more inclusive, differentiated and accessible (such as the **universal design for learning framework, used in the United States of America) is recommended in order to inform curriculum design and teaching methods**, ensuring multiple means of engagement and representation to meet diverse learning needs. Additionally, the Guidelines highlight the need to assess digital content accessibility, promote learner-centred pedagogies that enhance self-esteem and learning outcomes, and provide systemic support to teachers and caregivers to foster inclusive digital learning environments.

In addition, initiatives should be implemented to ensure access to education in the digital context for learners with disabilities. An example of such efforts is the work of the World Wide Web Consortium (W3C), which has published recommendations on web accessibility for people with disabilities (W3Techs, n.d.). Indeed, the W3C also developed ISO (International Organization for Standardization) standards to encourage the creation of platforms that guarantee inclusion and accessibility for individuals with disabilities. **Governments and institutions are encouraged to align their policies with international frameworks**, such as the Convention on the Rights of Persons with Disabilities, to foster inclusive access to digital learning.

3.5 Generational divide

The generational digital divide refers to the differences in Internet access and usage between age groups, particularly between elderly individuals (over 75 years) and child populations (under 15 years), in comparison to the general population, aged 15–74 years (ITU, 2022a).

Data from the International Telecommunication Union (ITU, 2022a) highlight significant disparities in digital engagement across age groups on a global scale. In many countries, **older adults experience much lower levels of Internet usage, reflecting substantial barriers to digital inclusion**.

Consequently, older learners are further disadvantaged where they lack personalized instruction and support in transitioning to new technologies. This undermines the goal of creating lifelong learning opportunities for all (DeMartino and Weiser, 2021).

Lifelong learning involves continuous support for individuals at all stages of life, not only enabling the acquisition of new

Box 9: Useful resources

SDG global indicator 4.4.1.

Reporting on SDG global indicator 4.4.1, which focuses on ICT-related activities, reveals significant generational divides across countries. For instance, according to their latest available data as of August 2025, in 19 selected countries, about 40% of individuals aged 15 to 24 years know how to send emails with attachments (e.g., in Colombia, Thailand and Uzbekistan). However, among elderly adults over 75 years, this percentage drops significantly, falling below 5% in most cases. Notably, only in Japan (22%) and Switzerland (58%) are over 10% of elderly adults capable of performing this task.

See more: Reporting on SDG global indicator 4.4.1

skills and adaptation to technological change (crucial for maintaining relevance in the workforce) but also fostering personal development and contributing significantly to reducing societal inequalities (Wang, 2024). To further advance inclusivity, curricula and digital platforms can be adapted to be more age-inclusive, for example by providing accessible content formats, promoting flexible learning pathways, and incorporating intergenerational learning approaches that enhance digital engagement among older learners.

Building on this, an international study conducted between 2020 and 2022 by the UNESCO Institute for Lifelong Learning (UIL) and Shanghai Open University (SOU) examined how higher-education institutions (HEIs) are addressing the learning needs of aging populations (UIL, n.d.). The study revealed key challenges older adults face in accessing lifelong learning opportunities, including funding mechanisms, quality assurance and governance structures (UIL and SOU, 2023). Continuing this effort, UIL plans to explore reskilling, intergenerational learning and digital literacy for older adults through further research from 2023 to 2025, aiming to expand learning opportunities beyond traditional HEIs and provide strategic policy recommendations to support older learners. In May 2024, the UIL team presented a road map outlining the completed literature review and upcoming case studies, which will inform the final research report upon completion (SOU, 2024).

Some considerations with regard to international and national guidance

- Addressing the digital divide is essential to upholding the right to non-discrimination in education, ensuring equal access for all groups.
- Unequal access to technology and the Internet deepens educational inequalities, especially for rural, low-income and disadvantaged, marginalized or vulnerable populations.
- Emerging technologies such as AI deepen inequalities because of disparities in access to technology and digital skills. Regions with stronger digital infrastructure benefit more, while under resourced areas risk falling further behind, limiting children's ability to thrive in an AI-driven world.
- Women and girls face cultural, social and economic barriers to digital education, such as lack of time and access, financial autonomy and exposure to gender stereotypes in tech-related fields.
- Older adults often have lower digital literacy and limited access to technology, making it harder for them to engage with digital education and lifelong learning opportunities.
- People with disabilities face accessibility issues with regard to digital platforms, lack of tailored digital tools and insufficient teacher training to support inclusive digital learning.

Considerations for guidance

- Ensure affordable access to digital tools and the Internet for rural and underserved areas, as well as vulnerable groups including people with disabilities and older populations.
- Implement targeted programmes to provide women and girls with equal access to digital education and skills training, helping to foster a cultural shift to challenge gender stereotypes and promote greater participation in technology.
- Develop digital literacy programmes for older populations to reduce generational divides and encourage lifelong learning.
- Invest in accessible technologies and teacher training to support inclusive education for people with disabilities.
- Provide digital educational tools and resources in the primary languages of all communities to ensure inclusive access to education.
- There is a growing and urgent need to bridge the digital divide before it widens further with the introduction of new technologies such as AI. Ensuring that no one is left behind requires immediate action to support equitable access to digital infrastructure and skills development.

Chapter 4

Non-State actors

The right to education, like all human rights, imposes three types or levels of obligations on States: the obligation to respect, protect and fulfil that right. In turn, the obligation to fulfil incorporates both an obligation to facilitate and an obligation to provide. The **State, as the primary duty bearer, must protect the right to education against human rights abuse by third parties** (CESCR, 1999, paras. 46 -47). Ensuring the regulation of all actors is therefore essential to ensuring that the fundamental principles underpinning this right — such as the principle of non-discrimination (CADE, article 1(1)), quality education (CADE, article 1(2)) and freedom of choice (CADE, article 5) — are upheld by all actors. In addition, "the best interests of the child shall be a primary consideration" for the elaboration of all action, including legislative and regulatory measures (UNCRC, article 3(1)). The Education 2030 Framework for Action further states that "the role of the State is essential in setting and regulating standards and norms" (para. 10).

Non-State actors have offered increasingly diverse educational services and range from non-State education providers (such as private schools, philanthropic organizations, NGOs, and providers of online courses like Coursera and Khan Academy) to non-State technology companies. The latter include large multinational corporations such as the GAFAM, that provide general digital infrastructure and services, as well as specialized education technology companies (ed-tech) that design tools, platforms and applications specifically for teaching and learning purposes. Such non-State actors may provide non-educational services (including computer servicing, IT support, security, human resources and payroll management) and educational ones. This section will focus on the latter. Over the COVID-19 pandemic, the involvement of these non-State actors grew as educational institutions struggled to move online. Because of limited resources, inadequate training and connectivity challenges, many institutions became increasingly reliant on these providers of educational services. At the same time, reductions in State education budgets further reinforced this dependence (UNESCO, 2022a).

State actors, including educational institutions, have long **outsourced all or parts of their activities and services to non-State actors**, an approach used as a solution to "diverse problems on the grounds of efficiency, cost cutting, quality and improvement" according to a study in the Republic of Korea, England and Hong Kong (Bates, Choi and Kim, 2019, p. 2). The 2021 GEM Report also noted that outsourcing freed up time and money to focus on instruction. Yet this is not without concerns.

First, when a non-State actor is responsible for providing educational services, the standard of the services it provides has a direct bearing on the quality of the educational institution concerned and its ability to fulfil its mission to educate and support learners (Mattes, 2017; UNESCO, 2022b). Yet companies that produce **education technology products can be misleading and may not be as effective as advertised** (GEM Report, 2021). Problems arise when a non-State actor (notably one operating for profit) operates without proper oversight on account of possible conflicts of interest between the non-State actor and the public educational institution concerned.

The agency problem is another key risk associated with the growing involvement of multiple non-State actors and the delegation of educational services to them. In this context, the State, as the principal duty bearer, relies on non-State actors, the agents, to deliver or support educational services. Yet the interests

of these agents, often profit-driven and shareholder-focused, may diverge from the public objectives of the realization of the right to education. This situation is likely to be exacerbated by a number of additional factors: the underlying conflict between the interests of non-State actors (profit-driven, and shareholder-focused) on the one hand, and the interests of the State, public and users of educational platforms on the other; information asymmetry (between these two sets of actors); and the likely difficulty of monitoring the conduct of such non-State actors in an effective and comprehensive manner.

Second, with educational systems placing "**growing reliance on private technology providers**", there is a risk that State actors, regulated by, accountable to and overseen by the State, will be replaced by non-State actors, whose business models are largely profit- and growth-driven, as well as shareholder- and investor-centric (UNESCO, 2022c). The European Parliament, in its resolution of 19 May 2021 on artificial intelligence in education, culture and the audiovisual sector (2020/2017(INI)), expressed concern over the increasing dependency on a few dominant ed-tech services in education that enjoy a dominant market position (para. 44).

At the same time, the COVID-19 pandemic resulted, in some contexts, in **cuts to education financing** both in national budgets and international development aid, which are below international benchmarks (UNESCO GEM Report et al., 2022). Because of the incrementally growing involvement and influence of these non-State actors, there is a risk of: increased privatization of the educational sector, with a transfer of responsibilities and activities from State actors to non-State actors; an increase in the financial burden of learners, caregivers, guardians and parents; a lack of regulation governing the provision of educational services by non-State actors, leading to potential privacy and security risks for users and their information; a reduction in equitable quality education; an increase in the existing inequalities, due in the main to the digital divide and digital illiteracy; exposure to threats online; lack of privacy and a failure to protect data (individual and collective) (Garde et al., n.d.; UNESCO, 2022c).

Finally, the private sector plays an important role in teacher training in several low- and middle-income countries and can help in alleviating the shortage of trained teachers (Chudgar, 2020). However, there is a tendency that technology companies in the private sector, "**certify teachers only in the use of proprietary tools and services**" limiting the ability of teachers and in turn learners and their families to make an effective use of the broad range of other digital tools on offer (UNESCO, 2022c, p. 5).

Additionally, ensuring accountability also extends to the private sector, particularly education technology companies. Governments often engage with private actors through public-private partnerships to expand digital infrastructure and provide educational content. However, **these partnerships can sometimes blur the lines of accountability, especially when companies exert undue influence on decision-making processes or introduce products that prioritize profitability over educational value** (GEM Report, 2023). Clear guidelines and regulations are needed to ensure that these partnerships serve the public interest, and that private entities are held accountable for their impact on the education system.

Box 10: Useful resources

The best interests of the child

Article 3 of the Convention on the Rights of the Child explicitly states that "the best interests of the child shall be a primary consideration" in all actions concerning children, whether undertaken by public or private social welfare institutions. The same article stipulates that "States Parties shall ensure that the institutions, services and facilities responsible for the care or protection of children shall conform with the standards established by competent authorities". Referring specifically to children's rights in the digital environment, Garde et al. speak of the need to use the precautionary principle, and to guarantee the best interests of children, adding that States should ensure that non-State actors meet their responsibilities for children's rights in the context of the digital environment (Garde et al., n.d.).

