

# Executive Summary

The COVID-19 pandemic has shown the potential and need to be ready for digital education. Countries have digitised their system-level management tools to some extent, but coherent digital education ecosystems still remain to be established in many countries.

The Digital Education Outlook 2023 proposes thematic and comparative analysis of OECD countries' digital ecosystem and governance, and highlights different opportunities and challenges to achieve different policy objectives. Taken together with its companion report, *Country digital ecosystems and governance*, that provides in-depth information about 29 countries/jurisdictions, it provides a state of the art of digital education in the OECD area, and a baseline to measure progress in the decade to come.

Part of the information in this book comes from a systematic survey of OECD countries and Brazil regarding their digital education infrastructure and their governance of education as of December 2023, desk research, as well as past work by the OECD Centre for Educational Research and Innovation on technology, innovation and research in education. The book provides policy considerations for countries to enhance their digital education ecosystem and governance and highlights some of the tensions between different policy objectives. It is fully informed by the *OECD Digital Education Outlook 2021: Pushing the frontiers with AI, blockchain and robots*, which allows to measure the gap between what could be possible and where countries stand.

This report has two main parts: one about countries' digital education ecosystem, including its human component, and one about its governance. The third part is devoted to a position paper on AI in education written by the OECD secretariat and Education International, the international federation of teaching unions, aiming to facilitate a dialogue between public education authorities and the teacher profession and their representatives to collaborate on the digital transformation.

## Digital education ecosystems

Digital education ecosystems consist of three parts: digital tools for system and institutional management, digital tools for teaching, learning and assessing in the classroom, and human beings that make these tools alive and meaningful. The pandemic raised a big question: what is the minimal infrastructure a country should provide to its schools, teachers and students for learning to continue in case of a disruption, but also generally speaking? Another observation it made visible is the gap between what would be possible to make education more effective and equitable if teachers and students were augmented by digital education, including AI, and what countries, educational authorities or schools provide as of 2023.

### ***System-level management tools***

The cornerstone of a digital education infrastructure at the system level lies in a longitudinal student information system. A second best is to have a central student register with unique longitudinal identifiers for students (and possibly teachers). Student information systems allow the entire education system to benefit from information that is gathered at the national level if and when it can be turned into actionable

information for local stakeholders. At the least, the information gathered will allow generating evidence that may inform education policies within countries. As of 2023, most OECD countries have established a student information system, although they still use it mainly for statistical purposes rather than as a way to provide real-time information to stakeholders (chapter 2).

The equivalent of student information systems at the school level are learning management systems: they allow schools to manage and track information about individual students, which classes they attend, with which teachers, and, in some cases, to access digital content for teaching/learning. Ideally, they should be able to “push” and “receive” data to and from their jurisdictional student information system. While most countries report that most of their school use such systems, at least to some extent, in about half of them learning management systems are not interoperable with system-level student information systems and require schools to manually provide information to their public authorities/ministries. They are also unable to receive any insight from the data collected at the jurisdictional level.

The report shows that most countries provide study/careers guidance information through digital means, even though few of them provide tools for more personalised enquiries, and that most national evaluations are digitised or in the process of being so. Digitising actual high-stakes exams for students is a different story, and while a few OECD countries are exploring this path, only few of them have done it (Finland is an example). A few countries have digitised some aspects of the administration of their paper-and-pencil exams as well as their selective admission processes into higher education (and sometimes high school) (chapters 3 and 4).

### ***Digital ecosystems for teaching and learning***

A second question is about the digital learning resources that are accessible by teachers and students. This is another issue that the pandemic has made salient and that led to many new promising initiatives within countries.

The OECD, alongside other international organisations such as UNESCO, have long encouraged countries to develop platforms of open educational resources (OERs). OERs tend to be available free of charge to all citizens speaking a given language. MOOC (massive open online courses) platforms have also expanded that offer, as is the case for TV and radio education and social network channels in selected countries. Most of these offers were boosted by the pandemic and are still available in some countries.

