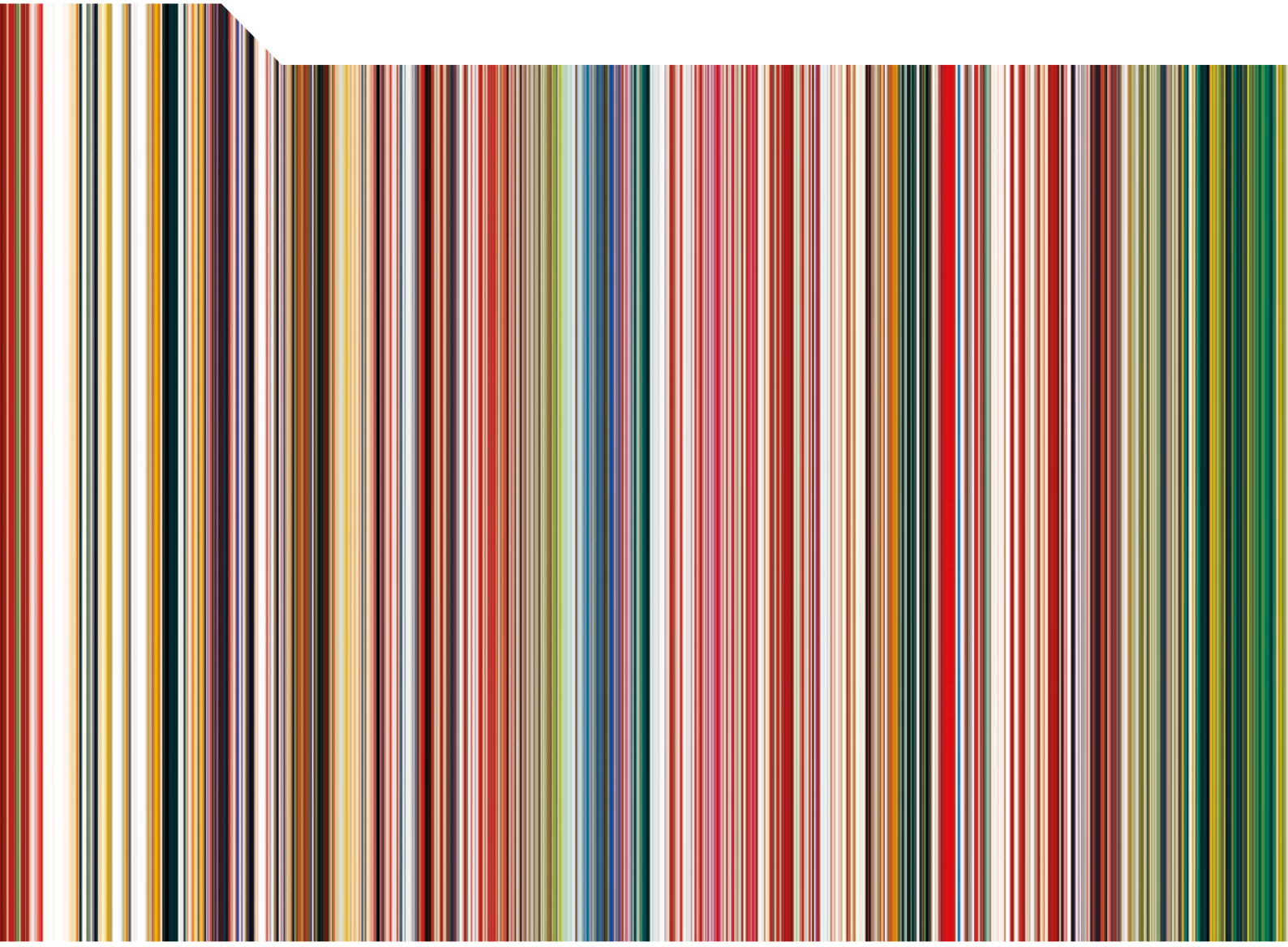
Country Digital Education Ecosystems and Governance

A COMPANION TO DIGITAL EDUCATION OUTLOOK 2023



OECD

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Foreword

The 2023 Digital Education Outlook provides, for the first time, a window into how OECD countries and partner economies are managing the digital transition and the extent to which they are prepared for a digital transformation. This companion report provides the basis of the work and supplemented it by offering a detailed descriptive analysis of countries digital ecosystem and governance, enabling a comprehensive of each country's approach to digitalisation.

A digital transition in education has been underway for decades but accelerated significantly during COVID-19 pandemic, when many education systems shifted to remote learning. The transition is characterised by the adoption of student information systems, online learning platforms and the use of digital devices in classrooms.

This transition, however, is not the same as a digital transformation. The latter would imply a fundamental change in some educational processes, integrating technology not just as a tool, but as a way to reshape teaching methodologies, learning processes, and the educational ecosystem at large, to make it more effective. Currently, the incorporation of technology in education often replicates traditional methods rather than reinvents them. The main benefit of a digital transformation lies in the personalisation of education, both in terms of learning and of student support.

65% of OECD countries have a national student information system. The US state of Colorado, for example, runs a public website called SchoolView that provides information and analysis from its longitudinal education information system. The portal provides a social network for teachers, a learner centre and resource bank, interactive school performance charts and access to performance data and reports.

Yet Colorado is an outlier. Few jurisdictions or countries link their student information systems with individual evaluation results or provide dashboards or visualisation tools to make the data more useable in real time. Privacy concerns and a lack of data linkages in many countries prevent information collected about students, teachers and schools to be translated into actionable information to improve education.

Or consider learning management systems – the tools to manage student attendance, classes, contacts and content. Most schools within OECD countries use learning management systems at all levels of school education, yet few are interoperable with system-wide student information systems or with the other digital tools they use.

Interoperability is crucial. Otherwise, it limits data collection and analysis at the jurisdiction or national level and creates inefficiencies as data is manually re-entered across systems and jurisdictions. Countries that provide their schools with a national learning management system are able to leverage system-level functionalities while collecting the data that they need to monitor and improve the education system. In Iceland, for example, the INNA system is both a learning management system for upper secondary schools, allowing for student tracking, timetables, communication with students and parents and handling of school fees, as well as a student information system for the government.

At a more fundamental level, a digital transformation cannot take place unless access to stable, high-speed Internet is ubiquitous. Reliable connectivity is key for students to fully enjoy digital, personalised, and engaging learning through digital solutions, for them to communicate with their teachers or tutors, and to receive timely feedback on their activities.

Faster and better internet throughout all levels of education is a policy priority of almost all countries. Yet how systems use digital devices and resources in schools also bears consideration. According to the 2022 PISA study, students who spent up to one hour per day on learning on digital devices outperformed those who did not by 14 points, even after accounting for socio-economic status. Yet many students reported being distracted by digital devices in the classroom, and this had a negative impact on performance.

The role of teachers thus remains central within any digital transformation. They are the agents who will help students navigate the digital world, not only from a technological adoption standpoint but also in terms of inculcating the behaviours and values necessary to regulate the use of digital devices and adapt to an increasingly data-driven world.

Yet many teachers feel unprepared to in this respect. Across the OECD, around 20% of secondary education teachers report the need for further training despite 60% of teachers having undergone digital education training in the past year. With rapid advances in AI and other digital technology, this is easy to understand. Yet most directives on professional standards with respect to digital competencies remain broad and high-level, leaving significant room for interpretation on how systems understand, develop and evaluate these skills in practice.

Systems like Austria's Digi.kompP model, conversely, provide a clear framework for eight digital competency areas and a progression model to guide teachers throughout their professional development. Micro-credential systems, like that offered by Digital Promise in the US, offer another model to provide credentialed learning across a wide range of digital competencies.

Recent rapid advances in generative artificial intelligence will likely disrupt many aspects of digital education. This transformative technology has the capacity to democratise autonomous learning experiences, providing support tailored to the needs of individual learners and redefining how, where and what students learn.

Yet, today, few OECD countries are prepared to understand or guide the use of generative AI in education. Although all reporting countries and jurisdictions noted that use of generative AI is already widespread, none of the 18 countries for which we have comparative information has issued a regulation on the use of generative AI in education and only nine countries or jurisdictions have published non-binding guidance.

The Digital Education Outlook 2023 outlines a set of opportunities, guidelines and guardrails for the effective and equitable use of AI in education, developed together with Education International, a global federation of teachers' trade unions, that is intended to guide countries and jurisdictions as they decide whether and how to integrate generative AI into their education systems.

These guidelines are essential to ensuring that AI tools are used responsibly and ethically, safeguarding against biased content generation, data privacy breaches, and unintentional reinforcement of stereotypes. The guidelines underscore the need for effective dialogue between education authorities and teaching professionals to ensure that teachers can maintain their role as the guiding force in the learning process while harnessing the potential of AI in education. They may be of interest to the readers of this book.

Above all, for the digital education transition to become a transformation, governments need to adopt a system-wide approach that strengthens the coherence of the tools, technologies, actors and entities across their education system. I hope that the analysis and insights offered by this book will allow for a better understanding of different countries' approaches and that, together with the perspectives offered by the Digital Education Outlook 2023, they will provide OECD Members with useful resources to navigate the digital transformation.

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Executive Summary

This book includes the depiction of countries' digital ecosystem and digital governance. It covers 28 countries (Austria, Belgium, Brazil, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Hungary, Iceland, Italy, Ireland, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Slovenia, Spain, Sweden, Türkiye, the United States and England (United Kingdom)), including the Flemish and French communities of Belgium. The objective of each of the chapters is to provide an overview of the resources that central governments provide to their schools, teachers, and students, how the responsibilities are divided between different public stakeholders, and how they ensure the security, privacy, equity and effectiveness of this digital ecosystem while keeping incentives for private education technology (EdTech) companies to develop a variety of digital resources and tools for education.

The information presented in this book was collected through the following process. The OECD Secretariat designed two questionnaires (in the Annex), covering a variety of aspects of a digital education ecosystem and of digital governance. The questionnaires were designed through an iterative process of consultation with country coordinators. The administration of the questionnaires followed a two-step process given the novelty and variety of denominations of the different issues covered. Countries were asked to answer the questions and provide the name and URLs of the digital platforms and tools they were referring to. One or more "validation" meetings with each country participant took place to make sure that the questions and response categories were understood the same way across countries, thus allowing for international comparisons, but also to collect qualitative information about the digital governance and infrastructure within countries. The chapters were drafted based on this information as well as on desk research by the OECD Secretariat. Inasmuch as possible, the secretariat accessed the different digital resources (when publicly accessible) to ensure they include the functionalities expected for these categories of tools.

While authored by the OECD Secretariat, all country notes were verified for accuracy by countries, with last changes occurring in December 2023. The book describes the situation as of end of 2023 (or early 2024) and provides a baseline to assess future evolutions. It provides a neutral account of countries' situation, highlighting what they do rather than what they do not do. Links to and names of the platforms and legislation or guidelines mentioned are provided throughout the chapters.

One challenge in referring to countries' digital education infrastructure lies in the lack of a common terminology across and within countries. For example, a school learning management system can refer to tools that have different types of functionalities (e.g. student information management, content management, communication with parents), including functionalities that correspond to other dedicated tools (e.g. customer relationships systems for communication with parents). These tools can also have different names within countries: student information systems, student tracking systems, student enrolment systems, etc. The chapters attempt to provide a similar language across countries – and definitions are provided in the *OECD Digital Education Outlook 2023.*

A second challenge pertains to the devolution of responsibilities within countries. Respondents to the questionnaires were officials in the national ministry of education (where there is one) but, depending on their responsibilities, the public provision of digital tools and governance arrangements differ across

countries. Comparing more centralised to more decentralised countries could give a wrong impression regarding the abundance or scarcity of digital tools and resources – as well as guidelines and regulation. To overcome this challenge, where possible and relevant, with the support and advice of country representatives, sub-government entities or associations of those sub-government entities answered the questionnaires and/or were interviewed. The book attempts to make the devolution of responsibilities and the internal logic of the provision of digital tools and resources and of its regulation as clear as possible, while recognising that there is no strict determinism between the two. It also highlights the roles of the national government (if any).

All the country chapters follow more or less the same outline, adapted to the country context:

- **General policy context**. This section describes the roles of the ministry of education and other relevant actors to highlight the devolution of responsibility between different subgovernment levels (as is most often the case). It also presents the latest digital strategy of the country for education and how it is coordinated with the overall digital strategy within the country/jurisdiction.
- **Public digital education infrastructure**. This section covers two aspects of a digital education ecosystem, in line with the study of the frontiers of education technology in the *Digital Education Outlook 2021*. On the one hand, it presents the digital ecosystem for system and school management, which is composed of digital *tools* such as student information systems (also known as education management and information systems), digital assessment platforms, admission management systems and career/study information systems at the education system level, as well as learning management systems, communication tools with parents and administrative tools at the institutional level. On the other hand, it presents the digital ecosystem for teaching and learning that is provided by public authorities, composed of digital *resources* such as open digital resources and the licensing of commercial resources for staff and students enrolled in their education systems. Public provision is only one possible mode and many countries let schools procure some of these tools and resources directly (usually with their public funds).
- **Access, use and governance of digital technology and data in education**. This section portrays how countries ensure access to digital tools and resources and support their use, acknowledging that mere provision does not equate to adoption. It highlights how they try to compensate for the possible inequalities induced by the devolution of responsibilities on digital issues within countries, and the incentives that are provided to develop teachers' competencies and teachers' use of these resources (either through formal and informal digital competency frameworks for the teaching profession or more indirectly through the national/jurisdictional curriculum, if any). It also covers the governance of data and digital technology in education as it ensures stakeholders' trust in the use of digital data and solutions: it covers the rules and guidelines for accessing and sharing administrative and commercial data collected within schools, and rules and guidelines related to algorithms and interoperability, if any, as well as rules and guidelines about public procurement.
- **Support for innovation and research and development (R- D) in digital education**. As building and sustaining a robust supply and use of digital tools and resources remains a challenge in education, this section covers efforts from governments to support the development of new digital tools and resources by education technology companies as well as their support to monitoring and researching the effective uses of digital education.

This book is the underlying basis of the comparative and thematic chapters of the Digital Education Outlook 2023, that analyses the information in a thematic and comparative manner and provides additional country and international examples of initiatives to foster an effective and equitable digital education ecosystem. This is a thus a companion book that provides more in-depth information about each country.

1 Austria

This note provides an overview of Austria's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Austria supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Austria engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Austria's education system is intricate, featuring federal and provincial school systems, with differing responsibilities. The 2017 Education Reform Act aimed to streamline governance by introducing Boards of Education, responsible to both federal and local governments. Both levels of government publicly procure digital tools to assist their schools with information and education management. Digital resources for teaching and learning are also publicly provided, notably digital textbooks and online platforms.
- The "Digital Austria" initiative, launched in 2020, outlines an 8-Point Plan focusing on improving digital infrastructure, providing devices to students, and enhancing digital competences. An investment of EUR 200 million supports measures such as providing digital devices, launching teacher training programmes, and upgrading school infrastructure.
- Austria emphasises equitable access to digital tools, providing devices to students, supporting socio-economically challenged learners, and offering guidelines and certifications for digital tools. Together with the European Union (EU) General Data Protection Regulation (GDPR), federal laws ensure data protection and privacy while fostering interoperability, with guidelines on data transfers and the use of technical standards. Guidance and certification services on school procurement as well as measures to advance teachers (and students) digital competencies further support the effective use of digital tools and resources in schools.

General policy context

The education landscape in Austria is complex, with two different school systems operating side-by-side: one that is governed by the federal government (schools in this system are hereafter referred to as "federal schools" [*Bundesschulen*]), and the other that is governed by the provincial governments (schools in this system are hereafter referred to as "provincial schools" (*Landesschulen*]).[1] Regardless of the ISCED level, all federal schools are funded and maintained by the federal government. By contrast, provincial schools are co-financed by the federal, provincial, and municipal governments, and provincial governments have devolved responsibility for the administration and maintenance of most provincial schools (except for part-time vocational schools) to the municipal level. For instance, teacher salaries at provincial schools are financed directly by the federal government, while the construction and maintenance of the same schools are generally financed by municipalities.[2]

The Education Reform Act (*Bildungsreformgesetz*) in 2017 aimed to streamline this complex arrangement of responsibilities by creating the Boards of Education (*Bildungsdirektionen*), a new education authority in each province (*Länder*), merging several of the previously dispersed duties for schools of the federal and provincial governments. The Boards of Education are therefore responsible to both the federal and provincial governments. They are in charge of, *inter alia*, implementing the ministry's guidelines, evaluating schools, reviewing whether educational goals and measures are met, and enforcing quality assurance, as well as executing teacher employment law and staff representation rights in provincial schools and other federal employees at provincial schools (BMBWF, 2019). However, the responsibility for financing, administration and maintenance of the Boards of Education remains divided among the federal, provincial, and municipal governments. This division of responsibilities has a profound consequence for how the digital education infrastructure in Austria has been developed and maintained.

Division of responsibility

In Austria, the responsibility for the digital education infrastructure depends on whether a school is a federal school or a provincial school. Providing schools with access to digital tools and resources for system and

school management falls within the remit of the level of government that is responsible for maintaining the schools. For instance, the federal government mandates federal schools to use certain digital tools for school management. Conversely, both federal and provincial schools decide autonomously as to which digital resources for teaching and learning they wish to procure and use, including the use of resources provided by the Federal Ministry of Education, Science and Research (*Bundesministerium für Bildung, Wissenschaft und Forschung*; hereafter BMBWF). The ministry may overrule schools' decisions regarding the use of resources, however, where expenses for the resources are provided federally.

There are several private schools in Austria, most of which are religious schools maintained by churches. Hence, the responsibility to secure for these schools access to the digital tools for system and school management falls upon each church (as well as schools themselves). But sometimes they may receive financial support from the federal government (mostly to fund teacher salaries). They can also freely access some of the publicly provided digital teaching and learning resources, e.g. digital textbooks.

Whereas the public responsibility to provide digital education infrastructure is divided at the federal and provincial (and municipal) levels, establishing and enforcing regulatory measures is mainly the responsibility of the Boards of Education and BMBWF. School quality managers (*Schulqualitätsmanager*) in the Boards of Education are federally appointed to implement quality assurance and oversee school development, maintenance, and inspection (OECD, 2019[1]). In addition, there are various federal ordinances, decrees, directives, and guidelines covering technical and organisational measures for the supply and maintenance of digital infrastructure in schools. The access to and use of data and digital technologies in education are regulated strictly by the law set at the EU and federal levels.

Digital education strategy

Against the backdrop of *Digital Austria*, a national initiative for a successful digitalisation of the country, the federal government has made efforts to develop state-of-the-art e-government, support the digital economy and innovate society, including education.[3] *Digital Austria* sets out the *8-Point Plan for Digital Learning* (*8-Punkte-Plan für den digitalen Unterricht*), an initiative launched by the federal government in June 2020.[4] Taking into account the consequences of the COVID-19 outbreak, the *8-Point* Plan aims to improve the digital infrastructure for teaching and learning, provide students with access to IT-supported education on a level-playing field, develop digital competences of students, and promote interest in the development of education technologies.

Consequently, the federal government has made changes to their digital education policy and expenditure. They have invested EUR 200 million to execute this plan, specifying a variety of developmental steps and sustainable implementation of digital strategies in education. Specific measures enacted include providing 5th grade students with a digital device (laptop or tablet) to use in schools and at home and offering a digital device to teachers at lower secondary schools.[5] The types of digital devices provided for students and teachers are decided by schools themselves. While students pay around 25% of the price of the device they receive, those from lower socio-economic background may be exempted from this payment.

Other measures include launching a range of online training courses for teachers (with a focus on blended and remote learning), aligning digital resources in the Open Educational Resources (OER) repository with the school curriculum, and developing the Digital School Portal (*Portal Digitale Schule*), which serves as a single point of entry (single sign-on) for several education and administrative platforms.[6] In terms of hardware upgrade, the *8-Point Plan* also aims to expand all schools' basic infrastructure, such as the fibre-optic broadband connection.[7]

The public digital education infrastructure

Digital ecosystem for system and school management

Student information system and learning management systems

Based on the Education Documentation Act (*Bildungsdokumentationsgesetz, BilDokG*), the BMBWF owns and maintains *BilDok*, a central educational database with some student information system functionalities, which is used for calculating educational statistics, resource planning, and school funding. To facilitate the collection and transfer of data for *BilDok,* federal schools must use *Sokrates Bund*, a digital tool that combines several features of a learning management system and a school administrative function system.[8] Conversely, provincial schools can choose which tools and resources to use for collecting and transferring data to *BilDok*; *Sokrates Web* is used in six provinces, while different systems are used in three (i.e. Burgenland, Upper Austria, and Vienna). All system and school management tools are procured publicly. Both *Sokrates Bund* and *Web* are developed by a private company called *Bit Media* and procured publicly for schools – either by federal or local government, depending on the school type – and schools use them to manage various information about their students (e.g. address, attendance, grade) and teachers (e.g. timetable, subject distribution). The collected information is then automatically transferred to *BilDok* annually, upon school principals' approval.

Sokrates also tags a unique and longitudinal identifier to students' personal information, such as their real name and individual exam records, and teachers and school principals can see and use the identifier to find the information about associated students. However, against the backdrop of high-level data protection rules in Austria, a pseudonymised identifier is assigned to students when the information is transferred to *BilDok*, and personal-level student information is not accessible to government officials (whether they are from federal, provincial, or municipal government), even though this granular information has been pseudonymised and has unique identifiers. By the same token, government officials are not permitted to directly access the information stored in *Sokrates*.

While *Sokrates* contains some functionality to manage the academic progress and attainment of students (e.g. recording attendance and grade, organising class activities, storing certificates in digital format), access to further digital tools are provided by the federal government to help schools manage students' learning. Two learning management systems, *Eduvidual* and *LMS.at*, can be used on an opt-in basis.[9] The former is a Moodle-based platform developed in 2019 by the Centre for Learning Management (*Zentrum für Lernmanagement*) – a shared initiative of the BMBWF and University of Education Upper Austria – and the latter is developed by *Knowledge Markets GmbH*, a private company, and procured publicly.[10] Albeit different in terms of the specific functions, both learning management systems are designed to help schools and teachers organise classes, provide learning resources and exercises for students, and offer communication facility with students and parents.

Other management support systems

The federal government provides a number of other applications that schools can choose to use for further management purposes. A customer relationship management system, an administrative function system and a library management system (for schools with a library) are provided for schools at all educational levels. As with *Sokrates Bund* and *Web*, these tools and resources are procured publicly by each school maintainer (federal or provincial governments). Access to the customer relationship management system is provided via *WebUntis*, which is procured publicly for all federal schools in the course of implementing the *Digital School Portal*.[11] Other tools used for communication between schools and parents, such as *SchoolFox*, *SchoolUpdate*, and *edu.FOW*, are also procured by each school maintainer.

The federal government also provides *Digital Professions* (*Digitale Berufe*), a career and study guidance platform for students at all educational levels (though mainly targeting secondary students) that specifically aims to arouse interests in the digital world of work.[12] This platform provides students with recommendations for their future studies and professions adaptively based on each student's declared interests and experience. Meanwhile, in the pipeline are a digital matriculation exam (*Digitale Reifeprüfung*) and a digital degree system. The former is currently being piloted in some federal schools at upper secondary and vocational education and training (VET) levels, while the latter is planned for launch in June 2023.

In the summer of 2023, an initiative was launched to equip pupils in upper secondary school with digital school ID cards that function as students' digital credentials. This digital ID system is used for giving access to systems in schools, printing of certificates, for issuing school attendance certificates.

Digital ecosystem for teaching and learning

The BMBWF provides a range of digital resources for teaching and learning that both federal and provincial schools as well as teachers may choose to use. Many of those resources are made openly available. For instance, the University College of Virtual Teacher Education (*Virtuelle Pädagogische Hochschule*), a national centre maintained by the BMBWF, serves as a Massive Open Online Course (MOOC) platform providing materials for teacher training.[13] The MOOC platform, called *imoox.at*, offers lifelong training courses for teachers on a wide range of subjects, including digital subject didactics. There is also *Eduthek*, an OER repository, which provides links to a variety of learning resources covering a different subjects following a taxonomy inspired by the national curriculum by grades, subjects, and competences.[14] The resources on *Eduthek* include apps, games, and other digital materials for teaching practices, and students can find the resources for themselves, while teachers or parents may assign resources to their students/children. The BMBWF also offers *Student Radio* (*Schüler/innenradio*), a radio channel on which students broadcast about diverse topics, in co-operation with the Austrian Broadcasting Corporation (*Österreichischer Rundfunk*).[15]

Some digital teaching and learning resources are available only to those who are enrolled in formal education. Examples include educational video clips that are offered via the *EduTube* platform, to provide educational institutions daily with reliable researched documentaries and movies in high quality for teaching purposes.[16] *Digi.folio* is an online platform for teacher development, also provided at the system level, mapping training measures in the area of digital competences for teachers.[17]

Other static resources, such as digital textbook and e-book, are delivered via *Digi4School*, an online platform part of the *Textbook Initiative* (*Schulbuchaktion*).[18] This is a federal initiative that, since 1972, has been curating and providing digital and non-digital textbooks and educational media (e.g. web-based interactive contents) coordinated with the curriculum requirement, supplying to both federal and provincial schools. This initiative is funded by the Federal Chancellery, and contracts with publishers and booksellers are signed by the Austrian Economic Chambers' Association for Book Trade and Media Management. Then the BMBWF conducts quality assurance for those resources contracted, against the framework and processes set out in the Ordinance on Expert Commissions for the Declaration of Suitability of Teaching Materials. Then, before the beginning of every new school year, it compiles a list of resources approved for purchase by schools.[19]

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily mean that schools and teachers will use them. Different rules and guidelines are thus in place to support access to, and use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

In Austria, there is no binding rule that applies universally to *all* educational levels to govern the equitable access to, and use of, digital technologies in education. However, the federal government has undertaken a range of efforts to enhance digital equity. The public provision of several digital tools for system and school management enables students, teachers, and schools to access the digital education ecosystem in a sustained and equitable way across all education levels. Some of those tools (e.g. *Sokrates*) are mandated for use, meaning that all schools have a minimal digital system for student management and data transfer to the government.

In addition, the *8-Point Plan* stated above stipulates that the federal government supplies a digital device (laptop or tablet) to all students at lower secondary schools – including the students at provincial lower secondary schools (e.g. *Mittelschule*) – with a view to creating the pedagogical and technical conditions for IT-supported teaching, as well as giving all students access to digital education on equal terms. In terms of learning resources, digital textbooks and some complementary learning resources are provided for free to schools as part of the *Textbook Initiative*. The BMBWF also implements projects like *100 Schools, 1 000 Opportunities*, which seeks to identify digital (and non-digital) resources needed by the chosen schools facing socio-economic challenges.[20]

Students with special educational needs, and from lower socio-economic backgrounds, are granted extra monetary support. For instance, via the Continue Learning (*Weiterlernen*) initiative, those students are offered free remote or in person learning assistance, and sometimes free digital devices.[21] Students and schools from rural areas are excluded from device distribution, however. This may be attributed to the findings that, in Austria, rural schools' information and communications technology (ICT) infrastructure tend to be better than urban schools', as opposed to most other OECD countries (OECD, 2022).

Besides these initiatives, the federal government's education strategies do not target a particular group, since the responsibility to provide access to tools and resources for system and school management is devolved to the respective maintainer of schools. Provincial and independent private schools are therefore relatively out-of-scope of the federal government's strategies and responsibility, with the exception of requirements on the curriculum and on digital textbooks (and devices) for students.

Supporting the use of digital tools and resources

The BMBWF seeks to facilitate the uptake of the publicly provided digital tools by providing guidelines and professional learning opportunities.[22] In addition, access to the publicly procured digital tools and resources – including *Sokrates,* the two publicly provided learning management systems, and several resources for teaching and learning (e.g. *Eduthek*) – has recently become facilitated through a single sign-on (SSO) service enabled by the *Digital School Portal*. Users are no longer required to create separate credentials to access and use these different applications.

The BMBWF also supports schools in acquiring digital tools as well as teaching and learning resources through the *Learning Apps seal of approval* ("Gütesiegel Lern-Apps"). This is a quality certificate awarded by the federal ministry of education, science and research for digital mobile learning apps (and their web versions). Obtaining the certificate requires the fulfilment of set quality criteria and positive evaluation by teachers according to pedagogical, functional, and student-oriented aspects. With the certification comes an authorisation for companies to use the *Learning-Apps* quality seal on their website. The certificate is intended to provide teachers, students and parents with guidance and assistance in selecting innovative products from the market.[23] The federal government also pays for recruiting educational IT custodians (*IT-Kustodiat*) at each school, who is responsible for the pedagogical support regarding the use of digital technologies.[24]

Finally, the BMBWF supplements the publicly provided digital tools and resources with several publicly procured commercial licensed software, such as *Google Classroom* and *Microsoft Office 365* (including *Teams*) which are made available for schools that choose to use these tools.25 The Austrian Federal Procurement Agency (*Bundesbeschaffungs GmbH*), an agency in charge of procurements for the federal government departments, also supports the tendering processes for schools, by offering provincial and municipal governments with the guidelines on the procurement of educational tools and resources.

On November 14, 2023, the BMBWF launched a six-point package of measures for schools to help integrate the use of AI in order to prepare students for a world influenced by AI. Part of the package includes the establishment of 100 schools as AI pilot schools that will integrate the use of AI in educational media and textbooks as well as teacher training. Furthermore, assistance will be provided for schools and teachers with regard to the use of AI in written work, such as school homework, final examinations, etc. A more specific research focus on "AI in everyday school life" is set by the government to promote active engagement in the subject matter.[26]

Cultivating the digital competence of education stakeholders

Cultivating the digital skills and competences of education stakeholders constitutes a vital part of education in Austria. Based on the European *DigComp* reference framework, the federal government has developed the Digital Competence Model for Austria, whose latest version *DigComp 2.3 AT* was published in late 2022, covering various aspects of digital competence – from data literacy to safe use of digital resources.[27] Any Austrian citizen above the age of 15 can obtain *Dig-CERT* and *DigComp-CERT*, digital knowledge and competence certificates, by taking an online exam based on the *DigComp 2.3 AT*.

For those enrolled in formal education, the *digi.komp* initiative is a long-standing tradition of the BMBWF to define digital competencies at various levels of education.[28] This initiative outlines digital competences and implementation examples for teachers (*digi.kompP*), and for students at different stages of education (*digi.komp4, digi.komp8,* and *digi.komp12* for primary, lower, and upper secondary levels, respectively).[29] It is designed to ensure that the competences signalled by the BMBWF are integrated into the curriculum and pedagogical approaches, thereby leading students to acquire the age-appropriate digital competences and teachers to develop digital competences for teaching, including those related to the pedagogical use of digital technologies.[30] Students and teachers can also voluntarily use *digi.check*, an online questionnaire on digital competence specified in the *digi.komp* models, to self-assess their digital skills and knowledge.[31]

The *digi.komp* initiative remained non-binding – except for *digi.komp8* that lower secondary students must pass. The former has recently been replaced by the Digital Basic Education *(Digitale Grundbildung*) – a new, graded course that has been made compulsory for all students at lower secondary schools (both federal and provincial). The course contents encompass digital competences, media literacy, and political literacy within digitalisation, and it is taught throughout the entire four years of lower secondary education, either as an independent subject or in the form of integrative teaching.

In addition to the *digi.komp* initiatives, other public initiatives also exist to support teachers and students in developing digital competences. For educators, the eEducation Network allows teachers to network for exchanging knowledge about schools' digital development, digital teacher training, and the pedagogical use of technologies. Ö1 Goes to School (*Ö1 macht Schule*) delivers podcasts on teachers' digital skills and digital education, in co-operation with the public radio station *Ö1* and the University College of Teacher Education Vienna.[32] For students, Learning to Think, Solving Problems (*Denken lernen, Probleme lösen*) is a pilot project mainly for primary school students to promote their computational thinking and the didactic use of digital media.[33] Finally, to communicate about responsible use of digital technology in school with students and parents, the ministry cooperates with the national co-ordination office *Saferinternet.at*, which supports schools with dedicated materials and workshops.

Governance of data and digital technologies in education

Supporting the use of digital technology in education and the data it generates works more easily if stakeholders recognise that this use will not work to their detriment. Thus, the federal government occasionally provides students and parents (or legal guardians) with information about the use of data and digital technologies in education. The government also involves them in consultations; for instance, by regularly engaging in exchanges with informal interest groups of parents (via the Parent Council [*Elternbeirat*]) and students (via the Federal Student Council [*Bundesschülervertretung*]).

There are also policies to govern the access to and use of data and digital technologies in schools. Digital technologies are used in the classroom as part of the curriculum given that developing students' digital competences is a key component of the Austrian education system, as noted in the previous section. For instance, using digital technologies is recommended to teachers as a teaching method in every curriculum, and there are specific cross-cutting subjects encouraging the use of digital technologies, such as computer literacy. In addition, since schools are increasingly allowing the use of digital devices in their own exams, the BMBWF offers some relevant guidelines, for instance, regarding the use of certain applications (e.g. using spell checker in language exams). The use of digital devices is only for in-person exams, however, and no remote exam is organised at present (except for the pilot of an online exam administration system).[34]

To improve the interoperability of education technologies and data, the BMBWF enforces the use of specific technical standards, providing a framework for ensuring the data transfer between schools and *BilDok*, so the data can be exchanged seamlessly whether they are manually imported (e.g. in CSV format via Excel) or synchronously and automatically transmitted (e.g. in XML format via REST API connected to database systems). They also offer relevant guidelines to promote the use of open standards to enhance the interoperability of technologies and data in education, and seek to consolidate the existing manual data interfaces with automated and synchronous data services, through an upcoming central data hub.

In Austria, there are data protection and privacy rules in place – both in general (under the European Union General Data Protection Regulation, EU GDPR), which has been ratified as national legislation within the Austrian Data Protection Act, and specifically regarding students, teachers and school staff's data and privacy at all educational levels (under the Education Documentation Act [*BilDokG*]).[35,36] These rules regulate the collection, storage and use of education data, including the processing of the data for calculating educational statistics and attainment of students. When the data leaves a school in which it is generated – for instance, transferred to *BilDok* or other statistical agencies – it becomes pseudonymised and thus linked to a different identifier than those used for students elsewhere. While the data can be transferred for statistical or research purposes, however, it is not transferred between schools, e.g. when a student moves to another school.

In addition to the Education Documentation Act, the ICT School Ordinance (*IKT-Schulverordnung*) entered into force as of September 2021.[37] This ordinance governs the use of digital devices within schools and defines the technical and organisational measures for ICT-supported teaching and learning, with a view to ensuring privacy and security in schools. For instance, it specifies that, for security reasons, a Mobile Device Management system, a government-operated device management software must be installed on digital devices publicly provided to students .[38] By the same token, IT systems used for data processing (such as cloud services) must have data stored in centres in the European Economic Area region or in countries where the EU GDPR applies; otherwise, a service provider from outside those regions (e.g. Google, Microsoft) is obliged to draw up a contract with the federal government before they can provide their tools to schools.[39] Such (cloud) services can also be used only for pedagogical purposes, not for school administration or student information management purposes, and companies are not allowed to use the data of students who use their tools and resources, including for advertising.[40]

Strong data and privacy policies being in place, however, does not mean that education data cannot be accessed by third parties. The Research Organisation Act (*Forschungsorganisationsgesetz*) governs the access to and use of data held by public bodies and authorities (thus, including education data from public schools).[41] This Act specifies that, subject to certain conditions, data can be shared upon request with third parties, such as research institutions and professional statistical agencies that conduct research, expand knowledge, calculate statistics, and contribute to solving social, economic, cultural and scientific issues.[42]

In principle, the school management is responsible for the processing of student data, and therefore data protection officers (including at least one IT expert) sit on the school committee, proactively inspecting the schools' digital infrastructure and IT security. However, with respect to publicly managed applications, such as *Sokrates* and *WebUntis*, the responsibility lies also with the government. Albeit not specific to education, the Official Liability Act (*Amtshaftungsgesetz*) states broadly that the government is responsible for all government-operated technologies, thus including publicly provided educational technologies. Defining the varying grades of responsibility of education stakeholders for IT errors (e.g. data breaches) is currently an important issue in Austrian education regulatory landscape.

The use of automated decision-making, AI-powered algorithmic model, and digital proctoring in education currently remains limited. Little policy effort or regulation governs these aspects. However, albeit not education-specific, the federal government adopted in 2021, as part of the strategies for the Artificial Intelligence Mission Austria 2030, a guideline addressing the development and use of AI applications across diverse sectors (including education).[43] Part of the guideline outlines a responsible and pedagogically meaningful use of AI in education – from smart content and intelligent tutoring system, to virtual learning companion and learning analytics – as well as developing students' AI-specific competences, such as knowledge of the basic functionality and societal implications of AI, as well as associated risks and opportunities. In late 2023, Austria adopted a six-point package of measures on artificial intelligence in schools. A group of experts from universities and university colleges of teacher education was assembled to help design this package of measures, which it will continue to refine and monitor. To that end, a hundred of schools were selected to pilot the use of AI learning tools for individual learning needs.

Supporting innovation and research and development (R&D) in digital education

In the last five years, the federal government has supported innovation in digital education in various ways. The BMBWF among other public institutions commissions universities and research institutions to conduct evaluation of educational policy measures. For instance, the University of Graz was commissioned to conduct research on a pilot project about the use of tablets in inter-school peer learning.