To address the issues raised, the **development of a legal and regulatory framework** governing the activities of non-State actors responsible for educational content is required to ensure that the right to education is upheld. Like State educational providers, non-State educational providers should also be **subject to auditing by the national bodies** charged with oversight and regulation of educational institutions. The discharge of these duties should never be transferred or delegated to non-State actors, whose business model may not promote respect for the rights of users (Garde et al., n.d.). In addition to, and never in lieu of, developing effective implementing legislation, States should obligate non-State actors to **maintain high standards of transparency and accountability** (Chakravorti, Bhalla and Chaturvedi, 2018; UNESCO, 2021c; UNESCO, 2022c). States should accordingly take all appropriate measures to address the prevention, investigation and sanctioning of violations of children's rights by non-State actors. In 2019, the Special Rapporteur on the right to education (2019, para. 77) recommended that States use the Abidjan Principles as a useful guiding tool in this respect (Abidjan Principles on the human rights obligations of States to provide public education and to regulate private involvement in education).

Some considerations with regard to international and national guidance

- The State remains the primary duty bearer when it comes to protecting the right to education, ensuring that non-State actors uphold key principles such as non-discrimination, quality education and the best interests of the child.
- Non-State actors, including technology companies, NGOs and private organizations, have expanded their role in providing digital education, especially during the COVID-19 pandemic.
- Increasing reliance on non-State actors could lead to the marketization of education, higher costs and greater inequality.
- A lack of strong regulatory frameworks governing non-State actors in education may lead to privacy risks, data security issues and inequitable access to educational services.
- The private sector's involvement in teacher training can limit teachers' exposure to a broad range of digital tools, focusing mainly on proprietary technologies, which can restrict their ability to offer diverse learning resources.

Considerations for guidance

- Ensure that the State maintains regulation and oversight of non-State actors to uphold educational standards, protect privacy and prevent over-privatization.
- Require non-State actors to respect human rights and to be transparent and accountable, particularly in handling student data and providing educational services.
- Implement mandatory, State-certified training programmes for teachers that focus on the general use of digital tools, rather than specific proprietary technologies, to ensure well-rounded digital training.

Chapter 5

Governance

The governance of digital education is a critical aspect of ensuring the effective, equitable and secure integration of technology into educational systems worldwide. It is also an important dimension of the 5C framework as it refers to coordination among different stakeholders. In an era where educational digital tools and platforms become increasingly widespread, governments, institutions and stakeholders must navigate complex challenges related to accountability, participation and monitoring to ensure that technology enhances, rather than hinders, the educational experience. This chapter will focus on key areas of governance within digital education, specifically examining accountability frameworks, mechanisms for stakeholder participation in policy formulation, and the importance of continuous monitoring in managing the growing role of technology in education.

5.1 Accountability in digital education governance

Accountability is a cornerstone of effective governance aimed at ensuring that digital tools and policies align with broader educational goals such as equity, inclusion and quality (GEM Report, 2023). **In the context of digital education, accountability requires a clear delineation of roles and responsibilities among governmental bodies, private sector partners and educational institutions**. However, ministries of education do not always lead the governance of digital education (GEM Report, 2023). In many countries, other ministries, such as those responsible for information technology or telecommunications, play significant roles, which can lead to conflicts of interest and a lack of pedagogical focus in policy implementation.

Indeed, 82% of countries have a government department or agency responsible for the governance of education technology. However, only 48% of these are led by the ministry of education, 29% are governed jointly by the ministry of education and another ministry, and 5% are led by another ministry altogether (GEM Report, 2023). **When multiple ministries share responsibility, it can lead to fragmented decision-making and a lack of coherence in policy implementation** (GEM Report, 2023), but it can also create opportunities for a whole-government approach that promotes coordination and shared accountability.

5.2 Participation in policy formulation

Effective governance of digital education requires the meaningful participation of a diverse range of stakeholders in the policy formulation process. This includes not only governmental bodies, but also educators, students, parents and caregivers, and civil society organizations. Participatory governance ensures that the needs and perspectives of all stakeholders are considered, leading to more inclusive and contextually appropriate policies.

In many countries, stakeholder participation has been formalized through mechanisms such as public consultations and advisory boards. For example, Australia developed its Schools Digital Strategy (SDS) with extensive input from educators, parents and students, ensuring that the policy was grounded in the realities of classroom practice (NSW Department of Education, 2019). Similarly, the European Commission's Digital Education Action Plan (2021-2027) engages a wide range of stakeholders through the Digital Education Stakeholder Forum, promoting collaboration between policymakers, educators and technology providers (European Commission, n.d.b).

However, in countries where such participatory mechanisms are less developed, **policies can eventually not fully address the needs of key stakeholders including teachers, learners including marginalized groups**. To bridge this gap, governments need to establish inclusive platforms for dialogue and consultation, where stakeholders from diverse socioeconomic backgrounds can voice their concerns and contribute to the decision-making process. This is particularly important in the context of digital education, where disparities in access to technology can exacerbate existing inequalities in educational outcomes.

Moreover, in 2024, the United Nations High Commissioner for Human Rights emphasized **the importance of meaningful youth participation in shaping digital education and safeguarding young people's online rights**. The High Commissioner stressed that young people should be actively engaged in all stages of policy and programme development, ensuring that their voices are heard throughout the design, implementation and evaluation of decisions that affect their digital lives. The High Commissioner placed special emphasis on engaging marginalized groups. Furthermore, he called for the **establishment of permanent, well-resourced structures that enable youth participation in legislative and policy processes at all levels**, ensuring that young people can effectively influence decisions related to their digital rights and education.

The United Nations High Level Panel on the Teaching Profession also recommended that teachers are given autonomy to choose how to use technology in their classrooms (ILO et al., 2024). Governments are encouraged to work with teachers to create policies that support learning and protect student data (ILO et al., 2024).

5.3 Monitoring and evaluation

Ongoing monitoring and evaluation are essential components of governance in digital education. As technology continues to evolve, the impact of digital tools and platforms on student learning outcomes, safety, data privacy and equity must be continuously assessed to ensure that policies remain relevant and effective.

In many countries, there is a growing recognition of the need for robust monitoring systems to track the implementation and impact of digital education policies. For instance, the Profiles Enhancing Education Reviews (PEER) framework provides a mechanism for countries to assess their progress in integrating digital technology into education and to identify areas where further improvement is needed (GEM Report, n.d.). However, challenges remain, particularly in countries where data collection and analysis capacities are limited. **Without accurate and timely data, it is difficult to evaluate the effectiveness of digital education initiatives and to make informed decisions about future investments**.

Monitoring is also crucial to ensuring that digital education technologies do not compromise student privacy or well-being. **The rapid adoption of artificial intelligence and other advanced technologies in education has raised concerns about the potential misuse of student data and the risk of reinforcing existing inequalities** (United Nations, 2024). An analysis of PEER country profiles reveals that only 16% of countries have laws that guarantee data privacy in education, with 29% having policies in place (primarily in Europe and Northern America); 41% of these policies have been introduced since the

COVID-19 pandemic (GEM Report, 2023). Governments must establish clear guidelines and regulations for data collection and use in educational settings, ensuring that student privacy is protected and that data are used responsibly to support learning.

Additionally, **AI models can provide immediate, data-driven responses, offering policymakers a valuable tool for guiding educational interventions**. This ensures that decisions are informed by accurate and actionable insights. Such was the aim of the UNESCO and Capgemini hackathon (UNESCO, 2024f) launched in October 2024, which focused on developing open AI solutions to improve learning outcomes, particularly reading proficiency. The hackathon leveraged data from the Progress in International Reading Literacy Study (PIRLS), with AI models released under open-source licences to promote global accessibility and innovation in education.

The governance of digital education presents both opportunities and challenges. Effective governance frameworks must prioritize accountability, ensuring that both public and private actors are held responsible for their contributions to digital education. Participation in policy formulation is equally important, as it ensures that the voices of all stakeholders, particularly marginalized communities, are heard and considered in decision-making processes. Finally, continuous monitoring and evaluation are essential for assessing the impact of digital education technologies, and for ensuring that they are used in ways that promote equity, inclusion and quality in education.

As digital education continues to expand, the need for strong governance frameworks will only grow. As highlighted by the "coordination and leadership" pillar of the 5C framework (UNESCO, 2024e), governments must work collaboratively with stakeholders at all levels to establish a clear vision and evidence-based policies and regulations, supported by monitoring and information. These measures should not only embrace the potential of technology but also safeguard the rights and well-being of learners in the digital age and ensure that the benefits of this transformation reach the most marginalized. The "cost and sustainability" pillar further reminds us that effective governance also requires sustainable financing to guarantee equitable and lasting impact.

Some considerations with regard to international and national guidance

- Clear accountability frameworks are essential in digital education governance, ensuring that both public and private actors prioritize educational outcomes, student safety, equity and inclusion.
- Effective governance requires the active and informed participation of diverse stakeholders (including educators, students and marginalized groups) in policy formulation to ensure that policies address real needs and inequalities.
- Continuous monitoring and evaluation are critical for assessing the effectiveness, safety and positive impact of digital education technologies, safeguarding student privacy, and ensuring that policies remain effective and equitable.

Considerations for guidance

- Ensure that profitability and commercial interests are not prioritized over the right to education. As the primary duty bearer, the State must hold all actors involved in digital education accountable to protect and uphold this right.
- Create mechanisms for diverse stakeholders, including marginalized groups, to be informed about and actively participate in policy formulation, ensuring that digital education policies are inclusive and contextually relevant.
- Develop systems to continuously monitor the impact of digital education technologies, ensuring that they improve learning outcomes, protect students and address inequalities.
- Establish strong guidelines for data collection and use in digital education to safeguard student privacy and promote responsible data management.

Part II

Human rights implications of the digitalization of education

This second part will examine challenges posed by the digitalization of education in relation to the right to privacy (chapter 6), the right to be protected from violence (chapter 7), the right to work (chapter 8), the right to information (chapter 9), the cultural rights (chapter 10), and finally, the right to be heard and the right to autonomy (chapter 11).

The rights identified and developed in this second part are likely to have the greatest impact on the realization of the right to education in the context of digitalization. This does not exclude implications for other human rights. While all the content falls under the broader umbrella of the right to education, the analysis is deliberately framed in the context of other relevant rights to highlight the holistic approach needed to address digitalization in education.