Another way for countries to support teachers and students is to license digital learning and teaching resources from education publishers or to enable schools/municipalities (etc.) to buy their resources from them. The advantage of a central provision is that central governments have in principle more capacity to quality assure resources. On the other hand, schools or local governments may be better placed to choose what suits their students. In any event, while having a baseline of “free of charge” or open resources is important to allow everyone to benefit from public education, private providers remain overall better placed to keep learning resources up to date and should certainly remain part of the public provision/procurement equation (chapter 5).

### ***Digital competences***

A strong digital education ecosystem encompasses students and teachers who can use the digital tools and resources at their disposal. There is no point in providing resources that are not effectively used by teachers and students. Countries incentivise teachers to develop their pedagogical digital competences in different ways: some have digital competency standards that pre-service teacher education programmes have to follow; others issue guidelines that sub-government authorities may or may not follow; others mandate regular in-service teacher training and provide teacher professional learning resources. Many include “digital competences” as an objective in their national/jurisdictional curriculum and hope that teachers and teacher pre- and in-service professional learning will adjust (chapter 7).

## **Physical infrastructure**

Too many digital education strategies have been limited to the physical digital infrastructure, that is high quality connectivity and enough devices for students and teachers to access. This is obviously still a prerequisite to embrace the opportunities of digital education. While this Outlook reports on that very important element, it did not start with it to make it clear that this is not the only important or necessary element of a strong digital education ecosystem. Just providing digital devices and good connectivity will not lead to a digital improvement of education. Most of the elements mentioned above are the drivers of such a transformation, even though it can only take place where hardware is available. This has been a key priority of countries' digital strategy in the recent past (chapter 6).

## **Access, use and governance of digital technologies and data in education**

### **Equality of access and use**

The COVID-19 pandemic exposed inequalities in access to the physical and “soft” digital education infrastructure. In normal times, almost all countries experience significant differences in terms of access and exposure to digital learning resources and tools. This is mainly due to the devolution of responsibilities within countries, which allows sublevels of governments to decide on the appropriateness or affordability to provide, encourage or support the use (and/or procurement) of digital tools and resources by schools, teachers and learners. Some countries have put in place ambitious programmes to incentivise all sub-governmental entities to invest in digitalisation. Others have managed to do so with no policy, but a “like-mindedness” across the country. And others just witness big disparities between “frontrunners” and “laggards”, whether by choice or by force. Providing equality in access and use, and equity for populations that are less likely to be able to benefit from digital education without intervention, will remain a key challenge for governments in the near future (chapters 6 and throughout).

### **Data and technology governance**

Another challenge relates to governing digital technology and data in order to generate public trust while keeping market incentives for commercial education technology companies and education publishers to develop appropriate tools and resources for the education sector.

Privacy and data protection, including cybersecurity, are key to data governance. All OECD countries have developed data protection and privacy regulation about access to and sharing of administrative education data. In many cases, countries have also developed specific legislation or rules about education data, in relation to their system-level student information and other administrative systems. While the regulation usually extends to commercial providers and prevents them from sharing data, no country has put in place any regulation or contract to access data that are collected by commercial providers within public schools. There are also no regulation or guidelines about algorithms or automated decisions (apart from government-wide decisions or guidelines where they exist), perhaps because automated decisions hardly exist anywhere in the OECD area. There is also no country that reports any high- or medium- stakes AI-empowered tool or resource in education as of 2024. AI resources will typically be embedded in adaptive learning systems or in the recent emergence of generative AI applications (based on large language or other types of models), for which an increasing number of guidelines are being developed (chapters 8 and 10).

Discussion about algorithmic bias should increasingly influence regulation in countries where equity is a high policy priority. Algorithmic bias refers to cases where an algorithm advantages some populations compared to others (whether the characteristics relate to gender, race and ethnicity, migration status, etc.). Research on algorithmic bias is mainly undertaken in the United States, including for algorithms and systems operating outside of the United States. An important take-away from this research is the

importance to collect personal (and sometimes sensitive) data within strong data protection and privacy policies to be capable to detect (and thus address) algorithmic bias (chapter 9).