The BMBWF also provides financial incentives to organisations, individuals, and teachers for developing educational software and digital learning resources – some of which include the resources contracted for the *Textbook Initiative*. Another example of supporting educational innovation is the *Mobile Learning* project, a cross-school peer learning programme by the BMBWF (in co-operation with the Ministry for Transport, Innovation and Technology).[44] Leveraging the experience from the eEducation Network of teachers, this project aimed to connect schools with little use of digital technology in classroom with a more digitally experienced school for mentoring and know-how transfer, and examine the pedagogical potential of digital devices for teaching and learning. Until 2019, it served as a preliminary project preparing for the Digital Learning (*Digitales Lernen*) initiative.[45]

Public-private partnerships are common in the education sector and the federal government supports these partnerships. For instance, albeit not education-specific, several federal ministries implement programmes to fund start-ups and promote innovation through their agencies, such as the Austrian Federal Development and Financing Bank (*Austria Wirtschaftsservice Gesellschaft*) and the Austrian Research Promotion Agency (*Österreichische Forschungsförderungsgesellschaft*). In terms of non-monetary

supports, the Innovation Foundation for Education provided EdTech companies cooperating with schools with funding for developing learning resources and educational technologies.[46]

References

OECD (2019), *Working and Learning Together: Rethinking Human Resource Policies for Schools*, OECD Reviews of School Resources, OECD Publishing, Paris, https://doi.org/10.1787/b7aaf050-en. [1]

Notes

[1] Federal schools are (1) academic schools (*Allgemeinbildende höhere Schule*, AHS), which span *both* lower and secondary education and account for 20% of general education schools as of the 2021/22 school year, and (2) vocational schools and colleges at the upper secondary level (*Berufsbildende höhere Schulen* and *Berufsbildende mittlere Schulen*, BHS and BMS), accounting for 60% of all vocational schools in the same school year. Provincial schools are (1) all primary schools (*Volksschule,* VS); (2) middle schools at the lower secondary level (*Mittelschule,* MS); (3) pre-vocational schools (*Polytechnische Schule,* PTS) and part-time vocational schools (*Berufsschule*, BS) at the upper-secondary level, and (4) special needs schools (*Sonderschule*). Provincial schools in Austria are often addressed as "state schools", as the German term *Land* means state. However, to avoid confusion with the word "state" and "state-funded schools" in other OECD countries, the term "provincial schools" is used in this country note.

[2] Technically, the funds for school construction and maintenance come from the federal government, too. However, it is local governments that make specific decisions about using the funds for such purposes.

[3] https://www.digitalaustria.gv.at/

[4] https://www.bmbwf.gv.at/en/Topics/school/krp/8_p_p.html. It replaces the former initiative in this field: *Masterplan for Digitalisation of Education* (*Masterplan für die Digitalisierung im Bildungswesen*), which could not be fully implemented due to the pandemic.

[5] In Austria, 5th grade is the first year in lower secondary education. In the first year of the plan (2021/22), 6th grade students were also entitled to receive a digital device; however, only 5th grade students benefit from the initiative since the second year. For students at the upper secondary level, there is currently no provision of digital device, and they are asked to bring their own device.

[6] https://www.pods.gv.at/willkommen/

[7] The federal government offers funding opportunity for fibre connectivity, which school owners must apply for. It does not fund build-out or ongoing operations. The Federal Ministry of Finance is responsible for this funding, and BMBWF offers a guide for building an IT environment in schools. See below links for further details:

[8] https://www.bitmedia.at/sokrates-schulverwaltung/

[9] https://www.eduvidual.at/; https://lms.at/

[10] https://www.km.at/

[11] https://webuntis.com/

[12] https://digitaleberufe.at/

[13] While anybody can access Virtuelle PH contents, only teachers and teacher trainees may obtain certification.

[14] https://eduthek.at/. Sometimes agreements are established between learning resource providers and the BMBWF, such as when the entire content repository of resource providers have been integrated in the Eduthek.

[15] https://bmbwf.gv.at/Themen/schule/schulpraxis/prinz/medienbildung/mb_schuelerradio.html

[16] *EduTube*: https://edutube.at/

[17] https://www.digifolio.at/

[18] Digi4School: https://digi4school.at/; Textbook Initiative: https://www.schulbuchaktion.at/

[19]https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10009918.

[20] https://www.qms.at/100schulen/100schulen-1000chancen

[21] https://weiterlernen.at/

[22] Examples of the guidelines and professional learning opportunities: Recommendations for the use of digital technology in schools (https://www.bmbwf.gv.at/Themen/schule/zrp/dibi/itinf/ndts.html) and MiniMOOCs (massive open online courses) for digitally supported teaching (https://www.virtuelle-ph.at/minimooc/).

[23] https://www.guetesiegel-lernapps.at/

[24] https://www.guetesiegel-lernapps.at/

[25] For legal requirements regarding the use of the commercial software, see the below section on the governance of data and digital technologies in education.

[26] Künstliche Intelligenz – Chance für Österreichs Schulen (bmbwf.gv.at)

[27] The digital competence classifies six fields are: foundations, access and digital understanding; information and data literacy; communication, interaction and collaboration; digital content creation, production and publication; safety and sustainable use of resources; problem solving, innovation and continuous learning. For a more comprehensive account of *DigComp AT*, see https://www.bmdw.gv.at/dam/jcr:54bbe103-7164-494e-bb30-cd152d9e9b33/DigComp2.2_V33-barrierefrei, which addresses the previous version (2.2 AT).

[28] https://digikomp.at/

[29] *Digi.kompP* is coordinated by *the University College of Virtual Teacher Education*. The model covers teachers' digital competence training from before entry into initial teacher education, and continues until the end of the fifth year of the profession. The ones for students are coordinated by the eEducation network.

[30] https://www.virtuelle-ph.at/digikomp/

[31] https://digicheck.at/

[32] https://eeducation.at/en/; https://oe1.orf.at/schule

[33] https://www.bmbwf.gv.at/Themen/schule/zrp/dibi/dgb/dlpl.html

[34] There is no general use of digital devices in official exams yet, though various pilot projects are ongoing.

[35] Datenschutzgesetz, DSG, available at https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=bundesnormen&Gesetzesnummer=10001597

[36] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011451

[37] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011647

[38] The type of this device management system differs according to the device used (e.g. iOS, Windows, Chromebook).

[39] See the following link for the detailed account (in German) of the General conditions for the use of private Cloud service provider in IT-supported teaching: https://www.bmbwf.gv.at/dam/jcr:609b6a2a-ce4d-455f-906e-dac14452461b/clouddienste_rahmenbedingungen.pdf

[40] This follows the *Schrems II Judgment* made in July 2020 by the Court of Justice of the European Union (CJEU). See: https://www.europarl.europa.eu/RegData/etudes/ATAG/2020/652073/EPRS_ATA(2020)652073_EN.pdf

[41] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10009514

[42] The Act also defines who qualifies as a research institution or researcher, and delineates the conditions for accessing the data. For instance, data must be anonymised and no personal data can be disclosed. A researcher can access and process the data only within a designated premise and cannot "take away" the data.

[43] https://www.bmf.gv.at/dam/jcr:c1312d0a-6209-4e92-8631-aea93130e392/2021-AIM_AT_2030_UA-bf.pdf; https://www.bmf.gv.at/dam/jcr:26d2ade5-6768-4e00-9cb0-dc99b560353c/2021-AIM_AT_2030_Annex_UA-bf.pdf

[44] *Mobile Learning* project: https://www.bmbwf.gv.at/Themen/schule/zrp/dibi/inipro/mobilelearning.html. The Ministry for Transport, Innovation and Technology has now been renamed as the Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology.

[45] https://digitaleslernen.oead.at/de/

[46] https://innovationsstiftung-bildung.at/de/

2 Brazil

This note provides an overview of Brazil's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Brazil supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Brazil engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Education in Brazil is governed by multiple stakeholders, from the federal to local level working in cooperative and complementary fashion, which is reflected in the provision of digital education resources and systems.
- Broad implementation and adoption of digital tools and resources are limited by the existing digital divide in Brazil, although dedicated programmes exist to breach it and notable implementations exist at sub-national levels.
- Digital literacy and competences are present and highlighted in Brazil's national curriculum and in its guidelines for teacher initial and ongoing training.

General policy context

Division of responsibility

In Brazil, public responsibility for providing education is distributed throughout its federal government, local governments at each of its 27 federative units (which will hereafter be referred to as "states" for brevity), and of its 5 569 municipalities in a model in which the federal government historically enacts top-down policy.[1]

Decentralised responsibilities notwithstanding, legislation assigns direct responsibility over a given level of education to each level of government.[2] Municipalities are primarily responsible for early childhood education and care (ECEC), primary, and lower secondary education – although the responsibility for lower secondary is sometimes shared with state authorities. States are mostly responsible for the provision of upper secondary education, while the responsibilities for vocational education and training (VET) are shared with the federal government and other stakeholders (such as the national industry confederation).[3] Finally, the federal government, mostly through the Brazilian Ministry of Education (MEC), is responsible for VET and higher education.

Responsibility for the provision of digital tools and resources for system management and for institutional management tends to reflect this governance model, with municipalities, states, and the federal government overseeing the provision of digital tools to institutions under their remit. Conversely, the provision of digital resources for teaching and learning is more nuanced. The federal government provides digital resources for VET education directly, whereas they provide such resources rather indirectly for all public primary and secondary educational institutions – by funding a purchase programme (PNLD) that provide learning materials for free, and by maintaining digital platforms (such as *Plataforma Integrada*, discussed below) containing a wide variety of curriculum aligned digital educational resources. In particular, PNLD- funded learning materials are foreseen to include digital materials as of ifs 2023 edition.[4]

Legislation regarding digital education, access to digital infrastructure, and assessment of student digital competences has recently been passed into law, while the competences on the use of digital technologies and computational thinking are contained in Brazil's national core curriculum (BNCC).[5] [6] In addition, Brazil has comprehensive data and privacy protection and openness laws, and associated control mechanisms.[7] Although these laws are federal-level initiatives, responsibility for the actual implementation of curriculum and policies remains decentralised. This reflects on the provision of digital tools, notably at schools for which states and municipalities have full autonomy to choose and procure the tools within their regulatory contexts at the local level. As of 2023; this decentralised policy implementation raises some challenges of interoperability and data portability.

Digital education strategy

Digitalisation and digital education are central policy topics in Brazil, and therefore efforts to draft a comprehensive digital public education strategy are currently underway. Nonetheless, important policies are already in place. As mentioned above, a national digital education policy (PNED) has recently been passed into law, prompting the federal and local governments to deploy a wide set of digital inclusion initiatives, foster digital education at schools for students and teachers, and foster research and development towards inclusive and accessible ICT although its impact at schools is yet to be determined. This policy complements existing legislation (PIEC) currently supporting connectivity at schools.[8]

In addition, this upcoming dedicated education strategy will be aligned with a broader, government-wide digital transformation strategy for 2022-2026 that has already been adopted and where education and training for digital competences figure as one of its axes.[9] Notably, this wider strategy aims to improve connectivity in public schools, incorporate digital technology into teaching and learning, and foster the development of digital competences, both at initial and in-service teacher training. In addition, implementation and evaluation plans are to accompany Brazil's digital education strategy as recommended by its Audit Courts.

Ahead of the development of Brazil's digital education strategy, initiatives were already underway to provide public primary and secondary institutions a physical digital infrastructure and digital education resources, such as the *Educação Conectada* (Connected education) innovation programme later converted into national policy. In tandem with partners at different government levels, this programme aims to enhance connectivity in schools via the provision of broadband, Wi-Fi or mobile Internet, purchasing digital equipment for students such as tablets and computers, as well as school IT infrastructure such as internet routers and servers.[10] The programme seems to have enjoyed some adoption within the Brazilian education system, with around 71 000 institutions listed on its website as beneficiary. It thereby prompted broader policy developments, notably an inspired piece of legislation that passed into law in 2021, focusing this initiative on schools located in areas of lower socio-economic status as well as other vulnerable areas (such as schools in rural settings).[11] In addition, there is also a policy interest in improving accessibility and thus supporting students with special educational needs (SEN), notably through digital resources compliant with accessibility standards. This aim is made particularly evident in the PNLD textbook programme mentioned above.

The public digital education infrastructure

The public provision of digital platforms for education management and information systems in primary and secondary education reflects the decentralised division of responsibilities in Brazil, with administrative student information, facility and financial management systems being provided by the municipal, state-level, or federal authorities in charge of managing the respective network of institutions. The same design applies to support platforms for local system-level assessments, as those are also organised, procured, and maintained by the relevant stakeholder for a given network of schools, notwithstanding the fact that the national systemic assessments themselves are organised by the federal government (for example the SAEB national assessment discussed in detail below).

On the other hand, the federal government plays a more central role in the provision of digital resources for teaching and learning. The Ministry of Education, either through its secretaries or executive agencies such as the national fund for the development of education (FNDE), provides digital resources to most public primary and secondary institutions and sets up digital content hubs and open educational resources platforms.[12]

Digital ecosystem for system and school management

Student information system and learning management system

The use of system management tools is fragmented in Brazil, reflecting which stakeholder has the responsibility for the institution following the primary administrative responsibility for the school system.

At the federal level, MEC maintains a comprehensive integrated platform for budget and programme participation management (*Sistema Integrado de Monitoramento, Execução e Controle* – SIMEC) and provides the *Sistema Nacional de Informações da Educação Profissional e Tecnológica* (SISTEC), a student information system to all VET educational institutions in Brazil. Data entry into this management system is mandatory for all VET institutions, as a central register allowing all issued professional certifications to be valid countrywide. Additionally, government-provided institutional management tools are also being piloted in primary and secondary public schools to support the management of resources coming from the federal government, as well as functionalities for diagnostics and needs assessment at the school level that could be improved by dedicated PDDE funds.[13]

States then provide access to management systems for institutions under their responsibilities, meaning the provision of these systems and available features might vary significantly from a state to another. There is no central student information system (or student register) and it is unclear whether most states maintain one for students under their educational responsibility. Nonetheless, several states provide rather comprehensive education management and information systems, such as those made available by the states of Ceará and Paraná. Through the SIGESCOLA platform, students at Ceará can submit and receive assignments from teachers, check their attendance online, and consult their classroom assessment online, while other stakeholders such as teachers and school principals also have access to restricted areas suited for their own use. The state secretary of Paraná maintains a learning management platform available to all state and municipality-run public schools that centralises information on student trajectories through the education system (e.g., student transcripts, certifications), on attendance and performance on classroom assessments, and supports the offer and enrolment into extracurricular activities. It also supports a platform with restricted areas for students, teachers and school principals, and provides a mobile app where students or parents can check report cards, class schedule, and attendance through digitalisation of classroom records aided by facial recognition technology. The integrated system also allows for the state secretariat to gather data on student attendance and performance and thus ascertain preferred institutions or regions for targeted interventions, and posterior impacts of implemented policy.

In addition to these examples of central learning management systems, there are multiple other ones used across Brazil. Open source platforms (such as Moodle) enjoy some popularity in VET and higher education, boosted by the significant disruptions caused by the COVID-19 pandemic and related need for digital platforms that allow for distance learning. States also provide learning management system (LMS) to schools under their responsibility or in some cases, to schools under the Municipalities that feed into the system managed by states. This provision is rather varied and reliant on partnerships in place at the federal, state or municipality level – for instance on the provision of access to the Google Education suite to all public schools, either municipality or state-run in Paraná during the pandemic. Notable examples such as the Espírito Santo state in South-eastern Brazil and the above-mentioned state of Paraná in the South.

Admission and guidance system

Access to education, free choice of educational institution, and the government's obligation to provide it are enshrined in the Brazilian Constitution and specified in further legislation. However, schools and sub-national education systems are afforded a large degree of autonomy regarding student admission to primary or secondary institutions. Notably, VET institutions at upper secondary level, educational institutions under the responsibility of the federal Ministry of Defence or universities, and private schools

all administer competitive admission processes, while state or municipality-administered public schools tend to admit students based on space availability and curriculum compatibility.[14] This variability is reflected in the digital tools and resources employed in these different types of schools.

Local approaches for primary or secondary education notwithstanding, the federal government sets up and maintains a unified selective admission system for upper secondary or VET students pursuing higher education (*SISU – Sistema de Seleção Unificada*, available at https://sisualuno.mec.gov.br). This is possibly the most widely used student admission platform in Brazil, being the primary means of admission to a significant majority of the country's public higher education institutions. Students can list their preferred degrees, universities and institutions on this online platform, as well as other selection variables (such as eligibility to affirmative action initiatives), and they are then selected based on their performance in the national university entrance exam (*Exame Nacional do Ensino Médio*, ENEM) and on those other factors. The SISU platform is made available for admissions twice a year, reflecting academic semesters in Brazil, and students are invited to select and adapt their choices based on dynamically calculated student rankings and threshold grades for admission before the deadline by when they are matched with universities with available openings.

Platforms for career guidance are available but not centrally or universally provided in Brazil. Digital tools and resources for career guidance exist and are available to students enrolled in private education, but publicly funded initiatives exist only regarding guidance through VET careers, notably through a self-assessment made available through a mobile app. As the enrolment in VET institutions remains low (by 2018, only 11% of upper secondary students were enrolled in VET, against the OECD average of 42% and Brazil's own policy goal of 25% by 2024), steering students into VET careers remains a strategic policy goal for Brazil under its national education plan (PNE) for the 2014-2024 period.[15]

The lack of generalised guidance for students in public schools contrasts with the stakes that students face when applying for higher education. Students receive little guidance about which diploma to pursue in higher education, but the choice they make is strategic as it affects the required entry grades and the higher education institutions they are eligible to.

Exams and assessments system

The basic education assessment system (*Sistema de Avaliação da Educação Básica*, SAEB) is a national standardised assessment in literacy and mathematics, sat by students enrolled in primary and secondary educational institutions at grades 5, 9 and 12 every three years. Results from the SAEB are used for system and school-level diagnostic, notably through the basic education development index (*Índice de Desenvolvimento da Educação Básica*, IDEB), as well as for analyses of the education system. States and some municipalities also conduct their own system-level assessments, often at the same grades as SAEB.[16]

The SAEB and other system-level assessments are conducted in paper and pencil format. Logistic constraints and insufficient infrastructure pose significant challenges to systemic transition to digital assessments for national or local assessments. Nevertheless, there are some digital platforms that are employed for the SAEB-related supporting tasks, for example for authoring and maintaining assessment item banks, for grading essay and open-ended questions, and for implementing administrative tasks related to the financial and logistical aspects of assessments. Some of those platforms are developed and maintained by the federal or local governments (for example the assessment item banks), whereas others, such as the platforms for assessment staff management (e.g., managing hiring, allocation and payment of test administrators, coders, and school coordinators), are procured from private contractors for use at the assessment.[17] In addition to the operational aspects, a platform (*Painel Educational*) to divulge aggregated results to local stakeholders and report assessment results from the national to the school level is also maintained by the federal government. States have also leveraged digital tools to obtain more timely results

in diagnostic assessments, with notable examples leveraging mobile applications for assessment data processing, and artificial intelligence (AI) to grade essays.[18]

Other digital tools and resources

There is an explicit focus in Brazilian education policy in minimising school drop-out and tracking and supporting individual students to meet the national plan policy goals, and similar more or less advanced digital tools tracking students' attendance are present throughout all States, with some notable implementations such as the classroom journal (*Diário de Classe*) platform in São Paulo state, and a tracking system connected to SMS messages to parents' mobile phones implemented in the state of Goiás using principles of behavioural economics. [19] There are a few platforms provided by the federal government and other stakeholders to support educational institutions with varying degrees of objectives, adoption, use of artificial intelligence technology, and data visualisation for generating actionable insights.[20] [21] [22] [23]

Digital ecosystem for teaching and learning

The federal government plays a central role in providing teaching and learning resources to schools in Brazil, and recent digitalisation initiatives are bound to foster a more vibrant digital ecosystem of teaching and learning resources. MEC has developed an array of open and closed platforms with educational resources for teachers and students in primary and secondary education.

The national textbook programme (PNLD) consists of a textbook and educational material purchase programme operationalised by the national education development fund (FNDE) under MEC. Publishers submit a portfolio of textbooks under strict specifications (e.g., format, accessibility, compatibility with curricula) as part of their bid to be selected to figure in a list of resources – which will remain freely available for primary and secondary institutions for the following four years. As of its 2023 edition, publishers must make textbooks and teacher handbooks available also in digital format and are also incentivised to provide interactive project-based learning materials, which are bound to increase the availability of static and dynamic digital learning resources to educational institutions in primary and early grades in lower secondary education. Similar improvements could be expected for the rest of secondary education in the subsequent phases of the programme. Accessibility is also a core requisite for all PNLD-eligible digital materials, and all offered digital resources must be accessible to students with special educational needs.

In addition to textbooks, MEC also maintains or supports an array of open education resources (OER) platforms for students and teachers, coherent with policies to provide ongoing professional development for the latter. Notably, MEC has set up an integrated OER platform (Plataforma Integrada MEC RED*)* of digital resources for students, teachers, and school principals with more than 320 000 available resources produced by a wide range of stakeholders, such as universities, research institutes, non-government organisations (NGO), among others. This repository is complemented by learning platforms (as those listed in the AVAMEC platform: TG212 - AVAMEC) offering massive open online courses (MOOCs), particularly aimed at teachers and school staff in topics such as classroom and school management, conflict resolution, and use of digital educational resources in the classroom. A dedicated platform for VET teachers and staff (PlatforEDU*)* is also maintained by MEC, listing available online courses for continued professional development provided by VET institutions and universities countrywide.

In addition to open resources, students can also benefit from a wide range of MOOCs produced by VET educational institutions, upon registration and issuing certifications that could be used for professional development or career progression at the *Aprenda mais* ("Learn more") platform (Aprenda Mais (mec.gov.br). Beyond learning opportunities with open resources, teachers can also self-assess their digital competences, using online tools and resources developed by civil society actors in technical co-operation with stakeholders at the federal and state-level governments.[24] Literacy, especially at early age, is also a policy focus in Brazil. This is reflected in the provision of directed digital materials for teaching and learning. MEC maintains an online platform with resources for teachers has supported the translation

and adaptation of educational apps for literacy education, and produced digital materials to support parents and foster literacy at home.[25]

Brazil also has an established environment of educational TV channels and TV-based remote training.[26] Notably, a federal ministry-supported TV channel (*TV Escola*) provides a digital resources platform for educational institutions aiming to prepare their students to the national higher education admission exams, upon request from institution maintainers.[27]

The federal government also acts as a partnership broker between private sector actors and the public education system, establishing partnerships providing digital resources to schools (such as the Microsoft Office software suite, or Google's workspace for education resources), or ICT-focused digital content for students and teachers (such as the content produced in collaboration with Huawei or Oracle). These resources are made available at a central hub maintained by MEC in a model that is also present at state-level.[28] [29] Nonetheless, the global pandemic also amplified the creation and dissemination of digital educational materials produced by educational technology (EdTech) companies, philanthropic foundations and other civil society actors that were aggregated and distributed to educational institutions through platforms created and maintained by MEC.

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

Ensuring access and supporting use

Equity of access

Students with special education needs and those enrolled at schools in disadvantaged socio-economic areas, such as remote and rural areas, are commonly targeted by policy in Brazil. As governance and responsibility for education are distributed, the federal government uses the funding of education as a policy lever through its wide-reaching national redistribution fund (FUNDEB). This broader focus notwithstanding, however, neither Brazil's digital policy 2023 law nor its foreseen digital strategy have explicit target groups for digital education or digital inclusion, albeit support for socially disadvantaged and initiatives aimed at SEN students are included. Initiatives, such as the above-mentioned *Educação Conectada* national policy, are open to all interested schools.

One motivation for such a broad policy might be the degree of inequality with respect to digital infrastructure in Brazilian schools. Internet connectivity can provide a reasonable first indicator, as reliable access is needed to fully leverage digital educational resources. Data from 2020 shows that, even though 82% of Brazilian primary and secondary educations have access to the Internet, this provision is very unequal: 77% and 51% of schools located in the historically socio-economically disadvantaged North and Northeast states reported the same.[30] Recent initiatives, organised by MEC in partnership with the World Bank, aim to focus on those states, with particular focus on teacher training for digital competences and infrastructure.[31]

Programmes dedicated to infrastructure are also underway to bridge the quality connectivity gap in the Brazilian North and Northeast.[32] Both regions are the target of a joint venture led by a network of institutions interested in implementing secure and high-quality Internet connections in municipalities within the regions, with schools directly benefitting. Implementation of the programme is supported by a wide range of actors, including government actors from the executive (ministries of Education, Defence, Health, and Communications) and judiciary branches (national justice council – CNJ) for the North, and a state-run energy company (the São Francisco Hydroelectric Company) for the Northeast.

Supporting the use of digital tools

The federal government supports the use of digital educational tools at all education levels in various ways. This may manifest through its central role in funding education, direct provision of digital tools, directed support programmes, or supporting monitoring and assessment of their implementation. As schools and sub-national entities enjoy some autonomy regarding their choice of digital educational resources, procurement for digital technologies and learning resources for institutions may be in rare occasions directly performed by the federal government, while more commonly procured by states or municipalities or other stakeholders maintaining school networks.

The federal government does not provide earmarked subsidies for the provision of digital tools and access to platforms, but state and municipality school systems, and sometimes institutions themselves, enjoy a large degree of autonomy to employ non-earmarked funds to support digital education. There are nonetheless earmarked funds available for the provision of Internet connectivity and ICT equipment within programmes aiming to bridge Brazil's existing digital divide, such as the above-mentioned *Educação Conectada* programme. In addition, the federal government also provides an approved selection of digital textbooks through its PNLD programme, which, given its size, affords the federal government significant leverage when negotiating prices with suppliers. The scale of the Brazilian education system also allows the federal, state or particularly large municipal governments to negotiate system-wide conditions with companies for the use of digital tools at schools, as observed in agreements with Microsoft for the use of its Office 365 educational suite, and with Google for the provision of its Google Workspace for Education tools to public schools.

In addition to the efforts aimed at all states, the federal government provides guidance on procurement processes conducted at the sub-national levels by states, municipalities or privately run institutions willing to procure tools with their own discretionary funds.

Cultivating the digital literacy of education stakeholders

Digital literacy and the development of student digital competences are central policy goals in Brazil, figuring extensively in its national curriculum for primary and secondary education (BNCC). In this new curriculum, digital competences are outlined as three of its ten general competences, and mentioned in all domain-specific competences, adding up to approximately 10% of the curriculum.[33] Furthermore, guidelines on developing a dedicated digital competences curriculum for basic education in alignment with the BNCC have been released in 2022 as a complement to the broader curriculum, complementing additions made by state and municipality school systems to their curricula.

Accordingly, the development of teachers' digital competences is also present in policy for initial teacher education and for their continued professional development. Guidelines to this endeavour are provided by the federal government through the national teacher training curriculum (*BNC – Formação*) that has been prepared in alignment with the BNCC lists of digital competences, albeit in broad terms. In line with the variety of responsibilities for maintaining schools, teacher training may also be provided by the stakeholder responsible for their employment, each providing varying degrees of continued development aimed at enhancing teachers' digital competences.[34]

Even though there is no direct dissemination from the federal government to students or parents about information regarding the use of student data and digital technology at schools, the federal government, either directly or through agencies, opens consultations on diverse topics. This interface with the broader public is made through a platform maintained by the federal government (*Participa + Brasil*), for which there are filters for education topics. Digital technology and data use in education are sometimes put for discussion through this channel.[35]

Governance of data and digital technology in education

Data privacy and data protection are regulated in Brazil through comprehensive legislation framed in its personal data protection general law (LGPD).[36] The LGPD presents several similarities to the European Union's General Data Protection Regulations (GDPR), although there are some differences in terms of protections and data rights of minors (including most primary and secondary students), as well as the dissemination of educational data. This is due to a stricter standard imposed in the LGPD regarding the classification of personal data.

Implementation of the LGPD is overseen by ANPD (*Autoridade Nacional de Proteção de Dados*), Brazil's data commissioner, and by relevant stakeholders such as the national comptroller general (*Controladoria Geral da União*, CGU). However, responsibility for accountability and exercise of data rights remains with data-collecting institutions themselves, meaning that for education, the relevant authority – federal, state, or municipality governments for public schools – are to inform students and parents about which data is collected and how to exercise their data rights, with notable examples in compliance and clarity among states.[37] [38]

Data portability and interoperability of education data was not a reality in Brazil as of December 2023, but initiatives for countrywide student identification were underway. Although platforms for interoperable data exchange among educational institutions have been proposed, said initiatives seem to lack traction among institutions and buy-in among lawmakers.[39]

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

Although data collection and management are distributed across multiple stakeholders, Brazil has a culture of disseminating and leveraging education data to inform developments in digital education. In addition to acting as a broker for strategic partnerships with the private sector, MEC, other Ministries, and federal government agencies play a role of fostering an innovation environment where education technology (EdTech) companies can flourish.

The National Institute of Educational Studies and Research Anísio Teixeira (INEP) is a federal agency under MEC that oversees national assessments, produces education statistics and indicators, and is in charge of the yearly school census. INEP plays a central role in the education data ecosystem in Brazil, and regularly divulges documented microdata for the school census it coordinates, in addition to the national assessments it manages. Its compliance with the LGPD is still underway. In addition, INEP and other data processing stakeholders within the government also divulge open data plans, mapping which data is available and means to access it.[40]

This wealth of educational data creates an ecosystem that can be leveraged by EdTech start-ups, for which there is a vibrant market in Brazil. Broadly within the start-up sector, the OECD Going Digital Toolkit indicates that nationally, 27% of all business in Brazil were information start-up firms by 2020, above the OECD average of 24.4%.[41] Within the EdTech sector, a survey from 2022 also shows a significant growth in the sector, with 813 active EdTech companies against 566 in 2022.[42] In addition to its role in brokering partnerships with the private sector, the federal government also fosters the start-up environment, albeit in a broader, cross-sectoral manner through incentive programmes.[43] As implementation of and compliance with the LGPD continue to affect educational institutions throughout Brazil, data governance, portability and interoperability are bound to remain policy priorities. The development, provision, and dissemination of student information and education management systems, possibly leveraging successful cases such as the SISTEC information system for VET education might be a promising direction. Similarly, continued engagement with sub-national stakeholders, especially with the states and municipalities, has the potential to boost overall adoption and result in standards for portability and interoperability that can foster the Brazilian digital education environment.

Notes

[1] Brazil has 27 federative units, consisting of its 26 states and a federal district where its capital, Brasilia, is located. These units are referred throughout this note to as “states”.

[2] Notably, Law No. 9 394 from December 20, 1996 (*Lei de Diretrizes e Bases da Educação Nacional* - LDB, accessible at https://www.planalto.gov.br/ccivil_03/leis/l9394.htm, in Portuguese)

[3] The national industry confederation – *Confederação Nacional da Industria* (CNI) is the maintainer of the “*Sistema S*” of educational institutions offering VET education at all education levels

[4] From the Portuguese acronym for *Programa Nacional do Livro e Material Didático*,

[5] Law No. 14 533 from 11 January 2023 – *Política Nacional de Educação Digital*, (PNED) national digital education policy in free translation, available at https://www.planalto.gov.br/ccivil_03/_Ato2023-2026/2023/Lei/L14533.htm

[6] From the Portuguese acronym to *Base Nacional Comum Curricular*

[7] Law No. 13 709 from 14 August 2018 – *Lei Geral de Proteção de Dados Pessoais* (LGPD, available at L13709 (planalto.gov.br), in Portuguese) and Decree No. 8 777 from 11 May 2016 – *Política de Dados Abertos do Poder Executivo Federal* (available at Decreto nº 8777 (planalto.gov.br), in Portuguese).

[8] Law No 14 180 from 1 July 2021 – *Politica de inovação Educação Conectada* (PIEC), available at https://www.in.gov.br/en/web/dou/-/lei-n-14.180-de-1-de-julho-de-2021-329472130

[9] Axis D of the Brazilian digital transformation strategy (*Estratégia de Transformação Digital,* available at https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/estrategia-digital-eixoD in Portuguese)

[10] From the Portuguese acronym for *Programa de Inovação Educação Conectada*, available at http://educacaoconectada.mec.gov.br/#ancora,

[11] Law 14 180 from 1 July 2021*, Politica de Inovação Educação Conectada*, available at LEI Nº 14.180, DE 1º DE JULHO DE 2021.

[12] From the Portuguese acronym for *Fundo Nacional de Desenvolvimento da Educação* – FNDE.

[13] Namely, the *PDDE Interativo* platform was developed jointly by the Ministry of Education and State secretaries, and is accessible to local stakeholders and school principals registered in the national school census to manage funds from the PDDE programme.

[14] Although the BNCC outlines a curriculum for basic education, significant regional variations exist, especially in VET education, meaning that some assessment of whether prospective students can adapt to ongoing instruction still exists.

[15] From the Portuguese acronym for *Plano Nacional de Educação*, Brazil’s national education policy plan and goals for the 2014-2024 period. Notably, its goal no.10 (*Meta 10*) pertains to enrolment in VET.

[16] More detail can be found in OECD Policy Perspectives No 34 – National Assessment Reform: Core considerations for Brazil, available at https://www.oecd.org/fr/bresil/national-assessment-reform-333a6e20-en.htm.

[17] Banco National de Itens, - BNI, available at https://www.gov.br/inep/pt-br/areas-de-atuacao/avaliacao-e-exames-educacionais/bni

[18] Both notable examples from the state of Paraná: the *Prova Paraná* diagnostic assessment digitalizes response cards to expedite data processing through a mobile app, and the *Redação Paraná* tool uses AI to grade grammatical aspects of the Portuguese language while leaving the content for teachers to grade.

[19] The Diário de Classe platform is available at https://decentro.educacao.sp.gov.br/aplicativo-diario-de-classe-sp and detail on the SMS "nudge" system can be found at https://site.educacao.go.gov.br/pesquisa-internacional-sobre-envio-de-sms/

[20] The SISSA (*Sistema Integrado de Suporte ao Sucesso Acadêmico*)platform, available at https://sissa.ufg.br/,.

[21] *Busca Ativa Escolar* (available at Busca Ativa Escolar Página inicial) is a student tracking initiative to guide social service interventions developed by UNICEF in partnership with Municipalities.

[22] Sistema de Alerta Preventivo (SAP) has been developed as part of the *Brasil na Escola* programme.

[23] *Sistema Presença* (available at https://presenca.mec.gov.br/seb/) is an attendance monitoring system maintained by MEC to track school drop-out a metric connected toparticipation in cash transfer programmes.

[24] Notably, through the self-assessment tool developed by the Brazilian education innovation centre (CIEB – *Centro de Inovação para a Educaçao Brasileira*), available at https://guiaedutec.com.br/educador and accessible to teachers upon registration.

[25] Outputs from axis no. 2 of the *Tempo de Aprender* literacy programme. Available at https://alfabetizacao.mec.gov.br/tempo-de-aprender, in Portuguese.

[26] Inclusing MEC-supported channels such as TV Brasil (available at https://tvbrasil.ebc.com.br/tags/canal-educacao) to channels such as *TV Escola* (available at https://tvescola.org.br) providing content for teachers.

[27] Through the *Hora do ENEM* platform, available at https://www.horadoenem.org.br/#, in Portuguese.

[28] The *MECPlace* platform (MECPlace – Ecossistema de Inovação e Soluções Educationais Digitais, available at https://www.gov.br/mec/pt-br/mecplace, in Portuguese).

[29] Such as the state of Paraná, which established partnerships directly with Google, Microsoft and EdTech such as Khan Academy, available to students enrolled in state-run schools and aggregated at a resources portal (available at Plataformas Educacionais | Escola Digital - Professor).

[30] From the *Pesquisa TIC Educação 2021*, survey available at Cetic.br - TIC Educação in Portuguese.

[31] Through the Educa Mais Norte e Nordeste programme, available at Programa Educa Mais Norte e Nordestein Portuguese.

[32] The *Norte Connectado* and *Nordeste Conectado* programmes, respectively.

[33] From the Portuguese acronym for Base Nacional Comum Curricular, available at http://basenacionalcomum.mec.gov.br/, in Portuguese. A detailed study has been performed by CIEB and can be found at https://cieb.net.br/wp-content/uploads/2018/10/BNCC-e-cultura-digital.pdf, in Portuguese.

[34] With notable examples such as the state of Ceará in the Brazilian Northeast or Paraná in the South that provide in-service teacher training in digital competences.

[35] Available at https://www.gov.br/participamaisbrasil/ministerio-da-educacao for Ministry of Education consultations, and https://www.gov.br/participamaisbrasil/ for the government at large.

[36] From the Portuguese acronym for *Lei Geral de Proteção de Dados Pessoais*, referring to Law No. 13 709 from 14 August 2018, available at https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/lei/l13709.htm, in Portuguese.

[37] The education secretary of Espírito Santo state in Southwestern Brazil, which provides data rights, relevant national and local legislation, means to access educational data, and details of its data protection officer at its website.

[38] The state of Paraná informs students and guardians of their data rights at enrolment and assures compliance with data protection regulation by keeping all collected data within the state borders by working in tandem with the state-run technology and IT company CELEPAR and adopting stringent privacy measures such as only storing hashed biometrical data used in facial recognition.

[39] Notably, the *ID Estudantil* (https://idestudantil.mec.gov.br/) and *Rede Aprender* (https://www.gov.br/mec/pt-br/rede-aprender) programmes, respectively.

[40] For example, INEP's open data plan can be accessed at https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos, in Portuguese.

[41] From the OECD Going Digital Toolkit, available at Start-up firms (up to 2 years old) in information industries as a share of all businesses | Innovation Indicators (oecd.org)

[42] From the EdTech mapping available at Mapeamento EdTechs 2022 (abstartups.com.br) in Portuguese.