Chapter 6

Protecting the right to privacy in digital learning environments

The right to privacy, or the right to a private life, is firmly grounded in several key international and regional human rights instruments, including the Universal Declaration of Human Rights (article 12), the European Convention on Human Rights (article 8), the Convention on the Rights of the Child (article 16), the International Covenant on Civil and Political Rights (article 17), and the Charter of Fundamental Rights of the European Union (article 7). Article 12 of the Universal Declaration of Human Rights states: "No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks." Similarly, the Council of Europe expands on the right to privacy, which encompasses the right to respect for private life, home, correspondence and communications, such as messages, phone calls and emails (Council of Europe, n.d.).

6.1 The protection of students' personal data

According to the European Data Protection Supervisor website (European Data Protection Supervisor, n.d.), although privacy and data protection are interrelated, they are recognized as distinct rights. The right to privacy derives from the fundamental principle of human dignity, and it pertains to individuals' autonomy over their personal information.

Privacy is universally recognized as a human right, whereas data protection—while widely acknowledged—has not yet achieved universal recognition as such. Data protection is concerned with the safeguarding of information related to an identified or identifiable living individual. This includes personal identifiers such as names, dates of birth, photographs, video footage, email addresses and phone numbers, as well as other types of information, such as IP addresses and communication content provided by end-users of communication services. **The right to data protection finds its roots in the broader right to privacy**.

The increasing use of digital tools in education has introduced new complexities in protecting the right to privacy, particularly as the personal data of students and educators may be shared with private companies or institutions providing these tools. This raises significant concerns regarding data transmission, which **may expose individuals to new risks and vulnerabilities** (OECD, 2023c). At the same time, the use of privacy by design and privacy-enhancing technologies offers promising avenues for better protecting users' data in educational settings. AI systems and digital tools need data and, in many cases, those data belong to individuals. Therefore, **these tools challenge traditional notions of consent, purpose and use limitation, as well as transparency and accountability— the pillars**

upon which international data protection standards rest (UNICEF and Ministry for Foreign Affairs of Finland, 2021). Children, particularly those from disadvantaged backgrounds, are at greater risk of privacy violations and surveillance (OECD, 2023c).

To illustrate this challenge, a 2019 review by the digital advocacy organization Common Sense found that only 20% of 150 educational technology products evaluated met basic privacy standards. The methodology assessed each product based on three criteria: the presence of a publicly available privacy policy, the use of encryption during login, and the presence of online trackers. **Notably, 20% of the products failed to meet even minimum privacy standards, while 60% of the products raised concerns for various reasons (UNESCO, 2023a)**.

Furthermore, **the data of students and educators are increasingly at risk of being hacked or stolen**, underscoring the urgent need for appropriate protections and safeguards. Robust measures must be put in place to ensure the security and integrity of this sensitive information. For instance, in the United Kingdom of Great Britain and Northern Ireland, recent data from the Information Commissioner's Office (ICO) revealed that 347 cyberincidents were reported in the education and childcare sector in 2023, representing a 55% increase over 2022 (Information Commissioner's Office, n.d.). This trend highlights the growing threats to data security in the education sector. However, it has also encouraged a surge in the development of improved cybersecurity measures and awareness programmes tailored for schools and educational institutions. For example, the European Union's Better Internet for Kids initiative offers online safety resources tailored according to age (European Commission, n.d.a).

6.2 The use of personal data to train AI systems

The above concerns are further exacerbated by the introduction of AI-based tools in education. Children merit specific protection with regard to their personal data, as they may be "less aware of the risks, consequences and safeguards concerned and their rights in relation to the processing of personal data" (UNICEF and Ministry for Foreign Affairs of Finland, 2021). Furthermore, when considering the privacy of children, it is important to understand that **very young children may not grasp the concept of privacy and therefore may disclose too much information to AI systems with which they interact**. Indeed, the Special Rapporteur on the right to education (2024) has highlighted that **AI systems often collect vast quantities of personal data, frequently to train algorithms, which intensifies privacy concerns**.

AI systems rely on extensive data processing, underscoring the need for transparency and explainability in their operation to ensure responsible use of personal data. This is absolutely critical in educational settings, **where AI-driven decisions can have long-lasting effects on individuals**, particularly children and students (Special Rapporteur on the right to privacy, 2023). At the same time, **parents and legal guardians often do not have the information or capabilities to ensure their children's safety and privacy**. They might also be unaware of future uses of their children's data (UNICEF and Ministry for Foreign Affairs of Finland, 2021).

The risks posed by the opacity of AI tools (such as tools for discriminatory profiling and automated decision-making) necessitate clear, transparent processes on the part of developers and institutions deploying AI in education. **Without transparency, it becomes challenging to identify and address potential breaches of privacy and fundamental rights** (Special Rapporteur on the right to privacy, 2023). Moreover, international bodies such as the Global Privacy Assembly have observed that AI technologies can exacerbate issues such as data profiling, automated decision-making, and even discrimination (Special Rapporteur on the right to privacy, 2024). If responsibly implemented, however, AI systems can also enhance personalized learning and provide timely support to students by leveraging their data, potentially improving learning outcomes (Special Rapporteur on the right to education, 2024).

In 2020, the state of New York (United States of America) enacted the NYS Technology Law (New York State, n.d.), imposing a temporary ban on the use of facial recognition technology in schools. This measure was taken in response to growing concerns over potential violations of the right to privacy, particularly regarding the use of AI-driven surveillance systems that collect and analyse sensitive biometric data, such as facial features. The law allowed state education authorities to conduct a thorough review of the privacy implications associated with AI in schools and to assess whether the security benefits provided by such technologies were proportionate to the privacy risks involved. There is an urgent need for robust legal safeguards to ensure that individuals (particularly vulnerable populations such as children) maintain control over their personal data and privacy in educational contexts.

6.3 Strengthening data protection and privacy safeguards in digital education

In 2024, the Special Rapporteur on the right to privacy underscored the need for the **adoption of comprehensive legal and regulatory frameworks to safeguard personal data in the digital age**. The Special Rapporteur highlighted the **crucial role of transparent practices**, including ensuring that individuals are adequately informed about the use of their data and that they have the right to rectify or delete their personal information when necessary. The Special Rapporteur further called for the **establishment of accessible administrative and judicial remedies for individuals whose data privacy rights have been infringed**. These remedies should encompass the ability to seek compensation for harm caused by the unlawful use of data.

Additionally, States are encouraged to take **proactive steps to promote the effective enjoyment of privacy rights**, particularly in sectors such as education, where vulnerable populations may be at risk (Special Rapporteur on the right to privacy, 2024). Ensuring **transparency and explainability in AI** processes is essential for building trust and ensuring that individuals, especially within educational environments, can understand how their data are being used. Such measures empower individuals to seek redress when their data privacy rights are compromised, while explainability ensures that those affected by AI decisions are informed about the rationale and criteria guiding such decisions (Special Rapporteur on the right to privacy, 2023). These measures also help to build trust in digital education tools, which is essential for harnessing the potential of technology in education. The Special Rapporteur on the right to education (2024, paras. 67, 70 and 125) raised concerns about AI-driven facial recognition technology, emotion recognition and social media surveillance in educational setting, and calls for ethics, privacy and transparency-by-design principles for AI in education.

While technology can enhance educational experiences, it also poses significant risks to learners' privacy and security (UNESCO, 2022c). A **balance between technological advancement and the safeguarding of individual rights is necessary**, with the implementation of robust data protection regulations to prevent the exploitation of students' information. For example, the United Kingdom's Data Protection and Digital Information Bill (United Kingdom Parliament, 2024) suggests creating a code of practice for ed-tech, supported by a certification scheme. Additionally, the bill facilitates the responsible sharing of education data to support innovation. The bill is currently under review in the House of Lords. The selection of educational technology tools should be carefully regulated, ensuring that, to the greatest extent possible, they incorporate privacy by design (which means that user privacy is taken into account even before a system is designed) and are appropriate for their specific context. This proactive approach not only mitigates risk, but also supports innovation in the development of responsible educational technology.

Some considerations with regard to international and national guidance

- The right to privacy is a fundamental human right, but it is increasingly jeopardized by digitalization in education.
- Students' data are at high risk, with educational platforms and AI-driven tools collecting, storing and sharing personal data.
- AI systems in education settings intensify privacy concerns, as they rely on vast amounts of data for training.
- Children require stronger protections, as they may not fully understand data risks and are more vulnerable to the breach and misuse of their data.
- Lack of clear regulations allows unchecked data exploitation, raising concerns about surveillance, profiling and discrimination.

Considerations for guidance

- Strengthen data protection laws to prevent students' data from being misused (specifically, for purposes unrelated to providing education or for purposes of commercial exploitation), while ensuring transparency, clear consent mechanisms and the ability to opt out of data collection.
- Increase oversight of non-State actors in education, ensuring that private ed-tech providers comply with the right to privacy for both students and educators, and implement accountability mechanisms in case of violations.
- Mandate privacy-by-design standards for ed-tech platforms, enforcing minimal data collection and retention.
- Strictly regulate AI surveillance, including facial recognition and automated student tracking, in schools.
- Promote digital privacy education, empowering students and educators to understand data risks and protect their right to privacy. Provide processes for remedy and redress for students and educators who have experienced the infringement of their rights.

Chapter 7

Safeguarding learners from cyberviolence and technology facilitated violence

The right to protection against violence and mistreatment is contemplated in article 19 of the Convention on the Rights of the Child, adopted 20 November 1989, by General Assembly resolution 44/25.

Violence refers to the intentional or unintentional use of force, whether physical, psychological, emotional, economic, threatened or actual, against another individual, oneself, a group of people, a community or a government. Violence can either be targeted or indiscriminate; it can be motivated by certain aims (including political, religious, social, economic, ethnic, and gender-based) or unintentional. It can be initiated with the intention of directly or indirectly inflicting harm, injury or death (World Health Organization, 2002). In the context of children's rights, the right to protection against violence encompasses the right to receive an education free from violence; this right entails ensuring that schools are safe spaces conducive to learning and development. Experiencing or witnessing violence in and around schools can have serious, long-lasting impacts on children's learning, health and well-being, and is associated with increased absenteeism and mental health problems such as anxiety, depression and low self-esteem (UNESCO, 2025c).

7.1 Cyberviolence

Cyberviolence refers to the use of Internet-connected devices by an individual or group to inflict harm (sexual, psychological, economic or otherwise) on another person, often by exploiting the target's specific circumstances, characteristics or vulnerabilities (UN Women and UNICEF, 2021). This form of violence also encompasses acts that facilitate harm or threats of harm. While cyberviolence occurs in online spaces, its impacts can manifest in physical harm (UN Women and UNICEF, 2021). As Internet and new technologies continue to evolve, new forms of cyberviolence will continue to emerge. Online violence intersects and overlaps with in-person violence, and shares root causes, such as harmful gender norms, exposure to violence in other settings, technology-related factors, and the broader rise of extremism and misogyny. Still, with the right regulatory frameworks and oversight, AI and digital tools can also be harnessed to detect harmful behaviours early and intervene before they escalate. These technologies offer new means of prevention and protection, as demonstrated by the AI for Safer Children Global Hub (UNICRI, 2025), which is already using them to combat child exploitation.