### ***Interoperability***

A second aspect of data and technology governance lies in interoperability standards and the mandate or incentives to use some of these standards. For a variety of reasons, including “legacy” systems and the distribution of responsibilities across multiple education agencies, sub-government levels and departments within a ministry, many digital education tools do not have the capacity to exchange and link data. This implies education staff often have to re-enter data multiple times and a significant share of the data collected at the system level remain dormant rather than being used for educational improvement and intervention. Another aspect of interoperability lies in the development of standard taxonomies to tag digital learning resources (semantic interoperability). Many countries have started to attempt to unify their digital ecosystem for users by providing a “single sign-on” service, but most still do not have interoperability between school-level and system-level management tools (or even between system-level management tools) (chapter 11).

### ***Procurement***

A third aspect of data and technology governance lies in procurement rules and regulation. As of 2024, more centralised countries tend to provide a framework for public procurement and pre-approve most of the digital education tools and resources that schools and teachers can procure, when they are not procuring themselves. More decentralised countries tend to leave the decision to schools or local authorities, but rarely provide guidance on what to procure. The procurement of digital tools and resources is also not conditioned on any particular outcomes other than data protection and security, contrary to what is observed in the health sector for example (chapter 12).

## **Supporting innovation and research and development (R-D) in digital education**

Supporting the development and improvement of digital education tools and resources as well as research on the effective uses of digital education are two important dimensions of a strong digital ecosystem and governance in education.

Traditional education stakeholders do usually not have the competence to develop digital tools for the education sector. Typically, those are developed by for-profit education technology companies, sometimes specifically for the education sector, sometimes by adapting tools that were developed for other sectors to education. It is rare for education ministries to support directly commercial companies, although education technology may benefit from governmental innovation programmes (e.g. for startups or for research and exploratory development). While a few support their education technology industry from an international trade perspective, many engage in a dialogue with them by supporting conferences, etc. Education authorities also collaborate relatively rarely with stakeholders such as parents or students when developing or introducing new digital tools and resources.

While governments sometimes commission research on digital education to their universities or place digital education as a clear priority of their research agenda, it is striking that very few countries do actually monitor and evaluate investments in digital education tools and resources. Information about the physical infrastructure available in schools is missing, not to mention information about uses of digital technology, either as a management tool or as a teaching and learning tool.

Acknowledging that education and computer scientists, education technology companies and governments often work in silo, with relatively little involvement of the teaching profession in the definition and development of AI products, they should aim to establish multi-stakeholder co-creation models. One

of the main purposes of this co-creation would be to develop digital technology tools and resources based on teachers and learners' needs and uses rather than on what is possible given a given state of technology. Some international examples of innovation laboratories based on different partnerships highlight some possible avenues to explore (chapter 13).

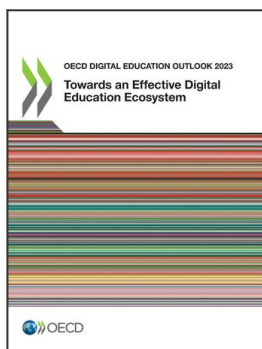
### ***Support organisations***

Almost half of the countries have published a new digital education strategy since 2020. Most have updated it during the COVID-19 pandemic. These strategies typically focus on the access to good hardware, the development of teacher and student digital competences, and more rarely the upgrading of digital learning resources with AI-based tools (chapter 14).

One of the challenges for governments in implementing their digital strategies lies in the difficulty of ensuring that staff have the digital competences to deal with the physical digital infrastructure, with digital tools and resources for management, the pedagogical knowledge regarding digital learning resources and tools, and the ability to support teachers in developing the pedagogical competences to embed the use of these tools and resources in their teaching repertoire. Countries have established different modes of support organisations to support the digitalisation of education. The analysis of the advantages and disadvantages of different models shows the benefits of these external organisations, even though in some countries driving the digital transformation from within the ministry of education might be the best solution (chapter 15).

## **Opportunities, guidelines and guardrails for an effective and equitable use of AI and digital technology in education**

Based on some aspects of the analysis of the Digital Education Outlook, the report finally includes a set of "opportunities, guidelines and guardrails" that was developed by the OECD Secretariat and Education International. The guidelines were designed to provide a position paper that could inspire countries, organisations or jurisdictions in their digitalisation efforts. It proposes a starting point for further discussions and guidelines on these issues.



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