[43] Such as the FINEP Start-up programme (http://www.finep.gov.br/apoio-e-financiamento-externa/programas-e-linhas/finep-startup), supported by the Ministry of Science and Technology, or the Booster SEPRO Ventures programme (http://booster.ventures.serpro.gov.br) maintained by SEPRO, an entity under the Ministry of Economy.

3 Canada

This note provides an overview of Canada's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Canada supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Canada engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Canada, the provinces and territories have exclusive jurisdiction over education. Provinces and territories provide school districts with digital tools for system and institutional management, and, albeit to a lesser extent, with digital resources for teaching and learning. School districts and schools staff receive guidance and professional training on the use of those tools and resources, but they can acquire and use those from other providers through their own procurement decisions.
- Provinces and territories follow their own digital education strategies and set up their own rules and guidelines as regards the governance of data and digital technology in education. Provinces and territories take action to cultivate students and teaching staffs' digital literacy, incentivise the use of digital tools in schools, and implement policy mechanisms to support equity of access and use of digital technology, interoperability, or research and development.

General policy context

Division of responsibility

In Canada, responsibility for education at all levels is vested in provinces and territories, and each province and territory has developed its own system of education. These different systems of education reflect the unique contexts of their provinces or territories, thereby allowing them to respond to their specific needs, most notably to their historical and cultural realities. While mechanisms to ensure co-ordination and joint activities across provinces and territories are in place, there is no federal ministry of education or national policy in education.[1]

Provincial and territorial departments and ministries responsible for education define the policy and legislative frameworks to guide management and teaching practices and provide administrative and financial management of their respective education systems. At a more local level, the governance of education lies in the hands of sub-provincial and sub-territorial units, which are called school districts (or school boards). Each school district is responsible for the administration of a group of schools (including the financial aspects), setting school policies, hiring teachers, implementing curriculum, and making decisions about new major expenditures.

Expenditure on public education comes from municipal, provincial, territorial, and private sources. Most public schools receive a per-student amount.[2] Private or independent schools also receive funding from government sources in six provinces or territories provided that they meet certain criteria, such as following the provincial or territorial curriculum and employing provincially or territorially certified teachers.[3]

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follow this division of responsibility. Across Canada, the provincial and territorial governments would typically be responsible for providing digital tools for system and institutional management, supported by school districts, while the responsibility for providing digital resources for teaching and learning would be delegated to school districts mainly, occasionally supported by their provincial or territorial governments.

Digital education strategy

As provincial and territorial governments hold exclusive responsibility over education, there is no digital education strategy at the national level. Provinces and territories have developed their own strategies. The province of Québec, for instance, released a comprehensive Digital Action Plan for Education and Higher Education in 2018 to support the development of digital literacy, enhance teaching and learning practices with digital technologies, and create an environment conductive to the development of digital technologies

in the education system.[4] At the pan-Canadian level, provinces and territories do come together to share best practices and learn from one another's digital strategies, policies and initiatives; this forum is coordinated through the Council of Ministers of Education, Canada (CMEC).

The COVID-19 crisis has sped up both the implementation and uptake of the measures initiated by the digital education strategies across the country. Since 2020, most provinces and territories have significantly increased their expenditures on schools' broadband connection or digital devices (in schools as well as for students directly, sometimes on a one-to-one basis). For example, Newfoundland and Labrador invested CAD 20 million (USD 14.8 million) for the purchase of laptops for all teachers, and *Chromebooks* for all junior and high school students across their primary through secondary education system. Some of the provinces and territories have also invested public funding to improve Wi-Fi connection and Intranet servers in schools, as well as to provide specific devices for students with special needs.

Beyond education policy, several provinces and territories have instituted regulations to ensure a coherent use of digital technologies across different policy areas. For instance, the "User Acceptable Use Policy" from Saskatchewan outlines policies, standards, and guidelines that should be followed when using the Government of Saskatchewan's digital assets (i.e., computers, software, communication tools, intranet, the Internet, etc.).

The public digital education infrastructure

Across Canada, provinces and territories publicly provide several components of the digital education ecosystems. Schools and teachers can choose to acquire additional elements, either directly from the private sector or from other education stakeholders that release tools and resources for free (e.g., philanthropists, education publishers, universities, teachers, EdTech and other companies). This section reviews two aspects of the public digital infrastructure in education across Canada: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information and learning management system

A student information system typically sits as the cornerstone of a digital infrastructure for education management. In Canada, most provinces and territories have one or more student information systems. They tend to be owned and developed by public authorities – rather than purchased from commercial providers, and sometimes managed at the school district level. Most systems store student data tagged with unique and longitudinal identifiers, which can sometimes be linked with students' teachers (at the district level, not above) or with standardised tests results – as many provinces and territories have their own standardised assessment, administered on a census basis, sometimes digitally as discussed below.

In New Brunswick, for instance, public authorities use a *Student Registration System* that they have developed and operate for primary and secondary education levels. This system allows schools to access analytics dashboard at the school district level. There is no dashboard at the provincial level yet, even though data are transferred to the provincial databases in real time.

In Manitoba, public authorities use their own student information systems (SISs) that are managed by individual school districts themselves. The province does not have a real time access to school district data. Instead, a snapshot of some data is collected on a regular basis and reflected at the provincial level in a system called *Education Information System*.

At the Canada-level, however, CMEC and Statistics Canada do not rely on the provinces' (and territories') student information system(s) to collect data for the Pan-Canadian Education Indicators Programme;

instead, they send questionnaires that all 13 provinces and territories answer in aggregate format, providing no micro data.[5]

Provinces and territories, as well as some school districts, usually provide schools with learning management systems (LMSs) to help them manage their operations and student information at the school level. Contrary to student information systems, learning management systems are typically licenced from commercial providers by provincial and territorial governments and distributed to schools, although generally there is no obligation to use them. Most learning management systems display analytics dashboards and provide learning repositories. They are sometimes interoperable with the student information system used in the province or territory (or the school district), but more rarely with other data management and learning systems used in schools because privacy and data protection rules would prevent it. For the same reason, learning management systems are typically not the solution used by schools to communicate with parents. A separate customer relationship management system fulfils that function, as is the case in New Brunswick where schools use *SchoolConnect*. In Canada, the operational decisions regarding the tools used to communicate with parents are often made at the school or school district level.

In Alberta there are eight vendors providing learning and education management services integrating with the *Provincial Approach to Student Information* (*PASI,* a student information system) - systems such as *PowerSchool*, *SchoolCloud* and *Edsembli*, which are licensed from commercial providers, and managed at the school district level. *PASI* was developed by Alberta Education to enable schools, school authorities, ministries, and authorised organisations in Canada and internationally to effectively share student information in real-time for a seamless transition from school to school. In Alberta, the Provincial Approach to Student Information (PASI) is a province-wide student information system that allows schools, school authorities and the ministry to share student information in real-time. Currently, 97.1% of student enrolments in Alberta are tracked in *PASI* via schools and authorities' learning management systems. The remaining 2.9% are schools who are using *PASI* directly, even though the use of *PASI* is not mandatory.

In New Brunswick, public authorities have procured the license for the Desire 2 Learn's *Brightspace* learning management system and mandated schools to use it. Microsoft's *OneNote* for classrooms is also procured by public authorities and used as a lighter system for learning management. In Manitoba, public authorities have also procured the licence for *Brightspace*, but its use is not mandated for schools, and school districts can provide a different solution instead. In other provinces or territories like the Northwest Territories, the choice of a learning management system entirely rests on school districts.

Admission and guidance

In Canada, neither provinces or territories nor school districts provide student admission management systems. Student admission into primary or secondary institutions is managed by schools themselves, and rarely so via a digital solution. The province of New Brunswick is one of the exceptions, as it provides a government-level system of online pre-registration to public schools, which parents and legal guardians can access through their *Parent Portal*, along with other online services and information about education in the province.[6]

Similarly, only a few provinces or territories provide study and career guidance platforms for students, although more and more provinces and territories are now developing such platforms. Manitoba has developed its own platform, *Manitoba Career Prospects*, to help students navigate the education system and find information about their future career.[7] The platform also provides guidance for educators to help young people in Manitoba explore career options and appropriate study paths in the province.

Some provinces and territories report providing schools with *myBlueprint* as the career and study guidance platform for students. In those schools, students have access to *myBlueprint*'s *Education Planner*. The planner is tailored to students' province or territory of residence and provides them with a comprehensive study and career planning programme from lower to post-secondary education, self-assessment tools to

understand their skills and aspirations, information about eligibility criteria into selective tracks, and province-specific graduation requirements, and more.

Assessment and exams

Across Canada, all 10 provinces, participate in the Pan-Canadian Assessment Program (PCAP) that assesses students in grade 8 (usually 12-13 years old) in reading, mathematics, and sciences. The PCAP is conducted on a sample basis, with only a proportion of students from some schools participating for each province or territory, so that their results are representative at the provincial or territorial level. Most provinces and territories also conduct standardised assessments on a census basis – meaning that all students from a specific cohorts participate in the evaluation. Some regions are working towards the implementation of digital tools to administer their own provincial/territorial student assessments. For example, the province of New Brunswick uses online tools to conduct provincial assessments and evaluations. In Alberta, since 2023, the *provincial achievement tests* (a student evaluation) in grades 6 and 9, as well as portions of the grade 12 exams (a high-stake assessment) administered by the province are accessible on a new digital assessment platform instead of using the traditional paper and pencil approach. Alberta is using a phased-in optional implementation approach to introduce the new platform to administer these provincial assessments.

Other digital tools

Provinces and territories resort to several other digital tools to support system and school management, although to varying degrees across Canada. Typically, smaller (or less populated) provinces or territories tend to provide additional tools at government level more often than larger ones would do, as the latter would delegate this responsibility to school districts.

This is notably the case for administrative function systems. In the Northwest Territories, teachers employed in six out of eight school districts are public sector employees, hence there is a central system managed by the territorial Department of Finance to support human resources management and pay, and budget functions. This is also the case in New Brunswick.

Provinces and territories also provide knowledge management systems, both for the francophone and anglophone communities. In New Brunswick, schools have access to digital textbooks via *OverDrive*, for instance; but in other provinces and territories, this type of content repository is directly integrated to the learning management system used across the school districts.

Digital ecosystem for teaching and learning

Similarly to the digital ecosystem for system and school management, Canadian provinces and territories – rather than the federal government – provide digital resources for teaching and learning, which schools, teachers and students are generally free to use.

Open-access resources

Albeit provided by specific provinces or territories, a share of the digital teaching and learning resources is openly available to anyone in Canada. TV education is an example. Provinces and territories provide video contents for teaching and learning that were typically aired on TV during the COVID-19 school closures and that are now curated online. For instance, Québec has *Télé Québec's Passe Partout*; other, less populated provinces such as Saskatchewan also have their own educational TV programmes. All contents are mapped to provincial or territorial curricula, but any Canadian can access them.

Some provinces and territories also launched educational platforms for distance learning during the COVID-19 crisis. Some of those platforms are at least partially accessible in an open-access mode. For

instance, Québec's *L'École Ouverte* ("Open School") platform opened in March 2020 to enable anyone to access open educational resources (OER).[8] Again, although this bank of resources is explicitly mapped to Québec's curricula from pre-primary to secondary education (including VET), and thus addressed to students studying at those levels, in practice anyone can consult those resources. Users have also access to digital resources for continuous adult learning, as well as pedagogical content to support parents and teachers. In Alberta, students, parents and teachers have access to *New.LearnAlberta.ca*, a bilingual platform that houses Alberta's new curriculum, learning and teaching resources, and other tools and information that support the implementation of curriculum.

Educational platforms and closed-access resources

In parallel to open-access digital resources, most provinces and territories also provide teachers and students formally enrolled in their education system with closed-access resources. For instance, on the same Québec's *L'École Ouverte* platform mentioned above, users with login credentials (provided by their schools) have access to a dedicated *Ma Classe* ("My Classroom") space.[9] On *Ma Classe*, students can find the right set of both static and interactive resources to foster and consolidate their learning; teachers can retrieve the peer-reviewed digital teaching resources in Québec or create their own resources, using their individual space as a workshop; and parents can find reference tools to provide their children with appropriate support. The platform features a set of assistive tools for accessibility, and some of the curated resources are tailored for students with special needs. The province of Saskatchewan has a similar educational platform, *EDonline*, whose access is permitted through a login credential given to all teachers and students in the province.[10]

Beyond what is developed and provided at the provincial or territorial level, teachers and students in Canada generally have access to sets of more specific digital teaching and learning resources that are directly procured by their school districts from commercial vendors. Virtually every school also offers access to a virtual classroom environment (such as *Google Classroom* or *Microsoft Teams*), and to a platform for teacher development. However, these are procurement choices that are generally made at the school district level or lower.

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

Ensuring access and supporting use

Equity of access

Across Canada, provinces and territories have issued rules and guidelines to ensure equitable access to digital tools and resources. Some equity mechanisms target schools and school districts, from rural or lower socio-economic areas for instance; while others are targeted directly to students from low socio-economic background and rural areas, or with special education needs. For instance, Québec's Digital Action Plan aims at recognising the diversity of people and needs in education and making sure all profiles can benefit from the Plan's measures. In particular, the Québec's ministry of education plans to increase its support on digital procurements wherever it can reduce digital gaps among teachers, students, and parents. Together with the deployment and strengthening of an enabling infrastructure for digital education, this represents the largest spending item in the Digital Action Plan's investment framework.[11]

In addition, several equity mechanisms were put in place in response to school closures during the COVID--19 crisis. British Columbia, New Brunswick, Nova Scotia, the Northwest Territories, and Newfoundland and Labrador provided devices to students with limited or no technology at home.[12] On the front of the digital divide, the Government of Canada implemented a federal strategy, "High Speed Access for All: Canada's Connectivity Strategy", that aims to connect all Canadians with access to the internet at

higher speeds. The strategy is funded by a new CAD 1.7 billion (USD 1.26 billion) Universal Broadband Fund and focuses on rural and indigenous communities with the objective of having 100% of Canadians connected by 2030.[13]

However, having equitable access to hardware infrastructure does not necessarily lead to equality in the use of software. Sections below describe what efforts Canadian provinces and territories deploy to measure and bridge the gap between the availability and uptake of digital tools and resources.

Supporting the use of digital tools and resources

Canadian provinces and territories use direct and indirect incentives to support the access to and use of digital tools and resources at the system, school district, school, and classroom levels.

First, provinces and territories may mandate the use of some of the tools that they directly provide or procure, for instance through binding regulation, typically when it concerns tools for system and school management that require full uptake to function at their best. Some provinces and territories may require the use of prescribed software, such as the student information system, to facilitate follow-up on students' educational progression.

Second, while schools and teachers have autonomy to procure additional digital tools and resources at their discretion, provinces and territories support them in the process in various ways. Most provincial and territorial governments directly procure digital tools and resources on behalf of schools using the leverage of larger orders to negotiate lower prices and more favourable contractual conditions with suppliers. Among them, some provinces and territories have mandated regional organisations to handle digital procurements in education, such as Service New Brunswick, Saskatchewan's Electronics Partnership programme, or Focused Education Resources in British Columbia.[14] Typically, provinces and territories provide non-earmarked subsidies (e.g. operational budget) to school districts, but in a few cases those subsidies are earmarked for digital technology. Some provinces and territories also pre-authorise lists of digital resources that school districts can acquire with their own budget, while others impose criteria on the purchase of such resources with regard to equity of access, interoperability, or security. For example, in Alberta, the ministry uses the standard Government of Alberta procurement policies and has requests for qualifications specifically for the procurement of teaching and learning resources, in line with the provincial curriculum. In addition to formal procurement and contracts, the use of grants, permission to use the province's or school districts' standing offers (i.e. offers from potential suppliers), and internally developed resources are being leveraged to provide a comprehensive set of resources that school authorities may choose to use.

In Québec, it is the responsibility of school boards and school service centres to purchase digital equipment (e.g., computers) and software (e.g., subscriptions to digital educational resources). Administrators are invited to use the Government Procurement Centre (*Centre d'acquisitions gouvernementales – CAG*) to make these purchases. The CAG proposes items that have been checked for their security, for example in terms of web hosting and pedagogical qualities. Purchases below a certain financial threshold can be made locally, without the engagement of CAG. In other cases, some purchases are made by the Québec Ministry of Education for the entire public network, such as the audio-visual kits distributed during the pandemic or the national licenses for access to digital educational resource platforms (e.g., Radio-Canada's *Curio*).

Finally, provinces and territories provide central and local guidance on the use of the digital tools they provide. For instance, Manitoba's MERLIN, a special operating agency set up within the Department of Central Services, is responsible for facilitating and coordinating the delivery of technology services to the education community across the province.[15] Provinces and territories also offer professional learning opportunities for administrative (government and school) staff to improve their use of data and digital management tools, and for teachers to improve their use of digital resources in their teaching. Here again, the COVID-19 pandemic has boosted the provision of professional learning for teachers in provinces and territories like Québec and Yukon.[16]

Cultivating the digital literacy of education stakeholders

Canadian provinces and territories aim to engage all education actors in the digital transformation of their education systems and developing teachers' digital literacy is one way to achieve this.

While setting rules and guidelines on digital competences and qualifications of teachers is a provincial and territorial responsibility, only a few provinces and territories have done so. Usually, teachers have the opportunity to develop their pedagogical competencies of the use of digital technologies through dedicated in-service professional development, on a case-by-case basis. Additionally, initial teacher education programmes offered by accredited institutions may offer courses on the use of digital technologies in teaching.

In Alberta, for instance, teachers and school leaders are held to professional practice standards.[17] In particular, the *Teaching Quality Standard* describes the professional competencies that teachers must demonstrate when working directly with students. The standard "Demonstrating a Professional Body of Knowledge" explicitly references indicators related to digital technology that includes incorporating digital technology and resources to build student capacity for acquiring, applying, and creating new knowledge; for communicating and collaborating with others; for critical thinking; and for accessing, interpreting and evaluating information from diverse sources.[18]

Another lever through which provinces and territories foster students' and – indirectly – teachers' digital literacy is reforms of their curricula. Across Canadian provinces and territories, most curricula now include at least some form of guidelines around the use of digital technology in class and integrate the development of student skills to use and understand digital technology as a learning outcome. For instance, British Columbia's curriculum includes a course that mentions competencies such as being able to use familiar tools and technologies to complete a task, to identify the impacts and consequences of the technology they use, and to know the history of technology and how to safely use it.

Digital literacy of students could also be the object of collaboration between provinces and territories. In the 2000s, the province of New Brunswick, Nova Scotia, Newfoundland and Labrador, and Prince Edward Island developed the Foundation for the Atlantic Canada Technology Education Curriculum, a foundational document outlining the common approach and vision for technology education in Atlantic Canada.[19] In Québec, the 2019 Digital Competency Framework promotes the development of digital competence throughout the educational community so that people can be autonomous and critical in their use of digital technology. To facilitate the implementation of the framework, a *pedagogical guide* and a *digital competency development continuum* have been developed. [20]

Governance of data and digital technology in education

At the federal level, Canada has two laws that define the largest part of the country's regulation around the protection of data and privacy, in education as well as in other public and private sectors: the Freedom of Information and Protection of Privacy Act (FIPPA), and the Personal Information Protection and Electronic Documents Act (PIPEDA). FIPPA protects personal information by setting guidelines for use and guarantees individuals the right to access their own information held by public bodies, such as schools; PIPEDA ensures that individual consent be acquired for personal information to be collected, used, or disclosed. As most other matters related to education in Canada, it then depends on commissioners from provinces and territories to enact further rules or guidelines about the protection of personal data and privacy that are specific to education. Manitoba's Freedom of Information and Protection of Privacy Act and New Brunswick's Right to Information and Protection of Privacy Act, for instance, set out rules that are specific to education in those provinces. In particular, New Brunswick has shared guidelines as regards what commercial vendors can and cannot do with the data collected within education settings, that school districts should verify prior to negotiating procurement contracts.

Beyond rules on data protection, provinces and territories regulate the use and management of education data. Québec has set up rules about the accountability for digital technologies in education, for instance defining responsibility in case of errors due to technology. In Québec, school boards are responsible for ensuring the security of information and the protection of personal information for their employees and students. The Québec Ministry of Education supports these practices through its Cyber Defense Operations Center ("*Centre opérationnel de cyberdéfense*"), which collaborates with its counterparts in other ministries and agencies, which are connected by the Québec Ministry of Cybersecurity and Digital Technology.

Ministries or departments of education in each province and territory also determine their own policies on the use of personal digital devices in schools. Across Canada, most schools encourage a bring-your-own-device (BYOD) policy in some way for learning purposes. In Prince Edward Island, a minister's directive has allowed students to use their own mobile devices in classrooms for educational purposes as long as they agree to abide by learning expectations and sign a responsible use agreement.[21] On the contrary, Alberta and British Columbia have no ban on the use of mobile phones in primary and secondary classrooms.[22] However, schools and school districts can set their own policies.

Only a few provinces and territories have set up guidelines to promote interoperability between their different digital tools. Such guidelines may encourage the use of open standards on educational technologies and on educational data, as well as of specific technical standards, or the use of tools certified by standard agencies. In Northwest Territories, the government promotes interoperability of data as part of the procurement process. In Québec, the ministry of education has set up the Digital Intelligence Task Force ("*Chantier d'intelligence numérique*") to address the challenges of harmonising student data across the public network. This work aims to provide easier access to reliable and relevant data to support education stakeholders in their decision-making, as well as to reduce the administrative burden through the sharing of a central information exchange platform between the education network and the Québec Ministry of Education. Moreover, to support the integration of artificial intelligence into the education network, the Québec Ministry of Education has set up a centre of expertise in artificial intelligence, whose objectives include defining a common AI vision for the network and providing expert support to make this vision a reality.[23]

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

Developing a national education technology ecosystem presents challenges both to developing appropriate local tools and to incentivising relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider. In Canada, such efforts are under provincial and territorial responsibility.

Canadian provinces and territories are trying to support the use of education data for research. In New Brunswick, for instance, educational authorities aim to reconcile data privacy legislation with the linkage of educational datasets as a way to facilitate equitable access to and use of educational data for research and development. However, provincial and territorial governments rarely interfere in academic research. Recent exceptions arose with the COVID-19 pandemic when governments set up research programmes with a focus on the impact of the crisis on learning and well-being. And in certain provinces or territories, such as Québec, provincial authorities have commissioned academic papers on the use of digital technologies to support teaching and improve school management functions.

Instead of conducting their own R-D on digital tools, several Canadian provinces and territories have established relationships with other education stakeholders, including from the private sector, to support digital innovation in education. Some provinces and territories provide monetary incentives for the development of teaching and learning resources by organisations as well as by teachers and school staff; as well as non-monetary incentives (such as organising conferences or networking forums) to support

collaboration between EdTech companies and educational institutions. For example, in Québec, the *Association des Enterprises pour le développement des technologies éducatives au Québec (Edteq)* is a central actor in the provincial educational technology landscape and internationally. The aim of the *Association* is to promote the work of its members and accelerate the digital transformation of education in the province.

In the future, Canadian provinces and territories envision to strengthen their provision (or their support to the provision) of various aspects of their digital infrastructure for education, depending on their current infrastructure. In Manitoba, work is underway to explore the creation of system that will consolidate school districts' information systems and the provincial department's system (*EIS*) into one province-wide student information system; while in New Brunswick, priority efforts will be made towards the implementation of digital exams and digital credentials. More broadly speaking, the digitalisation of different types of assessment is a prevalent topic of reflection across Canada. Similarly, most provinces and territories will continue to develop and improve their provision of online educational platforms and resources for teaching and learning.

Notes

[1] In Canada, the federal, provincial, and territorial governments have a constitutional responsibility for the education of First Nations, Métis, and Inuit students. While the Government of Canada has a responsibility for education of students who attend schools on First Nations reserves, provincial and territorial public education systems provide education to First Nations, Métis, and Inuit students who attend schools off-reserve.

[2] A fixed amount of money for each student enrolled in the school. In secondary school, it may be associated with number of credit hours in which the student is enrolled. A fixed amount of money for each student enrolled in the school. In secondary school, it may be associate with number of credit hours in which the student is enrolled. In Alberta, funding provided is not allocated for specific students or schools. Rather, the Weighted Moving Average (WMA) Full Time Equivalent (FTE) enrolment is used to allocate funding for the Early Childhood Services (ECS)-Grade 12 instructional activities of the entire school jurisdiction.

[3] Those six jurisdictions: Alberta, British Columbia, Manitoba, Québec, Saskatchewan, and the Northwest Territories.

[4] Québec's Digital Action Plan: http://www.education.gouv.qc.ca/en/current-initiatives/digital-action-plan/digital-action-plan/

[5] Report of the Pan-Canadian Education Indicators Programme: https://www150.statcan.gc.ca/n1/en/catalogue/81-582-X

[6] New Brunswick's Student admission management system: https://www.nbed.nb.ca/parentportal/en/PreReg/Home/Index/5/?district=; Parent Portal: https://www.nbed.nb.ca/parentportal/en/

[7] Manitoba Career Prospects: https://manitobacareerprospects.ca/request-a-speaker.asp

[8] Québec's Open School platform: https://ecoleouverte.ca/

[9] Québec's Open School's My Classroom: https://ecoleouverte.ca/se-connecter

[10] Saskatchewan's EDonline platform: https://www.edonline.sk.ca/webapps/blackboard/content/listContent.jsp?course_id=_3344_1&content_id=_132842_1&mode=reset

[11] Québec's Plan d'Action Numérique: http://www.education.gouv.qc.ca/fileadmin/site_web/documents/ministere/PAN_Plan_action_VF.pdf

[12] Provision of devices during the COVID-19 crisis: https://www.researchgate.net/publication/343816812_Documenting_Triage_Detailing_the_Response_of_Provinces_and_Territories_to_Emergency_Remote_Teaching

[13] Canada's Connectivity Strategy: https://ised-isde.canada.ca/site/high-speed-internet-canada/en/canadas-connectivity-strategy; Universal Broadband Fund: https://ised-isde.canada.ca/site/high-speed-internet-canada/en/universal-broadband-fund; Previous federal plans on universal broadband access include the Connect to Innovate Program, the Rural and Northern Stream of the Investing in Canada Infrastructure Program, the Accelerated Investment Incentive, and connectivity projects from the Canada Infrastructure Bank and the Canadian Radio-television and Telecommunications Commission (CRTC).

[14] British Columbia's Focused Education Resources: https://focusedresources.ca/en

[15] Manitoba's MERLIN: https://www.merlin.mb.ca/

[16] Professional learning opportunities for teachers as result of the pandemic: https://www.researchgate.net/publication/343816812_Documenting_Triage_Detailing_the_Response_of_Provinces_and_Territories_to_Emergency_Remote_Teaching

[17] Alberta's professional practice standards: https://www.alberta.ca/professional-practice-standards.aspx

[18] UNESCO Education Profile - Technology in Canada: https://education-profiles.org/europe-and-northern-america/canada/~technology#2.3

[19] Foundation for the Atlantic Canada Technology Education Curriculum: https://www.gov.nl.ca/education/files/k12_curriculum_documents_teched_te_found_nf-lab_full.pdf

[20] Québec's Digital Competency Framework, pedagogical guide and development continuum: http://www.education.gouv.qc.ca/en/references/tx-solrtyperecherchepublicationtx-solrpublicationnouveaute/results/detail/article/digital-competency-framework-1/?a=a&cHash=2f4087f0a706e2c970404d73cee9719d

[21] Rules on students' own device in schools: Ontario: https://www.ontario.ca/page/cellphones-and-other-personal-mobile-devices-schools#:~:text=Personal%20mobile%20devices%20are%20allowed,for%20health%20and%20medical%20purposes; Prince Edward's Island: https://www.princeedwardisland.ca/sites/default/files/publications/min_directive_2021_03_responsible_use_agreement_cit_21-22_0.pdf

[22] FIPPA: https://web2.gov.mb.ca/laws/statutes/ccsm/f175e.php; PIPEDA: https://www.priv.gc.ca/en/privacy-topics/privacy-laws-in-canada/the-personal-information-protection-and-electronic-documents-act-pipeda/pipeda_brief/

[23] The centre hosts experts from the Institut québécois d'intelligence artificielle (Mila), the Institut de valorisation des données (IVADO), the Observatoire international sur les impacts sociétaux de l'intelligence artificielle et du numérique (OBVIA), the Centre de transfert pour la réussite éducative du Québec (CTREQ) and GRICS.

4 Chile

This note provides an overview of Chile's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Chile supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Chile engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- A high degree of school autonomy combines with a significant presence of the government in Chile due to its funding of both public and private owned schools through subsidies.
- Widely adopted information systems are provided to schools, with mandated use for those benefitted by public funds. Those include a student information system and a student admission system. An early warning system is being piloted.
- Interoperability is mandated by law, and the country has long-standing data privacy and transparency regulations.

General policy context

Division of responsibility

Educational institutions, public or private, operate with a fair degree of autonomy in Chile. Institutions are, nonetheless, regulated, assessed, and supported by a network of institutions, forming the national quality assurance system (the Sistema de Securement de la Calidad – SAC). The SAC is made of four institutions working in co-ordination: the Ministry of Education (*Ministerio de Educación* – MINEDUC), that acts as the guiding institution regarding policy, curriculum, and its implementation; the education superintendency (*Superintendencia de Educación*), tasked with the inspection of institutions; the education quality agency (*Agencia de Calidad de la Educación*), in charge of educational assessment; and a national education council (*Consejo Nacional de Educación*), that discusses and approves key documents such as the national curriculum guidelines, performance standards, and the national assessment plan.

Schools can be publicly or privately run. The former can be administered by the municipality, or by local education services (*servicios locales de educación*), entities created to take over municipal responsibilities.[1] Private schools are managed by private individuals or entities, and most are publicly subsidised. This type of institution served the majority of Chilean students as of 2020 and are under similar governmental oversight as public schools.[2]

Responsibilities for providing access, supporting the use of, and leveraging the potential of digital technologies in education reflect this combination of autonomy and top-down policy, regulation, and assessment. While sub-national authorities or schools themselves oversee the provision of institutional management systems to the institutions under their care, the central government provides system management tools to all schools. Access to teaching and learning resources is also provided by the central government but, as schools are often autonomous with respect to their teaching, resources can be provided by institutions themselves or by their maintaining entity.

Regulation on equitable access and use of digital education in classrooms are set by the central government, albeit the quality of implementation depends heavily on schools. Data governance is also set by the central government, with comprehensive data protection and interoperability regulations, as well as rules on access to education data and a regularly updated national student register. In addition, compliance to regulations is checked by regular or prompted inspections by the above-mentioned education superintendency.

Digital education strategy

Digitalisation is seen as a key component of Chile's development strategy to foster economic growth and social inclusion, which motivated the development of digital transformation documents leading to the country's most recent 2035 government-wide strategy.[3] *Gobierno Digital* (digital government), a department under the Ministry of the General Secretary of the Chilean President, oversees and coordinates

coherent government-wide digital transformation efforts, with a mandate to establish norms related to digital transformation, operate transversal digital platforms for public institutions, and organise consultations on the implementation of digital transformation policy.

Albeit comprehensive, the national government-wide digital strategy does not focus specifically on digital education, which is complemented by an education-specific strategy along four axes: connectivity, digital infrastructure, development of capacities, and data governance, each with accompanying programmes being developed by the Ministry.[4] In addition to education-specific initiatives, the potential of digital tools to be a tool to improve the quality of education and the key role of digital competences are also highlighted in the government-wide strategy. The education-specific strategy lists digital education initiatives that exist in alignment with broader policy. Specific programmes exist for the provision of reliable high-speed connectivity to schools; to provide devices to students, to support students with special educational needs (SEN), as well as students most socio-economically disadvantaged, or schools in disadvantaged or remote locations.

The public digital education infrastructure

The Chilean government provides quite a few elements of the digital educational infrastructure available to public and publicly subsidised private schools, notably, a student information system that is widely used and frequently updated, a student admission system that is universally used, and an early warning system that is being rolled out in schools since its inception in 2020. Schools themselves have received support to adopt learning management systems, especially during the COVID-19 pandemic, and larger institutions often utilise platforms with embarked customer relationship management systems that facilitate communication with parents.

The provision of digital resources for teaching and learning is also varied in Chile, with the central government supporting open and closed repositories as a part of an environment where multiple stakeholders such as publishers, EdTech companies, non-governmental organisations (NGOs), and universities contribute with digital tools and resources.

Digital ecosystem for system and school management

Student information system and learning management system

Although the responsibility for providing primary and secondary education is devolved to sub-national public entities and private organisations, the central government plays a central role on admissions and notably funding, which being provided on a per-student basis and accounting for factors such as attendance, leads to the wide adoption of government-provided tools for system management.

A main pillar of this digital infrastructure is SIGE (*Sistema Información General de Estudiantes* – general student information system), a student information system adopted by most Chilean schools.[5] Due to how schools are funded, schools that receive public subsidies (meaning public and privately subsidised schools, accounting for over 90% of enrolled students) must provide data to SIGE. The system contains a comprehensive amount of student data such as enrolment, attendance, performance in classroom assessments, and indicators such as eligibility for supplementary funds (e.g., due to disadvantaged socio-economic status, or special needs). It also contains data on school staff, being used for human resource management and eligibility for further training, and for some tasks of institution management, such as acknowledging receipt of textbooks and some measures of ICT infrastructure.

Students and school staff can be tracked longitudinally via their national identification number, which is also used for all other interactions with the government and, allied with a significant degree of interoperability with learning management systems fostered by existing data standards, allows for a wealth

of information to be added to or obtained from SIGE.[6] Indeed, given that data must be provided within existing standards to allow for interoperability and accountability, schools can use a wide variety of learning management systems, depending on institutional choice or existing agreements, with *Google Classroom*, Moodle, and several nationally developed systems as the most adopted tools.[7] Data from SIGE are also available for the ministry and its quality assurance entities to guide data-driven policy making, and are made available for the wider community in aggregated form on an open data portal (*Datos Abiertos*)[8].

Admission and guidance

Admission to all public or publicly subsidised private schools to all education levels is managed by SAE, a school admission system managed by the central government.[9] Families enrolling students have access to a broad variety of school information, such as available openings and how competitive said openings were in previous year, teaching plan and curricula, performance information, and extracurricular activities. This information tends to be pushed into the SAE system directly through interoperability with the SIGE information system mentioned above, creating yet another incentive for schools to keep their data up to date.

As they submit their school selections to SAE, information is also retrieved from the Chilean Civil Registry systems, which is interoperable with SAE and pre-fills a significant part of the applications with key variables for the selection process such as socio-economic variables and the existence of enrolled siblings. Should more submissions than openings exist, a selection process is performed through an algorithm taking several priorities defined by existing regulations into account: prospective students with enrolled siblings are prioritised, then remaining openings are offered to socio-economically disadvantaged students up to a maximum of 15% of total openings, which are then followed by children of school staff and returning drop-out students that were not expelled. The remaining openings, if any, are then randomly assigned to prospective students not fitting the above-mentioned criteria.[10]

Although there are orientations from the Ministry to schools when it comes to career guidance, there is no comprehensive platform available to guide career choice available for Chilean students. There are nonetheless resources made available by the government for students interested in continuing their studies in tertiary education through the *Mi Futuro* portal (“my future”, available at https://www.mifuturo.cl/), where students can find higher education institutions, and information on admission, careers and future job prospects.

Exams and assessments

Students in Chile sit the *SIMCE*, a set of national system-level assessments in mathematics, reading and other subjects such as natural and social sciences for students in grade 2, 4, 6, 8 and 10. The assessment is administered on a census basis to schools, and the list of subjects can vary based on grade and year of administration, with all grades taking reading in all editions.[11] Given its scale, *SIMCE* is delivered as a paper-based assessment, but digital tools are employed to support its administration, such as online item grading platforms and digital tools for data reading and processing.

There is however the *DIA*, an online digital assessment, available on a voluntary basis for schools wishing to assess their students in academic (maths and reading, with optional assessments on other domains depending on the grade) and socio-emotional subjects on a formative basis.[12] The *DIA* assessment is designed to be delivered in three distinct moments within the school year: a first diagnostic test, a follow-up halfway, and a closing assessment at the end. It is also available for all grades, but it enjoys wider adoption within the first years of basic education.

Other tools and resources

An early warning system, the SAT, has been rolled out by the government in 2020: it aims to predict and prevent school drop-out from grade 7 to 12 students enrolled in public or publicly subsidised schools.[13] The SAT uses demographic, socio-economic, attendance, and performance information pushed from other interoperable systems such as the SIGE student information system mentioned above as inputs to a predictive algorithm, which then assigns a measure of drop-out risk to a given student. The algorithm is developed by the ministry for social development and family (the MIDESOF) and transferred to the ministry of education for management and implementation. Adoption of the SAT is not yet widespread within the Chilean education system, and the SAT is not yet available for students in early years (i.e., before grade 7) or in other education modalities such as special education.

Digital ecosystem for teaching and learning

The government plays an active role in the provision of digital resources for teaching and learning in Chile, providing access and resources, both in an open and closed form for the education community and aimed at students and teacher development.