Cyberviolence can be perpetrated by anyone: strangers encountered online or offline, friends, colleagues or former intimate partners (UN Women and UNICEF, 2021). It may occur between peers or across different generations. In some cases, perpetrators conceal their identities, remaining anonymous through the use of pseudonyms. Cyberviolence often reflects underlying power imbalances between the victim or

survivor and the perpetrator. Research has shown that **men and boys are the primary perpetrators of cyberviolence**, particularly in the context of intimate partner stalking (UN Women and UNICEF, 2021). These findings underscore the importance of engaging men and boys in prevention and intervention efforts, not only by addressing harmful behaviours, but also by challenging the underlying norms and perceptions of masculinity that may contribute to such violence. Integrating work on masculinities and promoting positive gender norms are therefore essential components of a comprehensive response to online violence.

The rapid proliferation of digital technologies and their widespread use among young people have given rise to significant challenges, particularly in relation to violence. For instance, in 2024, electronic service providers reported 62.9 million images, videos and other files of child sexual exploitation to CyberTipline (NCMEC, 2025). In 2024, there was an increase of 1,325% in reports of child sexual exploitation involving generative AI, with 4,700 reports in 2023 and 67,000 reports in 2024 (NCMEC, 2025). While cyberviolence can affect anyone, transgender and gender-diverse people are disproportionately victims of cyberviolence (Dunn, Vaillancourt and Brittain, 2023). Gender-diverse adolescents and young people face additional and, often intersecting, risks of online bullying and harassment, hate speech, exclusion, risks related to data privacy and surveillance. Women and girls are also disproportionately vulnerable, often facing more severe and traumatic forms of abuse (UN Women and UNICEF, 2021). Long-term consequences of cyberviolence span a range of behavioural, emotional, mental, physical and social impacts, including negative effects on education and learning outcomes (UNESCO, 2024d). Additionally, **women and girls are disproportionately affected, especially by severe forms of harassment and sexualized abuse** (UN Women and UNICEF, 2021). A Plan International study that covered 22 economies revealed that an alarming 58% of girls and women had personally experienced some form of online violence in 2020 (Plan International, 2020).

In education context, online educational collaborative tools, such as forums, discussion boards and learning platforms that facilitate interaction between students and teachers, provide a broad-reaching environment for children's engagement. However, the extensive exposure they involve also presents significant risks. These platforms can create opportunities for harmful activities such as cyberharassment, cyberbullying, revenge porn, cyberstalking, online child sexual exploitation, sexual abuse, the production of child sexual abuse material and sextortion. Nevertheless, when adequately safeguarded, these platforms can foster peer collaboration, increase access to digital educational resources and reduce isolation through peer support. Some strategies, such as the Council of Europe Strategy for the Rights of the Child (2022–2027) (Council of Europe, 2022b), recognize that the risk of violence against children remains present in all settings, including places where children should be safest, such as schools and care institutions. The Strategy aims to prevent violence against children and protect children from violence. Providing 46 member States with guidance, it identifies six priority areas for protecting and promoting children's rights. They include: 1, freedom from violence for all children; 3, access to and safe use of technologies for all children; and 4, child-friendly justice for all children.

Generative AI and, specifically, chatbots **introduce new risks of bias in digital platforms that may perpetuate stereotypes, reinforce discriminatory behaviours and inadvertently expose children, adolescents and young people to harmful content**. AI-driven educational tools must be designed to detect and mitigate biases to prevent the reinforcement of harmful narratives. To address such risks, a joint statement on AI and the rights of the child is currently being prepared by the Committee on the Rights of the Child and the International Telecommunication Union.

7.2 The right to be protected from economic exploitation

Economic exploitation, as a form of violence, extends beyond the context of traditional labour practices to include digital environments where children's personal data are collected, processed and monetized without adequate safeguards (UNICEF, 2024a). The Convention on the Rights of the Child, article 32,

recognizes children's right to be protected from economic exploitation, which traditionally refers to child labour. However, in the digital age, economic exploitation increasingly takes the form of the commodification of children's personal data, particularly in educational settings, where digital tools and AI-based platforms gather vast amounts of information for commercial purposes. The widespread integration of ed-tech applications, online learning platforms, and AI-driven adaptive learning tools designed to "personalize" learning has raised serious concerns about the collection, sale and use of children's data for targeted advertising, profiling and other commercial activities that may be detrimental to their well-being.

In the digital age, economic exploitation in education has evolved to include the unauthorized collection and monetization of students' personal data by technology companies. During the COVID-19 pandemic, the rapid shift to digital learning exposed students to increased data mining by private companies, often without adequate consent or transparency (UNESCO, 2023a). This practice effectively transforms students into economic assets, as their data are leveraged for commercial gain. Indeed, in a 2022 report, Human Rights Watch documented **widespread violations of children's privacy and rights by major ed-tech companies** (HRW, 2022). The report was entitled "*How Dare They Peep into My Private Life?*". This title reflects the deep concern and frustration of students and teachers subjected to an "invisible swarm of tracking technologies" while simply seeking to exercise their right to education.

7.3 Preventing cyberviolence and protecting learners from digital exploitation

To mitigate these risks, governments must ensure that AI-driven educational tools are developed and deployed in compliance with international human rights standards, particularly the Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2021b) and General Comment No. 25 of the Committee on the Rights of the Child, on children's rights in the digital environment. Strict regulations must be implemented to prohibit the use of children's data for commercial gain, while educational institutions must prioritize privacy-by-design approaches in selecting digital learning tools. Furthermore, **greater transparency and accountability measures must be imposed on ed-tech companies to ensure that economic interests do not override children's rights**.

Digital platforms also have the potential to strengthen child protection rather than expose children to harm. The Protection through Online Participation (POP) initiative (ITU, n.d.), led by the International Telecommunication Union, aims to create a world where children and young people can safely access online support and referral systems. By collaborating with over 30 global partners, including the private sector, academia, civil society, and young people themselves, POP works to improve online protection services through research, intersectoral cooperation and policy recommendations. The AI for Safer Children Global Hub (UNICRI), launched in July 2022, is an online UNICRI (United Nations Interregional Crime and Justice Research Institute) platform helping law enforcement to combat child exploitation by providing access to more than 80 AI tools. Available in six United Nations languages, it offers an AI tools catalogue, training resources and global networking to streamline investigations and reduce forensic backlogs. Officers report significant time savings and improved efficiency, enhancing efforts to prevent, detect and prosecute child exploitation crimes. Such initiatives represent a critical step towards ensuring that digital education environments remain safe for students, particularly children.

Some considerations with regard to international and national guidance

- Digital technologies expose children, adolescents and young people to new forms of violence, including cyberbullying, harassment and online exploitation.
- Cyberviolence disproportionately affects women and girls and gender-diverse individuals, who are more vulnerable to severe and targeted online abuse.
- AI-driven educational tools risk amplifying harmful biases, reinforcing discrimination and exposing children to unsafe content.
- Economic exploitation of students' personal data is an emerging threat, with ed-tech companies profiting from data collection without adequate safeguards.
- Stronger policies and regulations are needed to protect students from digital violence and ensure a safe and inclusive learning environment.

Considerations for guidance

- Enforce legal protections against cyberviolence, ensuring clear policies on cyberbullying, harassment and other forms of online abuse in education, specifically to protect vulnerable groups.
- Implement stricter and human rights-based regulations for AI-driven educational tools, requiring child-centred design and bias mitigation strategies.
- Ensure that the students' best interests, instead of commercial interests, remain the focus of digital educational tools.
- Strengthen oversight of digital platforms, ensuring effective reporting mechanisms for harmful content and online abuse, including the blocking and removal of such harmful content.
- Develop AI-driven child student protection systems that can detect risks early and enable swift, effective responses to protect students.
- Develop educational programmes on digital safety and responsible online behaviour, and invest in school-based violence prevention education programmes that address online violence, as well as the underlying drivers of all forms of violence and abuse.

Chapter 8

Reimagining the right to work in a digital world

The right to work is recognized as a fundamental human right in several key international human rights instruments. Article 23 of the Universal Declaration of Human Rights affirms that "everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment". This principle is reinforced in the International Covenant on Economic, Social and Cultural Rights, particularly in its article 6, which obligates States Parties to recognize the right to work and to take appropriate steps to safeguard this right, through measures including technical and vocational training programmes. Beyond these general protections, specific international agreements address the right to work in particular contexts. For example, article 27 of the Convention on the Rights of Persons with Disabilities underscores the need for equal employment opportunities and the elimination of workplace discrimination. Similarly, article 11 of the Convention on the Elimination of All Forms of Discrimination Against Women highlights the right of women to work free from discrimination and under conditions of equality. The promotion of the right to work is also embedded in global development frameworks. Sustainable Development Goal 8 of the 2030 Agenda aims to promote "sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all".

However, in the digital era, the landscape of work is undergoing profound transformations, driven by new technologies, including AI. While digital tools offer unprecedented opportunities, such as economic inclusion, skill development and flexible working arrangements, they also present significant challenges, such as job displacement, algorithmic bias and the erosion of traditional labour protections. These transformations call for a critical reflection on labour rights and policies to ensure that digitalization fosters inclusive and sustainable employment, rather than deepening inequalities. In the field of education, equipping students with the necessary digital skills and competencies is absolutely vital to preparing them for the evolving job market.

8.1 Equipping learners for the future workforce and an evolving world of work

The rapid advancement of digital technologies, particularly AI, is reshaping labour markets worldwide. As work evolve and new industries emerge, individuals must acquire digital skills and technological competencies to remain employable and effectively exercise their right to work. **Ensuring that learners are equipped with the necessary knowledge and adaptability is essential for fostering inclusive and sustainable economic participation**. Basic digital skills, such as proficiency in productivity software, online collaboration and digital communication, are now considered essential across most professions. However, significant variations in national definitions of AI literacy, skills and

competency, underscore the urgency of a harmonized approach to integrating AI-related content into school curricula (UNESCO, 2024a). The growing integration of AI and data-driven technologies necessitates more advanced competencies, including coding, data analysis, problem-solving with AI and ethical considerations in technology use.

Despite the increasing demand for digital proficiency, **significant disparities in digital skills acquisition persist worldwide**. The Organisation for Economic Co-operation and Development (OECD), in its briefing note on digital skills and digital inclusion (OECD, 2023b), found that approximately 30% of Americans and 42% of Europeans lack basic digital skills. As educational attainment increases, individuals have greater exposure to technology, learning opportunities and training programmes, fostering a culture of lifelong learning that enhances digital competencies. **Across Europe, the proportion of high-skilled individuals with basic digital skills (81%) is nearly three times higher than that of low-skilled individuals (29%). However, certain communities face greater challenges in acquiring these skills. In the United States of America, Black and Hispanic workers are disproportionately affected, with 50% and 57% respectively lacking basic digital skills, compared to the national average of 30% (OECD, 2023b)**.