Textbooks are bought centrally for public and publicly subsidised schools, but students and teachers can access all materials in digital form upon logging into a dedicated website, thus representing a wide offer of static digital learning resources.[14] These resources are complemented by digital libraries containing a wide range of reading materials, both for classroom and leisure reading, in closed and open access modes.[15] In addition, platforms exist for students to learn through massive open online courses (MOOCs), ranging from the broad courses of additional languages and office software towards specific courses such as programming.[16] There is also a dedicated TV channel for educational content, and dedicated TV and radio education produced for primary, secondary and VET students for broadcast and use.[17]

Besides the above-mentioned resources that teachers can leverage in the classroom, resources are shared to teachers through a government-maintained portal dedicated to the implementation of the national curriculum. Teachers can find similar static digital learning resources as those provided to students, but also guidance on the curriculum, its standards, and on assessment. There is also a bank of assessment items, classified according to the curriculum, for use in the classroom.[18] In-service teacher training is also facilitated by an online portal offering courses directed at teachers reaching diverse facets of the teaching profession, often with tutors through the *Desarollo docente en linea* portal.[19]

Students with special educational needs are also a focus on the provision of digital resources. The ministry supports a hub with an open educational resources (OER) repository containing textbooks with increased fonts for students with vision impairments, guidance for teachers and institutions serving these students, and a curated list of digital tools and resources for use in the classroom, including several to support assistive technologies.[20]

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

Ensuring access and supporting use

Equity of access

In Chile, funding for all public and publicly subsidised private schools is provided by the central government on a per-student basis through a mechanism called preferential school grant (SEP).[21] This funding scheme aims at increasing equity within the education system by establishing increased funding for students with disadvantaged socio-economic backgrounds, for those with special education needs, and those in rural areas. Funding via the SEP also outlines a clear division on governmental oversight and implementation

of policy – for instance, all institutions receiving funding via SEP are subject to the same admission procedure (using the SAE system mentioned above) and providing required data for the government to receive its funding.

Equity of access to reliable, high-speed, Internet connections and up-to-date devices capable of leveraging digital education tools and resources are also the target of directed programmes. Indeed, dedicated funding of high-speed Internet connectivity to schools, with accompanying guidance and support is provided by the CpE2030 programme, which built on its previous CpE2011 cycle to bring infrastructure to thousands of schools allied to the *Aulas Conectadas* programme, the latter providing also support and further guidance.[22] Devices are also provided to students at secondary education through the *Me Conecto para Aprender* programme, which provided access to devices, resources, and Internet connectivity to students and enjoyed quite a large coverage of students in public and publicly subsidised private schools, with provision of equipment to schools, teachers, or students complemented by recent initiatives such as the *Kit Tecnologico para la Transformación Digital* equipment provision programme.[23, 24]

Directed support to students with special educational needs (SEN) can be achieved by fully leveraging digital educational resources and dedicated programmes exist to achieve this goal. Notably, the *Tecnologias de Aceso Universal para la Educación* (TAUE) programme aims to support access to curriculum, combat drop-out, and foster the improvement of learning outcomes of students with special education needs via the provision of assistive technologies, specific teacher training, and follow-ups in institutions that serve SEN students such as special education schools or health facilities.[25]

Supporting the use of digital tools and resources

The interplay between school or sub-national authorities' autonomy and the government's role as a funder and supporter of education in Chile is also reflected in the resources and support available for the use of digital education tools and resources for teaching and learning. There is a varied landscape of requisites and resources: use of some platforms is mandatory for institutions funded by public resources and additional non-earmarked subsidies exist for the adoption of others or acquisition of digital education resources.

Indeed, the use of several digital platforms is mandated by the government for all schools funded by public resources (i.e., public or publicly subsidised private institutions), namely assiduous data entry into the centrally provided student information system (the aforementioned *SIGE* platform). In addition, the use of the centrally provided student admissions system (the *SAE*) is also mandated.

Furthermore, the government also provides additional earmarked and non-earmarked subsidies for the purchase of digital educational tools and resources. The former are connected to directed initiatives to provide ICT infrastructure or devices, or assistive technologies (such as the programmes for students with special needs mentioned in the previous section), while the latter are related to resources connected to broader programmes supporting the improvement of overall learning outcomes.[26] Furthermore, the government also provides significant guidance for school administrators and other members of the community looking to access these and other resources for instance, through the *Comunidad Escolar* portal.[27]

Cultivating the digital literacy of education stakeholders

The government provides professional learning opportunities for teachers to discover as well as improve their use of digital education tools, and to embed digital competences into their teaching. Notably, the *Educarchile* portal provides a list of curated digital tools for diverse uses in the classroom and in the teaching profession (such as grading, presenting, or publishing material), while providing opportunities for professional development and peer learning such as the *Educarchile* portal.[28] Also, within the wide variety of initial and in-service training provided within the ministry's CPEIP, there are courses for teachers using

the *Google Classroom* suite, to those wishing to embed digital competences into their teaching, and the above-mentioned MOOC platform *Desarollo Docente en línea*.[29]

In addition, Chile is also promoting a framework for fostering digital citizenship of teachers, students, and their families. This framework aims to develop the knowledge, skills and attitudes necessary for the full exercise of data rights and democratic co-existence through the safe and responsible use of digital technology. Resources and training, including on existing digital tools, is made available through a dedicated website *Ciudadania Digital* (https://ciudadaniadigital.mineduc.cl/) and the initiative is expected to inform curriculum development.

The training provided through these resources, both in pre- and in-service training, is regulated by exiting standards. Rules dictating which standards teachers must meet exist within the legal framework underlying Chilean education, and said standards have very clear competences and guidelines related to the use of digital technology in teaching.[30] Indeed, both initial and in-service standards highlight the need of leveraging digital tools and resources within the classroom to improve teaching and accessibility of the material, and promoting safe behaviours online and when using technology.[31]

Teachers' digital literacy is also indirectly fostered by the presence of requisites for digital competences in students' national curricula. Educational institutions have a degree of autonomy implementing their own approach but are bound to be based on national curricular basis and fundament documents outlining what is expected from students at a given grade, arising from legislation in the matter that outlines the role of schools in providing access to information and the effective use of information technology.[32] These documents, prepared and circulated by the ministry, outline the presence of digital competences, with ICT competence figuring as a transversal skill to be taught in the early years (grades 1 to 6), and the use of technology and technology-inspired problem-solving to present in the basis for further years (grades 7 to 12).[33]

Governance of data and digital technology in education

Data privacy is regulated in Chile through a specific law (*Law 19 628*) promulgated as early as of 1999, making it the first one of its kind in South America. This law is due to be reformed following technological developments in the last decades and Chile's accession to the OECD in 2010.[34] A bill proposed to this goal has been proposed, inspired by the EU General Data Protection Regulation (EU GDPR), but has yet to be promulgated into law. There is no specific legislation regarding schools or the broad data rights of students, but legislation exists on the protection of financial information or debts acquired during education.[35]

Privacy regulations notwithstanding, access to education data is assured both by a broader access to information law guaranteeing access to anonymised state information, and by specific legislation obliging the government to provide disaggregated information on quality, equity, and coverage of educational institutions.[36] Beyond legal obligations, the government proactively maintains an open data portal where a wealth of anonymised data on students, teachers, and data on education institutions through the *Datos Abiertos* ("Open data") portal.[37]

Interoperability of platforms and data managed by the government is enshrined in national legislation regulating digital transformation initiatives, with open data standards provided by a dedicated digital government agency and based on the *Common Education Data Standards* (CEDS) for a measure of international interoperability.[38, 39] In addition, proactive or provoked inspections by the above-mentioned education superintendency can also foster the adoption and use of digital education in alignment with curriculum and legal requirements.

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

Fostering local digital tools and resources, providing incentives, and engaging with relevant external stakeholders are key to development of a national digital education ecosystem. Monetary and non-monetary incentives directed support of research and development (R-D) in academia and in the private sector or directly funding or incubating education technology (EdTech) start-up companies are elements of an innovation portfolio to be explored by countries.

Chile has a conducive environment for open education data, including regulation, access, and documentation of public administrative datasets, for instance through the *Datos Abiertos* platform mentioned above. There is, however, no dataset or surveys on digital education, the country's digital infrastructure or ICT resources available at schools at this date, and the government has performed studies on the impact of digital education and other initiatives through a research centre connected to the ministry responsible for impact studies.[40]

In addition, there are funds available providing monetary incentives for research in education that have been used to conduct research on digital education or ICT competences. The ministry itself manages an "investigation and development in education" fund (FONIDE) that funds research on education, often conducted within universities, through yearly calls for proposals. [41] Beside earmarked ministry funds, other parts of the government can also contribute with funding research efforts. For instance, the broader scientific and technologic development fund (FONDEF) has also been used to fund the development of ICT in education through thematic calls for proposals.[42]

Beyond research, there is some in-house development of digital tools and resources within the ministry. One example is the *Aula 360* platform, an interactive platform for students to engage with the curriculum and foster the development of metacognition, independent, and creative thinking.[43] The platform has been developed for selected subjects of the grade 11 and 12 mathematics curriculum as a pilot and its roll-out is underway.

The ministry also collaborates with EdTech start-ups to support research, development and innovation in digital education. Formal engagement with the private sector is regulated by broader legislation regulating lobbying activities and other interactions between public officials and representatives of private entities.[44] Nonetheless, rapport exists between the government and the EdTech sector through a national entity representing the sector (*Associación General de Empresas de Tecnologias en Educación* – AGETECH). This informal channel of communication also provides an industry perspective in consultations for making policy decisions, contributing with a private sector perspective to the public viewpoints from other entities of the quality assurance system: the national education council, and education superintendency.

Looking forward, the government aims to support pilot programmes using classroom analytics technologies, to maintain and increase the support for information systems available to schools – both for well-established and widely adopted systems such as the *SIGE* student information system and the *SAE* student admission system, but also for nascent programmes such as the *SAT* early warning system. Technology and data governance is also of particular interest for the ministry going forward as a revision of data protection regulations approaches in the near future, which would deeply change the current process that relies on compliance with data privacy and protection regulations at a per-institution basis.

Notes

[1] As of Law 21 040 (*Ley 21 040*, available at https://www.bcn.cl/leychile/navegar?idNorma=1111237)

[2] 54% of student enrolments as of 2020 are on publicly subsidised private schools, against 32% on public schools and 9% on entirely private institutions (MINEDUC, 2020, available at https://centroestudios.mineduc.cl/wp-content/uploads/sites/100/2020/09/APUNTES-7_2020_f02.pdf)

[3] *Estrategia de transformación digital Chile Digital 2035*, available at https://www.cepal.org/sites/default/files/events/files/estrategia_de_transformacion_digital_chile_2035_.pdf

[4] *Transformación Digital,* available at https://www.innovacion.mineduc.cl/iniciativas/transformaci%C3%B3n-digital

[5] SIGE is available at https://sige.mineduc.cl/

[6] All Chileans are issued a national id that is used for tax and for a wealth of other purposes, called RUT (*Rol Unico Tributario*). Non-nationals are provided a provisional id number, which is replaced in the case of becoming Chilean nationals.

[7] For example, by tools such as the *Libro de Clases Digital*, available at https://www.webclass.cl/libro-de-clases-digital/, Kimche (https://www.kimche.co/libro-digital), Napsis (https://napsis.com/plataformas/plataforma-de-gestion-escolar/libro-de-clases-digital/), Paipnotas (https://papinotas.cl/libro-de-clases-digital/), Colegium (https://info.colegium.com/libro-de-clases-digital-chile/), and Limri (https://www.lirmi.com/es-cl/libro-de-clases), to cite a few of the most popular.

[8] Datos Abiertos, available at https://centroestudios.mineduc.cl/datos-abiertos/

[9] *Sistema de Admisión Escolar*, available at https://www.sistemadeadmisionescolar.cl/

[10] The process, including how the algorithm prioritised student applications, can be found at https://www.sistemadeadmisionescolar.cl/como-funciona.html, in Spanish.

[11] More detail can be found on Chile's 2021 – 2026 national and international assessment plan (*Plan de Evaluaciones Nacionales e Internacionales 2021-2026*), available at https://bibliotecadigital.mineduc.cl/bitstream/handle/20.500.12365/17312/plan%20de%20evaluaciones%2021-26.pdf?sequence=1&isAllowed=y

[12] From the Spanish acronym for *Diagnostico Integral de la Aprendisaje*, available at https://diagnosticointegral.agenciaeducacion.cl/

[13] From the Spanish acronym for *Sistema de Alerta Temprana*, more information is available at https://www.mineduc.cl/sistema-de-alerta-temprana-contra-la-desercion-escolar/

[14] Available at https://www.curriculumnacional.cl/portal/Secciones/Textos-escolares-2023/

[15] Namely, through the digital school library (*Biblioteca Digital Escolar*, available at https://bdescolar.mineduc.cl/) and the UCE free library (*Biblioteca Escolar UCE* de descarga liberada,

available at https://www.curriculumnacional.cl/portal/Secciones/Biblioteca-Escolar-UCE/), that are closed and open repositories of reading material, respectively.

[16] A broad offering of online courses can be found at the BiblioRedes (https://moodle.biblioredes.gob.cl/) and SENCE (available at https://sence.gob.cl/) portals, while programming courses were made available at https://jprogramadores.biblioredes.gob.cl/moodle/

[17] Through the TV Educa Chile channel (https://www.tvn.cl/tveducachile/), Aprendo TV (https://www.curriculumnacional.cl/estudiantes/Aprendo-en-linea/Aprendo-TV/214638:Aprendo-TV) and Aprendo FM (https://www.curriculumnacional.cl/estudiantes/Aprendo-en-linea/Aprendo-FM/223682:Aprendo-FM), respectively.

[18] Available at https://www.curriculumnacional.cl/portal/

[19] Available at https://desarrollodocenteenlinea.cpeip.cl/.

[20] Available at https://especial.mineduc.cl/

[21] From the Spanish acronym for *Subvencion Escolar Preferencial*, and outlined by Law 20 248 (*Ley 20 248*, available at https://www.bcn.cl/leychile/navegar?idNorma=269001&idParte=)

[22] From the acronym *Conectividad para la Educación 2030* (connectivity for education 2030) available at https://www.innovacion.mineduc.cl/iniciativas/cpe2030 and *Aulas Conectadas* (Connected classes), available at https://www.innovacion.mineduc.cl/iniciativas/aulas-conectadas

[23] *Me Conecto para Aprender*: https://escolar.mineduc.cl/tecnologias-para-el-aprendizaje/me-conecto-aprender/

[24] Available at https://www.innovacion.mineduc.cl/iniciativas/kit-tecnol%C3%B3gicos-para-la-transformaci%C3%B3n-digital

[25] Universal access technologies for education, available at https://www.ayudamineduc.cl/ficha/tecnologias-de-acceso-universal-para-la-educacion-taue

[26] Such as the resources provided within the scope of the *Plan de Mejoramento Educativo* (PME), https://www.ayudamineduc.cl/ficha/plan-de-mejoramiento-educativo-pme

[27] Available at https://www.comunidadescolar.cl/

[28] Available at https://www.educarchile.cl/

[29] From the Spanish acronym for *Centro de Perfecionamento, Experimentación e Investigaciones Pedagogicas*, https://www.cpeip.cl/

[30] Namely through Law 20 903 (*Ley 20 903*, available at https://www.bcn.cl/leychile/navegar?idNorma=1087343)

[31] The standards can be found at https://estandaresdocentes.mineduc.cl/, in Spanish.

[32] As of MINEDUC DFL 2 of 2010 (*Decreto con Fuerza de Ley* 2/2010), in particular Articles 29 2 d) and 30 2 e), available at https://www.bcn.cl/leychile/navegar?idNorma=1014974&idVersion=2023-02-09&idParte=8940681

[33] The basis and fundaments documents produced by MINEDUC are available at https://www.curriculumnacional.cl/portal/Documentos-Curriculares/

[34] *Ley 19 628 sobre proteccion de la vida privada*, available at https://www.bcn.cl/leychile/navegar?idNorma=141599

[35] Namely Laws 18 591 and 21 214, available at https://www.bcn.cl/leychile/navegar?idNorma=29982 and https://www.bcn.cl/leychile/navegar?i=1142880 respectively.

[36] In particular, Law 20 285 and Article 4 of the DFL 2/2010 mentioned before. The former is available at https://www.bcn.cl/leychile/navegar?idNorma=276363

[37] Datos Abiertos portal: https://datosabiertos.mineduc.cl/

[38] As of Law 21 180 (*Ley 21 180, Transformación Digital del Estado*, available at https://www.bcn.cl/leychile/navegar?idNorma=1138479&idParte=10067375&idVersion=2222-02-02)

[39] Gob digital Chile, available at https://digital.gob.cl/plataformas-transversales/

[40] Namely, the *Centro de Estudios* (studies centre, available at https://centroestudios.mineduc.cl)

[41] From the Spanish acronym for *Fondo de Investigación y Desarollo en Educación*, available at https://centroestudios.mineduc.cl/fondo-de-investigacion-y-desarrollo-en-educacion/

[42] From the Spanish acronym for *Fondo de Fomento al Desarroyo Cientifico y Tecnológico*, available at https://www.conicyt.cl/fondef/

[43] Aula 360: https://aula360.mineduc.cl/

[44] In particular, through Law 20 730 (*Ley 20 730*, available at https://www.bcn.cl/leychile/navegar?idNorma=1060115).

5 Czechia

This note provides an overview of Czechia's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Czechia supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Czechia engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Although the central government does not publicly provide much digital infrastructure for system and institutional management, the Czech School Inspectorate does own and provide access to several digital tools (*InspIS systems*) including a school information register and tools for self-evaluation, curriculum planning and assessment. The government and its agencies do publicly provide some digital resources to support teaching and learning.
- Schools have significant autonomy in Czechia to choose, acquire and use their own digital infrastructure solutions, both for institutional management and for supporting teaching and learning. Only a minority of tools for system management provided by the Czech School Inspectorate must be used by all public schools.
- Ensuring the equity of access to and use of digital infrastructure is a challenge. While the country has invested in hardware infrastructure in educational institutions, particularly since the COVID-19 pandemic, there remain inequities across institutions and educational levels.
- The ministry has recently revised the curriculum for primary and lower secondary education to include new areas of informatics (to develop computational thinking) and digital competence. To support its implementation, the ministry created a dedicated website (Revize.edu.cz) as well as learning resources for educators on the new curriculum content. The ministry has also established a website (edu.cz/Digitalizujeme) and network of local experts to support the general digitalisation process of schools.
- Beyond the general provisions of the EU GDPR laws, there are no national rules or guidelines that govern the management, protection, use and access to student and education data. Access to educational microdata for third party research is also not provided for in any rules or guidelines.

General policy context

Division of responsibility

In Czechia, the governance of the education system is shared between government authorities at the central and lower levels. The central Ministry of Education, Youth and Sports (*Ministerstvo školství mládeže a tělovýchovy*) sets priorities, publishes national curriculum frameworks ("Framework Educational Programmes") and defines national reforms, while municipalities are usually responsible for organising pre-primary (ISCED 0) and basic education (ISCED 1 and 2). Regional authorities are usually responsible for organising secondary education (ISCED 3), including vocational education and training (VET) and tertiary professional schools (ISCED 6).

Decision-making is highly devolved within the Czech education system: schools have significant autonomy over how they allocate resources and how they implement the national curriculum and assessment (via each institution's "school educational programme"). Local municipalities or regions are primarily responsible for providing schools with equipment, investment and maintenance funds while the ministry provides funds to pay teachers and to purchase teaching resources for students. The ministry (together with other government ministries) is also responsible for setting the rules and conditions of funding programmes financed by the European Union (EU) and from which schools can additionally finance their digital infrastructure and equipment.

Public responsibilities for providing access to and use of digital technologies in education follow this partially decentralised and highly devolved context, with some of the digital infrastructure provided centrally but significant portions acquired locally or independently by schools. The public responsibility for providing hardware infrastructure is split between several ministries (Ministry of Education, Youth and Sports; Ministry for Regional Development; and Ministry for Trade and Industry).

Digital education strategy

The current national education strategy ("*Strategie vzdělávací politiky České republiky do roku 2030+";* hereafter referred to as the Strategy 2030+), published in 2020, aims to modernise the entire education system and it references digital technologies both as a motivation for and means to achieve modernisation.[1] The document explicitly addresses digital education: developing students' skills to use technologies responsibly, independently and appropriately, across all subject areas; ensuring adequate hardware, software and connectivity; strengthening teachers' digital skills; using technology to improve teaching and learning; and supporting the use of digital infrastructure to collect educational data for self- and system evaluation and improve communication between stakeholders.

The Strategy 2030+ integrates and replaces the previous digital education strategy, published in 2014.[2] In 2019, the country's Supreme Audit Office (*Nejvyšší kontrolní úřad*) reviewed the implementation of that strategy and concluded that the ministry had failed to create the conditions necessary for the long-term successful development of digitalisation in education and for improving digital literacy.[3] A new review published by the Supreme Audit Office focusing on support for digital education in the period 2019-2021 found that schools were not well prepared for distance learning, but that the COVID-19 pandemic significantly contributed to developing digital education in the country including the provision of portable digital devices.[4] Over CZK 8 billion (EUR 3.4 billion) was spent by the ministry during this period on supporting digital education.

A significant proportion of the country's projects on digitalisation in education are funded by the European Union in addition to the funding provided by municipalities and/or regions. These include projects focused on developing digital skills and computational thinking, supported via European Structural and Investment Funds (ESIF), as well as the "National Recovery Plan" (*Národní plán obnovy*), supported via the EU Recovery and Resilience Facility (2021-2026).[5] One of the aims of the National Recovery Plan is to support the revision and implementation of the new digital curriculum and the meaningful integration of digital technologies in teaching, as well as to increase the digital capacity of schools and tackle the digital divide.

Beyond education specifically, the government created a national Digital and Information Agency in 2023 as part of a project to transform the co-ordination and management of digitalisation in the country.[6]

The public digital education infrastructure

In Czechia, both the ministry and the regions/municipalities provide components of the digital education infrastructure. Given the significant autonomy of schools, institutions are primarily responsible for acquiring their own digital ecosystem and choosing which digital tools to use. This section reviews two aspects of the public digital infrastructure in Czechia: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system

The ministry does not currently use or provide a centralised student information system (SIS). Schools do have to share certain student data with the ministry for administrative and statistical purposes, but they usually collect and transfer data using commercially procured solutions for institutional management (e.g. *Bakaláři* or *Škola online*).[7] The country plans to create an "Education Registers System" to simplify the acquisition and transfer of data amongst relevant stakeholders (e.g. the ministry and education agencies, schools, research organisations, etc.). The system aims to reduce the administrative burden on schools by defining a clear framework of required data and optimising the data sharing and collection process, as well as increasing the compatibility of existing institutional management systems. Similarly, the ministry

does not provide or use any kind of student admission management system but has recently established a task force to digitise this process for students in upper secondary education.

While the ministry does not have a centralised student information system, the Czech School Inspectorate (CSI; *Česká školní inspekce*) – an independent national authority for evaluating the quality and effectiveness of education – does have a publicly accessible national school register called the *InspIS Portál.*[8] The register provides basic information about schools at all education levels collected by CSI, but also allows schools to enter additional information related to their school characteristics or facilities (e.g. specially equipped classrooms, ICT equipment, assessment methods, etc.) and to attach relevant school documents. The register also contains reports on each school produced by the CSI following their inspections.

Ministry officials estimate that the majority of schools in the country do use some kind of learning management system (often including tools for knowledge management or customer relationship management) to manage students at the institutional level, but these digital tools are not publicly provided by the ministry. Some digital tools for administrative functions may also be used or provided by local municipalities, but there are significant differences across the country in terms of how schools are managed and what tools municipalities provide to schools.

Self-evaluation tools for institutional management

The importance of school self-evaluation in Czechia was recognised in a 2001 White Paper by the ministry and was subsequently enshrined in law via the Education Act in 2004.[9] It is further developed in the current Strategy 2030+. The CSI provides modules of its online *InspIS* system (Inspection Information System) to schools to support their self-evaluation activities.[10] Aligning the tools used for self-evaluation with those used for external evaluation by CSI helps to ensure coherence between the two activities.

The *InspIS DATA* module is the main information system used by the CSI to monitor and record findings during school inspections. All schools must fulfil part of their legal obligations towards the CSI (e.g. implementing inspection surveys, transfer of records) by registering in the *InspIS DATA* system, and school management staff can access their external inspection reports via this system. Via the platform, staff can also access online self-evaluation tools that are aligned with those used for external evaluation. Although schools cannot modify these tools for their own school context, it does allow schools to generate a summary report that links directly to their last CSI external evaluation. The CSI cannot access any school data generated by self-evaluation in the *InspIS DATA* platform.

The *InspIS ŠVP* module facilitates the creation and administration of school educational programmes (ŠVP; *školních vzdělávacích programů*). It guides school leaders to formalise and systematically link their schools' educational offer with the national Framework Educational Programmes. The *InspIS ŠVP* system also serves school self-evaluation by automating the creation of targeted self-evaluation plans. Unlike the self-evaluation tools provided via the *InspIS DATA* module, the *InspIS ŠVP* module allows schools to select the criteria on which they want to focus a self-evaluation exercise and it pre-populates the plan with suggested objectives and goals that schools can modify or add.

In addition to providing the *InspIS DATA* and *ŠVP* modules for schools at all education levels (including VET), the CSI website makes available a range of resources for school management staff linked to monitoring and improving the quality of education in schools. These include research reports, concrete recommendations for particular issues and information about best practices for linking self-evaluation and external evaluation.

Finally, the National Pedagogical Institute (NPI; *Národní pedagogický institut*), an education agency managed by the ministry, provides a self-evaluation tool for schools focused specifically on digital education. Schools can use the *Profil Škola21* tool to create their own school ICT profile, evaluate their progress towards ICT integration and compare their school with others on the platform based on the European Digital Competence Framework for Educational Organisations (DigCompOrg).[11] The EU

SELFIE for Schools tool functions similarly.

Examinations, career guidance and professional development

While high-stakes, end-of-year examinations are paper-based, the CSI conducts annual low-stakes online assessments through its *InspIS SET* module for a representative sample of students in primary and secondary education.[12] These assessments contribute to the CSI's evaluation and verification of learning outcomes in the Czech education system. Schools can also directly use the *InspIS SET* module to carry out their own online assessments using a public bank of test items (as well as add their own items). The CSI is working to supplement the bank of items with released items from international surveys.

To help students navigate their school trajectory and find their future career, the National Pedagogical Institute (NPI) offers a career guidance platform that provides a range of information, tools and resources for students in primary, secondary and tertiary education (e.g. on choosing subjects or orienting career decisions post-secondary education).[13] The platform also provides some resources for educators and employers, for example on labour market statistics or information on graduate employability.

In terms of career support and professional development for teachers, the CSI provides the *InspIS E-LEARNING* module that school leaders and teachers can use for online learning and to access professional resources. They can also test their skills and obtain electronic certificates via the platform.

Digital ecosystem for teaching and learning

Digital teaching resources in formal education

The NPI provides teachers with the *Metodický portal RVP*, a platform with static teaching resources created and shared by other educators and targeted at pre-primary, primary and lower secondary educational levels.[14] Resources cover a wide range of subjects and are classified on the platform according to the relevant level of education, subject domain and topic. The platform connects to the *Katalog EMA*, which is a centralised catalogue of open-licensed digital educational resources otherwise stored on several different portals and websites.[15] The catalogue ranks resources according to their popularity and quality to help teachers find useful resources. However, a recent review by the Supreme Audit Office found that 64% of the materials on the portal had never been viewed by any user.[4] The NPI is therefore currently working on improving the coverage, accessibility and functioning of the platform.

During the COVID-19 pandemic, virtual classroom environments were used significantly by schools across the country as the primary mode of teaching to ensure distance learning; however, it is unclear to what extent such tools continue to be used in schools. The ministry has started a pilot programme on hybrid teaching and learning (where schooling is in-person Monday-Thursday, and online on Friday) with 70 schools (including primary and secondary education).[16] Other resource providers, including education publishers, philanthropic organisations and EdTech companies (e.g. Microsoft), also provided digital resources for teaching and learning to educators for free during the pandemic.

Open educational resources

As part of the EU-funded project on developing computational thinking managed by the ministry, the University of South Bohemia developed the *iMyšlení* platform which provides a range of open educational resources (e.g. Massive Online Open Courses, free applications, videos and texts) for online learning for students, teachers, parents and the wider general public.[17] It also aims to popularise topics related to computational thinking, like programming and robotics, for different audiences. The ministry, together with the Ministry of Labour and Social Affairs (MLSA; *Ministerstvo práce a sociálních věcí*) and with funding from European Social Funds, also manage the *PortalDigi* open portfolio of resources focused on developing citizens' digital competencies.[18] The platform links to other portals (e.g. *DigiVýuka, DigiKatalog,*

Evaldo) that provide resources for developing digital skills and for identifying potential issues when working with digital technology, both in general and for specific roles in the workplace.

Other openly accessible teaching and learning resources are available through public (social) media channels. For example, the NPI runs a YouTube channel with content targeted at educators.[19] *Česká televize*, a public television network, produces free educational programming and interactive games and learning resources for pre-primary, primary and secondary students on its *CT edu* channel.[20] While students normally view and interact with content online on its website, some content was also directly broadcast on television during the COVID-19 pandemic.

Online assessment and self-evaluation tools for teaching and learning

In addition to resources for teaching and learning, the ministry and education agencies provide several self-evaluation tools for teachers, schools and students. The *Metodický portal RVP* provides access to instruments developed by other education professionals for evaluating various institutional and classroom issues (e.g. school climate) as well as student and parent attitudes.[21] It also provides a self-assessment tool for teachers, *Profil Učitel21*.[22] Teachers can use the tool to evaluate their own digital competencies, based on the European Digital Competence Framework for Educators (DigCompEdu).

Separate to the *Metodický portal RVP,* there is also a publicly available online assessment application called *Evaldo* aimed at the general public that forms part of the *PortalDigi* platform.[23] The application simulates common digital environments and asks users to complete tasks in order to evaluate their digital competencies. The application is based on the European Digital Competence Framework for students (DigComp II). Based on users' results, it recommends areas for further development and links to relevant educational resources elsewhere on the *PortalDigi* platform.

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

Providing a public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

Czechia does not have specific laws on ensuring equitable access to and use of digital tools and resources in education. In practice, both the CSI and the NPI in particular publicly provide various digital tools (e.g. *InspIS* system and modules) and resources (e.g. *Metodický portal RVP, Profil Učitel21, Profil Škola21*), in principle enabling school staff and teachers to access components of the digital education ecosystem in a homogenous and equitable way across all education levels. However, the devolution of responsibilities to schools for ultimately using those resources (with the exception of the *InspIS DATA* system), their discretion to acquire additional components of their digital infrastructure, and the varying levels of ICT integration in schools and across educational levels leads to possible disparities and inequities across institutions.

In terms of funding, there is no specific equity component of the non-earmarked funding provided to primary and lower secondary schools by the ministry for their operational needs. Outside of this central operational budget, there is some earmarked funding for expenditure related to digital education specifically. The National Recovery Plan provides two such funds (via the municipalities) for public primary and secondary schools (including VET institutions). The first fund is targeted towards students and schools from low socio-economic backgrounds with the aim of closing the digital gap in education. It is available in multiple years

for purchasing hardware equipment including mobile devices to loan for free to disadvantaged students; the formula to define the eligible allocation takes into account a school's socio-economic situation. The goal is to purchase 70 000 devices nationally to support pupils in need, and for at least 80% of schools to implement the loan initiative. The second fund is designed as a one-time subsidy to purchase digital teaching aids (e.g. robotics kits, virtual reality devices, specialised software); the budgets for this purpose are calculated using a fixed amount per student (therefore no equity component to the funding formula). While the two funds are differentiated in this way, schools maintain autonomy over how to spend them (i.e. which hardware or software solutions to purchase). Private and religious schools can also apply for this funding. While these earmarked funds are accessible to all schools and could thus mitigate some disparities across schools, uneven access to (digital) hardware and resources will likely remain issues given the high degree of school autonomy and that only one of the two funds includes an equity dimension in its funding formula.

Finally, although the development of digital competences now forms part of the mandatory educational objectives defined by the ministry, schools and teachers can meet this objective with some pedagogical discretion – therefore possibly leading to different educational offers across schools in this area.

Supporting the use of digital tools and resources

In addition to providing earmarked funding for digital infrastructure through the National Recovery Plan, the ministry has developed dedicated online support and guidance materials on digitalisation through its *Digitalizujeme* ("We digitise the school") website, including examples of good practice, a handbook on IT administration for school directors, and standards on school connectivity and security.[24] A network of so-called "IT gurus" – expert consultants paid by the ministry and located regionally – has also been created to support schools in their digitalisation process. Furthermore, schools can have a dedicated "ICT methodologist" in their school whose task it is to help colleagues integrate digital technologies in their teaching and to help create their school's Digital Strategy. This role has state-recognised concessions in teaching duties and individuals must complete specific trainings.

The NPI's *Metodický portal RVP* platform, in addition to providing pedagogical supports, also provides broader resources for educators on various aspects of teaching and learning including digital education, such as academic articles, webinars and blogs.

Cultivating the digital literacy of education stakeholders

In Czechia, there are guidelines providing a framework for teachers' digital competencies at all educational levels (*Rámec digitálních kompetencí učitele*), based on the EU's DigCompEdu.[25] As outlined in the Strategy 2030+, the ministry is also revising the national curriculum framework for basic education to include the new areas of informatics and digital competence. The revised framework was approved and published in 2021 for both basic schools and grammar schools. Basic schools at ISCED level 1 must integrate the revised curricula in their school educational programme from September 2023; basic schools at ISCED level 2 must do so from September 2024, and grammar schools from September 2025. A similar reform for upper secondary VET education is currently underway.

To support schools with this transition, the NPI has created the *Revize* website which contains comprehensive information resources on the curriculum reform, as well as guidance and best practices for its implementation.[26] At the request of schools, the ministry also developed and published a model school educational programme for informatics and digital competence which schools can access via the *InspIS ŠVP* system. To support teachers with the transition, the NPI provides courses, teaching resources and methodological support on the new areas of the curriculum as a part of a project financed by the EU's Recovery and Resilience Fund.[27]

In 2016 *DigiKoalice* was established as a joint platform of the ministry and the NPI. It is a unique platform connecting schools with stakeholders interested in digital education, with a particular focus on developing digital skills and on digital jobs.[28] It brings together more than 200 member organisations, from state institutions and agencies, to schools, ICT companies and non-profit organisations. Members can share resources and find courses or events focused on the development of digital skills (some of which are free).

In terms of broader engagement with stakeholders, a new Interdepartmental Group for Digital Education has been formalised within the Government Council for Information Society, following its role in the context of the Structured Dialogue on Digital Education and Skills initiative by the European Commission. The National Office for Cyber and Information Security (NUKIB; *Národní Úřad pro Kybernetickou a Informační Bezpečnost*) also provides online learning resources on cybersecurity issues targeted at different groups of the general population, including students, teachers and parents.[29] In collaboration with the ministry, the Office has created resources specifically for students and teachers on topics related to cybersecurity, fake news and Internet scams.

Governance of data and digital technologies in education

In Czechia, data protection and privacy are provided for under the European Union's General Data Protection Regulation (GDPR). The ministry also provides some guidelines related to digital security in schools via its *Digitalizujeme* website (although these focus on secure network connectivity rather than data protection and privacy).[30] However, the government does not have any specific additional rules related to student data protection and privacy nor are there any rules or provisions related to accessing student microdata (anonymised microdata for research purposes are currently made available upon request). An exception to this is the selected aggregated data that the CSI makes publicly available from their national inspection activities and from international surveys (e.g. PISA).

There are some standards of interoperability among digital tools used by the ministry and national agencies, but no formal rules or guidelines governing the interoperability of the broader digital education infrastructure. In terms of guidelines for ensuring the quality of digital educational resources, in 2016 the NPI published quality educational criteria for digital resources developed with public funds.[31]

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

Developing a national digital education ecosystem presents challenges both to develop appropriate local solutions and to incentivise relevant innovation by external stakeholders. Providing incentives, supporting research and development, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

Although no public research priorities have been formulated in the field of digital education nor is there a specific research programme funded by the ministry to support research on the topic, some national agencies do conduct their own research on aspects of digital education (particularly since the onset of the COVID-19 pandemic). For example, the CSI has conducted research on distance learning and on the use of and perceptions of ICT in education, and in 2023 the national technological agency (*Technologická agentura České republiky)* had one project focused on examining the state of digital infrastructure and its financing in education.[32]

The Strategy 2030+ also signals an intention to strengthen educational research in general and improve communication between the ministry and the research community. The creation of the Education Registers System, in effect a centralised information register connecting various existing student datasets within the education system, will facilitate information sharing between education stakeholders including research organisations and will promote access to anonymised educational microdata (upon request) for research

purposes. Currently there is no publicly available or documented educational microdata (beyond the basic information about schools gathered in the *InspIS Portál*).

The ministry and associated agencies do not develop any EdTech solutions directly, nor are there institutionalised partnerships between independent EdTech companies and the ministry. While there are no formal financial mechanisms (e.g. investment, subsidy) to incentivise private sector innovation and development in this field, the ministry does support and foster some collaboration with EdTech indirectly or through non-monetary means (e.g. the *DigiKoalice* platform). The ministry and the NPI also organise an annual *DigiSeč* conference dedicated to digital technologies in teaching that brings together teachers in primary and lower secondary schools with other professionals, researchers, and EdTech companies.[33]

Notes

[1] https://www.edu.cz/wp-content/uploads/2021/09/brozura_S2030_en_fin_online.pdf

[2] https://www.edu.cz/strategie-msmt/strategie-digitalniho-vzdelavani-do-roku-2020/

[3] https://www.nku.cz/assets/kon-zavery/K18018_en.pdf

[4] https://www.msmt.cz/file/55382/

[5] For more on ESIF projects see: https://www.edu.cz/podpora-skol/projekty-esif/ (overview), https://digigram.cz/ (project on developing digital literacy), and https://www.imysleni.cz/o-projektu (project on developing computational thinking); For more on the National Recovery Plan, see: https://www.edu.cz/npo/.

[6] https://digitalnicesko.gov.cz/dia/

[7] Bakaláři: https://www.bakalari.cz/; Škola online: https://www.skolaonline.cz/

[8] https://portal.csicr.cz/

[9] White paper (2001): https://www.msmt.cz/reforma-terciarniho-vzdelavani/bila-kniha/narodni-program-rozvoje-vzdelavani-v-ceske-republice-bila-kniha-2001; Education Act (2004): https://www.msmt.cz/dokumenty/skolsky-zakon-ve-zneni-ucinnem-ode-dne-1-2-2022

[10] https://csicr.cz/cz/Informacni-systemy/Informacni-systemy

[11] https://skola21.rvp.cz/

[12] https://inspis.csicr.cz/pipe/Login

[13] https://www.infoabsolvent.cz/

[14] https://rvp.cz/

[15] https://ema.rvp.cz/

[16] https://www.msmt.cz/vzdelavani/zakladni-vzdelavani/vyhlaseni-pokusneho-overovani-kombinovaneho-vzdelavani

[17] https://imysleni.cz/

[18] https://www.evaldo.cz/projektove-weby

[19] NPI YouTube channel: https://www.youtube.com/channel/UCzx0HUrvq48ZPtKvqIrKJAg/featured

[20] https://edu.ceskatelevize.cz/?_ga=2.186807914.395114136.1668783469-1279886337.1668783463

[21] http://evaluacninastroje.rvp.cz/nuovckk_portal/Default.aspx?tabid=72&language=cs-CZ

[22] https://ucitel21.rvp.cz/

[23] https://www.evaldo.cz/

[24] Resources portal for schools and digitalisation: https://www.edu.cz/digitalizujeme; Standards on connectivity: https://www.edu.cz/digitalizujeme/standard-konektivity-skol/; Headmaster's guide to IT administration and management: https://www.edu.cz/digitalizujeme/it-sprava/; IT gurus: https://www.edu.cz/digitalizujeme/it-guru/

[25] https://ucitel21.rvp.cz

[26] https://revize.edu.cz/

[27] https://www.nidv.cz/

[28] https://digikoalice.cz/

[29] https://osveta.nukib.cz/

[30] https://www.edu.cz/digitalizujeme/standard-konektivity-skol/

[31] https://clanky.rvp.cz/clanek/c/Z/21071/kriteria-kvality-digitalnich-vzdelavacich-zdroju-podporenych-z-verejnych-rozpoctu.html

[32] CSI research on 1) distance learning during the Covid-19 pandemic https://www.csicr.cz/html/2021/TZ_Distancni_vzdelavani_v_ZS_a_SS/html5/index.html?&locale=CSY&pn=1 and 2) the use and teachers' perceptions of ICT using PISA data www.csicr.cz/Csicr/media/Prilohy/2021_přílohy/Dokumenty/Sekundarni-analyza-PISA-2018.pdf; National Technology Agency digital education project: https://starfos.tacr.cz/cs/project/TIRDMSMT015MT05#project-main

[33] https://digisec.npi.cz/

6 Denmark

This note provides an overview of Denmark's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Denmark supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Denmark engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- The provision of digital infrastructure for education in Denmark is mainly a public responsibility divided between central and municipal governments. At the central level, the ministry provides a selection of digital tools for system management. At the local level, municipalities provide primary and lower secondary schools with digital tools for institutional management (e.g. learning management systems) or for teaching and learning purposes (e.g. all sorts of digital resources) that they (or their schools) procure from the EdTech market. In upper secondary education (including VET), schools themselves are responsible for procuring their digital management tools and learning resources.
- Schools and teachers have a growing degree of autonomy in making choice about digital tools, from the ones publicly (centrally or locally) provided or from the private market. To some degree, the government supports and guides them in their procurement and imposes requirements and standards to ensure interoperability and security.
- The Danish education system builds on high degrees of trust and interaction between public authorities and citizens, as well as on excellent hardware infrastructure. In this well-established digital environment and following the 2014 User Portal Initiative, the 2018 Supplementary Agreement and the 2021 Policy Agreement, the role of the central government as regards digitalisation in education has been shifting from that of a provider to that of an enabler. This suggests that the government has come to prioritise the enactment of rules and guidelines to ensure a coherent and harmonised uptake of digital technologies nationally, over the distribution of specific digital tools that municipalities and schools are better placed to acquire.

General policy context

Division of responsibility

In Denmark, the Ministry of Children and Education (hereinafter “the ministry”) is responsible for determining the policies and direction of the Danish education system. However, the governance of the education system is largely decentralised. Primary and lower secondary schools are funded and governed by Danish municipalities; while upper secondary schools and vocational education and training (VET) institutions are state-funded but self-governed.

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follow this devolved context. Providing schools across all levels of education with access to digital tools for system management is mainly the ministry’s responsibility; but providing digital tools for institutional management as well as resources for teaching and learning is a responsibility delegated to Danish municipalities in primary and lower secondary education, and to institutions themselves in upper secondary and VET.

What is true of the provision of digital tools is also true of their regulation in Denmark. The Danish central government leaves a large room for manoeuvre to municipalities, or to schools themselves, to set local rules and guidelines that govern the access to, and use of, data and digital technologies in education.

Digital education strategy

In 2021, the Danish government published a Policy Agreement and invested around EUR 7 million into three main areas: raising students’ awareness about safety and security issues on the Internet; developing digital teaching resources; and fostering a healthy digital culture in schools.[1]

The 2021 Policy Agreement exemplifies the recent priorities of the Danish central government in terms of digitalisation in education, whereby it devolves more and more of the provision of digital infrastructure to other public authorities or to schools themselves. For instance, in the past five years, no significant change was made – at the central level – in the policy or expenditures for hardware infrastructure (e.g. broadband connection in schools, digital devices for students). The hardware infrastructure is already well established in Denmark, with 97% of the 16-74 year-olds having access to the Internet at home, and 100% of businesses. Upgrading this infrastructure, or maintaining it, is a responsibility that the ministry devolves to municipalities locally.

Beyond the education sector, the central government's strategy is to ensure a coherent uptake and use of digital technology across different policy areas and levels of government. In 2010, it has set up the Danish Agency for Governmental IT Services within the Ministry of Finance to that effect. The Agency is responsible for operating an effective digital support service and for ensuring a high quality and consistent digital service across the whole Danish government.[2]

The public digital education infrastructure

In 2014, the central government and Local Government Denmark (representative of the Danish municipalities) agreed upon a financial model for implementing a public "User Portal Initiative".[3] This initiative clarified the roles and responsibilities of the ministry and municipalities in setting up a public digital infrastructure in primary and lower secondary education, on the principle that local governments were better placed to meet the needs of end-users (teachers, students, parents). This initiative aimed at: building an "integration platform" as a single interface between the municipalities' learning management systems and the state's databases; setting up public interoperability standards for data exchange (e.g. *IEEE LOM* for metadata, *Common Cartridge* for learning resources, LTI for exam results); and making some educational data openly available to provide opportunities for vendors to create innovative products.

As a result of the 2014 User Portal Initiative and in line with the devolution of responsibility in education, the central government and municipalities share public responsibilities for providing a public digital infrastructure in education; and schools can choose to acquire further tools from private companies or use free materials from external stakeholders such as philanthropists, education publishers, EdTech and non-EdTech companies, universities, teachers, and teacher unions.[4]

This section reviews two aspects of the public digital infrastructure in Denmark: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management systems

The Danish ministry does not centrally maintain a student information system (SIS). The ministry used to use and provide its own system for VET and private institutions, *EASY-A*, which integrated the functionalities of a student information system and an administrative function system in schools. However, in June 2021 the ministry closed this system and asked all municipalities to equip schools with a market supplied system to manage their administrative operations, and report back to the central administration and other public authorities.[5] To make sure that schools' substitute tools match with the data standards of the central student register as *EASY-A* did, the ministry has set up a list of several approved learning management systems from which municipalities and schools can choose from.[6]

Although the government stopped operating a student information system, the agreement reached in the 2015 User Portal Initiative stipulated that it would set up a common interface to integrate and connect the various schools' learning management systems and facilitate all mandatory data transfers into the

government's central registers. All this is done through the portal of the National Agency for IT and the Learning's Knowledge Base that acts as a one-stop shop for school staff.[7] The Knowledge Base portal lists the digital tools provided by the government for system management, indicates to what extent (fully or in part only) the use of those tools to report data is compulsory for schools, and provides step-by-step guidance on data transfers – as well as information on other educational matters. Data are then aggregated to compute statistics that are displayed online at *Uddannelsesstatistik* ("Education Statistics").[8]

Admission and guidance

The central government maintains a student admission management system, *Optagelse* ("Admission").[9] Students use it to apply for upper secondary education, VET, and higher education institutions. All relevant information are then transferred from *Optagelse* to institutions' education management systems so that they can review and select applications. *Optagelse* is not powered by algorithms yet, but automated decision-making is being developed and should be rolled out in *Optagelse* in some parts of the country by 2024. Municipalities also use a digital system for enrolment in primary and lower secondary schools that digitises enrolment procedures in a simplification effort. The enrolment process is not competitive.

To help students navigate their studies, submit applications to the student admission management system and find their future career, the ministry has set up a platform for career and study guidance called *UddannelsesGuiden* ("Education Guide" in English). It is available for students at all levels of education.[10]

Finally, VET students can use the *Lærepladsen* ("Apprenticeship") platform to find an apprenticeship in companies that are approved by the ministry.

Exams and assessments

The ministry manages three digital systems to support the administration of assessments: *Testogprøver* ("Tests and trials") in primary and lower secondary education, *Netprøver* ("Online Tests") in secondary education, and XPRS in upper secondary education (specifically for exams).[11] In *Netprøver* for instance, students can work with centrally managed written assessments online. *Netprøver* automatically checks students' submissions for plagiarism, assigns them grading by appointed examiners, and transfers students' grades to their schools' learning management system.

Those systems also support the administration of online student evaluations. In primary and lower secondary education, since 2022 the ministry has implanted the *Folkeskolen's National Test* ("Primary schools' national test"), which will pave the way for the larger-scale development and implementation of the *Folkeskolen's National Skills Test* by the 2026-27 school year. This new compulsory online student evaluation will be assessing students' competencies in reading and mathematics. Compared with the former adaptive national evaluation, in which the questions difficulty adapted in real time to student performance, the upcoming *Folkeskolen's National Skills Test* will be linear: all students will be asked the same questions in the same order. This reversal on adaptive assessment followed complaints from education researchers, from politicians on both sides of the political spectrum and from parts of the public opinion. The former, adaptive national evaluation will remain available on a voluntary basis in a variety of disciplines until the 2025/26 school year, including biology, geography, chemistry, physics, English and Danish as a second language.

Finance, administration, and communication management

In primary and lower secondary education, the ministry provides schools with *Centralt Økonomi- og StudieAdministrativt* (*CØSA*, "Central Finance and Study Administration"), a digital administrative system used for computing central subsidies received by municipalities to fund their schools, based on data about their educational operations, student enrolments and activities. *CØSA* allows the quarterly updated payment of municipal subsidies. In upper secondary and VET institutions, the publicly provided Navision

Stat serves the role of a digital administrative system. *CØSA* and Navision Stat are provided to facilitate specific data transfers between schools' and their corresponding authorities. Although they allow for a certain degree of integration with schools' learning management systems, they are not intended to be used as a comprehensive student information system by the ministry.

Consecutive to the division of responsibility envisioned in the 2014 User Portal Initiative, municipalities were also tasked with the development and maintenance of the *Aula* platform. Built and implemented in 2019 in collaboration with KOMBIT, the municipalities' joint IT organisation, Aula operates as the primary customer relationship management system (that is, communication tool) for millions of students, parents, and school staff in primary and lower secondary education in Denmark.[12] It has been progressively adopted by more than 1 700 primary schools (and over 4 000 day-care providers) and emerges now as a uniform system across institutions and municipalities. Its scalable data processing infrastructure runs through *Amazon Web Service* and meets all local authorities' data protection measures. With its massive uptake, government officials reckon that *Aula* has encouraged EdTech firms to raise their transparency standards so that their products could be connected with *Aula*.

Digital ecosystem for teaching and learning

Danish municipalities have a large degree of autonomy in providing digital resources for teaching and learning to schools. There are only few examples where this responsibility falls upon the central government.

Most of the centrally provided digital resources for teaching and learning are curated on *Emu*, the ministry's online platform for learning and for teacher development that covers all levels of educations.[13] On *Emu*, teacher and educational staff can find teaching resources and activities, examples of good pedagogical practices, open educational resources in different formats (text, audio, or video), as well as templates for research papers, articles, and courses, and legal guidelines about copyright for image and video materials or accessibility requirements, for example. All those resources are openly provided, and so is the social media channel maintained by the ministry, which notably broadcasts podcasts as educational resources.[14]

For students, the ministry openly provides self-assessment resources such as those curated as sample exercises from the National Tests. It also maintains *Prøvebanken* ("Test bank"), a digital bank of assessments that students can access to test their skills and knowledge on exams and assignments from 2010 on in various subjects at all levels of education.[15] The latter is accessed through a single sign-on service rather than openly.

Other than that, municipalities can provide their schools with additional learning resources, virtual classroom environments or other digital tools for teaching and learning. The "Teachers Digital Everyday" report helps school staff explore what types of digital tools and resources are used by their peers.[16]

When publicly provided, whether by the ministry or by the municipalities, those digital tools are generally accessible through a single sign on (SSO) service called *UNI login*. Its development and expansion were allotted to the central government in the 2014 User Portal Initiative.[17]

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily imply that stakeholders will use them. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

In Denmark, as in other Nordic countries, the government aims to provide *equal* access to education and educational resources to everyone – therefore no specific student groups or school types (rural or urban, public or private, etc.) are targeted as a policy priority. Data collected by the OECD Teaching and Learning International Survey (TALIS) study across the 2017/18 school year provide some evidence of the equity of access to digital infrastructure across Denmark. Whether you compare Danish schools by socio-economic status, type (public or private) or location (city or rural area), the difference in the level of teachers' use and self-efficacy with ICT or the prevalence of ICT equipment in schools, are either statistically non-significant or far lower than in most other OECD countries. On average, 90% of Danish lower secondary teachers report that they frequently or always let students use ICT in their learning (compared to 53% on average in the OECD); 88% feel that they can support student learning through the use of ICT (67% on average in the OECD); and only 13% of principals reckon that their school's capacity to provide school instruction is hindered by a shortage or inadequacy of digital technology for instruction (25% on average in the OECD).

Supporting the use of digital tools and resources

To expand the digital education ecosystem beyond the tools that it directly provides (e.g. the student admission management system, the bank of (self-) assessment tools, the online platform for teacher development), the ministry delegates the procurement of digital tools to municipalities. In those cases, it provides them with certain amount of funding agreed upon the 2014 User Portal Initiative, and sometimes with a list of recommended tools to choose from. This followed a EUR 67 million investment made in 2011 to support the use of digital tools and resources in education. When schools themselves want (or need) to equip themselves with additional digital tools, the ministry grants permission on a case-by-case basis (through the SKI platform described below). In the latter case, the ministry imposes criteria with regard to security as per *Systemrevisionsbekendtgørelsen* ("system audit executive order"), a 2021 legal order on requirements for digital tools used in education.[18]

In Denmark, *Statens og Kommunernes Indkøbsservice A/S* (SKI, or in English "State and Municipal Purchasing Service") is an agency mandated by the government to streamline and professionalise public procurement across sectors. It was founded in 1994 as a limited company and co-owned by the Danish government and Local Government Denmark.[19] Out of the approximately EUR 49 billion that the Danish public sector spends every year to purchase goods and services from private companies, 2.5% are made through SKI (that is, EUR 1.2 billion). In education as much as in other sectors, the aim is to secure good quality products and services at better prices and conditions than each individual public organisation (e.g. schools) can obtain alone. At the local level, KOMBIT provides municipalities with further guidance on the procurement of digital tools and help them negotiate with vendors for better prices and quality.

To support the use of those tools in educational institutions, the ministry may impose the use of certain tools, whether it itself provides them (see the student admission management system for instance) or not (see the learning management systems, purchased by municipalities and schools). The ministry also provides central guidance (for instance, through the ministry's support website when related to publicly provided tools, or through the SKI platform when procured from private companies) at all levels of education, as well as local guidance for education levels it is responsible for, in the form of workshops in VET and adult learning institutions.[20] The ministry has also set up financial incentives for adult learning institutions to use distance learning tools with the objective to strengthen the attractivity and flexibility of adult learning.[21]

Finally, the ministry monitors and evaluates the use of digital tools in schools. The Danish Evaluation Institute (EVA), established in 1999 to succeed the Evaluation Centre which existed since 1992, serves as an independent state institution under the ministry of education to explore and evaluate the quality of

schools at all educational levels. Among other areas of interest, EVA carries out quality evaluation on pedagogies and innovative pedagogical methods, including the monitoring of the uptake of digital tools in schools.

Cultivating the digital literacy of education stakeholders

In Denmark, VET teachers must acquire certain competencies regarding the use of digital technologies for teaching in their pre-service training. This is a requirement imposed nationally by the central government as a way to implement the national curriculum at all levels of education. The new legal corpus imposes the use of specific digital technologies in class and establishes the development of student skills to use and understand digital technologies as a key educational objective.

Beyond teachers, Denmark seeks to engage its whole population with the digitalisation of education. The Danish government therefore involves students and their parents in government-supported projects to foster a healthy digital culture in schools and raises awareness around the use of digital technology in education. These are two pillars of the 2021 Policy Agreement that refined Denmark's digital strategy in education.

Governance of data and digital technology in education

The Danish government has set up rules that regulate the access to, and use of, data and digital technologies in education. Although some of those rules, as well as guidelines, emanate from the central ministry, many are at the discretion of the municipalities. For instance, setting up rules about equitable access to, and use of, digital technologies in education, in particular for official exams, is the central government's responsibility. However, it falls to lower levels of government to regulate or guide the possible use of digital proctoring methods or automated decision-making systems (within the general legal framework for data protection described below) – although they are seldom used.

As is the case across EU countries, the largest part of Denmark's regulation around the protection of data and privacy, in education as well as in other sectors, is a transposition in national law of the EU General Data Protection Regulation (EU GDPR). The Danish National Agency for IT and Learning provide support to apply the EU GDPR in the education system, but it is mainly the municipalities and schools' responsibility to ensure compliance with data protection regulation. Additional rules exist, though, in line with the particularities of the Danish digital infrastructure in education. For instance, the online student evaluations come with specific regulation on privacy and data protection. Also, there exist further rules around the protection of staff data, who are protected as other employees by the 2019 National Economy Agreement – and by additional rules set up by municipalities.[22] Finally, the Danish government has set up rules and guidelines about accessing and using educational administrative data for public or private research and development (more details at the end of this section).

As the use of automated decision-making tools and AI-based tools in education remains limited, there is no specific policy effort at the central level to regulate these aspects. As of December 2023, neither are there central-level rules or guidelines about the accountability, effectiveness, transparency, bias of algorithmic models or automated systems, other than what the EU GDPR imposes (that is, nothing). However, the municipalities can implement rules or guidelines at their discretion (about minimal standards of performance of the digital technologies that they procure to their schools, for instance). According to ministry officials, such municipal regulation remained marginal as of 2023.

The ministry is the primary public authority that enacts rules and guidelines to promote increasing data portability and interoperability between the different tools that compose the Danish digital education infrastructure. *Systemrevisionsbekendtgørelsen* ("system audit executive order), a legal order enacted in 2021 that also regulated some aspects of procurement, imposes rules and requirements on the use of open standards on educational technologies and data, as well as on the use of specific technical standards,

all of which are enacted to improve interoperability of the tools used across municipalities at different levels of education. Examples of requirements include that the chosen system must feature "appropriate controls for the allocation, follow-up, maintenance and withdrawal of access rights to systems and data, as well as logical access controls that limit the risk of unauthorised access to systems or data", or that "the system supplier has established procedures that ensure that the SA system complies with applicable interfaces and that management of communication takes place in accordance with applicable interface descriptions".[23] Another way for the ministry to ensure interoperability in the digital ecosystem is to limit the schools' choice to a list of pre-approved tools, as in the case of learning management systems mentioned above. As in most other OECD countries, these efforts were accompanied by the implementation of a single sign-on service (*UNI Login*).

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

Developing a national education technology ecosystem is a challenge for local tools to be developed. Providing incentives, supporting R-D, funding education technology start-ups are part of the typical innovation portfolio countries could consider.

In the past five years, the ministry has commissioned research on topics directly or indirectly related to the use of digital technologies, to improve learning outcomes and assessments, support teaching, and help students with special needs. In parallel to this commissioning, the ministry releases documentation on its public administrative datasets to facilitate the use of education data. For instance, the Danish Evaluation Institute (EVA) is mandated with the mission to provide actionable data on education to both public and private research organisations.

The Danish government also monitors the uptake of digital technology through various studies. Most notably, the ministry conducted a quantitative survey in 2021 to map teachers' daily experience with digital tools.[24] The questionnaires were sent to representative samples of primary school teachers and principals. Acknowledging the low response rates, the survey found that 64% of teachers consider they have at least some influence on the choice of digital resources purchased by municipalities; and 76% are satisfied with this level of influence. Virtually all teachers consider that those digital resources are of good quality (92%), but some also find their provision insufficient (40%). In the same year, Denmark also participated in a study of the International Association for the Evaluation of Student Achievement (IEA) to assess changes in teachers' use of digital tools during the COVID-19 pandemic. The ministry partnered with researchers from Aarhus University, the second largest university of the country, to carry out the study. The result showed lesser amplitude of change in Denmark than in other countries, due to the already deeply integrated digital culture.[25]

As the Danish central and local governments partly rely on private EdTech companies to provide some of the building blocks of schools' digital infrastructure, the ministry and its agencies have secured public-private relationships that aim to mobilise innovations in education. These efforts mostly consist in non-monetary incentives. For instance, the ministry supports the collaboration between EdTech companies and educational institutions by organising conferences (e.g. the *Digitaliseringsdage* ["Digitisation days"] conference) that bring together teachers, publishers and other relevant (private) partners, sometimes members of the EdTech Denmark association.[26] The ministry no longer invests in start-up companies working on EdTech tools, but it continues to incentivise research and development to encourage EdTech innovation through competitive educational grants.

In terms of future priorities, in software as much as in hardware infrastructure, the central government will continue to review, for each type of digital tool, whether it should provide this infrastructure centrally or entrust municipalities (and schools themselves) to acquire it from the private sector, with the guidance and supervision of a central authority. As is the case in other Nordic countries, the Danish government's role

is willing to shift from a provider to an enabler, whereby it sets the conditions for engaging all stakeholders in the digitalisation of education.

Notes

[1] 2021 New Policy Agreement: https://www.uvm.dk/aktuelt/nyheder/uvm/2021/dec/211206-ny-aftale-skal-styrke-boern-og-unges-digitale-dannelse

[2] Agency for Governmental IT services: https://statens-it.dk/english/ & https://www.dga.or.th/wp-content/uploads/2019/03/file_dff0e1173ce315d0a824c2236d78b943.pdf

[3] 2015 User Portal Initiative: http://lre.eun.org/edrene/seminars/012/1374.pdf

[4] See for instance: Corona – Gode råd til undervisning | emu danmarks læringsportal

[5] The closure of EASY-A: https://www.stil.dk/administration-og-infrastruktur/frit-valg-af-studieadministrative-systemer/markedsgoerelsen

[6] List of approved learning management systems: https://www.stil.dk/administration-og-infrastruktur/studieadministrative-systemer/til-uddannelsesinstitutioner/godkendte-studieadministrative-systemer

[7] The Knowledge Base: https://viden.stil.dk

[8] Uddannelsesstatistik: https://uddannelsesstatistik.dk/pages/Vejledning_statistik.aspx

[9] *Optagelse:* https://www.optagelse.dk/

[10] UddannelsesGuiden: https://www.ug.dk/

[11] *Testogprøver:* https://xn--testogprver-ngb.dk/; Netprøver: https://www.uvm.dk/gymnasiale-uddannelser/proever-og-eksamen/tilrettelaeggelse-og-afholdelse-af-proever/netproever/om-netproever; XPRS: https://www.stil.dk/administration-og-infrastruktur/systemrevision-af-studieadministrative-systemer/integrationer-og-gaeldende-graensefladebeskrivelser

[12] Aula: https://aulainfo.dk/wp-content/uploads/Aula-foraeldrefolder-Gladsaxe-engelsk.pdf and https://www.netcompany.com/int/cases/Kombit-Aula and KOMBIT: https://kombit.dk/aboutkombit

[13] EMU: https://www.emu.dk/

[14] Social media channel: emu - Danmarks læringsportal | Facebook; BØRNEHØJDE på Apple Podcasts

[15] Prøvebanken: https://www.xn--prvebanken-1cb.dk/

[16] Teachers Digital Everyday: https://www.uvm.dk/aktuelt/nyheder/uvm/2021/maj/210517-ny-kortlaegning-en-velfungerende-digital-hverdag-med-plads-til-forbedring

[17] UNI Login: https://mit.uni-login.dk

[18] Systemrevisionsbekendtgørelsen: https://www.retsinformation.dk/eli/lta/2022/725

[19] SKI: https://www.ski.dk/videnssider/facts-about-ski/

[20] Ministry's Agency for IT and Learning's Support website: https://www.stil.dk/support

[21]Adult distance learning: https://www.uvm.dk/trepart/trepart-om-voksen-og-efteruddannelse/%C3%A9n-indgang-til-voksen-og-efteruddannelsestilbuddene/trepartsaftalens-initiativer-til-digitalisering-af-veu/forsoeg-med-veu-godtgoerelse-ved-fuld-fjernundervisning-i-amu

[22] 2019 National Economy Agreement: https://www.regeringen.dk/aktuelt/publikationer-og-aftaletekster/aftale-om-kommunernes-oekonomi-for-2019/

[23] Requirements on procurements: https://www.retsinformation.dk/eli/lta/2023/476

[24] Quantitative mapping of teachers' digital everyday life (2021): https://www.uvm.dk/aktuelt/nyheder/uvm/2021/maj/210517-ny-kortlaegning-en-velfungerende-digital-hverdag-med-plads-til-forbedring

[25] ICILS Teacher Panel (2021): https://projekter.au.dk/icils/icils-teacher-panel/

[26] EdTech Denmark promotes collaboration and gain from the development and use of digital technology in education: https://edtechdenmark.dk/ / Example of cross-sector conferences: https://www.digidage.dk/om-digitaliseringsdage

7 England (United Kingdom)

This note provides an overview of England's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how England supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how England engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In England (United Kingdom) (hereinafter England), the responsibility for providing access to digital infrastructure for education is split between the Department for Education and schools themselves. Schools receive set funding from central government to spend as they see fit. For local-authority-maintained schools, funding is managed by the authority; or by the trust if the school is part of a Multi-Academy Trust.
- The Department does not mandate individual products, such as student information systems and learning management systems. Schools are free to procure whichever system to meet their own requirements in relation to their educational contexts and circumstances. Though, the department maintains several dashboards which schools can use to draw data about schools and students.
- The department commissions other institutions and agencies to develop and provide digital teaching and learning resources (e.g. *Oak National Academy*). Schools may independently choose to acquire and use additional resources. The department offers various guidelines to help schools make decisions, but the use of any resources is not mandatory.
- Computing is a statutory part of the national curriculum from key stages 1 to 4.[1] Organising digital skills trainings for in-service teachers, specifying the use of digital technologies in curriculum, and developing students' digital literacies fall within the remit of schools themselves. However, the department provides several kinds of training opportunities for teachers and students.
- England's digital education strategy previously focused on building connectivity as a precondition for digital education. This work is ongoing and detailed below. Hardware provision was prioritised during the COVID-19 outbreak, to ensure an equitable access to and use of digital technologies – including various initiatives and grants targeting towards students from disadvantaged backgrounds. The department's current policies and programmes as well as future priorities are set out below.
- There is a UK wide digital strategy, encompassing topics wider than education, which focuses on six key themes: digital foundations, ideas and intellectual property, digital skills and talent, financing digital growth, spreading prosperity and levelling up, and enhancing the UK's place in the world. [1]

General policy context

In England, the Department for Education is responsible for children's services and education at all levels of state-funded schools.[2] These schools include local-authority-maintained schools, faith schools, academies, free schools and grammar schools, and they receive funding through either their local authority or directly from the government.[3] By contrast, fee-charging private education institutions – sometimes called "public schools" or "independent schools" in England – receive no government funding and do not have to follow the national curriculum. They are also exempted from benefitting from most government support programmes, which are only open to schools who meet certain criteria, for example high levels of deprivation. However, independent schools do have to be registered with the government and are inspected regularly.[4]

Division of responsibility

In England, the responsibility to provide schools with a digital education infrastructure is split between the Department for Education and schools themselves – as well as local authorities (for local-authority-maintained schools). For example, the department provides several digital systems to support schools directly, such as the Get Information about Schools database, and also guidance for schools on various topics, for instance their data and technology standards. Schools themselves procure other solutions for

school management, such as learning management systems and administrative function systems. They are also free to procure additional digital resources for teaching and learning from private vendors and education stakeholders, such as philanthropic organisations (for example, the *British Library*), education publishers (for example, *FlashAcademy*), teachers, and the country's public broadcaster *British Broadcasting Corporation* (BBC). As the responsibility for procuring a large proportion of digital infrastructure is devolved to schools, private companies have opportunities to provide privately developed digital solutions and resources for education.

To help schools make well-informed decisions regarding their procurement, various guidelines are provided by the Department for Education and public bodies. In addition, the rules that govern the access to and use of data and digital technologies in education, including data and privacy protection, are enacted by the central government. The United Kingdom General Data Protection Regulation (UK GDPR) – the UK implementation of the EU GDPR (with some minor modifications) – sits alongside the Data Protection Act 2018, governing all processing of personal data from individuals in the United Kingdom (hence, including students, teachers, and other education stakeholders in England).

The *Keeping children safe in education* (KCSIE) statutory guidance provides schools and colleges with information on what they should be doing to protect students online.[6] This includes specifying that schools have responsibility for: providing staff with regular safeguarding and child protection updates (including online safety); ensuring filtering and monitoring software is in place and regularly review its effectiveness; including online safety in relevant policies and considering it while planning the curriculum, any teacher training, the role and responsibilities of the designated safeguarding lead and any parental engagement; including the school's approach to personal mobile phone use in their behaviour policy.

Digital education strategy

The UK government has made efforts to digitalise various domains of the public service. The *Central Digital and Data Office* and the *Government Digital Service*, part of the UK Cabinet Office, are dedicated to providing digital service and enforcing several rules and policies across the government departments.[5] They are also working to streamline, personalise and modernise the Department for Education's digital and data services, automating processes and saving time at every level of the system.

In the context of digitalising public service sits a nationwide *Digital Strategy*, which the UK government published in June 2022.[6] The strategy is aimed at "harnessing digital transformation and building a more inclusive, competitive and innovative digital economy [in the United Kingdom]". It contains a section on education in England, which highlights cultivating digital skills and talents of students and people in various ways. For instance, by providing teachers with training on digital skills; equipping schools with the knowledge and facilities to teach students computing and related courses; encouraging the uptake of computer science subject in academic qualifications (GCSE and A-Levels, i.e. end of lower secondary and upper secondary diplomas); offering lifelong digital skills trainings for adults.

Taking into account this strategy and the aftermath of the COVID-19 pandemic, the Department for Education has made changes in their digital education policies and expenditure to enhance the digital infrastructure in schools, improving broadband, Wi-Fi and mobile coverage in schools, as well as providing digital devices to schools and students. The findings from a department-commissioned survey in 2021 confirm that the majority of schools has invested in new or upgraded technologies, including devices for students and teachers, to enable remote teaching and learning to take place smoothly.[7]

In terms of promoting the use of digital education infrastructure during the pandemic, the department offered the *Get Help with Remote Education* service that served as a one-stop-shop for teachers, providing guidance and resources for facilitating remote learning, including information about supporting vulnerable students and keeping students safe in digital education.[8] Technical support and training for accessing educational platforms (e.g. Google Classroom, Microsoft 365) were also provided: for example, the *EdTech*

Demonstrator Programme offered free peer-to-peer support on the effective use of digital technologies in education to over 2 500 state-funded schools and VET institutions.[9]

In terms of promoting the use of digital education infrastructure during the pandemic, the department offered the *Get Help with Remote Education* service that served as a one-stop-shop for teachers, providing guidance and resources for facilitating remote learning, including information about supporting vulnerable students and keeping students safe in digital education.[10] Technical support and training for accessing educational platforms (e.g. Google Classroom, Microsoft 365) were also provided: for example, the *EdTech Demonstrator Programme* offered free peer-to-peer support on the effective use of digital technologies in education to over 2 500 state-funded schools and vocational education and training (VET) institutions.[11]

The department has also started running a biennial *Technology in Schools Survey*, to capture up-to-date data to understand the current state, use and spread of technologies within primary and secondary schools in England, and thereby to support their policy commitments and inform future interventions.[12] Findings from the first *Technology in Schools* survey will be published in summer 2023.

In future years, the department will continue investing in hardware infrastructure, including broadband and Wi-Fi connections in schools (see *Equity of access* section later for details). Standards on broadband, Wi-Fi, and cybersecurity have been published, and the sets of standards on filtering, monitoring, cloud services and storage are forthcoming, to help schools and multi-academy trust leaders better understand their needs, maintain security, and support online safety. The department is intervening in cases where schools lack budget to meet these standards, for example their connectivity programmes which upgrade broadband or Wi-Fi to schools in priority areas who fall below these standards. In parallel, England's digital strategy for education will also focus on building a strong evidence base for effective use of technologies and embedding this evidence across their school system.

The public digital education infrastructure

This section reviews two aspects of the public digital infrastructure in England: digital solutions for system and school management, and digital resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and school information system

To facilitate system and school management, the Department for Education manages a central education database, the *National Pupil Database* (NPD), which is created by linking individuals' personal information collected from data provided by schools and local authorities via statutory data collections (e.g. the school census) and attainment data from awarding bodies.[13] The database thus stores a broad range of students' data – from their name and date of birth, to standardised assessment results, special educational needs, family background and eligibility for free school meals. This data is tagged with the *Unique Pupil Number*, a unique identifier that tracks all students in state-funded schools throughout their schooling regardless of changes in their situation. Independent schools are not required to issue the *Unique Pupil Number* for their students, though some do so on a voluntary basis.

The National Pupil Database (NPD) is contained within the *Get Information About Pupils Service,* which is a student information system where schools and local authorities can find student-level NPD data and Pupil Premium funding information.[14] Access to this database is restricted as it contains confidential pupil information. Each school has a super user/approver who controls access to school users, and appropriate members of the local authorities also have access to this service.

Together with the Office for Standards in Education (Ofsted), the department has developed Analyse School Performance (ASP).[15] This system is designed to help education stakeholders – school principals, governors, local authorities, multi-academy trusts, dioceses, *Ofsted* and the Department for Education – to review and compare *both* school and student-level performances, and thereby plan school improvement. *Analyse School Performance* is a secure web-based service that gives school leaders, governors, Local Authorities, Multi-Academy Trusts, dioceses, the department, and Ofsted access to official detailed pupil level performance data. The service is designed to support accountability policy and helps schools improve by providing accurate attainment data. ASP is accessible via the department's single sign-on (SSO) service which offers users access to a number of systems. However, ASP is not interoperable with other Department for Education data websites. ASP reports use tables, graphs and charts to show the attainment and progress of the school and a wide range of different pupil groups. ASP data comes from a mix of collections, including census and performance data that is either sent directly to the Department for Education by schools or local authorities, or is collected on behalf of the department directly, some of which is a legal requirement.[16] Schools do not need to directly input data into ASP. This data is part of the assessment process, and schools cannot opt out of having this data collected: if their students participate in national examinations then their results will be collected. The type of information end-users can access on this system varies depending on their status (for instance, governors and trustees will only be entitled to view non-student-specific information).

ASP is only available only to schools, governors, trust leaders, inspectors, local authority and the Department for Education staff, but the *Find and Check School Performance* tool is a public dashboard.[17] Any parents or other members of the public can access this dashboard and look at a range of information available about any school in England. *Find and Check School Performance* draws data from *Analyse School Performance*; however, it is not as extensive. For instance, it does not contain Key Stage 1 (ages 5-7, Years 1 and 2) or phonics data, or detailed group and individual student performance data. Neither *Analyse School Performance* nor *Find and Check School Performance* is updated in real time. However, certain information about schools and their governance (e.g. the appointment or removal of headteachers, changes in contact detail) is updated on the *Get Information About Schools,* an online register for schools in England and Wales, whenever any of the fields associated with their record is changed. *Get Information about Schools* data is drawn from other national data collections in the same way as *Get Information about Pupils*.

In addition to these systems, *Ofsted* maintains the *Inspection Data Summary Report* system, its own web-based page accessible via *Analyse School Performance* or a separate *Ofsted* sign-in. This system is designed to show data for *Ofsted* inspectors to use when preparing for and during school inspections; though schools may require an account and associated permissions to access the information.

Analyse School Performance, *Find and Check School Performance*, *Get Information about Schools* and *Get Information about Pupils* are all separate systems, but they do pull data from each other. For instance, on a daily basis, the former two systems will pull some information (e.g. name, address) from *Get Information about Schools*.