Box 11: Useful resources

Digital skills and education

European Commission's Digital Education Action Plan (2021-2027)

The European Commission's Digital Education Action Plan (2021-2027) (European Commission, 2020) highlights the need to embed digital and AI-related competencies at all levels of education, from early childhood to higher education and vocational training. Beyond formal education, fostering a culture of lifelong learning is critical to ensuring that individuals continuously update their skills to adapt to technological advancements.

See more: Digital Education Action Plan (2021-2027)

South Africa's National Digital and Future Skills Strategy

In 2020, South Africa launched its National Digital and Future Skills Strategy, outlining eight key strategic areas to advance digital skills (Republic of South Africa, 2020). The Implementation Programme Guide for the Strategy (2021–2025) (Republic of South Africa, 2022) builds on this framework, detailing measures, stakeholders and expected outcomes. The Strategy focuses on digital skills for society and the workforce, with a particular emphasis on youth not in employment, education or training (NEET).

See more: National Digital and Future Skills Strategy

For education systems to effectively prepare learners for the future of work, curricula must align with **emerging labour market demands**. Yet new technologies also offer new employment pathways, especially for individuals in remote or underserved communities, through remote work, digital entrepreneurship and online education platforms.

Curricula must be aligned and sustain a long-term vision, while digital resources that integrate future-ready skills must be accessible and empower teachers to adapt them to diverse learners' needs, as highlighted by the "content and solutions" of the 5C framework (UNESCO, 2024e). To address these challenges, countries may turn to international references such as *ITU's Digital Skills Toolkit* (ITU, 2024a) or *UNESCO's AI Competency Framework for Students* (UNESCO, 2024a). These documents provide policymakers with guidance on integrating future-ready skills into national education frameworks, ensuring that learners can exercise their right to work and are equipped to thrive in the digital economy.

8.2 Protecting labour rights by providing learners with future-ready skills

The OECD publication *AI and the Future of Skills (Volume 2)* (OECD, 2023a) underscores that **understanding AI's capabilities and their evolution is essential for assessing its impact on the economy, society and education**. Comparing AI with human skills helps determine where it may replace or complement human work, enabling better prediction of automation trends, skill demand shifts, and challenges for employment and education. *AI and the Future of Skills (Volume 2)* says that "policy makers can use this information to reshape education systems in accordance with future skills needs and to develop tailored labour-market policies" (OECD, 2023a, p.13). In alignment with this, the Beijing Consensus on Artificial Intelligence and Education (UNESCO, 2019a, para.17) calls for "**updat[ing] and develop[ing] mechanisms and tools to anticipate and identify current and future skills needs in relation to AI development**, in order to ensure the relevance of curricula to changing economies, labour markets and societies".

On a regional level, the European Commission's Digital Education Action Plan (2021–2027) (European Commission, 2020) recognizes the importance of **developing common guidelines for teachers and educational staff** to foster digital literacy and tackle disinformation through education and training. It also aims to promote professional development opportunities for teachers, trainers and other educational staff in schools, technical and vocational education and training (TVET) institutions, adult-education institutions, and higher-education institutions. In 2023, the European Digital Education Hub's Squad on Artificial Intelligence in Education, an initiative of the European Commission, published a report on AI (EECEA, 2023). The report details key competencies required by teachers working with AI and teaching about AI to enhance education. The report also provides practical use scenarios and recommendations to help educators with integrating AI while addressing challenges such as data privacy and digital literacy in schools.

In a national context, the Ministry of Education of the Republic of Korea has developed a strategy for integrating AI into classrooms through the AI Digital Textbook Promotion Plan. This initiative emphasizes the pivotal role of teachers in leveraging AI to enhance personalized learning experiences. According to the Ministry's press release (Ministry of Education of the Republic of Korea, 2023), starting in 2025, AI digital textbooks will be introduced for subjects including mathematics, English, informatics and Korean. These textbooks are designed to help teachers by providing tailored learning content based on individual student data, to address the diverse needs of learners and to support inclusive teaching practices. Deputy Prime Minister and Minister of Education Lee Ju-Ho emphasized that teachers would play a crucial part in leveraging AI digital textbooks to facilitate holistic student growth by designing effective classroom education. After the evaluation of 146 AI digital textbooks in 2024, 74 are being implemented this year in elementary school, middle school and high school (Ministry of Education of the Republic of Korea, 2024).

Some considerations with regard to international and national guidance

- New technologies are reshaping the job market, making digital literacy and skills essential for employability and economic participation.
- AI and new technologies bring both opportunities and risks, creating new jobs, enabling skill development, but also raising concerns about job displacement and inequality.
- Significant disparities in digital literacy and skills remain, particularly affecting disadvantaged communities and underrepresented groups in the workforce.

Considerations for guidance

- Ensure education systems align with future labour market needs, keeping a specific focus on integrating digital literacy and skills, particularly those related to AI, into curricula at all levels.
- Expand access to digital literacy and skills training, particularly for marginalized communities, to bridge the skills gap and prevent exclusion from the workforce, thereby promoting lifelong learning opportunities.
- Develop policies that regulate AI's impact on employment, ensuring that automation enhances human work, rather than replacing it.
- Invest in teacher training programmes, equipping educators with the skills and literacy needed to use digital tools in educational settings and to provide students with digital literacy and skills.
- Strengthen labour protections for educators, ensuring that AI-driven educational tools do not undermine fair working conditions or job security.

Chapter 9

Facilitating access to education through reliable information

The right to information is enshrined in several key international human rights instruments, underscoring its significance in promoting transparency, accountability and public participation. Both the Universal Declaration of Human Rights (article 19) and the International Covenant on Civil and Political Rights (article 19) affirm that everyone has the right to freedom of opinion and expression, which includes the freedom to seek, receive and impart information and ideas through any media and regardless of frontiers. Additionally, other instruments guarantee the right to information in particular contexts. For instance, article 17 of the Convention of the Rights of the Child provides that "States Parties […] shall ensure that the child has access to information and material from a diversity of national and international sources".

Sustainable Development Goal target 16.10 is to ensure public access to information and protect fundamental freedoms. In September 2015, the General Assembly of the United Nations appointed UNESCO the custodian United Nations agency for global monitoring of SDG indicator 16.10.2: "number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information" (UNESCO, n.d.b). The same year, at its 38th session, UNESCO's General Conference proclaimed 28 September International Day for Universal Access to Information (UNESCO, 2015b). The right to information is absolutely crucial to fully enjoying the right to education. It provides the foundation for informed learning, enabling individuals to access knowledge, verify facts and develop critical thinking skills, all of which are vital for both formal and informal education, as well as for lifelong learning. However, digital and AI-driven tools play an increasing role in accessing information in the educational context. The divide in access to these tools and the lack of reliable information on them pose significant threats to the full realization of this right. Conversely, digital and AI tools have also made high-quality information more accessible to millions of learners, including those previously left out of formal education systems. In fact, more than 220 million students participated in MOOCs in 2021 (GEM Report, 2023).

9.1 Equal access to information

The lack of access to digital information disproportionately affects marginalized communities, particularly those in rural areas, people with disabilities, women, older persons and low-income groups (ITU, 2022a). Access to information is essential for learners to develop critical thinking skills, engage in informed decision-making, and fully participate in society. UNESCO advocates for access to information as a fundamental freedom and a key pillar in building inclusive knowledge societies (UNESCO, n.d.).

Additionally, **disparities in digital access can pose significant barriers to lifelong learning**, particularly for specific groups of adults who may face greater challenges in accessing digital education. For instance, Mehmet Reşit Arslan and Orhan Bingöl v. Turkey of 18 June 2019 (ECHR, 2019) is a case concerning two prisoners who were serving life sentences and who sought to continue their higher education, which

had been disrupted by their conviction. The applicants requested access to a computer and the Internet to facilitate their studies; however, their requests were denied by the prison authorities. They appealed to the courts, but were unsuccessful. The European Court of Human Rights (ECHR) determined that this refusal constituted a violation of article 2 of Protocol No. 1 (right to education) to the European Convention on Human Rights. This case shows that access to the Internet and digital tools is increasingly linked to the right to education and access to information, thereby reinforcing the recognition of the right to digital education as part of the broader right to education.

UNESCO's Recommendation on Open Educational Resources (OER) (UNESCO, 2019c) states that technology "can open possibilities for OER to be accessible anytime and anywhere for everyone, including individuals with disabilities and individuals coming from marginalized or disadvantaged groups" (para. I.3.). Furthermore, the Recommendation acknowledges that advancements in information and communications technology, including AI and related innovations, create opportunities to enhance the free flow of ideas. However, it also highlights the challenges associated with ensuring inclusive participation in knowledge societies (UNESCO, 2019c).

9.2 Bias, misinformation and transparency in AI-driven education

With the emergence of AI-driven educational tools, it becomes more urgent than ever to ensure that **such tools are designed to prevent the spread of misinformation and disinformation, biases and discriminatory narratives**. Indeed, the UNESCO Recommendation on the Ethics of AI recognizes that AI poses fundamental ethical concerns regarding bias, which can result in discrimination. The Recommendation calls for the transparency and understandability of AI algorithms and the data on which they have been trained. It also discusses their potential impact on human rights and fundamental freedoms (UNESCO, 2021b, p.1).

Additionally, **generative AI tools reduce the diversity of opinions**, which inevitably further marginalizes already marginalized voices, as highlighted in UNESCO's *Guidance for Generative AI in Education and Research* (UNESCO, 2023b). The *Guidance* calls for learners and teachers to be taught about the output of generative AI and the fact that it only represents "the most common or dominant view of the world at the time when its training data was produced and that some of it is problematic or biased" (p.17). It recommends that **learners and teachers be critical when assessing the information provided by generative AI**, and that they be aware of how minority voices can be left out because they are less common in the training data. Critical digital literacy skills are playing an increasingly important role in addressing this challenge. Educators and learners who possess such skills are better able to identify bias and seek out diverse sources, thereby fostering a more inclusive digital culture.

9.3 Ensuring equitable access to reliable and diverse digital information

In the context of regulating digital educational platforms, it is vital to strengthen the implementation of UNESCO's guidelines for a multi-stakeholder approach to safeguarding freedom of expression and access to information (UNESCO, 2023c). According to these guidelines, "States should respect and promote human rights including the right to freedom of expression and the right to access information [...] States have positive obligations to protect human rights against unjustified interferences by private actors, including digital platforms as they have the responsibility to create a regulatory environment that facilitates platforms respect for human rights; and provide guidance to the digital platforms on their responsibilities" (para. 27). The right to information for students and teachers can be further strengthened through the Recommendation on Open Educational Resources (OER) and the UNESCO publication *Re|Shaping Policies for Creativity*. Both recommend that governments support public digital libraries, expand open access to research and education, and promote knowledge-sharing networks (UNESCO, 2019c; UNESCO, 2022d).

The Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2021b) recommends that "**AI actors should promote social justice and safeguard fairness and non-discrimination of any kind in compliance with international law**" (para. 28). It goes on to say that "the transparency and explainability of AI systems are often essential preconditions to ensur[ing] the respect, protection and promotion of human rights, fundamental freedoms and ethical principles" (para. 37). These principles are closely tied to the right to information, as transparent and explainable AI helps individuals to understand and assess the information they receive. Additionally, **private tech companies providing digital educational tools, specifically those based on AI, should be monitored** with clear regulations to ensure alignment with human rights principles and serve the interests of students, teachers and schools (UNESCO, 2023a). Indeed, transparency, fairness and non-discrimination in AI outputs and training data sets are essential in the educational context to guaranteeing students' right to information and ensuring their access to diverse and reliable sources of information.

Some considerations with regard to international and national guidance

- Access to information is essential for education, and for public participation. However, disparities in digital access limit opportunities for marginalized communities.
- AI-driven educational tools pose the risk of bias, potentially reinforcing discrimination and limiting diversity in knowledge.
- AI-driven educational tools also pose the risk of misinformation and disinformation, because of AI hallucination and unreliable information.
- Digital literacy, specifically with regard to AI, is key to exercising the right to information, equipping learners with skills for navigating and critically assessing digital content.

Considerations for guidance

- Strengthen digital (specifically AI-related) literacy education, enabling students and educators to critically assess information, including AI-generated content.
- Ensure equitable access to reliable information and digital resources (including information on sexual and reproductive health and rights), prioritizing marginalized groups such as rural populations, persons with disabilities, women and girls, gender-diverse individuals and low-income communities.
- Mandate transparency and fairness in AI-driven educational tools, ensuring that content is reliable, diverse unbiased and representative of all voices.
- Expand open-access educational resources and public digital libraries, supporting inclusive knowledge-sharing and reducing information barriers.
- Regulate AI in education to prevent misinformation and discriminatory content, ensuring that systems are aligned with human rights principles.

Chapter 10

Promoting cultural and linguistic diversity in digital education

Cultural rights are recognized as fundamental human rights in several international legal instruments, including the Convention on the Rights of the Child (article 31), the Universal Declaration of Human Rights (article 27), and the International Covenant on Economic, Social and Cultural Rights (article 15). These legal instruments affirm that everyone has the right to participate in cultural life, enjoy the benefits of scientific progress and its application, and benefit from the protection of the moral and material interests resulting from their creative work. The International Covenant on Economic, Social and Cultural Rights also stresses the need to respect the freedom indispensable for scientific research and creative activity. Additionally, the Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005) highlights the need to promote cultural diversity through education (article 10), particularly in the face of globalization and technological advancements.

Additionally, the UNESCO Framework for Culture and Arts Education (2024g) recognizes that education serves not only to transmit culture, but also to shape cultural identities and promote intercultural understanding. It empowers communities to preserve and celebrate their heritage while engaging with diversity.

Article 13 of the Convention on the Protection and Promotion of the Diversity of Cultural Expressions sets out the Parties' obligation to integrate culture into their development policies at all levels. This echoes article 11 of the UNESCO Universal Declaration on Cultural Diversity (2001), which describes cultural diversity as "the key to sustainable human development". However, emerging educational technologies such as AI present new challenges and opportunities for: cultural diversity; linguistic heritage; the freedom indispensable for scientific research and creative activity; and the equitable representation of marginalized groups (particularly as regards minorities' and Indigenous Peoples' cultural resources) in learning environments and the digital era. The following sections examine the risks of cultural homogenization and language marginalization in AI-driven education, before setting out guidance to ensure that digital technologies promote cultural and linguistic diversity rather than diminish it.

10.1 Cultural homogenization in digital educational technologies

The increasing influence of AI and digital platforms on cultural expression has raised concerns regarding cultural homogenization. Cultural homogenization is the process through which dominant cultural narratives, primarily from economically and technologically powerful regions, overshadow and marginalize diverse cultural expressions. This issue is particularly relevant in education, where AI-driven learning tools play a growing role in shaping children's knowledge and worldview. As **AI systems are predominantly trained on data sets that reflect mainstream cultural norms**, the unique traditions,

perspectives and knowledge systems of marginalized groups, particularly Indigenous Peoples and minorities, are often underrepresented or entirely absent (Foka and Griffin, 2024). As underlined in the Recommendation on the Ethics of Artificial Intelligence, "AI technologies can enrich cultural and creative industries, but can also lead to an increased concentration of supply of cultural content, data, markets and income in the hands of only a few actors, with potential negative implications for the diversity and pluralism of languages, media, cultural expressions, participation and equality" (UNESCO, 2021b, para. 3c). Nonetheless, there are several promising initiatives that aim to enrich AI-training data sets with Indigenous and local knowledge, thereby fostering more inclusive learning technologies. The Papa Reo project in New Zealand is an example of the efforts being undertaken to enrich AI-training data sets with Indigenous knowledge. Through collaboration with Māori communities, Te Hiku Media has developed a te reo Māori language data set to train speech recognition tools that respect cultural context and promote linguistic inclusion (Papa Reo, n.d.).

Cultural homogenization is exacerbated by the dominance of Western-centric data sets in AI training. As AI models learn from vast corpora of online content, they often reflect and perpetuate Western cultural biases, reducing the visibility of educational traditions and historical narratives. The *2025 AI Index Report*, published by Stanford University, notes that the United States of America and European countries, closely followed by China, have made substantial contributions to global AI research and innovation. As a result, there is a marked predominance of Western and Chinese influence in data resources and technological advancement (HAI, 2025). Initiatives such as the Global South AI Directory, developed by the Knowledge 4 All Foundation, aim to address this disparity by mapping and connecting AI researchers, projects and institutions across the global South to increase visibility and support for AI research and development beyond Western-dominated AI hubs (Knowledge 4 All Foundation, n.d.). **Ensuring that AI-driven educational tools respect and represent cultural diversity is essential to fostering inclusivity, critical thinking and the right of all learners to engage with a broad spectrum of cultural knowledge** (UNESCO, 2021a).

A significant risk of cultural homogenization in education lies in the reliance on algorithm-driven content curation by major digital learning platforms. AI-based recommendation systems prioritize educational materials that align with prevailing user preferences, often shaped by dominant cultural influences. This can lead to a self-reinforcing cycle, where certain narratives and learning approaches gain disproportionate visibility, while others remain obscured. **Digital monopolies contribute to the concentration of cultural production, limiting access to diverse educational content and perspectives** (UNESCO, 2022d).

10.2 Language marginalization in AI systems

Linguistic diversity is an essential aspect of cultural heritage, yet **AI technologies often fail to adequately represent the languages of marginalized groups, in particular Indigenous and minority languages**. **There remains a major linguistic imbalance in digital content, with English constituting over 50% of online material, while seven other languages account for another 30% (Snene, 2024). In contrast, over 30 languages spoken by millions of people represent just 0.2 to 2% of digital content, and thousands of languages are barely represented at all (Snene, 2024)**. **AI-generated content may deepen the marginalization of underrepresented languages and the cultural expressions they convey** (Special Rapporteur in the field of cultural rights, 2025, para. 48).

The exclusion of Indigenous and minority languages from AI systems has profound implications. Firstly, it **restricts digital access for speakers of these languages, reinforcing linguistic inequalities**. Secondly, it **accelerates the decline of endangered languages**, as younger generations may be less inclined to use them if they are absent from digital spaces. The preservation of linguistic diversity may depend on its integration into technology, particularly educational technologies. On the other hand,

learners' engagement can be reinforced through the use of technology that leverages local and home languages. Such tools not only support comprehension, but also promote more meaningful and inclusive learning experiences. The link between AI and the languages of instruction is critical and must be reinforced, especially in a context where 40% of learners are unable to fully understand the language in which they are taught (UNESCO, 2025b).

Box 12: Useful resources

Inclusive digital learning

The X5GON Project

The X5GON Project addresses the exclusion of Indigenous and minority languages and culture from AI systems by leveraging AI to create an OER network that facilitates cross-lingual and cross-cultural learning. By employing AI-driven translation, speech recognition, and semantic analysis, X5GON enhances access to learning materials in multiple languages, ensuring that speakers of minority languages can engage with digital education resources (X5GON, n.d.).

See more: X5GON Project

The **underrepresentation of Indigenous languages in AI-driven translation and speech recognition technologies hinders communication, knowledge sharing and educational access**. While initiatives such as the International Decade of Indigenous Languages (GA, 2020) seek to address these disparities, the rapid expansion of AI in education necessitates greater inclusion of linguistic diversity in digital tools and platforms. However, new AI-driven translation and speech tools are being developed with a focus on lesser-used languages, which could support revitalization efforts and improve inclusivity. For instance, tools such as ChatGPT can use and cover around 100 languages, including several local languages, thereby expanding opportunities for access and participation. AI is also being used to support language learning through personalized learning, speech recognition for pronunciation feedback, and automatic translation to aid comprehension and cross-cultural communication (UNESCO, 2021a). Additionally, some AI systems aim to analyse reading skills to provide tailored feedback and could potentially support language preservation.

10.3 Safeguarding cultural and linguistic diversity in AI-driven education

The UNESCO Recommendation on the Ethics of AI highlights the importance of **integrating AI systems into the preservation and accessibility of cultural heritage**, including both tangible and intangible elements, as well as Indigenous languages and knowledge. The Recommendation calls for participatory approaches that engage institutions and the public in educational initiatives to incorporate AI for the purposes of cultural preservation (UNESCO, 2021b, para. 94). Indigenous Peoples' and local communities' right to free, prior and informed consent in matters that concern them should be respected and protected. In the context of education, this also means **leveraging AI to support culturally responsive teaching and learning**, ensuring that students have access to diverse linguistic and cultural materials. The Special Rapporteur in the field of cultural rights emphasizes that AI must not perpetuate historical bias or "maintain power structures or decontextualize cultural heritage" (Special Rapporteur in the field of cultural rights, 2025, para. 78). In this connection, attention should be given to "**ensur[ing] broad accessibility for all, including by diversifying the languages represented online to explain and contextualize heritage assets**" (Special Rapporteur in the field of cultural rights, 2025, para. 84(f)).