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Digital assessment and career guidance systems

The Department for Education and its executive agency, the *Standards and Testing Agency*, administer *Multiplication Tables Check*, a statutory digital assessment for all Year 4 students (8-9 years old, primary education).[18] Another statutory assessment for measuring English and maths skills of new primary school students, *Reception Baseline Assessment,* is currently administered partially digitally, but the department is considering digitalising it further. In addition, a new *Digital Test for Literacy and Numeracy* is currently in the pipeline, which will involve a series of short digital activities and will be taken by Year 9 students (13-14 years old, secondary education).[19]

Digital assessments are also used in some VET and technical qualifications – for instance, in *Functional Skills Qualifications* delivered within apprenticeship standards, and also to adults. Some awarding organisations have developed qualifications to support teachers in the implementation of this digital assessment. There is no digital assessment used in GCSE and A-Levels, though all four of the main exam boards are now piloting digital exams and assessments. The department is also working with the *Office of Qualifications and Examinations Regulation* (*Ofqual*) to explore the potential opportunities and implications of further use of digital assessment in qualifications. Students using assistive technology for assessment has increased in England, as evidenced by a Department for Education study in 2021.[20]

The department also offers *Get into Teaching* an online career guidance platform for teachers and would-be teachers.[21] In addition, through the *National Careers Service*, the department also funds a digital careers advice platform for anyone over the age of 13 that provides skills self-assessment and connection to a professional advisor.[22] The *Careers and Enterprise Company*, which the department grant funds, complements this by supporting schools to fulfil their statutory duty to provide good career guidance for their students. This includes an online resource directory to support schools and colleges to manage their careers programme, plan careers activities, target support and collect student feedback systematically.[23]

Digital ecosystem for teaching and learning

Digital teaching and learning resources

The department provides various digital teaching and learning resources that schools may choose to use. Static digital learning resources (notably video lessons) targeted at early childhood, primary and secondary educational levels, as well as resources for students with special educational needs and disabilities (e.g. therapy-based lessons), are made openly available via the *Oak National Academy* website.[24] Established in response to the COVID-19 outbreak, the *Oak National Academy* operates independently, although it is strategically aligned to (and partly funded by) the Department for Education. Their resources therefore cover a broad range of subjects, and all are aligned with the curriculum objectives and classified according to a central (England-specific) taxonomy. Schools can choose to use these resources, and they often additionally procure interactive digital learning resources from the EdTech market. The department does not actively back or mandate individual products, and instead allows individual educational establishments to decide what technology they need to meet their requirements in relation to their educational contexts and circumstances. Yet, the Department for Education does operate the *Get help buying for schools* service, which offers free and impartial advice and guidance from procurement specialists for all state-funded schools in England on buying goods and services.

Some digital teaching and learning resources are also openly accessible to anyone in the country. In addition to the contents from *Oak National Academy*, the BBC, the country's main public broadcaster, delivers educational contents at primary and secondary levels via their public radio and television channels. They also maintain the *BBC Teach* website that supports teachers by curating curriculum-related content for the classroom, and the *BBC Bitesize* that provides educationally approved, curriculum-relevant self-study and home-learning materials to 5-16 year olds.[25] The resources on the *BBC Bitesize* are directly curriculum-relevant, although they are not developed in partnership with the Department for Education, instead using a small roster of education resource providers to co-produce curriculum content.[26] Students and teachers do not need to pay the TV licence fee to access the *BBC Teach* or *BBC Bitesize*.

Enabling the use of digital solutions and resources

Providing a public digital education infrastructure or funding to use digital resources does not necessarily mean that schools and teachers will use them. Different rules and guidelines can therefore support access to, and the use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

England has undertaken a diversity of efforts to ensure an equitable access to educational opportunities at all levels of school. Building on the GBP 30 million (EUR 35 million) investment made available in 2021 for the *Connect the Classroom* pilot programme, which targeted schools with weak educational outcomes, the Department for Education is investing up to a further GBP 150 million (EUR 173 million) to upgrade schools that fall below their Wi-Fi connectivity standards in priority areas.[27] *Connect the Classroom* investment is targeted at all schools in the 24 Priority Education Improvement Areas, as part of intensive investment to address entrenched causes of underperformance and barriers to improvement.

The Department for Education and the Department for Digital, Culture, Media and Sport are investing a joint GBP 82 million (EUR 94 million) to accelerate gigabit capable broadband roll-out to schools to enable all schools to have access to a high-speed connection by 2025. The programme will cover the costs of connecting up to 3 000 rural schools not likely to be connected by commercial roll-out, and currently using outdated copper cables.

During the COVID-19 outbreak, the department rolled out 1.95 million laptops and tablets through the *Get Help with Technology* programme to disadvantaged students, assisting in their remote learning.[28] The laptops and tablets distributed through the Department for Education are now owned by schools, trusts, local authorities or VET providers, who can lend them to children and young people who need them the most. The department also provided grant funding to schools, local authorities and VET providers to contribute towards the technical support costs of setting up or resetting these devices. They also provided support for over for over 130 000 families to get online through uplifts in mobile data and 4G wireless routers. This included partnering with the country's leading mobile operators to provide free data to help over 33 000 disadvantaged children get online, and delivering over 100 000 4G wireless routers for students without connection at home.

In addition, albeit not specific to the education sector, wider efforts to tackle the digital divide and provide support for disadvantaged groups are underway by other government departments. For instance, the Department for Digital, Culture, Media and Sport funded a GBP 2.5 million (EUR 2.9 million) *Digital Lifeline* project to reduce the digital exclusion of people with learning disabilities, offering them free devices, data and digital support.

The Department for Education is currently in the process of creating a set of standards to support schools to understand their digital environment and know what technology they should have in place. Uneven access to digital learning platforms and resources will be a possible challenge as schools procure themselves their digital resources with no guidance or oversight.

Supporting students with special educational needs and disabilities (SEND)

In November 2020, the department-commissioned report *Rapid Literature Review on Assistive Technology in Education* evaluated studies of using these technologies with SEND students.[29] The report concluded that assistive technologies are under-utilised in the education sector, and recommended to develop assistive technology training courses for educators.

In March 2021, the department piloted training for mainstream school staff on how to use assistive technology effectively. The course focused on the technology that schools already have available or can easily obtain, such as text-to-speech tools. It aimed to give staff the confidence and capability to take full advantage of the range of technologies available in the classroom to support students with SEND. The findings from the independent evaluation of the pilot were promising, with participants reporting improved awareness, understanding and confidence in using assistive technologies, and feeling that the training would contribute towards removing barriers to learning for all students.[30]

Following the results of the pilot, the government is running another training course, with more schools, over a longer period, and with a more in-depth evaluation, to add to the evidence base in this area. This programme will continue to use the resources created for the pilot, including case studies, videos, short introductions, and a self-audit tool which schools can use to identify their key areas for development. They are publicly available in the *National Association for Special Educational Needs* online assistive technology resource bank.[31] The Office of Qualifications and Examinations Regulation (Ofqual*)* has also published a study on the use of assistive technologies for assessment.[20]

Supporting the use of digital tools and resources

Most centrally provided digital solutions and resources, such as the career guidance platforms and the *Oak National Academy* contents, are used on an opt-in basis, and schools may choose to acquire additional solutions and resources. There is no other direct government involvement in procuring digital education infrastructure. However, the department seeks to facilitate the uptake of digital tools and resources by providing guidelines and professional learning opportunities. For instance, comprehensive guidelines exist on procuring and using digital technologies in education, and include a detailed list of privately-developed learning management systems (called "school management information systems" in the list), digital and technology standards, as well as the department-approved framework for buying digital goods and services.[32] Further guidance is provided for schools at upper secondary and VET levels from the *Joint Information Systems Committee* (JISC), a government-funded non-profit organisation. Also, the *EdTech Demonstrator Programme* mentioned earlier (offering peer-to-peer support on the use of digital technologies) created a peer-to-peer network to support schools move to a more sustained use of technology to reduce workload, improve outcomes, support school improvement, and create a more inclusive curriculum.

More supports were available during the COVID-19 outbreak. In addition to the *Get Help with Technology* programme providing devices for disadvantaged students, the department launched the *Digital Platform* programme, for which primary and secondary schools could use earmarked grants to buy the virtual learning environment.

Cultivating the digital competence of education stakeholders

The Department for Education has published standards for the minimum level of practice expected of primary and secondary teachers in England, which include their digital competence.[33] During the pandemic, extra measures were introduced to enhance teachers' digital skills, such as the *Get Help with Remote Education,* the *EdTech Demonstrator Programme*, and the *Assistive Technology Training Pilot*.

The department also funds the *National Centre for Computing Education*, which offers a variety of services to support teachers and students with the computing curriculum.[34] This includes funding of 34 Computing Hubs, which offer continuous professional development opportunities for teachers, and guidance and support to local schools and colleges, to improve the teaching of computing and increase participation in computer science qualifications.[35] Computing Hubs receive funding directly from the department, and then make free or subsidised courses available to local schools. All state-funded schools and colleges, special schools and alternative provision setting in England are eligible for support, but some hubs only target specific phases of education. In addition, *T Levels*, new vocational and technical-based qualifications at upper secondary level (for England only) was launched in September 2020, including qualifications on the digital skills, data analysis as well as software development.[36]

While these initiatives should help enhance teachers' and students' digital skills and competence, some disparities in their digital capacity will likely remain considering that teacher standards are not strictly enforced and the responsibility for the actual provision of digital trainings to both in-service teachers and students is devolved to the schools themselves. Some schools (e.g. academies, free schools, private schools) have considerable autonomy and can decide whether and how to teach students digital skills

throughout the curriculum; their teaching staff are also not required to meet the minimum level of practice expected of teachers in England, including those around digital competence.[37]

The department also engages with parents, carers and students via its *Parents and Pupils omnibus survey*. The panel consists of 11- to 17-year-olds who attend state-funded secondary schools in England and their parents or carers. Questions are submitted via policy teams, and sometimes include questions on digital and technology-based topics.[66] This is also the case for the School and College panel, a regular online survey which gathers views from senior leaders and classroom teachers in state-funded primary and secondary schools and colleges.[67]

Governance of data and digital technologies in education

Supporting the use of digital technology and the data it generates can only work if stakeholders recognise that this use will not work to their detriment. There are thus rules about protecting the data and privacy of education stakeholders, and ensuring the interoperability across digital education ecosystem. As schools are also responsible for providing access to components of the digital education infrastructure, part of the regulatory efforts concerns offering relevant guidelines to support schools in their decision-making.

Protecting data and privacy in education

In education, as in other sectors in England, data and privacy protection falls under the Data Protection Act 2018 and the UK GDPR.[38] There is no further rule that *specifically* covers the protection of data and privacy of students, or of teachers and school staff; although the department provides guidelines about these aspects, including the resources for understanding schools' responsibilities after the Brexit.[39] There is also a statutory guidance on what schools and college should be doing to protect students online, such as: providing teachers and school staff with regular safeguarding and child protection updates; ensuring filtering and monitoring software is in place and regularly reviewing its effectiveness; considering online safety while planning the curriculum; including in schools' behaviour policy their approach to personal mobile phone use, and so forth.[40]

In terms of access to education data (including student data), there are several specific rules that govern the equitable access to and use of data in England.[41] These rules specify that, subject to the Data Protection Act and the UK GDPR, non-child identifiable data can be shared upon request with third parties that conduct research, conduct educational statistics, evaluate education policies, or provide information, advice or guidance for promoting the education and well-being of children as well as for the public good. As part of the department's commitment to transparency, they publish details of all organisations with whom they have shared personal data, and a short description of the project.[42] These details are updated quarterly and include details of all shared in the quarter after data sharing agreement is signed.

The department also provides suggested wording for privacy notices to schools, local authorities and other organisations that are the initial data controllers in the data supply chain, and with whom parents typically have the most active and visible relationship.[43] These notices include specific sections of how government uses the data. Alongside this, the department's overarching personal information charter outlines to data subjects how they use their personal data, and their rights and responsibilities.[44] Sitting below the charter will be dataset or system-specific privacy materials specifically informing how data might be used within a certain system or dataset. For instance, the Longitudinal Education Outcomes privacy notice or the National Pupil Database privacy notice.[45]

The use of automated decision-making, AI-powered algorithmic model, and digital proctoring in education currently remains limited. Therefore, few regulations exist to govern these aspects (other than the restriction imposed by the UK GDPR). Given the prominence of the AI and algorithm-related issues today, however, some regulatory efforts are in the pipeline, such as a 2020 review into bias in algorithmic decision-making and the National AI Strategy.[46] Also, albeit not education-specific, a standard about

algorithmic transparency in public decision-making processes was recently published in early 2023 by the *Central Digital and Data Office*, an agency of the UK Cabinet Office.[47]

Enhancing interoperability

In light of the diverse digital solutions developed by different private companies and education stakeholders, interoperability of digital technologies and the data they generate is currently a crucial issue in England. To enhance the interoperability and facilitate data portability across systems, the department specifies the *Common Transfer File*, a specific technical standard which is used to transfer student data in a consistent format when a student transfers from one school to another.[48] This ensures the receiving schools receive information necessarily to support the student continuing education and welfare. Detailed guidelines are offered to help with this data transfer process.[49] While using this standard is not mandatory for non-local-authority-maintained schools like academies and free schools, it is still highly encouraged.

The department maintains a Common Basic Data Set (CBDS) which is a file containing definitions for common data items that schools and local authorities use in certain software systems, for example school management information systems.[48] The CBDS also gives information on the structure and standards used within many department data collections relating to schools and local authorities.

The Department for Education (DfE) has also set up *DfE Sign-in*, a secure single sign-on (SSO) service, which offers eligible end-users with access to a number of the department's data systems, including two student information systems (*Analyse School Performance* and Get *Information About Pupils*) and online register for schools (*Get Information About Schools*).[50]

Supporting innovation and research and development (R&D) in digital education

In the last five years, the Department for Education has supported innovation in digital education in various ways. It has published white papers to clearly communicate their innovation priorities about digital technologies and data in education. The department has also commissioned academics, universities and research organisations to actively research various aspects of digital education. This includes a report on the use of assistive technology for SEND students, and a comparative analysis of 14 countries' policies and strategies on EdTech usage.[51] There is also a suite of four reports on the EdTech industry in England, which aim to understand the current market, consider future opportunities, better understand EdTech implementation, and learn from the experience of using technology for remote teaching.[52] As noted in the previous section, there are rules ensuring that researchers and research institutions can equitably access educational data for R&D purposes (subject to rigorous processes).

Since 2023, the department runs a biennial *Technology in Schools survey (TiSS)* to understand the current state, use and spread of technology within primary and secondary schools in England. This allows them to support various strands of their current policy commitments and to inform future interventions.

In addition, the department has endowed the *Education Endowment Foundation*, an independent charity, with a further GBP 137 million (EUR 157 million) to encourage innovative and effective evidence-based teaching, including using digital technology.[53] The foundation gathers evidence for raising the attainment of students from socio-economically disadvantaged backgrounds, including the evidence on the use of digital technologies to improve student learning and support enhanced teaching.[54] Their upcoming research trials will explore teaching approaches using EdTech, which features of the technology, and how they are used, may support academic attainment.[55] The trials will cover three focus areas: EdTech for formative assessment; EdTech used to support the development of specific skills in mathematics, literacy, and modern foreign languages (current trials, and; Computer adaptive learning (CAL) or Artificial Intelligence (AI) technologies for teaching and learning).

In terms of public-partner partnerships, there is no particular policy in England for financially supporting the development of the EdTech sector (e.g. through formal subsidies, tax credit, or direct investment in start-up companies). Incentives to foster public-private collaborations are therefore mostly non-monetary. For instance, the government has worked with the *British Education Suppliers Association* on the *LearnED* roadshow – a national series of free educational technology conferences for educators between 2021 and 2022. The Department for Education has also collaborated with the same association in the *Great British Classroom* events, which showcased the education products and services, including EdTech materials.[56]

Notes

[1] "Key stages" are blocks of years into which the national curriculum in England is organised: key stage 1 (5-7 years old), key stage 2 (7-11 years old), key stage 3 (11-14 years old), key stage 4 (14-16 years old).

[2] The three other constituent nations of the United Kingdom, i.e. Scotland, Wales and Northern Ireland, have their own devolved government department responsible for education.

[3] For a detailed explanation on the types of schools, see https://www.gov.uk/types-of-school.

[4] https://www.gov.uk/types-of-school/private-schools#:~:text=Private%20schools%20(also%20known%20as,being%20funded%20by%20the%20government. For this reason, "schools" is used in this country note to refer to state-funded schools, unless otherwise stated.

[5] *Central Digital and Data Office*: https://www.gov.uk/government/organisations/central-digital-and-data-office; *Government Digital Service*: https://www.gov.uk/government/organisations/government-digital-service

[6] https://www.gov.uk/government/publications/uks-digital-strategy

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057817/Education_Technology_EdTech_Survey.pdf

[8] https://www.gov.uk/guidance/get-help-with-remote-education

[9] For the full list of supporting programmes and initiatives, see:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057817/Education_Technology_EdTech_Survey.pdf

[10] https://www.gov.uk/guidance/get-help-with-remote-education

[11] For the full list of supporting programmes and initiatives, see:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057817/Education_Technology_EdTech_Survey.pdf

[12] https://portal.iffresearch.com/mrIWeb/mrIWeb.dll?I.Project=J12069O&id=

[13] https://find-npd-data.education.gov.uk/

[14] Pupil premium is funding to improve education outcomes for disadvantaged pupils in schools in England. For more information: https://www.gov.uk/government/publications/pupil-premium/pupil-premium.

[15] https://www.analyse-school-performance.service.gov.uk/

[16] For instance, if their students participate in national examinations, schools cannot opt out of having the exam data collected.

[17] https://www.gov.uk/school-performance-tables

[18] https://www.gov.uk/government/collections/multiplication-tables-check. While this is a statutory assessment, it is not an exam, and students do not re-sit regardless of their result.

[19] Further details about this new assessment (e.g. sample or whole cohort, launch date) are to be confirmed. Currently, there is also a whole cohort assessment at the end of primary education (Year 6), but this is paper based.

[20] 2021 Study on the use of assistive technology: for assessment https://www.gov.uk/government/publications/the-use-of-assistive-technologies-for-assessment/the-use-of-assistive-technologies-for-assessment

[21] https://getintoteaching.education.gov.uk/

[22] https://nationalcareers.service.gov.uk/

[23] https://www.careersandenterprise.co.uk/careers-leaders/gatsby-benchmarks/

[24] https://www.thenational.academy/

[25] *BBC Teach*: https://www.bbc.co.uk/teach; *BBC Bitesize*: https://www.bbc.co.uk/bitesize

[26] https://www.bbc.com/aboutthebbc/whatwedo/publicservices/learning#:~:text=BBC%20Bitesize%20supports%20students%20with%20their%20educational%20needs,reception%20age%20through%20to%20school-leaving%20exams%20and%20beyond

[27] The *Connect the Classroom* programme is targeted at schools in the "Education Investment Areas" selected by the department, as part of the investment to address entrenched causes of educational underperformance and barriers to improvement. All schools within the areas, and particularly those below the Ofsted rating of "Good" (i.e. rated "requires improvement" or "inadequate") are the main target of the *Connect the Classroom*. For further details on the selection of Education Investment Areas, see: https://www.gov.uk/government/publications/education-investment-areas-selection-methodology

[28] https://www.gov.uk/government/collections/get-help-with-technology-for-remote-education

[29] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/937381/UKAT_FinalReport_082520.pdf

[30] https://www.gov.uk/government/publications/assistive-technology-training-pilot-evaluation

[31] https://nasen.org.uk/assistive-technology/

[32] https://www.gov.uk/government/collections/using-technology-in-education#buying-ict-hardware-and-services. The Department of Education also operates the *Get help buying for schools* service, which offers free and impartial advice and guidance from procurement specialists for all state-funded schools in England on buying goods and services in general: https://www.gov.uk/guidance/get-help-buying-for-schools.

[33] https://www.gov.uk/government/publications/teachers-standards

[34] https://computingeducation.org.uk/

[35] https://teachcomputing.org/

[36] https://www.gov.uk/government/publications/introduction-of-t-levels/introduction-of-t-levels

[37]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026591/Staff_Advice_Handbook_Update_-_October_2021.pdf

[38] Data Protection Act 2018: https://www.gov.uk/data-protection; UK GDPR: https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/

[39] https://www.gov.uk/guidance/eu-exit-guide-data-protection-for-education-providers

[40] https://www.gov.uk/government/publications/keeping-children-safe-in-education--2

[41] For example: *The Education (Individual Pupil Information) (Prescribed Persons) (England) Regulations 2009*; *The Education (Information About Children in Alternative Provision) (England) Regulations 2007*; *The Education (Student Information) (England) Regulations 2015*. For the full list, see: https://www.gov.uk/guidance/data-protection-how-we-collect-and-share-research-data .

[42] https://www.gov.uk/government/publications/dfe-external-data-shares

[43] https://www.gov.uk/government/publications/data-protection-and-privacy-privacy-notices

[44] https://ukc-word-edit.officeapps.live.com/we/error/error.html?aspxerrorpath=/we/Our%20personal%20information%20charter%20tells%20you%20how%20and%20why%20the%20Department%20for%20Education%20(DfE)%20uses%20your%20personal%20data%20and%20your%20rights%20and%20responsibilities

[45] https://www.gov.uk/government/publications/longitudinal-education-outcomes-study-how-we-use-and-share-data/longitudinal-education-outcomes-leo-privacy-notice; https://www.gov.uk/government/publications/national-pupil-database-npd-privacy-notice/national-pupil-database-npd-privacy-notice

[46] https://www.gov.uk/government/publications/cdei-publishes-review-into-bias-in-algorithmic-decision-making/main-report-cdei-review-into-bias-in-algorithmic-decision-making; https://www.gov.uk/government/publications/national-ai-strategy

[47] https://www.gov.uk/government/publications/guidance-for-organisations-using-the-algorithmic-transparency-recording-standard/algorithmic-transparency-recording-standard-guidance-for-public-sector-bodies

[48] https://www.gov.uk/government/collections/common-transfer-file. For more information on what the CTF comprises, see https://www.gov.uk/government/publications/common-basic-data-set-cbds-database.

[49] https://www.gov.uk/government/publications/school-to-school-guides-for-schools-and-local-authorities

[50] For the full list of services accessible via DfE sign-in, see: https://services.signin.education.gov.uk/. These services are not always necessarily interoperable with one another; for example, *Analyse School Performance* is not interoperable with other department data websites.

[51] https://www.gov.uk/government/publications/assistive-technology-at-stakeholder-reports;

https://www.gov.uk/government/publications/international-evidence-on-decision-making-on-technology

[52] https://www.gov.uk/government/publications/the-education-technology-market-in-england; https://www.gov.uk/government/publications/future-opportunities-for-education-technology-in-england; https://www.gov.uk/government/publications/implementation-of-education-technology-schools-and-colleges; https://www.gov.uk/government/publications/education-technology-for-remote-teaching

[53] https://educationendowmentfoundation.org.uk/

[54] https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/digital

[55] The trials will cover three focus areas: (1) EdTech for formative assessment; (2) EdTech used to support the development of specific skills in mathematics, literacy, and modern foreign languages [current trials]; (3) Computer adaptive learning or Artificial Intelligence (AI) technologies for teaching and learning.

[56]

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/958990/International-Education-Strategy-_2021-Update.pdf

8 Estonia

This note provides an overview of Estonia's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Estonia supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Estonia engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Education governance in Estonia involves shared responsibilities between the central Ministry of Education and Research and municipal governments. The national curriculum and teacher standards are set by the central government, while municipalities play a key role in implementing these at the local level. The translation of national guidelines into local practices is a municipal responsibility.
- Estonia's approach to providing digital education infrastructure involves a clear division between system and school management tools. System management tools, including the national education database (EHIS), are centrally managed, while learning management systems at the school level are developed by private companies and procured publicly by municipalities. The procurement entity depends on whether a school is state-run or municipally operated. Additionally, the ministry provides various digital tools for administrative purposes, including career guidance platforms, online examination systems, and student admission systems. Adding to this comprehensive digital ecosystem, the government encourages open competition for educational resources while publicly providing its own, notably though a comprehensive online learning portal.
- Estonia's Education Strategy 2021−2035 aligns with a broader, cross-sector national development plan, Estonia 2035. Prioritising digital inclusion and literacy, the strategy emphasises the integration of digital skills across all education levels.
- Beyond the EU GDPR, a set of rules govern the use of digital tools within schools, safeguarding the data of education stakeholders, and enhancing interoperability across the digital education landscape. In addition, the central government takes steps to inform and engage students and parents, involving them in consultations regarding the implementation of digital technologies in educational settings.

General policy context

In Estonia, the public governance of the education system is a shared responsibility between the central and municipal governments. The Ministry of Education and Research (*Haridus- ja Teadusministeerium*) develops and sets the national curriculum, defines teacher professional standards, and supervises schools' adherence to the curriculum and standards. Municipalities take on the task of translating national guidelines into local educational practices, as well as ensuring the effective delivery of education.

Division of responsibility

Public responsibilities for offering schools with access to components of the digital education infrastructure follow this context. System-level tools, such as the national education database, are managed centrally. Conversely, school-level tools, like learning management systems, are developed by private companies and procured publicly, with either the ministry or municipalities serving as the procurement entity, depending on whether a school is state-run or municipally operated. Concerning digital teaching and learning resources, their procurement practices is mainly done by the schools' governing body (central government or municipalities). However, schools retain autonomy in selecting inexpensive digital tools and resources that best suit their needs.

The central government plays a pivotal role in facilitating and regulating the utilisation of digital education infrastructure. The government establishes regulations governing the access to and the use of data and digital technologies within education. In addition, the Ministry of Education and Research extends comprehensive guidelines to aid schools in making informed decisions regarding their digital infrastructure procurement.

Digital education strategy

In 2021, the Estonian government unveiled the *Education Strategy 2021−2035*, aligning its overarching objectives with *Estonia 2035*, the nation's 15-year development plan.[1] This education strategy places a significant emphasis on several key aspects, notably digital inclusion, the cultivation of digital literacy and skills among all education stakeholders, and the augmentation of education's accessibility, diversity, and efficiency through digital tools. It also prioritises the enhancement of teaching methods, particularly emphasising the adoption of digital pedagogy, and promotes innovation driven by digital technologies in education. Concurrently, during the same year, the government adopted the *Digital Agenda 2030*, outlining the country's vision and action plans for harnessing digital technologies to drive future development.[2] In education, this agenda underscores the integration of digital skills as a natural component of curriculum across all educational levels.

Estonia embarked on its journey of digitalisation with the launch of the Tiger Leap (*Tiigrihüpe*) programme in 1996, with the primary aim of establishing a modern IT infrastructure nationwide.[3] Since 2015, an EU-funded modernisation initiative has further advanced the infrastructure of schools, providing essential hardware such as fibre-optic networks, routers, and Wi-Fi access points.[4] At present, all Estonian schools benefit from high-speed Internet connectivity, with approximately 75% connected via fibre-optic networks. Connection speeds for individual schools are determined locally, yet all fibre-optic connections guarantee a minimum speed of 1 Gbit/s.

In the forthcoming years, the Ministry of Education and Research is committed to sustaining investments in hardware infrastructure. This includes the efforts to enhance Internet speed and access across educational institutions at all levels. In addition, upper secondary and vocational education and training (VET) institutions may receive additional digital teaching tools to further bolster the adoption of digital education methods. They need to apply for the tools, and demonstrate that those tools align with the objectives set out in the national curriculum and help foster students' digital skill development. Yet, rather than prescribing changes in digital education policy and expenditure, the government will continuously monitor data flows and Internet traffic dynamics to assess the adequacy of existing investments and predict future infrastructure needs.

The public digital education infrastructure

This section reviews two aspects of the public digital infrastructure in Estonia: digital tools for system and school management, and digital resources for teaching and learning.

Digital ecosystem for system and school management

Central education database and learning management systems

Based on the Estonian Education Information System Act and its accompanying statutes (*Eesti Hariduse Infosüsteemi asutamine ning põhimäärus*), the Ministry of Education and Research owns and operates *EHIS* (*Eesti Hariduse Infosüsteem*), a central web-based educational database.[5] This database serves various purposes, including the calculation of national education statistics, informing decisions related to school financing, guiding educational policymaking.[6]

For those purposes, *EHIS* houses a diverse array of data, encompassing student grades and performance metrics, standardised test results (for secondary and VET levels), teacher-given grades (for secondary level), and indicators of special educational needs and disabilities, among other points. Within *EHIS*, each student (and teacher) is tagged with a unique and longitudinal identifier, and their data can be processed using *EHIS's* non-AI algorithms, which assist in determining eligibility for certain student benefits. The

collected data is aggregated and presented through a public dashboard called *HaridusSilm*, which offers insights into the government's educational strategy goals, but also tracks progress towards achieving those objectives.[7] In addition, a dashboard for *HaridusSilm* is currently under development, set to integrate data from various databases, enabling data-driven self-analysis for school management and administration.

To facilitate the collection and transfer of data to *EHIS*, all educational institutions (both public and private), from primary and secondary schools to VET institutions, universities and adult learning centres, are mandated to input and regularly update information about students, teachers and school-related details. School principals are required to appoint at least two employees responsible for overseeing *EHIS* data entry, a role often assumed by the school secretary (OECD, 2020).

The bulk of the data within *EHIS* is sourced directly from educational institutions, while certain data, such as students' place of residence or certificates, is obtained through data exchanges with external databases like the Population Register (*Rahvastikuregister*) and the occupational qualification register (*Kutseregister*). These exchanges are facilitated through *X-tee*, a centrally managed data exchange layer that bridges disparate information systems and provide interoperability across all government systems (for more details, see the section *Governance of data and digital technologies in education*).[8] As of 2023, schools can choose to transfer data to *EHIS* automatically via a learning management system (such as *eKool*), manually through the *EHIS* user interface, or by generating Excel sheets containing school data and uploading XML files to *EHIS.* However, in the forthcoming version of *EHIS*, which will include student information system functionalities, all data exchange will be mandated to occur automatically through learning management systems.

At the institutional level, two learning management systems, namely *Stuudium* (meaning Studio) and *eKool* (meaning e-School), are the most used across the country. Approximately 95% of schools in Estonia use one of these two systems, available on an opt-in basis.[9] While privately developed, they are procured publicly either by the ministry or municipalities, depending on the school administering entity. Private schools also employ one of these systems, but they procure independently.

Although each system may offer unique features, both *Stuudium* and *eKool* are designed to assist schools and teachers in classroom management. They provide analytical dashboards, enable teachers to assign homework and monitor student academic progress, offer learning materials and exercises, and facilitate communication between teachers, students, and parents. Crucially, these systems are interoperable with *EHIS*, ensuring that data stored within them is transmitted to *EHIS*, typically on a daily basis. However, while *eKool* supports automatic data transmission, *Stuudium* is not yet integrated with *X-tee*. This necessitates manual data entry, namely, generating Excel sheets for upload to *EHIS*.

Administrative management and other support systems

The central government offers a range of additional applications that schools can choose to use for various administrative purposes. One such application is *Tahvel*, a career and study guidance platform designed for students at VET institutions and universities of applied sciences.[10] In addition, the government provides an online examination system and a central student admission system. The online examination system, known as *EIS* (*Eksamite Infosüsteem*), allows students in grades four (10-11 years old) and seven (14-15 years old) to take national-level assessments online, and encompasses features such as an e-assessment database, digital exam certificates, and the provision of statistics on national exam results.[11] The student admission system, known as *SAIS* (*SisseAstumise InfoSüsteem*), facilitates student applications to certain gymnasiums (upper secondary schools), VET schools, and universities.[12] It can also retrieve applicant data from other databases and registers, including *EHIS*, *EIS*, and the Population Register (with the applicant's consent). This eliminates the need for students to provide physical certificates and documents. Historically, *EIS* and *SAIS* were managed by two non-profit organisations, although since 2020 they are consolidated and managed within the ministry.

Some municipalities also maintain their own educational service management systems tailored for regional students. For instance, in Tartu, the *Arno* system offers information about schools and kindergartens, including curriculum details. *Arno* is used by Tartu municipality's departments of education, culture, and finance, as well as by recreational schools, school caterers, and public transport in Tartu. It is also interoperable with *EHIS*.

Digital ecosystem for teaching and learning

The Ministry of Education and Research offers a range of digital resources tailored for teaching and learning, allowing schools and teachers the flexibility to choose the resources that align with their needs. Many of these resources are openly accessible to the education community. For instance, the ministry provides *HTM Moodle*, a localised version of Moodle, to schools and universities across Estonia at no cost.[13] This platform serves as a valuable tool for many schools for managing learning content and facilitating information exchange. The ministry also runs E-Schoolbag (*E-koolikott*), an online portal designed for finding, creating, and sharing digital learning resources, such as static and interactive resources (e.g. texts, games, and assessments) suitable for students at all educational levels.[14] While some resources within E-Schoolbag are collaboratively developed and shared by teachers, others are procured from a variety of sources, including publishers and universities.

Furthermore, the ministry's agency, *Harno*, manages two public YouTube channels, featuring webinars and lessons pertaining to teaching methods and the pedagogical use of various digital tools.[15] These channels serve as resources for teachers seeking professional development opportunities. Additionally, some municipalities operate their own social media channels dedicated to education-related matters. For instance, in Tartu, a Facebook page managed by the school leaders' association is regularly updated with information about educational events from the municipality's education department.

Certain digital teaching and learning resources are accessible exclusively to those who are enrolled in formal education. Examples include the aforementioned *EIS* that houses an e-assessment database, and *Juhan*, an online platform geared towards teacher development. *Juhan* enables teachers to search for courses of interest, which are offered by various organisations, including *Harno*, colleges, and universities.[16] In addition, while (digital) textbooks and associated exercise sets are developed by private vendors, they must undergo evaluation by teachers, lecturers, or other experts, and adhere to criteria outlined in the pertinent regulation.[17] Many of these resources are available on *Opiq*, a cloud-based learning environment that provides digital textbooks and relevant assessment tools, as well as *TaskuTark*, an e-learning platform offering courses and online assessments across various curriculum subjects.[18]

In general, the Estonian government champions open competition for educational resources, anticipating that it will produce diverse, high-quality materials that cater to teachers' (and students') needs. However, due to the niche market for students on a simplified curriculum, such as those with special educational needs and disabilities, the government takes the lead in developing materials in that case: most resources for these students are government-developed.[19]

Enabling the use of digital tools and resources

While providing a public digital education infrastructure or funding for the utilisation of digital resources is essential, it does not guarantee their adoption by schools and teachers. Therefore, to ensure effective use of these tools and resources, various rules and guidelines are established to facilitate access to, and promote the use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

In Estonia, comprehensive system-level policies are in place to promote digital equity in education. The public provisioning and procurement of various digital tools for system and school management aim to ensure that students, teachers, and educational institutions have sustained and equitable access to the digital education ecosystem across all levels of education. Some of these tools, such as *EHIS*, are mandated for use, incentivising every school to possess a foundational digital system for student management and data reporting to the government. In addition, both central and municipal governments bear the responsibility that the schools they oversee have the requisite resources and opportunities to meet the demands of the national curriculum.

Further, specific rules and guidelines exist to ensure equitable access to and use of digital technologies in education. Schools are obligated to offer an appropriate digital environment for the digital assessments conducted in different grades (e.g. general competence test, baseline test, or diagnostic test), and ensure that students possess the necessary competence to participate in these assessments. Schools retain autonomy in how they implement these requirements, though.

During the COVID-19 outbreak, a concerted effort was made to enhance teachers' proficiency in using digital learning resources and platforms through additional in-service training. Schools and local municipalities also supplied students with digital devices when necessary. In cases where schools could not meet the demand, the ministry, in collaboration with the Estonian Union for Child Welfare, acquired over 1 200 computers, distributing them to 244 schools nationwide.[20]

Apart from these initiatives, the Estonian government’s education strategies do not target a particular group, and the Ministry of Education and Research does not proactively inspect or oversee how schools internally manage and allocate their operating budgets for digital infrastructure. Therefore, uneven access to digital learning platforms and resources within schools may persist. However, given that a significant proportion of digital tools and resources are openly available (or publicly procured when privately developed materials are insufficient), the disparities in access and resources across schools likely remain minimal.

Supporting the use of digital tools

The Ministry of Education and Research actively promotes the adoption of publicly provided open educational resources digital tools through several strategic avenues. Apart from allocating an operating budget that schools can use for the acquisition of digital tools, the ministry extends support by offering guidance on system-level tools, such as *EHIS*. In cases where additional clarification is needed, the ministry also conducts outreach to schools, providing in-depth explanations and addressing any queries. It also coordinates professional development opportunities for teachers, including training on the effective use of learning management systems. These training sessions are typically organised in collaboration with teaching centres operated by universities and other educational organisations. Additionally, at the regional level, some municipalities occasionally allocate funding earmarked specifically for teaching and learning tools, encompassing both digital and non-digital materials. For instance, the municipality of Tartu procures a variety of digital devices, like computers, laptops, tablets, and interactive whiteboards, in large quantities, and then rent them out to schools. However, the ownership of these devices remains with the leasing company.

Regarding digital teaching and learning resources, schools and teachers in Estonia exercise a high degree of autonomy in selecting, using, and procuring these resources. Upholding the autonomy of schools, the ministry does not mandate the use of any digital resources, and its role primarily revolves around offering guidance and facilitating professional development opportunities to assist schools in navigating this

process. Yet, a post-pandemic study by the ministry indicates that students and teachers still grapple with limited digital learning resources, skills, and equipment availability. As a result, the ministry believes that schools need further encouragement to embrace digital tools, with a view to strengthening evidence-based teaching and learning.

Cultivating the digital competence of education stakeholders

Digital competence is one of the eight key competences emphasised in Estonian schools. Cultivating students' digital competence thus stands as a core objective within the national curriculum. To facilitate this, the ministry's agency, *Harno*, has developed a comprehensive digital competence framework tailored to Estonian students. This framework is adapted from the European Commission's DigComp 2.1, and encompasses a wide spectrum of digital skills and proficiencies, spanning from information and data literacy to digital content creation and problem-solving abilities. Integrated into the national curriculum, this framework is further complemented by various supporting tools, such as a publicly accessible set of student assessment criteria for each key educational stage, and a low-stakes digital competence test conducted on a sample of students via *EIS*, the online examination system.[21] There exists also a digital glossary which is designed to standardise the language used by teachers and students when discussing digital competences.[22]

In parallel, fostering the digital competences of teachers is another pivotal component of the Estonian education landscape.[23] *Harno* has therefore crafted dedicated digital competence frameworks for Estonian teachers as well, drawing on the European Commission's Digital Competence Framework for Educators (DigCompEdu, 2019).[24] As with students, this teacher-oriented framework is accompanied by tools intended to facilitate its implementation, such as an online self-assessment questionnaire that teachers can use to assess their own digital competences and identify areas for further development. The aforesaid digital glossary is affiliated with both student and teacher frameworks, thereby fostering a common language for discussions around digital teaching and learning. Further, *Harno* extends a range of training opportunities to bolster teachers' digital competences. These include the Digital Key programme that supports subject teachers in gaining a deeper understanding of how digital technologies can enhance teaching and student learning in their specific subjects. The Digital ABC initiative is another example, which offers peer teacher training, enabling participants to support each other's professional growth.[25]

Public initiatives at the local government level may supplement these efforts. In the municipality of Tartu, for instance, professional learning communities on the effective use of digital systems, such as learning management systems, have been established.

Governance of data and digital technologies in education

Effective support for the integration of digital technologies in education, as well as the management of the resulting data, hinges on the recognition by stakeholders that such adoption is not detrimental to their interests. Consequently, there exists a set of rules governing their use within schools, safeguarding the data of education stakeholders, and enhancing interoperability across the digital education landscape. In addition, the central government takes steps to inform and engage students and parents, involving them in consultations regarding the implementation of digital technologies in educational settings. However, there are currently no specific policy initiatives in place to regulate the use of automated decision-making, AI-powered algorithms, or digital proctoring in education. As of 2023 their application remained limited.

Protecting data and privacy of education stakeholders

In education, as in other sectors in Estonia, data and privacy protection falls under the European Union's General Data Protection Regulation (EU GDPR), which has been incorporated into domestic law through the Personal Data Protection Act of 2018.[26] There are no specific regulations addressing the protection of

data and privacy for students, teachers, or school staff. However, data and privacy for teachers and staff may be further discussed and protected through agreements with their respective employers, meaning that additional data protection and privacy rules may be included in teacher's employment contacts.

The Ministry of Education and Research also issues guidelines about data protection and privacy, including those related to data protection officers, data security, and the implementation of GDPR requirements.[27] Further, municipalities have the discretion to introduce their own rules, provided these rules do not contradict those established at the central government and European Union levels. For example, the municipality of Tartu has instituted data protection statutes concerning *Arno*, the municipal educational service management system, emphasising that all data and privacy measures are grounded in the GDPR and the Personal Data Protection Act.[28]

Regarding access to education data (including information within *EHIS*, the national education database), the Personal Data Protection Act of 2018 governs equitable access and data use in Estonia. The act stipulates that, in accordance with the EU GDPR provisions, education and personal data may be shared without the consent of the data subjects. This sharing is permissible when requested by third parties conducting scientific and historical research, official educational statistics, or when the request serves the public interest.

To streamline data portability across systems while safeguarding the protection of data and the privacy of education stakeholders, Estonia widely employs *X-tee*.[29] As stated above, this is a centrally managed data exchange layer, originally developed by the Information System Authority (*Riigi Infosüsteemi Amet*). *X-tee* facilitates secure and standardised data exchange among diverse IT systems, encompassing government databases and private sector systems. To enhance its adaptability and foster data and technology interoperability, the sources of *X-tee* have been made openly available, rendering it an open-source software solution.

Supporting innovation, research and development (R&D) in digital education

The Ministry of Education and Research has not publicly outlined specific research priorities within the field of digital education, nor has it established a dedicated research funding programme or public agency exclusively focused on digital education research.[30] Nevertheless, it actively supports digital education innovation through various means.

One notable way of support is the availability of well-documented education data stored within *EHIS*, which can be accessed and used by the broader research community, as previously mentioned. In parallel, comprehensive information about researchers, ongoing projects, qualifications, and publications can be found on the Estonian Research Portal (*Eesti Teadusinfosüsteem*), a platform co-operated by the Ministry of Education and Research and the Estonian Research Council. Over the past five years, the ministry has commissioned academic research to investigate the impact of digital technologies on student learning outcomes. Examples of such research include projects about the use of digital technologies to enhance teaching, student engagement, and assessment, as well as strategies for supporting students with special educational needs.[31] The University of Tartu, among other institutions, is a key partner working on research projects funded by the ministry.[32] Tallinn University is also involved in EdTech research, and was focusing on a project related to introducing flexible learning pathways for students as of 2023.[33]

Further, utilising funds from the European Commission's European Social Fund, from 2014 to 2023 the Ministry of Education and Research invited schools and companies to create digital educational materials, ensuring their accessibility to users. To this end, financial incentives were offered to organisations, individuals, and teachers to foster the creation of educational software and digital learning resources. This initiative concluded in 2023.

One of the driving forces behind digital innovation in Estonian education is the dynamic ecosystem of public-private partnerships that involve government entities, schools, and EdTech companies. While the Ministry of Education and Research does not directly invest in EdTech companies or offer tax incentives, it collaborates with organisations like EdTech Estonia to nurture the growth of the country's EdTech business environment, and subsidises research and development efforts of EdTech companies.[34] EdTech Estonia is a strategic partner to the ministry, and as such receives financial support. To foster the EdTech community, the ministry also provides resources encompassing monetary incentives, such as funding for EdTech hackathons, as well as non-monetary support, including mentoring programmes and opportunities for the companies to collaborate with schools and university researchers. Furthermore, some local governments have their own initiatives to support EdTech companies. For instance, the municipality of Tartu invested in *M-klassijuhataja*, a mobile app designed to facilitate communication between teachers, students, and parents via mobile devices.[35]

Notes

[1] https://planipolis.iiep.unesco.org/sites/default/files/ressources/estonia_education_strategy_2021-2023.pdf

https://www.hm.ee/sites/default/files/haridusvaldkonna_arengukava_2035_kinnittaud_vv_eng.pdf

https://valitsus.ee/en/estonia-2035-development-strategy/strategy/strategic-goals

[2] https://www.mkm.ee/media/6970/download

[3] The name of the programme is a reference to the economic boom of several Asian countries (e.g. Chinese Taipei, Korea, Singapore) in the late 20th century.

[4] https://www.educationestonia.org/internet-infrastructure-school/

[5] https://www.riigiteataja.ee/akt/12863550?leiaKehtiv

[6] https://www.ehis.ee/

[7] www.haridussilm.ee

[8] https://www.x-tee.ee/home. It was developed by Estonia's Information System Authority. Until 2018, it was named *X-Road* in English. However, since 2018, *X-Road* is used to refer to the technology developed together by Estonia, Finland, and Iceland through MTÜ Nordic Institute for Interoperability Solutions (https://x-road.global/). The Estonian *X-tee* is now called *X-tee* in English.

[9] https://e-estonia.com/solutions/education_and_research/school_management_systems/.

https://stuudium.com/; https://www.ekool.eu/#/en/

[10] https://tahvel.edu.ee/

[11] https://eis.ekk.edu.ee/eis/. From 2024, VET students will also be able to take assessments online via EIS. In addition, while students in grades four and seven can take the national-level assessments online, schools can also find diagnostic tests, evaluation of initial skills tests, etc. which are for open use. For instance, see: https://projektid.edu.ee/display/THO/Testid+ja+hindamine

[12] https://www.sais.ee/. For the list of participating institutions, see: https://www.sais.ee/ContentPages

[13] https://harno.ee/en; https://moodle.edu.ee/

[14] https://e-koolikott.ee/en

[15] https://www.youtube.com/c/haridusjanoorteamet; https://www.youtube.com/c/HITSAvideokanal/. The latter channel was run by HITSA, and it is no longer updated following the incorporation of HITSA into Harno.

[16] https://koolitus.edu.ee/

[17] https://www.riigiteataja.ee/akt/129032016001

[18] https://www.starcloud.ee/; https://www.taskutark.ee/

[19] https://www.opiq.ee/Search/Kits?searchPhrase=&curriculumGroups=GeneralEducationSimplified&SelectedKitType=default&classcourse=&subject=&publishinghouse=&package=&language=&sortingorder=LanguageFirst

[20] https://www.lastekaitseliit.ee/et/2021/03/lastekaitse-liit-korraldas-riigihanke-ning-ostis-haridus-ja-teadusministeeriumi-toetuse-eest-koolidele-1254-arvutit/

[21] https://www.educationestonia.org/innovation/digital-competence/

[22] https://digipadevus.ee/sonastik/#sonastik

[23] Occupational Qualification Standards for teachers: https://www.kutseregister.ee/ctrl/en/Standardid/vaata/10824210

[24] For further details, see: https://www.educationestonia.org/innovation/digital-competence/; https://digipadevus.ee/.

The teachers' digital competence framework has six dimensions: (a) professional development and engagement; (b) digital resources; (c) teaching and learning; (d) assessment; (e) empowering learners; (f) facilitating learners' digital competence.

[25] https://www.educationestonia.org/innovation/digital-competence/

[26] https://www.riigiteataja.ee/en/eli/523012019001/consolide

[27] Guidelines on data protection officer: https://www.aki.ee/et/eraelu-kaitse/andmekaitsespetsialist;

Guidelines on data security: https://www.aki.ee/et/eraelu-kaitse/andmeturve

Implementation of the GDPR requirements: https://www.hm.ee/gdpri-rakendamisest-htmi-haldusalas

[28] https://www.riigiteataja.ee/akt/423092016023?leiaKehtiv

[29] https://www.x-tee.ee/home

[30] This includes *Harno,* which does also not independently conduct digital education research.

[31] https://digiefekt.ut.ee/avaleht. An overview of all research projects carried out can be found at: https://www.hm.ee/et/tegevused/uuringud-ja-statistika-0

[32] For instance, see the following links: https://www.etis.ee/Portal/Projects/Display/38d931dd-fb47-4929-8a33-bed792176521?lang=ENG#Publications; https://www.etis.ee/portal/publications/display/7d91e3cf-12e2-431b-9709-18ae4f26ec0c; https://www.etis.ee/portal/publications/display/0575c0a6-b2c8-4f89-

ac4f-d1b540dae71c; https://www.etis.ee/portal/publications/display/20cfdae3-c77f-4d6f-9fd0-51a8c2c4bc96.

[33] https://www.etis.ee/Portal/Projects/Display/84b0b7d6-db8e-445b-9c79-b4e8f4d7bf6a

[34] https://www.edtechestonia.org/

[35] http://kool.mobi.ee/

9 Finland

This note provides an overview of Finland's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Finland supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Finland engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Finland as in other Nordic countries, the governance of the education system is shared between the central government, supported by various education agencies, municipalities, and education providers. In Finland the central government is thus only partially responsible for providing access to, supporting the uptake of, and regulating the use of, digital technology in education. Providing schools across all levels of education with access to digital tools designed for system management is its responsibility; but providing access to tools designed for institutional management or for teaching and learning purposes is devolved to municipalities (supported with central funding) and to schools themselves.
- A cornerstone of Finland's digital infrastructure in education is its student information system, *KOSKI*. It centralises the functionalities of a student register and of a platform for transferring, storing, and sharing education data, collected from schools. Along with the digital exam and its administration system, there are only a few digital tools that the central government mandates the use of; choices of additional tools (e.g. learning management system, digital teaching and learning resources) are left to municipalities and schools' discretion, sometimes under regulation and guidance of the government's agencies.
- Finland has long invested in its digital hardware infrastructure which now ensures that all education stakeholders can at least have *access* to the ecosystem of digital tools on an equal basis. Further policies are now in place to support equal *use* of those tools: adapting curriculum requirements, providing professional learning opportunities, guiding procurements towards interoperability, etc.

General policy context

Division of responsibility

In Finland, the Ministry of Education and Culture (hereinafter "the ministry") is responsible for determining the policies and direction of the Finnish education system. It outlines the general education strategy, manages all operations financed with state budget, and prepares legislation and governmental decisions regarding education. The Finnish National Agency for Education oversees the development and execution of education policy. However, in Finland as in the other Nordic countries, the central government devolves certain responsibilities to municipalities (sometimes groups of municipalities in upper secondary education) that it guides with central legislation.[1] Schools in Finland operate partly with central government funding but draw the majority of their budget (about two-thirds, depending on educational levels) from local taxes. This share is slightly lower than it is Sweden or Norway.

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follow this devolved context, with part of the digital education infrastructure provided centrally and large bits acquired locally. The ministry provides schools across all levels of education with access to digital tools designed for system management, whose use is often compulsory; but providing access to tools designed for institutional management or for teaching and learning purposes is devolved to the municipalities and to schools themselves – resources that they can acquire, use and complement at their discretion.

The regulation around the access to and use of digital tools and resources in education in Finland is more centralised than their provision, as it revolves around a curriculum set at the national level. In general, the Finnish ministry is the authority that sets the national rules and guidelines in a more top-down manner than in neighbouring countries. Finnish municipalities and schools have a large degree of autonomy in decision-making (see their agency as regards teacher-training requirements below), and further guidelines may exist at the local level, but their power of governance is limited.

Digital education strategy

Finland published a digital education roadmap in 2015, when the ministry undertook the "digital leap" programme. The "digital leap" programme was the seventh and latest component of a long sustained digital education reform effort that started in the 1980s. It aimed to modernise further schools' ICT infrastructure, allocate funding to increase teachers' and students' digital skills, develop teachers' pre-service training and a digital champions' model, and support the use of ICT for special education needs.

In 2023, the ministry published the *Policies for the Digitalisation of Education and Training until 2027*.[2] It aims at making Finland the world's leading developer and user of sustainable digitalisation in teaching, education and training by 2027. As per this plan, digitalisation should promote equal opportunities for everyone to learn and develop; and support co-operation between actors and learning at different stages of life. The ministry has also launched a *Framework for Digitalisation in Early Childhood Education and Care, Comprehensive School Education and Liberal Adult Education* in 2023.[3] The framework aims to develop the steering and co-ordination of digitalisation by defining the principles, targets and measures for seven different areas of digitalisation. The *Policies for Digitalisation in Early Childhood Education and Care, Pre-primary and Comprehensive Education* will be published in at the end of 2023.

Although it was not part of a formal digital education strategy, Finnish municipalities have significantly increased their expenditure on *hardware* infrastructure after the outbreak of the COVID-19 pandemic, to improve broadband and Wi-Fi connections in schools, and to distribute digital equipment to teachers and students (laptops or tablets for instance). Again, funding for this came from the central government and was available to public and private schools alike, as they are all government-dependent in Finland. Maintaining widespread and quality access to physical digital infrastructure (hardware) is set to remain one of the government's priorities in the future.

Since January 2020, the digitalisation of the Finnish society as a whole is promoted and overseen by the Digital and Population Data Services Agency. This agency ensures a coherent uptake and use of digital technologies across different policy areas, mainly pertaining to civic life but also to education activities.[4] In 2022, Finland published the Digital Compass, a national strategic roadmap extending to 2030 that provides an overview of Finland's digital transformation and provides the direction for national development work.[5] The digital compass sets national targets for the effective use of digital systems so that Finland can succeed in the ongoing transformation. It strengthens the shared understanding of the benefits, concepts and direction of digitalisation and the data economy. It also includes targets for the digital literacy skills.

The public digital education infrastructure

As a result of the decentralisation of public responsibility in education, the digital tools and resources that Finnish schools have access to are not solely provided by the central government. Municipalities share public responsibilities for providing and maintaining a digital infrastructure for education; and schools can add to their digital ecosystem by acquiring tools from private EdTech companies and publishers (sometimes in a "freemium model" where basic features are provided free of charge while more advanced features must be paid for), or by using free materials from external stakeholders such as philanthropists, education publishers, universities, and teachers.

This section reviews two aspects of the public digital infrastructure in Finland: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management systems

The cornerstone of the Finnish digital infrastructure for system management is *KOSKI*, the student information system owned and used at the national level. The National Agency for Education launched *KOSKI* in 2018 to serve both as a national registry for primary and secondary education (including VET), and as a platform for sharing student data.[6] *KOSKI* centralises the collection of various types of information (student attendance, progress, diplomas, certificates, study records, teacher-given grades, etc.) in a single data warehouse. The database, fed with data from schools' student admission registers and from the national registry of matriculation examination, assigns a unique and longitudinal identifier to every student.

KOSKI data inform the central government's transfer of funding to municipalities, as school funding is primarily calculated based on the number of students enrolled in each school. In that sense, *KOSKI* also serves the functionalities of an administrative function system. Further to that, *KOSKI* data are aggregated and displayed on *Vipunen*, the government's public dashboard of educational statistics, and made readily available for download or consultation to any interested party.[7] In the coming years, the National Agency for Education plans on providing analytics dashboards to school principals across all levels of education, for instance to allow them to better forecast and adjust their operations in comparison with other schools.

Beyond making data available to education stakeholders, *KOSKI* displays a level of data portability that allows other government institutions to access and use the data, including Statistics Finland, the Finnish Social Insurance Institution, or the Finnish Centre for Pensions. It is also well connected with non-governmental services promoted in Finland, such as *MyData*, a third-party digital passport. Thanks to the portability of *KOSKI* data, users can give consent to the National Agency for Education to transfer some of their personal information to *MyData* so that they can, for instance, attest that they are currently studying and benefit from student discount when they purchase a public transport card.[8]

Schools are required to transfer their student data to *KOSKI* twice a year – although there are plans to make the data transfer continuous in the future. Schools are offered two options: a manual transfer through *KOSK*I's user interface; or an automatic transfer through the application programming interface (API) of their learning management system (LMS). However, learning management systems are not publicly provided by the central government in Finland; instead, the National Agency for Education – together with LocalFinland, the association of Finnish municipalities, provide guidance to schools and instructions to LMS providers so that they can ensure the interoperability of their tool with the *KOSKI* environment. For instance, most schools in Helsinki use *Wilma*, a learning management system provided by the municipality and licenced from a commercial provider.[9] *WILMA*, as most other learning management systems used in Finland, is a web interface where students (and their parents, until students turn 18) can access information on their learning and their studies; and that school staff use to interact with other system-level administrative systems, especially *KOSKI*. In addition to *Wilma*, the ministry has subsidised the development of *DigiOne*, at national platform for the education ecosystem. *DigiOne* will enter the market in 2024 and some municipalities already envisioned to make it their learning management system.[10]

Admission and guidance

In addition to student information systems,[11] the central government also maintains a platform called *StudyInfo* that acts both as a student admission management system and as a career and study guidance website for students applying to upper secondary education and VET.[12] On the platform, students can find study programme information updated by schools and higher education institutions. They can then submit joint or separate applications online that Finnish institutions can review according to their pre-set admission criteria.

StudyInfo also hosts a range of other services such as *eHOKS*, a digital tool for planning professional studies dedicated to vocational education students and teachers; or *Valpas*, a monitoring and tracking service fed by data from *KOSKI* and *StudyInfo* that provides learners with a record of their enrolments and applications and facilitates their registration when relocating to a new school or returning to unfinished studies.

Exams and assessments

In 2012, Finland decided to digitise the matriculation exams taken at the end of secondary education to qualify for entry into higher education. The ministry collaborated procured the services of a private firm specialised in digital products to build a platform operating on the free and open access Linux operating system. After four years of research and development, in 2016 the first digital exams were held in subjects with a smaller number of candidates: geography, philosophy, and German language. By 2019, all matriculation exams were digitised.

Candidates can take the matriculation exams on their own laptop or borrow one from their schools. Whichever they opt for, all students have to access the Linux operating system from a thumb drive distributed by the matriculation board at the start of the exams. In this restrained, self-contained environment, candidates cannot access their local files or the Internet but only the pre-installed software and materials.[13] There is no cloud-based architecture to minimise the risk of technical difficulties: both the assessments and students' answers are saved on local severs, not connected to the Internet.

To support schools in this transition, the Matriculation Examination Board has developed *Abitti*, a digital system for exam administration.[14] *Abitti* provides instructions and guidance on the administration of the digital exams and allows teachers and students to get accustomed to the digital environment before they take the exams. The exam digitalisation was accompanied by an extensive training programme, provided by the ministry in a waterfall approach: across the country, 50 teachers were trained on the platform during a series of workshops so that in turn they could champion this transition and disseminate their knowledge among their peers.

In addition to their high-stake, end-of-course exams, students in years 3 and 9 in Finland are also assessed on a random basis (at the school level) to monitor and evaluate the education system. The Finnish Education Evaluation Centre (FINEEC) is the independent agency responsible for evaluation, from early childhood education and care to higher education. It operates as an independent unit within the National Agency for Education. In 2014, FINEEC experimented with digitising the national evaluation of basic learning outcomes in primary education, traditionally held on paper. By 2017, it had fully digitalised all national evaluations that were taken on *KODA*, FINEEC's own system for digital evaluation.[15] As per its *National Plan for Education Evaluation 2020-2023*, plans are to develop new evaluation systems (to replace *KODA*) and methods to diversify tasks and allow for automated scoring.[16]

Other tools for system and school management

The majority of Finnish schools also have access to additional digital tools for system and school management that are not publicly provided by the central government. This is most notably the case of the customer relationship management system that schools use to communicate with parents, in those rare cases where they have no municipality-provided LMS to accommodate for that; or of the online library they have access to, as it is often the digital counterpart of a physical library in their geographical area (see *Kiriasto* ("Library"), a joint service available in four cities including Helsinki, or *Koulukiriasto* ("School library"), a programme to foster reading available in the city of Oulu).[17] In both cases, the central government devolves the provision of those tools to municipalities, in collaboration with their libraries.

In Helsinki, *AI-HOKS*, an AI-based system has been developed and piloted to explore the use of an early warning system that may support VET students to graduate (and limit their risks of dropping out). It collects

data and construct indicators based on personal competence development plans, login and use of various tools and learning environments, weekly mobile questionnaires sent to students' cell phones, and students' feedback, as a way to provide – after a couple of years of use and larger data sets are available – ethical learning analytics.

Digital ecosystem for teaching and learning

In Finland as in the other Nordic countries, the responsibility of the central government, in terms of the provision of digital tools and resources, generally stops at the door of the classroom. It is primarily the role of municipalities to provide their schools with teaching and learning resources (with central funding), and that role extends to digital resources. The central government steers the development from time to time with discretionary government grants that the education providers apply as they see fit.

In many municipalities, most textbooks are now provided in digital format. Both the printed and digital version are available, but schools tend to use either one or the other. According to the Finnish Publishers Association, nearly 80% of upper secondary education learning materials were digital as of 2023; and up to 82% in Helsinki, all education levels combined – but around 15% if considering all levels of education across the country. The Finnish Association for School Materials partners with the Finnish Publishers Association to bring together municipalities with commercial providers of resources. Most schools thus have access to static and interactive digital learning resources, including digital resources for students with special needs, as well as a variety of online assessment content.

Finnish teachers and students can also use digital teaching and learning resources that are openly available to the general public. Several of those are provided or curated by the central government. There are public TV education programmes for instance, although no longer aired on TV since schools reopened after the COVID-19 crisis, but available for replay on a web platform;[18] as well as open education resources (OER), such as the ones curated by the newly established Finnish Library of OER, *aoe.fi*, jointly developed by the ministry and the National Agency for Education.[19] The service is intended for all levels of education and seeks to support lifelong learning. The agency also maintains a website for teacher development, with examples of teaching practices, opportunities for training, blog posts, etc.[20]

Other, non-governmental actors make digital resources available for free. For instance, some Finnish universities provide MOOCs (e.g. *MOOC.fi*, hosted by the University of Helsinki MOOC Centre) that learners and teachers can use at their will, and organisations such as EdTech Finland (the Finnish association of education technology industries) and the Finnish Publishers Association provide teaching resources and social media channels for teachers.

Furthermore, The National Library of Finland maintains and develops a national service, *Finna.fi*, which is a search service that collects material from hundreds of Finnish organisations under one roof, free of charge.[21] The service includes material that is available online in a variety of formats and enables the search for information from library and archive material that has not been digitised or with limited access.

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily imply that stakeholders will use them. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

In Finland, as in neighbouring Nordic countries, the government aims to provide equal access to education and educational resources – and no student groups are marked as a policy priority. Government funding for education (about 22% of schools budget) is proportional to the number of students enrolled in government-dependent schools (public or private), and municipalities generally provide all students with the same materials. For example, in upper secondary education, most municipalities buy all students a computer and make learning materials (most of which are digital) available for free, in line with the education legislation.[22]

However, having equitable access to hardware infrastructure does not necessarily lead to equity in its use. TALIS data found that teachers in Finnish private schools used ICT in their teaching more regularly than their peers in public schools (+7 percentage points) and felt better able to support student learning through the use of digital technology (+8 percentage points).[23] One way to ensure a minimal use of digital technologies for teaching and learning across all country's schools is to integrate the development of digital competences into the national curriculum, as is described in the sections below.

Supporting the use of digital tools and resources

For the ministry, there exist direct and indirect means to support the use of digital tools at the system, school, and classroom levels. When it concerns tools for system management, the ministry simply imposes the use of many of the tools that it provides (e.g. the student information system, the student admission management system, the digital exam system). When it concerns tools for school management or for teacher and learning purposes, whose provision is mostly devolved to municipalities (e.g. learning management systems, digital learning resources), the ministry supports their procurement through several means. First, schools being partly state-funded, the ministry provides non-earmarked subsidies that municipalities can use for those procurements. Second, under the lead of the Ministry of Economic Affairs and Employment (MEAE), the central government provides general guidance on procurement as enacted by the *Acts on public contracts*. The MEAE and the Association of Finnish Local and Regional Authorities jointly maintain the Public Procurement Advisory Unit, whose role is to provide contracting authorities at a lower level of government (e.g. municipalities in education) with information and advice on the application of procurement legislation. Third, the ministry incentivises the interoperability of the various tools procured by municipalities, for instance by encouraging Finnish EdTech companies to sell tools that accepts *MPASSid*, the national single sign-on (SSO) service. There is no formal or regulatory criterion but it has become a standard practice in procurement, as well as in the development of new digital tools such as the *DigiOne* LMS mentioned above.

In addition, the ministry provides guidance on the use of centrally provided tools (for instance through the National Agency for Education's platform for teacher development mentioned above), as well as professional learning opportunities and training to teachers. On a yearly basis, the agency allocates around EUR 15 million for this, to cover for the compensation of school staff and incentivise schools with grants. At a more local level, the agency offered guidance by providing funding to municipalities so that they can hire digital tutors whose role is to champion and share advice with their peers on the use of digital resources for teaching and learning. Funding for this was limited and subject to a competitive funding programme. It ended in 2022, but many municipalities continue to fund this activity.

Finally, Finland conducts monitoring and evaluation studies to quantify and map the use of digital technologies across the country and identify shortages or inadequacies, but they are not specific to education hence not undertaken by the ministry or the National Agency for Education.

Cultivating the digital literacy of education stakeholders

Finland aims to engage all education actors in the digital transformation of the system and developing teachers' digital literacy is one way to achieve this. However, the central government does not decide what competencies teachers must acquire in their preservice training as this falls within the remit of universities that set their own curricula. TALIS data from 2018 show that using ICT for teaching featured in just over half (56%) of lower secondary teachers' formal training – a proportion on par with the OECD average, and evenly distributed across city and rural areas, or private and public schools. Similarly, the central government does not decide what competencies teachers must develop as part of their in-service training as this is only stipulated in the contract they sign with their employers and the municipalities. Therefore, Finnish municipalities hold a key policy lever for cultivating teachers' digital literacy as they can provide incentives towards certain types of training, such as training in teaching with digital technology. In the year 2017, 74% of teachers reported that they took part in professional development in ICT skills, way above the OECD average (60%). Municipalities are also the preferred interlocutors of parents in the public conversation around the use of data and digital technology in school, although the National Agency for Education can also assume at the central level. this role in the form of online Q&A.

The central government uses another lever to foster students' and – indirectly – teachers' digital literacy: it updates the national curricula. In 2016, a transversal "ICT competence" was integrated as a learning outcome into the curriculum of primary and lower secondary education. Fostering ICT competence is not taught as a subject on its own, but rather as a cross-curricular activity taught as part of other subjects. Typically, this has often translated into adding programming exercises in mathematics (starting from year 1) and crafts (from year 3), up to algorithmic computing in years 7 to 9. Practical descriptions of what those curriculum changes imply are not normative, but they work as a framework to support municipalities in their planning and guide hiring and in-service training.

In addition, the Finnish National Agency for Education's *national framework for digital competence* steers the digital ecosystem in teaching and learning by describing competence as well as good pedagogical practices in media literacy, computational thinking and digital competence in early childhood education and care, primary and lower secondary education.[24] The descriptions have been widely adopted by educators.

Since 2012, Finland also has a public authority with a statutory duty to promote media education nationally: the Finnish National Audio-visual Institute (KAVI).[25] KAVI develops media education practices and models as well as supports the media education readiness of the educators, for example by maintaining an online *Media Literacy School*.[26] The site provides information on media education, the media culture of children as well as materials for media education. Furthermore, KAVI supports the provision of versatile and safe media content meant for children, and work in active co-operation with the actors in the media field.

Governance of data and digital technology in education

As is the case across European Union countries, the EU General Data Protection Regulation (EU GDPR) and its translation and supplementation as a national Data Protection Act defines the largest part of Finland's regulation around the protection of data and privacy, in education as well as in other sectors.[27] In education, the ministry additionally shares guidelines that are specific to the protection of students' and teachers' personal data and their privacy, and the National Agency for Education has released a "privacy guide" to support stakeholders in personal data processing.[28] Conversely, the ministry has also set up rules and guidelines to ensure that authorised researchers can access and use education data under similar conditions, and to allow public or private research and development (R-D) agencies to access and use educational administrative data – providing that data re-identification is impossible.

Finland's regulation of digital education places a strong emphasis on interoperability with a view to connecting the different tools that compose the Finnish digital education infrastructure, whether they are

publicly provided or not. When the student information system *KOSKI* was set up and rolled out across the country, its implementation was supported by rules and guidelines on the use of open standards for educational data to improve data transfer between schools (e.g. from learning management systems procured from private providers by municipalities) and the central government. Similarly, in upper secondary education the ministry accompanied the digitalisation of the matriculation exams with a number of rules and guidelines about the use of specific technical standards, ensuring that everyone could take the exams from their own or rented devices through a common, open operating software (Linux) accessible via a simple flash drive. Finally, as most other OECD countries have done recently, Finland developed its own single sign-on service (*MPASSid*) to facilitate teachers and students' access to education and service providers' tools. Finland also engages in or promotes international initiatives to facilitate interoperability, in particular with the European Union.

The 2019 Act on Information Management in Public Administration embodies the objectives that the central government pursues in the governance of its own data. It establishes the need for harmonised, open, secure and efficient data processing and use across various public authorities, and for interoperability across information systems and datasets.

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

Developing a national education technology ecosystem presents challenges both to develop appropriate local tools and to incentivise relevant innovation by external stakeholders. Providing incentives, supporting R-D, funding education technology start-ups are part of the typical innovation portfolio countries could consider.

The Finnish ministry supports academic research on digital technology in education. To facilitate the use of education data (within the legal framework discussed above), researchers have access to documented datasets collected by Statistics Finland, by the ministry and by the National Agency for Education (in large part via *KOSKI*) which are publicly available on Education Statistics Finland's dashboard.[29] The 2023 *Policies for the Digitalisation of Education and Training until 2027* call for the national register data base to be up-to-date and of high quality. All data resources are set to form an information infrastructure, which will enable digital tools for research and data utilisation to be developed accordingly. Going forward, the data sets and results are to be described in a compiled, comprehensive and uniform manner, as well as easily available and actionable.

Universities or public research agencies conduct research on education, sometimes with the support of government's funding programmes; however, they do not focus solely on digital education. Instead, the government prefers to commission academic research papers on digital education on an ad-hoc basis. This includes research on the use of digital technologies to improve learning outcomes and teaching, to support students with special needs, to improve assessment and to better predict school dropout with early warning systems.[30]

The ministry of economic affairs and employment provides public funding for R-D. *Business Finland*, the Finnish Funding Agency **for Innovation**, channels this funding to undertake transformative projects in the Finnish economy. One of these funds (EUR 5 million) was aimed to develop to create a national digital service platform and education ecosystem (*DigiOne*). The central government either develops EdTech tools in its own public agencies (e.g. the digital exams and its administration system, developed by the matriculation examination board) or it gives autonomy to municipalities and schools themselves to collaborate with EdTech companies and their association, EdTech Finland.

In its future activities, the central government does not envision to provide – or support the provision of – new types of digital tools. Instead, it aims to further develop *KOSKI*, the student information system, and *Abitti*, the digital system for administrating the matriculation exam. As is the case in other OECD countries

where the public responsibility for providing digital education infrastructure is largely devolved to lower level of governments (except for system management tools), the central government will focus on setting up policies that connect the different tools of the digital ecosystem and support their use in a digitally skilled population.

Notes

[1] Upper secondary education and VET can also be organised by (private) registered communities or by foundations. In some cases, VET is also offered by the government or state-owned enterprises.

[2] Policies for the digitalisation of education and training until 2027: http://urn.fi/URN:ISBN:978-952-263-963-9

[3] Framework for Digitalisation in Early Childhood Education and Care, Comprehensive School Education and Liberal Adult Education: https://okm.fi/en/project?tunnus=OKM013:00/2022

[4] Digital and Population Data Services Agency: https://dvv.fi/en/-/digi-ja-vaestotietovirasto-aloittaa-1-1-2020-yhteiskunnan-digitalisaation-uusi-suunnannayttaja-helpottaa-kansalaisten-arkea

[5] Government report: Digital Compass: http://urn.fi/URN:ISBN:978-952-383-609-9

[6] KOSKI: https://www.oph.fi/sites/default/files/documents/Mikkonen_koski_en_25012021.pdf

[7] Vinunen: https://vipunen.fi/fi-fi

[8] MyData: https://oldwww.mydata.org/portfolio/mydata-breaking-through-in-political-level/

[9] Wilma: https://www.wilma.fi/

[10] DigiOne: https://www.digione.fi/digione-eng/

[11] Finland also uses a student information system in early childhood education and care (VARDA) and in higher education (VIRTA).

[12] StudyInfo: https://opintopolku.fi/konfo/en/

[13] Digital Matriculation Exams: https://www.ylioppilastutkinto.fi/en/matriculation-examination/digital-matriculation-examination

[14] Abitti: https://www.abitti.fi/

[15] KODA: https://karvi.fi/esi-ja-perusopetus/digitaalinen-oppimistulosten-arviointi/

[16] National Education Evaluation Plan 2020-2023: https://karvi.fi/wp-content/uploads/2020/03/National-Education-Plan_2022-2023_updated-S2022_web.pdf

[17] *Kiriasto* in Helsinki: https://www.helmet.fi/fi-FI; *Koulukirjasto* in Oulu: https://www.ouka.fi/oulu/kirjastoreitti/oulun-koulukirjasto

[18] TV Education: https://areena.yle.fi/tv/ohjelmat/57-6AXjXXPdl

[19] Library of Open Educational Resources: https://aoe.fi/#/etusivu

[20] Website for teacher development: https://www.oph.fi/fi/opettajille

[21] Finna.fi: https://www.finna.fi/

[22] Law: https://finlex.fi/fi/laki/ajantasa/2020/20201214#L4P16

[23] TALIS : Mending the Education Divide: https://www.oecd-ilibrary.org/sites/d8a3978a-en/index.html?itemId=/content/component/d8a3978a-en#section-d1e11602. In Finland, no data were collected to measure possible gaps between socioeconomically advantaged and disadvantaged students.

[24] The Framework for Digital Competence: https://eperusteet.opintopolku.fi/#/en/digiosaaminen/8706410/tekstikappale/8709071

[25] KAVI: https://kavi.fi/en/

[26] Media Literacy School: https://www.mediataitokoulu.fi/en/

[27] Data Protection Act: https://www.finlex.fi/fi/laki/ajantasa/2018/20181050

[28] Privacy Guide: https://www.oph.fi/fi/tietosuojaopas

[29] Data documentation on Education Statistics Finland : https://vipunen.fi/en-gb/Pages/Tietosis%C3%A4lt%C3%B6.aspx

[30] See for instance the work of the Research Group for Education, Assessment and Learning (REAL): https://www.researchreal.fi/en/projects/digivoo-project/; or the research conducted by the University of Oulu: https://www.oulu.fi/en/research/digitalization-and-smart-society

10 The Flemish Community of Belgium

This note provides an overview of the Flemish Community of Belgium's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how the Flemish Community of Belgium supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how the Flemish Community of Belgium engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In the Flemish Community of Belgium, the government publicly provides some of the digital tools for system management (e.g. student information system) and for teaching and learning (e.g. an Open Educational Resources (OER) network, a digital media bank). Schools and school boards are incentivised to use system management tools, but not strictly required to, as long as they use other digital tool that complies with the ministry's standards (in particular in terms of data transfers); teachers and students are free to use the digital resources provided by the government or to acquire on their own.
- The government's digital strategy for education is aimed at establishing a digital ecosystem that covers both hardware and software infrastructure, at cultivating education stakeholders' digital literacy, and at promoting collaboration with the academic and EdTech sectors. The ministry and its agencies have deployed monetary and non-monetary mechanisms to ensure equal access to digital tools, support their use, and promote research and development for innovation.