The UNESCO Recommendation on the Ethics of AI urges Member States to assess and mitigate the cultural impact of AI-driven NLP (natural language processing) technologies, such as automated translation and voice assistants, on human linguistic expression (UNESCO, 2021b, para. 95). UNESCO's *Guidance for Generative AI in Education and Research* (UNESCO, 2023b) recommends the **development of inclusive specifications to protect linguistic and cultural diversity, ensuring that AI-training data**

sets incorporate multiple languages, particularly local and Indigenous languages. This measure aims to prevent generative AI systems from unintentionally erasing minority languages or favouring dominant linguistic and cultural norms (UNESCO, 2023b). By integrating these principles into AI-driven educational technologies, learning environments can become more inclusive and representative of diverse linguistic and cultural identities, fostering a deeper appreciation for global heritage.

The Special Rapporteur in the field of cultural rights also stresses the **need for digital technologies to "respect cultural diversity, promote linguistic inclusivity and prioritize underrepresented communities' perspectives**" (Special Rapporteur in the field of cultural rights, 2025, para. 43). Without careful implementation, the widespread use of AI in language processing "could lead to the disappearance of endangered languages, local dialects, and tonal and cultural variations associated with human language and expression" (UNESCO, 2021b, para. 95). Consequently, policy measures should actively counterbalance these risks by ensuring that AI technologies support, rather than diminish, global linguistic and cultural diversity. To achieve this, it is essential that digital educational tools and platforms, particularly those using AI, be designed to incorporate multilingual support, ensure equitable access and uphold cultural sensitivity, thereby enabling students from diverse backgrounds to engage with learning materials in their native languages and cultural contexts. This also represents an opportunity to expose learners to a broader range of cultural perspectives, promoting intercultural dialogue and global citizenship.

Some considerations with regard to international and national guidance

- Digital educational platforms, specifically those that are AI-driven, risk cultural homogenization, prioritizing dominant cultural narratives while marginalizing Indigenous and minority traditions,
- Western- and Chinese-centric AI-training data threaten cultural diversity, limiting students' exposure to varied educational traditions and historical perspectives.
- Linguistic marginalization in AI-driven education disproportionately affects speakers of underrepresented languages, restricting access to digital learning resources.
- Generative AI tools may reinforce biases and exclude minority voices, leading to further cultural and linguistic inequalities in educational content.

Considerations for guidance

- Ensure that AI-driven educational tools promote cultural and linguistic diversity, preventing the overrepresentation of dominant cultures and preventing the erasure or misrepresentation of cultural heritage.
- Integrate diverse, Indigenous and minority languages into AI-training data sets, ensuring equitable access to educational content, as well as free, prior and informed consent and other participatory rights.
- Mandate transparency and accountability in AI-driven content curation, preventing biased recommendations that reinforce cultural homogenization.
- Expand access to OER in multiple languages, supporting inclusive knowledge-sharing and preserving linguistic diversity.
- Encourage AI-driven tools that actively support language preservation, such as automated translation and voice recognition technologies for Indigenous languages.

Chapter 11

Upholding learners' and teachers' right to be heard and right to autonomy in digital-driven education

The right to be heard and the right to autonomy are fundamental principles enshrined in various international human rights instruments. The right to be heard is guaranteed by article 12 of the Convention on the Rights of the Child, which states that "States Parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child", ensuring that children's voices are taken into account. More broadly, the right to be heard is linked to the "right of freedom of opinion and expression", guaranteed by article 19 of the Universal Declaration of Human Rights, and the "right to hold opinions without interference" is guaranteed by article 19 of the International Covenant on Civil and Political Rights.

Article 1 of the International Covenant on Civil and Political Rights states the following with regard to the right to autonomy: "All peoples have the right of self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development". Additionally, Article 1 of the Convention on the Rights of Persons with Disabilities affirms the right of persons with disabilities to participate fully in society. Similarly, the Convention on the Elimination of All Forms of Discrimination against Women protects women's autonomy in decision-making, particularly regarding employment (article 11), education (article 10) and family life (article 16).

Sustainable Development Goal target 16.7 is to "ensure responsive, inclusive, participatory and representative decision-making at all levels", which reinforces the right to be heard. Sustainable Development Goal 5 is to empower women and girls by ensuring their "full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life" (SDG target 5.5), and by advancing autonomy in social (SDG target 5.4) and economic (SDG target 5.a) spheres.

In the context of digital education, the integration of digital and AI-driven tools presents both opportunities and challenges for upholding the right to be heard and the right to autonomy. For instance, the proliferation of surveillance technologies in educational settings can undermine student autonomy and stifle open expression, as students aware of constant monitoring may be less inclined to participate freely in discussions. Additionally, algorithmic suggestions could hinder the right to autonomy by subtly influencing students' choices, behaviours and learning paths, potentially limiting their ability to develop independent critical thinking. There is a crucial need to hear students' voices, particularly those of children, regarding the deployment of digital tools in educational settings, ensuring that these technologies align with their needs, rights and perspectives.

11.1 The risks of algorithmic suggestion, decision-making and manipulation

AI-driven recommendations, automated grading systems, and predictive analytics are designed to enhance learning efficiency, but they can also undermine student autonomy. In the context of predictive modelling, application criteria are applied differently and inconsistently across government agencies and can reinforce historical patterns of systemic bias and discrimination (UNICEF and Ministry for Foreign Affairs of Finland, 2021). In addition, **AI systems used for profiling "can limit and/or heavily influence a child's worldview, online experience and level of knowledge, and as such, the child's right to freedom of expression and opinion"** (UNICEF and Ministry for Foreign Affairs of Finland, 2021, p.23). Conflict between respect for educators' and learners' autonomy and their individual needs, goals and attitudes is a key risk, especially when highly autonomous AI systems or intelligent tutoring systems (ITS) are used, since these may negatively affect users' self-determination, undermining their ability to "self-determine the educational content in their individual context and to evaluate it with regard to its personal relevance" (Zinn, 2021, pp. 5-6). However, when designed ethically, AI tools can also support learner autonomy by providing adaptative pathways tailored to individual interests, needs and pacing. In response to these challenges, the European Union's AI Act (2024), in its Annex III, has classified AI systems for admissions and placement, learning outcome evaluation, education level assessment, and exam monitoring for detecting prohibited behaviour as high-risk, subjecting them to stricter regulatory requirements and oversight.

Algorithms used in decision-making can bring with them racial and gender biases with which the associated data were collected and treated; in the end, they compromise the results of the warning system (Zinn, 2021). Moreover, the use of AI-driven monitoring and behavioural analytics in education raises concerns about digital surveillance and autonomy. Some educational institutions employ AI tools to track student engagement, monitor attendance and even analyse facial expressions or online activity to assess attention levels. **Such invasive surveillance practices can lead to psychological discomfort and a loss of autonomy**, as emphasized in UNESCO's Minding the Data report (2022c). These surveillance practices also run counter to the right to privacy (Article 16, UNCRC).

11.2 The development of digital tools with student and teacher participation

The rapid expansion of digital tools in education has not been accompanied by adequate mechanisms for student and teacher participation in their design and governance. One of the primary challenges is that students and teachers often lack access to decision-making processes related to ed-tech deployment. **Teachers are often excluded from decision-making regarding technology**, with 45% of educators across 94 countries reporting that they were not consulted about new technology with which they had to work, and that students and parents were consulted even less (Education International, 2020).

The Special Rapporteur on the right to education has emphasized that determining the role of educational technology necessitates broad consultation and deliberation (Special Rapporteur on the right to education, 2024). The Special Rapporteur advocates transitioning from the top-down, unilateral decisions made at the onset of the COVID-19 pandemic to more inclusive decision-making processes that actively involve parents, school leaders and learners themselves (Special Rapporteur on the right to education, 2024). **The absence of structured feedback mechanisms contradicts international commitments to inclusive and participatory decision-making**, such as Sustainable Development Goal target 16.7, which calls for responsive and representative decision-making at all levels. Without participatory safeguards, AI-driven education systems risk treating students as passive subjects rather than active agents in their learning journeys. There are growing efforts to include student voices in the development of digital education strategies, contributing to more responsive and rights-based design of learning technologies.

Such participatory models have already shown positive outcomes in several countries, where digital solutions co-created or created in consultation with students, parents and teachers have better aligned

with the needs of classrooms and communities. The Special Rapporteur on the right to education (2024) notes successful national stakeholder engagements concerning artificial intelligence in education. In countries such as Canada, Ecuador, Saudi Arabia, Singapore and Uruguay, feedback from teachers, students and parents has informed regulations addressing ethics, data privacy, bias and automation. Additionally, Lithuania and Uruguay have engaged students and youth in these discussions. The United Kingdom's Department for Education has also gathered input from teachers, parents and students, providing valuable insight on AI use from users across all educational stages.

Digital-driven educational systems tend to prioritize efficiency and cost-effectiveness, and "**the objectives [used to] design codes, business models and regulatory frameworks of ed-tech should be realigned to prioritize the best interests of students and teachers**" (UNESCO, 2023a, p.442).

11.3 Protecting autonomy and participation of learners and teachers in the governance of digital education

In Policy Guidance on AI for Children (UNICEF, 2021, p.34), UNICEF recommends **meaningful child participation in both AI policies and AI design and development processes**. When an AI system is intended for children, is expected to be used by children, or affects children even if they are not direct users, their meaningful and informed participation in the design and development process is strongly encouraged, in accordance with their rights under article 12 of the Convention on the Rights of the Child.

The United Nations High Level Panel on the Teaching profession also recommended that teachers are given autonomy to choose how to use technology in their classrooms (ILO et al., 2024). It further encouraged governments to ensure that teachers have a voice in the broader decisions that shape and impact education (ILO et al., 2024).

Similarly, the International Task Force on Teachers for Education 2030, in a forthcoming position paper, emphasized that AI integration must protect teachers' professional autonomy and decision-making capacity. It called for AI systems to complement rather than replace teachers' core responsibilities, and urged the co-design of AI tools with teachers to strengthen, rather than diminish, their agency.

In her 2024 report on AI in education, the Special Rapporteur on the right to education **calls for teachers to be involved in the entire digitalization process** (from development and acquisition to use and adaptation in schools) through collegial discussions on digital working methods (para. 125(a)). The Special Rapporteur also emphasizes the need to create platforms for meaningful participation and multi-stakeholder collaboration on the use of AI in education, involving **key actors such as teachers, students, parents, local communities, education authorities, public and private educational institutions, ed-tech companies and start-ups, academia and civil society** (para. 131). She also calls for human oversight of AI-based decisions concerning students to safeguard fairness, correct errors and prevent the displacement of teachers' roles (para. 132). Lastly, in her report, the Special Rapporteur recommends **measures to "counteract the negative effects of privatization of public education systems"**, including requiring companies that provide AI systems to educational institutions to waive commercial confidentiality and ensure that their technologies are fully auditable by independent third parties (para. 136). This approach is also reflected in the 5C framework, specifically in the "coordination and leadership" pillar, which emphasizes the need to engage all stakeholders in the digital transformation of education and to foster multi-stakeholder cooperation (UNESCO, 2024e).

Building on these recommendations, States and education authorities should ensure that AI-driven tools in education respect learner autonomy, prevent undue algorithmic influence, and safeguard against discriminatory outcomes. Regulations should mandate transparency, accountability and independent audits of AI systems. Above all, learners and teachers must be meaningfully included in the governance and design of technologies in education, ensuring that they strengthen rather than diminish their rights to be heard and to autonomy.

Some considerations with regard to international and national guidance

- AI-driven tools in education can undermine student autonomy, influencing learning paths, decision-making and self-determination through algorithmic suggestions and automated grading.
- AI-driven monitoring and behavioural analytics raise concerns about digital surveillance, potentially discouraging free expression and eroding students' right to privacy and autonomy.
- Bias in AI-driven decision-making systems can reinforce discrimination, particularly in predictive modelling, student assessments and dropout-prevention strategies
- The exclusion of teachers and students from ed-tech decision-making processes contradicts principles of participatory governance. It limits teachers' and students' agency in shaping educational technologies.
- Stronger policies are needed to ensure that AI in education prioritizes human agency, respects autonomy and includes teachers and students in decision-making processes.

Considerations for guidance

- Ensure that AI-driven educational tools respect student autonomy and rights, preventing undue algorithmic influence on learning paths and decision-making.
- Mandate transparency in AI-driven decision-making systems, ensuring fairness, accountability and the prevention of bias.
- Require meaningful participation of students and teachers in the development, selection and regulation of digital education tools.
- Establish human oversight of AI-based decisions in education, ensuring that AI complements, rather than replaces, educators in critical decision-making processes.
- Implement regulatory frameworks for ed-tech companies, requiring audits of AI systems by independent third parties.

Conclusion

The digitalization of education and the increasing use of AI are gradually reshaping educational systems around the world, offering both opportunities and challenges for the realization of the right to education. When appropriately designed and implemented, digital technologies hold the potential to improve access to education, enhance learning outcomes, and bridge divides. However, without firm policy, the legal commitment to use digital technologies to enhance the right to education, and adequate legal and policy safeguards, digitalization (especially that involving new technologies such as AI) risks exacerbating existing inequalities, compromising data privacy, and undermining fundamental rights, including the right to education.

The international human rights framework provides a crucial foundation for guiding digital transformation in education. Article 4 of the Convention against Discrimination in Education and article 13 of the International Covenant on Economic, Social and Cultural Rights guarantee the right to education. General Comment No. 13 of the Committee on Economic, Social and Cultural Rights emphasizes that education must be available, accessible and adaptable to all. The Convention on the Rights of the Child further reinforces the obligation to ensure that learning environments, including digital ones, safeguard children's rights to education (article 28), privacy (article 16), and protection from exploitation (article 36). However, the rapid expansion of AI and digital tools requires a more explicit regulatory framework to address emerging risks, such as algorithmic discrimination, surveillance in education and data commodification.

Despite regional variations in digital learning environments, several overarching legal concerns emerge:

- **Access:** Access to digital education is not yet guaranteed for all, leaving millions of students, particularly in marginalized communities, without meaningful connectivity, digital tools and digital literacy skills.
- **Bias and ethics:** AI-based decision-making in education requires legal safeguards to identify and prevent bias, ensure transparency and uphold principles of non-discrimination, due process and academic freedom. Automated decision-making, predictive analytics and algorithmic grading risk entrenching existing inequalities if left unregulated.
- **Protection:** Digital education environments expose students, particularly children and female students, to new forms of violence, including cyberbullying, harassment and online exploitation.
- **Cultural and linguistic diversity:** Generative AI-driven tools raise concerns about unreliable information or misinformation, cultural bias and cultural homogenization, including the erosion of linguistic diversity.
- **Vulnerability:** Data protection, privacy and security remain at major risk, with growing concerns over student data collection, surveillance and commercialization by ed-tech companies.
- **Accountability:** The role of non-State actors in education must be clearly regulated, ensuring that private sector involvement aligns with human rights principles and does not undermine State obligations to provide public, free and quality education.

Considerations and guidance for action

To ensure that digitalization enhances rather than undermines the right to education, States must integrate human rights protections into digital education environments by taking action across each dimension of the 5C framework (UNESCO, 2024e). This framework provides the structure through which the following recommendations are articulated, ensuring that the analysis in the report is translated into clear guidance for action.

- **Coordination and leadership:** Governments must ensure intersectoral governance frameworks that align digital education policies with international human rights obligations. National legal frameworks should clearly define the role of the State as the primary duty bearer, ensuring that education remains a public good, even when private actors are involved. According to the human rights normative framework, States retain the overarching responsibility to ensure that education is provided as a public good and to regulate the involvement of non-State actors in accordance with the principles of human dignity, equity and non-discrimination. Crucial to maintaining appropriate oversight of digital education policies is the strengthening of mechanisms for accountability, transparency and public participation (paragraph 12 of the Incheon Declaration alludes to this), including consultations with teachers, students and civil society. Additionally, participatory governance structures must empower marginalized voices - including learners with disabilities, girls and displaced populations - to co-design inclusive digital policies.

- **Content and solutions:** AI and digital education must be legally aligned with the principles of non-discrimination, respect for cultural diversity and the realization of cultural rights, including linguistic rights, as recognized in articles 13 and 15 of the International Covenant on Economic, Social and Cultural Rights and article 10 of the Convention on the Protection and Promotion of the Diversity of Cultural Expressions. Regulatory frameworks should require transparency in AI-generated educational content, ensuring that algorithms do not reinforce biases or restrict diverse perspectives. In alignment with States' obligations to ensure that educational content is adaptable, as recognized by the Committee on Economic, Social and Cultural Rights in its General Comment No. 13 (1999), national curricula should explicitly include critical digital literacy, ethics and responsible use of technology, functional digital skills and information literacy at all levels. UNESCO's AI Competency Framework For Students (2024) provides a structured framework to support States in making these changes and promotes responsible digital citizenship and resilience against misinformation or algorithmic manipulation. Open educational resources and inclusive content must be prioritized to ensure that the educational commons remain public and accessible.

- **Capacity and culture:** Legal frameworks must protect teachers' professional autonomy and academic freedom in digital learning environments. They must ensure that AI does not replace the human role in education and that it instead supports, where relevant, pedagogical innovation and effectiveness, in line with the principles set out in the Recommendation concerning the Status of Teachers. Teachers must be provided with legal protections regarding their right to work and working conditions, academic freedom and professional autonomy, privacy rights and the ethical use of AI in classrooms, as well as training in critical digital skills, which can be achieved through UNESCO's AI Competency Framework for Teachers (2024). Moreover, fostering a digital culture that supports inclusive pedagogies and supports the right to education for all learners is essential, in line with article 2 of the Convention against Discrimination in Education, which obliges States to eliminate and prevent any form of exclusion or limitation based on race, sex, language, religion or other status. Investing in teacher-led innovation and supporting professional communities of practice can empower educators to shape ethical uses of digital tools in classroom.

- **Connectivity and infrastructure:** Access to digital education is necessary in order to fully realize and exercise the right to education. It should be explicitly recognized in national legislation, ensuring equal access to connectivity, devices and digital platforms for all learners. The principle of non-

discrimination in education under international human rights law—enshrined in instruments such as the Convention against Discrimination in Education and the International Covenant on Economic, Social and Cultural Rights—requires that States take all appropriate legislative, administrative and budgetary measures to ensure equitable access to the digital dimensions of education. States must fulfil their obligations under SDG 4 and SDG 9 by investing in public infrastructure that guarantees universal, affordable and rights-based digital access, with particular attention to rural, underresourced and marginalized communities.

- **Cost and sustainability:** National policies should secure stable public funding for teachers, school infrastructure development and maintenance, Internet connectivity and digital tools, reducing reliance on short-term or limited financing mechanisms and ensuring the timely adoption of new technologies. In line with article 2(1) of the International Covenant on Economic, Social and Cultural Rights, States are required to take deliberate, concrete and targeted steps—using the maximum of available resources—towards the full realization of the right to education, which increasingly includes its digital components. Dedicated funding for teacher training is essential to equipping educators with digital skills, ensuring the effective integration of technology in classrooms. Digital education should never replace or weaken face-to-face education. Educational investment must prioritize those traditionally excluded from quality education, as called for in the Vision Statement of the Secretary-General on Transforming Education (Secretary-General of the United Nations, 2022). The Vision Statement emphasizes the need for effective public financial management, regular monitoring and impact assessments, which are essential to ensuring that resources reach their intended beneficiaries and contribute to the expected learning outcomes set in educational policies.

Using this framework to guide approaches to digital transformation in education would ensure that all efforts target the human-centred, rights-based use of digital technology in education to benefit all learners and the common good. Aligned with Transforming Education Summit follow-up actions, using this framework to guide strong, system-wide policy directives would accelerate efforts towards achieving the objectives of the United Nations Secretary-General's Our Common Agenda, the Global Digital Compact and the Summit of the Future.

The legal framework governing AI and digital education must be continuously updated to align with evolving human rights standards. This includes integrating principles from the UNESCO Recommendation on the Ethics of AI, which emphasizes transparency, accountability and fairness in AI deployment. Additionally, national and international education policies should guarantee access to digital education, ensuring that emerging technologies support the progressive realization of the right to education, rather than creating new barriers.

In a rapidly digitalizing world, alongside the growing development of AI in the education sector, the right to education cannot be left to market forces or technological developments alone. States must uphold their human rights obligations by ensuring that digital education remains inclusive, equitable and free from undue commercial influence. Legal protections must be proactive rather than reactive, preventing algorithmic bias, data exploitation and the erosion of educational autonomy before they become entrenched problems.

By strengthening governance, legal accountability and both national and international cooperation among the relevant stakeholders, the digital transformation of education can serve as a force to uphold the right to education, rather than a source of exclusion and privatization. As AI and new technologies continue to evolve, the responsibility of policymakers, educators and international actors is clear: to safeguard education as a fundamental human right, ensuring that no one is left behind in the digital age.

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AI and education

Protecting the rights of learners

Digital technologies, including artificial intelligence, are rapidly reshaping education worldwide. They offer the promise of broader access, personalized learning experiences, and more efficient educational management. At the same time, they raise critical questions about equity, privacy, and the ethical use of technology. This report argues for a human-centred, rights-based approach that ensures these innovations strengthen learning opportunities for all, rather than leaving anyone behind. It calls on policymakers, educators, and technology developers to act decisively to align digital progress with the universal right to education.

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4 QUALITY EDUCATION

Sustainable Development Goals