General policy context

Division of responsibility

In Belgium, the public responsibility for providing education is split across the country's three linguistic communities: Flemish, French, and German. The Flemish Ministry of Education and Training (hereinafter "the ministry") is responsible for determining the policies and direction of the Flemish education system. The ministry is also responsible for providing access to, supporting the uptake of, and regulating the use of, digital technology in the Flemish education system. The Agency for Educational Services (*Agentschap voor Onderwijsdiensten* – hereinafter "AGODI") supports the ministry by developing and providing Flemish schools with a selection of publicly owned digital tools. However, schools (and school boards) in the Flemish Community of Belgium have a large degree of autonomy, and they are free to use those tools or not. Although the ministry provides schools with system and institutional management tools – which schools are incentivised to use, but not required to – it is mostly at their discretion to acquire (partly with governmental funds) and manage their digital infrastructure for teaching and learning.

While the Flemish government leaves a large room of manoeuvre to schools in terms of the acquisition of digital tools, it sets the rules and guidelines that govern the access to, and use of, data and digital technology in education. This central regulation applies equally across all educational levels in the Flemish Community.

Digital education strategy

Digisprong ("Digital Jump"), the Flemish Community of Belgium's digital education strategy, was initiated during the COVID-19 crisis as part of the *Vlaamse Resilience* ("Flemish Resilience") recovery plan.[1] *Digisprong* represents a EUR 375 million budget to advance digitalisation in education along four "spearheads": (1) establishing a future-oriented and secure ICT infrastructure in schools (which covers hardware as well as software infrastructure), and equipping students from grade 5 and over with a digital device on a *one-to-one* basis; (2) setting up a supportive and effective ICT school policy and supporting school ICT coordinators in their role and autonomy; (3) equipping teachers and teacher trainers with a relevant set of digital skills by giving them access to learning resources (see below section for further details), and; (4) establishing a *Digisprong Kenniscentrum* ("Knowledge Centre") whose role is to facilitate peer-learning and co-operation between schools and external actors.[2]

In 2021, the Flemish government established the *Digitaal Vlaanderen* ("Digital Flanders") agency to support the digital transformation of the Flemish and local government authorities. Born from the merger

between the Flemish Departments of Information, of ICT Facilities and of Services, the Digital Flanders agency supervises all sorts of digital transformation projects at the community and local levels. Finally, at the level of Belgium as a whole, the Federal government has appointed an assistant secretary of state in charge of digitalisation to coordinate policy efforts between the Flemish, French and German-speaking Communities.

The public digital education infrastructure

In the Flemish Community of Belgium, schools (and teachers) have a large degree of autonomy to acquire digital tools in addition to (or in lieu of) the public digital ecosystem set up by the Flemish government. Education stakeholders can acquire those tools directly from private companies or use materials that are made available for free by other stakeholders, such as philanthropy, universities, and teachers. This section reviews two aspects of the public digital infrastructure in the Flemish Community of Belgium: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management systems

To support system and school management, collect data and generate education statistics, on behalf of the ministry the Agency for Educational Services (AGODI) has developed two main digital tools for system management: *Discimus* and *Edison*.

Discimus is a student information system that allows primary and secondary schools to exchange student data with AGODI in a seamless way. Through *Discimus*, the Flemish government has access to data on students' school and pre-school attendance. The government also uses *Discimus* to allocate funding to schools as per its funding formula, to verify if students meet certain admission requirements before enrolment, to deliver secondary education diplomas, to issue study records and, since 2018, it transfers those records to the Flemish Employment Agency. With this information, the Flemish Employment Agency can identify young people between 15 and 24 years old who are not in education, employment, or training (NEET) and provide them with specific support and assistance. Students are registered in the databases with unique and longitudinal IDs (which are also used to generate their single sign-on (SSO) identifier and access other tools within the digital ecosystem for education). The data transfers take place in real-time: as soon as schools enter student data into *Discimus*, the ministry's databases are updated. Administrators and school staff can then navigate part of those databases through analytics dashboards built in the system's interface. The ministry allows schools that prefer not to use *Discimus* to contract commercial agreements with private software providers to transfer their student data to AGODI, as long as the chosen tool complies with certain standard of quality established by a circular letter.[3] Whichever means they choose, AGODI organises training courses to help school staffs send quality and actionable data.

Next to *Discimus*, *Edison* – Dutch acronym for "Electronic Transmission of Information between Schools and the ministry" – is another system management tool publicly owned and provided by the ministry. Compared with *Discimus*, *Edison* is more of an administrative function system whose role is primarily to facilitate the exchange of data about school staffs, although it also integrates features that relate to student administration in secondary education (e.g. data on internships). *Edison* does not operate in real-time as *Discimus* does, but the processing of data updates hardly takes more than one business day. Here again, schools are free to switch to a different digital tool if they wish to, provided that their chosen tool can also transfer key pieces of information to AGODI.

As far as school management tools are concerned, the Flemish government does not own or provide a specific learning management system (LMS) to schools. Most secondary schools, and a sizeable share of

primary schools, use *Smartschool*, a private provider's tool that incorporates all typical LMS functionalities, from school-level student management to content sharing, scheduling, communication with students and parents.[4] *Smartschool a*lso displays analytics dashboards available to both school staffs and parents and is interoperable with other system-level and institution-level administrative and learning systems. For instance, students can log into *Smartschool* through their *Leer ID*, the single sign-on tool generated through *Discimus*.

Other tools for system and institutional management

Besides *Discimus* and *Edison*, the ministry publicly provides a platform for digital credentials called *LED*.[5] It collects data from student credentials (e.g. diplomas, proofs of experience) and makes them easily accessible online – even automatically when the credential is issued by a Flemish school. People can log in to the platform with their electronic identity card (*eID*), retrieve their own credentials, and demonstrate their authenticity, for instance as a proof of eligibility for a study grant, or to their (future) employers when they apply for a position. The platform integrates data from, and connects with, other services of the Flemish government: AGODI for primary and secondary education credentials, the Agency for Higher Education, Adult Education, Qualifications and Study Allowances (AHOVOKS) for higher education credentials, and the Flemish Service for Employment and Vocational Training (VDAB) for employment and training certificates; as well as from services in non-education sectors (e.g. environment, social affairs). *LED* credentials are aligned with Europass' "European Qualification Framework".[6]

Finally, the ministry offers a knowledge management system (an iLibrary) and hosts a platform for study and career guidance for students called *Colombus*, which is powered partially by non-AI-based algorithms.[7]

By 2024, the ministry plans on developing and implementing a digital student assessment at the system level. This standardised assessment will support the monitoring of learning outcomes, generate data for research, and help improve the quality and accountability of the whole education system. It will initially focus on Dutch language (reading, writing, grammar) and mathematics (OECD, 2023[1]).

Digital ecosystem for teaching and learning

The ministry plays a less prominent role in terms of providing digital resources for teaching and learning. Schools and teachers operate and teach with a high degree of pedagogical autonomy that leads them to use a variety of teaching and learning resources. Still, the ministry provides some digital resources, sometimes openly, that teachers, students, or the general population, are free to take up.

For instance, in 2013 the ministry's Agency for Educational Communication took over the management of *KlasCement*, an open educational resources network initiated in 1998 as a teacher-led initiative. Before the COVID-19 pandemic, more than 200 000 members were using the network to share their teaching resources and ideas for free, covering all student ages and class subjects.[8] *KlasCement* is now part of the *Kenniscentrum* ("Knowledge Centre") instituted as part of the *Digisprong* action plan.

Het Archief voor Onderwijs ("The Archive for Education"), a digital media bank, is another example of a teaching resource repository that is offered by the government. Access to this repository is restricted to teachers enrolled in the education system, contrary to *KlasCement.*[9] This bank helps teachers enrich their lessons with video and audio contents aligned with curriculum objectives.

Schools in the Flemish Community of Belgium have also access to a range of centrally provided static and interactive digital learning resources, including tools for students with special needs. Among them, *ADIBIB*, *Bednet* and *WAI-NOT* are three platforms developed or publicly procured by the government to suit the needs of students, who cannot attend classes or suffer from different kinds of learning impairments.

Finally, the Ministry has developed an online platform for teacher development called *Digisnap*.[10] Based on the EU's *SELFIE* tool, the platform gives teachers insights on their digital competences and allow school leaders to set up tailored development plans.

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily imply that stakeholders will use them. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

The *Digisprong* action plan is aimed at reaching everyone in the education sector, but specific attention is given to students with special needs (through the provision of the three special-needs teaching and learning platforms mentioned above) and students from lower socio-economic background. Other than those equity mechanisms, the Flemish Community of Belgium, as many other countries in the OECD, aims to provide equal access to digital infrastructure. This is notably enforced through *Digisprong*'s one-to-one policy on digital devices, whether those devices are student- or school-property. *Digisprong* treats different types of institutions equally: whether public or private, urban or rural, located in rich or poor areas, all schools receive the same kind and level of attention from the ministry, can access and use the same publicly provided digital tools, and acquire their own digital infrastructure through the same mechanisms.

Following *Digisprong*, the ministry has passed decrees and circulars that guarantee equitable access to, and use of, digital technologies in education.[11] A number of rules and guidelines, some of which translated into the official curriculum framework, further determine, for instance, what are compulsory (and prohibited) uses of digital technologies in class, as a way to enforce a minimal access to such tools for everyone.

In terms of hardware infrastructure, the *Digisprong* action plan has led to increased investments in broadband connectivity, Wi-Fi and mobile connectivity, devices in schools and devices for students (including specific devices for students with special needs); as well as some other changes in expenditures geared towards fostering innovation in digital learning resources, augmented reality, and in-service professional development.[12] As of September 2022, the plan's priorities in improving schools' hardware infrastructure remain focused on the provision of digital devices to students and teachers, digital equipment in classrooms, and Internet access and connectivity in schools.

Having equitable access to hardware infrastructure does not necessarily lead to equity in its use. Sections below describe what efforts the Flemish Community of Belgium deploys to measure and bridge the gap between the availability and uptake of digital tools and resources.

Supporting the use of digital tools and resources

For the ministry, direct and indirect means are meant to support the use of digital tools at the system, school, and classroom levels. Financially, the ministry provides schools with a mix of earmarked and non-earmarked subsidies. Earmarked subsidies are channelled through the *Digisprong* action plan and are meant to cover the acquisition of digital resources for teaching and learning, while non-earmarked subsidies (i.e. schools operational budget) can be spent on any type of resources. With those subsidies, schools have autonomy to procure digital resources on their own. Nonetheless, the ministry and its Knowledge Centre for Digital Education support them by negotiating prices with certain EdTech suppliers (such as *Microsoft*) and providing guidance on procurement practices. The ministry has also circulated non-binding criteria on schools' purchases: one with regard to equity of access; one with regard to security

and safe management; and one with regard to sustainability, in the sense that procurement guidelines generally encourage to buy socially and environmentally responsible solutions.[13]

Outside of (financial) support for procurement, the ministry also supports the *use* of digital infrastructure by delivering central guidance and professional learning opportunities. For instance, AGODI organises training courses for school staffs to learn how to transfer data to student information systems; and the implementation of the *Digisprong* action plan has been accompanied by a portfolio of in-service training sessions offered to education stakeholders (e.g. bootcamps, digital classes).[14]

Finally, the ministry monitors and evaluates the use of digital tools and resources in schools through the ICT Monitor report.[15] Since 2006, the ministry has developed a set of key indicators concerning the use of ICT in education in a systematic, quantitative, and representative manner. Researchers from KU Leuven and Ghent University developed the first model of indicators clustered around four components: infrastructure and policy, usage, competences, and perceptions. The mapping of ICT integration across educational levels, fed from large-scale surveys of principals, teachers, and students, has evolved over years to account for changing policy priorities and include new forms of integrations of ICT in education such as digital games, social media, and media literacy. This comprehensive and longitudinal mapping allows policy makers to identify shortages (or inadequacies) as well as efficient uses of digital tools and resources in education across the Flemish Community.

Cultivating the digital literacy of education stakeholders

Cultivating the digital literacy of education stakeholders is integral to the digital transformation of the education system. Developing teachers' digital competences is one way to achieve this. However, in the Flemish Community of Belgium, the ministry does not require teachers to acquire, as part of their pre-service training, specific competencies related to the use of digital technology in their teaching; nor does it make in-service training compulsory – although it is strongly encouraged. In 2017, 45% of teachers reported that they took part in professional development in ICT skills, below the OECD average (60%).

The central government uses another lever to foster students' and, indirectly, teachers' digital literacy: updating the Flemish curriculum. The ministry has integrated the development of student digital skills into the most recent curriculum reform, hence reinforcing the need for teachers to meet certain standards in their ability to use and teach with digital technologies.[16] To further anchor the importance of such skills in education, the ministry also plans to integrate them into the upcoming system-wide standardised student evaluation, and has tasked the Flemish inspectorate with the mission of proactively enforcing their development in schools, as part of the General Reference Framework for Quality of Education.[17,18] A ministry's Working Group in charge of supporting schools and controlling that schools comply with the EU GDPR supports the inspectorate in its mission.

Finally, the ministry communicates with students and parents about the use of data and digital technology in education. This fits in a broader effort to introduce people to different aspects of digitalisation and media literacy. Examples of this are the *Amai!* Project that aims to bring citizens and experts together to work on projects around the themes of artificial intelligence; the *Scivil* (short for CitizenScience) initiative where scientists and non-scientists collaborate on research projects; *VeiligOnline* ("SafeOnline"), which provides information to parents about issues related to digitalisation in the classroom, social media, privacy, gaming, cyberbullying, and online relationships, and; the *Datawijsheid* ("Data Wisdom") webpage developed by *Mediawijs* ("Media Wise"), the Flemish Knowledge Centre for Digital and Media Literacy, that informs people on data literacy.[19]

Governance of data and digital technology in education

As is the case across European Union countries, the EU General Data Protection Regulation (EU GDPR) defines the largest part of the Flemish Community of Belgium's regulation around the protection of data

and privacy, in education as well as in other sectors. In education specifically, the Flemish government has produced specific rules and guidelines about the protection of personal data and privacy of students, teachers and school staffs. The *Intentieverklaring Privacy in Digitale Onderwijsmiddelen* ("Statement of Intent on Privacy in Digital Education"), which education providers as well as suppliers of digital educational resources must sign, is an example of such data protection rule specific to education.[20]

The Flemish regulation of digital education places a strong emphasis on interoperability with a view to connecting the different tools that compose the Flemish digital education infrastructure, whether they are publicly provided or not. The ministry has put in place rules and guidelines about the use of open standards on educational technologies and data, some of which are technical standards (e.g. on formats), to improve interoperability.[21] In practice, schools must meet certain requirements, for instance when they transfer their student data to AGODI – if done through a digital tool different from the publicly provided *Discimus.* To further promote interoperability, *LeerID*, a single sign-on (SSO) identifier, will soon be implemented to access to all ministry-provided digital tools.[22]

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

Developing a national education technology ecosystem presents challenges both to developing appropriate local tools and to incentivising relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

The ministry supports the use of education data for academic research on digital technology in education. It has notably set up specific funding programmes for academic research on digital education and education data use (see the ICT Monitor for instance), which helps communicate clear research and development priorities in this area.[23] In the last five years, the ministry has also commissioned academic research on the use of digital technologies to improve learning outcomes, to support teaching, to improve school management functions, to help students with special needs, to improve assessment, and to evaluate blended learning.[24]

As EdTech companies provide many blocks of the Flemish digital infrastructure in education, the ministry and its agencies have engaged strong public-private relationships that aim to guide, incentivise, and mobilise innovations in education. For instance, the ministry provides monetary incentives to organisations for the development of digital learning resources or educational software. In practice, the *KlasCement* network and the *Het Archief voor Onderwijs* digital media bank are two examples where the ministry subsidises the platform (though not the content). Another example is the *Smart Education @ Schools* programme where teachers can submit a project to partner with research institutions, companies, and other partners to develop smart technology in education.[25] Best projects can receive up to EUR 75 000 through an annual open call organised by IMEC, the Ministry of Economy, Science and Innovation's main research and development centre.[26]

Through IMEC, the Ministry of Economy, Science and Innovation also invests in start-up companies, subsidises R-D to encourage digital innovation in education through competitive educational grants, incentivises R-D on EdTech through tax credit, and develops EdTech tools on its own. IMEC's iStart programme, for instance, helps start-up companies grow by injecting between EUR 50 000 and 250 000 to support their early development, and by providing them with coaching and support.[27] Together with Ministry of Education, it supports the collaboration between EdTech companies and schools through monetary and non-monetary incentives, for instance by setting up a dialogue on good procurement practices.

In the next five years, the ministry's priorities are to develop and improve its provision of online educational platforms and digital resources, to upgrade and generalise the use of *Discimus* (the student information

system), and to provide a tool for digital assessment administration which will first serve the administration of the national student evaluation.

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[2] The Digisprong Knowledge Centre: https://www.vlaanderen.be/kenniscentrum-digisprong/over-ons

[3] *Discimus* circular letter: https://data-onderwijs.vlaanderen.be/edulex/document.aspx?docid=14347

[4] *Smartschool*: https://www.smartschool.be/

[5] *LED*: http://leerenervaringsbewijzendatabank.be/

[6] European Qualification Framework: https://www.cedefop.europa.eu/en/projects/european-qualifications-framework-eqf

[7] *Colombus*: https://columbus.onderwijskiezer.be/

[8] When a member's account is not used for a year, it is deleted from the network. Approximately 14% of the users are teachers from the Netherlands. For more details, see: (Minea-Pic, 2022[2]).

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[20] For more details, see: https://www.privacyinonderwijs.be/

[21] For instance, *LeerID* relies on *openIDconnect*, *SAML 2.0* and *OAuth2.0*; while learning resources are aligned on *Learning Object Metadata* (*LOM*).

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11 France

This note provides an overview of France's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how France supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how France engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In France, the ministry of national education and youth provides a multiplicity of digital tools for system and school management as well as digital resources for teaching and learning. The central provision of several key national tools is supported by the efforts of regional, sub-regional and local entities, in line with the governance of the education system. Schools and teachers receive central and local guidance for using those tools and resources, and they can be mandated or incentivised to use them. However, they still have freedom to acquire and use resources from other providers, in compliances with central guidelines on procurement and data protection.
- France's 2023-2027 digital education strategy outlines and guides the actions of the ministry in the digitalisation of the education system at all levels. Aiming for establishing a comprehensive, multi-faceted public digital ecosystem in education, the ministry has implemented policy mechanisms that support all education stakeholders in their access to, and use of, digital tools in education, with specific attention given to disadvantaged schools and students.
- France supports innovation, research, and development on digital education through a host of partnerships that join together government officials, academic research centres, EdTech firms, and educational actors. Through rules and guidelines, the ministry promotes interoperability and the use of common standards, and it facilitates the use of education data for research in compliance with strict data protection laws. In addition, the ministry cultivates all stakeholders' digital literary by offering professional development opportunities and establishing specific requirements related to digital tools as part of teacher training and in the national curricula.

General policy context

Division of responsibility

In France, the *Ministère de l'Éducation nationale et de la Jeunesse* (ministry of national education and youth (hereinafter "the ministry")) is responsible for providing education at the central level. It devises policy, prepares and implements legislation, sets curricula, oversees state diplomas and manages the recruitment and training of teaching staff as well as of most educational administrative, technical and health staff. The ministry has a devolved structure with "academic regions" and "academies" that are regional and local education authorities responsible for implementing the national policy taking into account the particularities of the different territories. However, some areas of competence have been devolved to local governments, in particular as regards the physical infrastructure and operation of public schools (buildings, equipment, school meals, etc.): municipalities are responsible for primary schools, *départements* (sub-regional units) for lower secondary schools, and regions for upper secondary schools.

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follow this division of responsibility to some extent. Across all levels of education, the central government is the sole public provider and operator of digital tools for system management; but it is supported by regional and municipal authorities for institutional management tools. Providing access to digital resources for teaching and learning is also a responsibility that the central government shares with regions, *départements* and municipalities at their corresponding level of competence.

Digital education strategy

In early 2023, France published its 2023-2027 digital education strategy.[1] Various education stakeholders – the State, regional and local authorities, publishers, EdTech representatives, and associations – have contributed to this strategic reflection, taking stock of the lessons learnt during the COVID-19 crisis and building on proposals that emerged from years of national and local consultations on

digitalisation. The 2023-2027 strategy is structured around four pillars: i) an engaged ecosystem serving a shared public policy; ii) a digital education that fosters citizenship and digital skills; iii) an educational community supported by a thoughtful, sustainable, and inclusive digital offering; and iv) a new state of play for a user-oriented information system.

This digital education strategy is undertaken within the framework of France 2030, a EUR 54 billion cross-sector investment plan, which followed the France Relance plan designed during the pandemic. This plan entails spendings on hardware infrastructure and digital equipment. As part of France 2030, local authorities (regions, *départements*, municipalities) have massively invested in broadband, Wi-Fi, mobile connection, and Intranet servers in schools and in the provision of computers, tablets and mobile devices to students, at school or at home.[2] School equipment is indeed one of their prerogatives. The ministry has guided those investments with a centrally defined framework called *Socle d'équipement numérique de base* ("Core digital equipment framework"), declined for primary, lower secondary and upper secondary schools.[3] This "Core digital equipment framework" has primarily targeted students with special needs and schools with low socio-economic pupils and in rural areas.

Beyond education, the French government has established three main organisations that centrally coordinate the deployment and use of digital tools across sectors. First, the *Direction interministérielle du numérique* (DINUM, or "Inter-ministerial Digital Directorate"), which was established as a department under the prime minister and reports to the minister for public transformation and the civil service, is responsible for developing the State's digital strategy and for overseeing its implementation.[4] Second, also placed under the prime minister's authority, *France Stratégie*, an independent public institution, has established a National Committee for Digital Strategy that produces policy analyses and recommendations to guide public actions.[5] Finally, the *Commission Nationale de l'Informatique et des Libertés (CNIL)* acts as the French Data Protection Authority for everyone within and outside the education sector.

The public digital education infrastructure

The French ministry of education and youth provides several components of the public digital ecosystem in education. Schools and teachers can then choose to acquire additional elements to this baseline digital ecosystem, either directly from the private sector or from other education stakeholders that release tools and resources for free. This section reviews two aspects of the public digital infrastructure in France: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information and learning management system

Two central student information systems support the French ministry in operating the education system: the first, *Onde (Outil numérique pour la direction de l'école*, meaning "digital tool for school administration"), is addressed to primary school principals and their corresponding municipalities; and the second, SIECLE (for "*Système d'information pour les élèves en collèges et lycée et pour les établissements*" – information system for students in middle and high school and for establishments), is addressed to lower and upper secondary schools.[6] Both tools are free, publicly owned, and managed at the central level. Both systems use a unique and longitudinal National Student Identifier (*Identifiant National Étudiant*, or INE), enabling to follow students across time and to link them to their teachers, and to teacher-given grades. They display analytics dashboards, fed with real time information, which are accessible to administrators at the central level and to school principals at the institutional level.

In primary education, *Onde* is available in two versions: *Onde mairie* and *Onde échanges*. *Onde mairie* proposes a more comprehensive sets of functionalities for municipalities and for primary schools that have

no learning management system. This extra module allows them to manage enrolments, exchange student information with school principals, and ensure that all children are enrolled in compulsory obligation. Primary schools that already use an LMS, typically licensed from a commercial provider, must have it approved by the ministry before they can use the *Onde échanges* module, whose role is to transfer student data in real time from their tool to the central services.

In secondary education, *SIECLE* also consists of a set of modules that combines the functionalities of: a student information system, which allows access to and requests from the national school-student database (*Base Élèves Etablissements*); a learning management system, with the *Siecle Vie scolaire* module that displays tools and analytics dashboards on student attendance, sanctions, etc.); a customer relationship management system (to exchange with parents via text message, email or phone); and various administrative function systems, with the *GFE* (student finance management), *Bourse des collèges* (scholarship management), and *SDO* (students' career choices management) modules. Other modules in *SIECLE* allow teachers to report their student grades online (*Evaluation, LPC, Seveva*) and to keep track of their lessons through a digital class register (*Cahier de texte*).

Compared to their previous generations (*Base Élèves* in primary education and *Sconet* in secondary education), both tools are built on open standards and do not require to use other commercial systems such as Microsoft's. Data management and server hosting are devolved to the French academies (i.e., regional education authorities), in compliance with data protection and security standards.

In addition to, or instead of, Onde and SIECLE, schools can choose to use an *Espace Numérique de Travail (ENT)* (Digital Working Environment) to fulfil the functions of a learning management system. Those systems are provided by regions*, départements*, and municipalities. Some of them are developed publicly, for example the *Toutatice ENT* in the Britany region while others are acquired from commercial providers, such as *OpenENT*, *OpenNEO*, *Classe numérique*, etc. The ministry has published and continuously revises its "Blueprint for ENT", which defines a common architecture, expected services, as well as technical standards.[7] An *ENT*'s primary role is to allow all school actors (principals, teachers, students, parents) to access, through a single sign-on (SSO) login, a unique platform to communicate, exchange, and retrieve digital resources for teaching and learning. As such, all *ENT*s typically offer communication tools, provide a repository for learning content, and are made interoperable with other administrative and learning systems at the level of the school. Most *ENT*s are also interoperable with *PRONOTE*, a commercial tool widely used in France that supports school staff's management of teacher-given grades, students' timetable, attendance, sanctions, mailing, communication with parents, etc. A majority of lower secondary and upper secondary schools now use an *ENT* or another digital tool that fulfils the extended functions of an LMS. Most primary schools, however, typically use systems that simply feature customer relationship management to communicate with parents.

Admission and guidance

The French ministry of education also provides two digital tools to manage student admission at the central level. First, *Affelnet (AFFectation des Eleves par le NET*, or "online student admission") is the platform used for managing the enrolment process of lower secondary school students into upper secondary schools.[8] In addition to students' preferences, regional academies use criteria such as students' place of residence, academic achievements, and status of scholarship-holder to determine their affectation into upper secondary schools that match their study choices. To transition from upper secondary education to higher education, all students have to submit their study wishes on another platform, *Parcoursup*.[9] Following a unique national calendar, students in their last year of secondary education must use this platform to fill in a single application file, consult the 21 000 post-secondary education study tracks on offer, formulate wishes for the ones they prefer, receive admission proposals after their application has been examined, and prepare for their enrolment into their next educational institution. *Parcoursup* relies on non-AI-based algorithms to sort out applications based on certain criterion (e.g., scholarship status) and to

transfer those applications back and forth between the institutions and their candidates; however, *Parcoursup* in itself neither reviews nor ranks students' applications: this remains managed by post-secondary education institutions themselves, using their own selection criteria. This can be seen as a "matching" platform.

While students (and parents) receive study and career guidance on Parcoursup during their application process to higher education, a dedicated website can be consulted to this effect, provided by the *Office National d'Information sur les Enseignements et les Professions (ONISEP)* (the "National Information Office about Study paths and Careers"). The ONISEP produces and shares information on studies and careers through different means and channels: online resources, video content, online support services, helpdesk, iLibrary, etc.[10] In 2022, as part of the France 2030 digital strategy, the ministry and *ONISEP* have also initiated the *Avenir(s) ("Future(s)*") programme that aims to improve the process of study and career choices by helping students identify their skills and have more agency and ownership on their lifelong learning.

Assessments and credentials

The ministry has developed the Cyclades tool to assist schools with the administration of examinations. Since June 2021, schools have been able to scan and digitise the *baccalauréat* (French end-of-high-school exam) and other high-stake exams' response sheets, filled in by students with paper and pencils, so that teacher-graders can grade them online, annotate students' responses, and leave comments that students can access almost instantly after the results of the exams.

The *Application de Suivi des Passations (ASP)* is another tool developed by the ministry to support the administration of assessment. In contrast with Cyclades though, the *ASP* role is to support school staff in the administration of the national student assessments in French and mathematics.[11] From lower secondary education onward, students take those evaluations digitally.

All national diplomas awarded since 2003 are digitalised on diplome.gouv.fr, a digital credential system that delivers certified digital certificates and allows third parties to verify the authenticity of a person's diploma through a digital key.[12]

Digital ecosystem for teaching and learning

The ministry provides digital resources for teaching and learning, which schools, teachers and students can use and complete with external resources of their choice.

Open-access resources

Some of the resources publicly provided by the ministry are available to anyone in France, whether enrolled in the education system or not. For instance, *France Television* (the French public TV channel), the Centre for Media and Information Literacy (*CLEMI*), the ministry of culture, the ministry of education and youth have developed the joint *Lumni* educational platform.[13] On *Lumni*, everyone has access, for free, to more than 10 000 learning resources in all subjects of the national primary, lower secondary and upper secondary curriculum. Resources range from video to audio contents, games, quizzes, and articles. *Lumni* is typically addressed to students who want to delve deeper in – or go beyond – their courses. Teachers can also use up to 3 000 verified resources to prepare, illustrate or enrich their lessons. *Lumni*'s resources are accessible through schools' digital working environment (*ENT*). Although it provides contents that target more post-secondary education, the ministry of higher education and research has also supported the development of a MOOC platform called *France Université Numérique* (*FUN*) ("France Digital University"). It can be used by teachers as well as French citizens to learn about specific subjects.

Since 2016, everybody in France can self-assess their digital literacy through *Pix*, a public platform designed by government departments.[14] *Pix* is free and open source. On average, it allows 75 000 users per day to self-assess and improve their digital competences and has now delivered more than 3 million digital certificates. *Pix* has been partly financed by the European Union's NextGenerationEU programme and is also used in the French-speaking Community of Belgium.

Closed-access resources

France also publicly provides digital resources exclusively for teachers and students enrolled in the education system. Teachers have notably access to the resources curated on the *Réseau CANOPÉ* ("CANOPÉ Network") operated by the ministry.[15] Initiated as an online platform for teacher development, and in particular for training for and with digital tools, *Canopé* now comprises a rich set of digital tools and services: *Canotech* for in-service teacher training, m@gistère for tutoring, *BSD* for accessing a bank of best teaching practices, extraclass for podcasts on the teaching profession, *TICE* for integrating digital practices in teaching, *Munaé* for exploring the history of education in France, *Quizinière* for creating interactive digital activities, *Etincel* for accessing resources on technological and industrial education, *viaéduc* and eTwinning to exchange with peers respectively at the national and European levels, etc.

French teachers also have access to publicly provided digital tools that help them create their own digital education resources (see *Édu-up*) or that build on AI to help them teach fundamental subjects like French and mathematics in primary school (see the *P2IA* projects).[16]

The ministry also supports and promotes digital initiatives that are launched at the regional level. For instance, in 2016 the *Versailles académie* launched *Éléa*, a version of Moodle for teachers allowing them to design and integrate digital learning features into students' digital working environment (*ENT*), which makes practices such as flipped classroom or learning gamification easier to implement.[17] The *Éléa-Moodle* platform is now being progressively rolled out. From 2025 onwards, the *Éléa-Moodle* platform will be available in all French *académies*.

The ministry may also resort to public-private partnerships to ensure a central provision of teaching and learning resources. In 2016, a public tender resulted in the development of several Banks of Educational Digital Resources for School (*BRNE*) by French publishers and EdTech companies. The *BRNE* provide access to thousands of digital teaching and learning resources, tools for creation, and services for dissemination and interaction between teachers and students. Thanks to the strong relationships developed between the ministry and contractors during the procurement phase, publishers were able to fully align the *BRNE*'s pedagogical content with the French national curriculum in all disciplines and grades. The *BRNE* were instrumental in ensuring education continuity during the COVID-19 crisis as they were made available to everyone, for free, in less than a fortnight.[18]

Overall, through the open-access or closed-access platforms, students have accessed to a wealth of publicly provided static and interactive digital learning resources, including resources for students with special needs, and to virtual classroom environments (e.g., the *classes virtuelles* ("virtual classrooms") hosted by the *Centre national d'enseignement à distance* ("National Centre for Distance Education"), or CNED). Teachers have access to more virtual classroom environments for training or peer-learning activities, notably through the apps.education.fr national portal.[19]

Taxonomy

Digital resources available on the public educational platforms are classified according to a national taxonomy for learning resources: *ScoLOMFR*.[20] *ScoLOMFR* is the educational adaptation of the *LOMFR* standards, published in 2006. Digital learning resources are encoded through a given XML format and characterised by a common set of descriptors (Learning Object Metadata, or LOM), such as their type, interactivity level, typical age range, language, etc., which facilitates teachers' (and students') search,

consultation, use, and sharing of pedagogical resources. The *ScoLOMFR* taxonomy is also applied in the French-speaking Community of Belgium.

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

Ensuring access and supporting use

Equity of access

France pays attention to ensuring equity of access and use throughout the digitalisation of its education system. Rules and guidelines establish that centrally provided resources – the bulk of publicly available resources in France – must be available to everyone enrolled in the public education system. Regional authorities and inspectorates in the *académies* are responsible for ensuring equitable access when relaying and implementing education policies from the central level to the local ones – except when digital tools are first piloted at a lower scale in a handful of schools. In particular, regional authorities were consulted to design the "Core digital equipment" framework mentioned above, which establishes a shared definition for a minimum set of high-quality foundational resources that all schools should have at least access to. This mechanism helps ensure that local variations in terms of access to hardware infrastructure have a lower bound.

There can still be strong variations across and within regions, for example between primary, lower and upper secondary schools as investment in equipment depend on different local governments. Data collected by the OECD TALIS study across the 2017/2018 school year illustrate the pre-pandemic access to digital hardware infrastructure across schools in France.[21] Before the COVID-19 outbreak, 30% of lower secondary principals reported that their schools' capacity to provide quality instruction was hindered by shortage or inadequacy of digital technology for instruction (compared to 25% on average across the OECD countries), and 28% of them noted that it was hindered by insufficient Internet access (while 19% was the average across the OECD countries). Several programmes have aimed at closing the investment gaps observed between more or less wealthy municipalities, departments, and regions by financing between 30 and 75% of primary, lower secondary or upper secondary schools' digital infrastructure – public and government-dependant schools alike.[22] Particular attention is given to schools from low socio-economic or rural areas, and to students with special needs.

Supporting the use of digital tools and resources

In France, the ministry considers that, without specific action, digital tools take between three and five years from deployment to training to achieve consistent use. To accelerate their uptake, the ministry uses direct and indirect incentives to support the access to, and use of, digital tools and resources at the system, school, and classroom levels.

First, the government sometimes mandates the use of specific digital tools, typically digital tools for system and institutional management (e.g., *Onde* and *SIECLE* as student information systems, *Affelnet* and *Parcoursup* for the management of student admission).

Second, the government directly procures digital tools on behalf of schools. Procurements are generally conducted by the ministry and its agencies, such as the *CANOPÉ Network*; but other public institutions such as the *Banque des territoires* ("regional bank") may also fulfil that role. The 2016 public tender that resulted in the development of the *Banks of Educational Digital Resources for School* (BRNE) by French publishers and EdTech companies is a good illustration of such public-private partnerships.

Recent projects such as the resource account ("*compte ressources*") have also aimed at giving schools (and teachers) more autonomy to procure additional digital tools and resources at their discretion – or at

the discretion of their local authorities, in the case of primary schools. To accompany schools in their procurement choices, the ministry has set up the *Gestionnaire d'Accès aux Ressources Numériques* (*GAR)* ("Digital Resources Access Manager"), a publicly operated interface between schools and (commercial) EdTech providers.[23] Through this interface, the ministry imposes criteria on the purchase of digital tools and resources with regard to equity of access, interoperability, and security. The ministry delivers a security label to resources provided by EdTech firms on the *GAR* catalogue.[24] Individuals and organisations are also encouraged to develop new digital tools and resources that comply with data protection, privacy and accessibility requirements. Projects that meet those criteria may receive subsidies through the *Edu-Up* plan.[25] In addition to guiding and procurement criteria, the ministry provides general guidance to schools related to their procurement practices.[26]

Finally, the ministry provides central and local assistance on the *use* of the digital tools and resources. A network of local education advisers (*Délégués académiques au numérique* [*DAN*]) liaise with local authorities and companies on digital education matters and lead actions and teacher networks around the uses of digital resources in education. Beyond advising the academies' leaders, they develop projects, training and share and mobilise knowledge for teachers to become more active in the use of digital tools for learning. In the outset of the COVID-19 crisis, they notably ensured a quick transition to online distance schooling by lending and delivering computers to students, mobilising existing repositories of online resources, and providing online training and sharing best practices on the use of digital tools with teachers and school principals.[27]

Certain digital tools have received priority efforts from the ministry to support their deployment and use. This has most notably been the case of the LMSs (*ENT)*, with positive results: the 2022 mapping conducted by the ministry showed that 90% of lower and secondary schools use an LMS, as well as a growing proportion of primary schools – a significant increase compared to previous monitoring.[28]

Cultivating the digital literacy of education stakeholders

France aims to engage all education actors in the digital transformation of its education system and to develop teachers' digital literacy. The ministry encourages teachers to acquire competencies regarding the use of digital technology for teaching as part of both their pre-service and in-service training. In 2019-20, the ministry introduced new ICT-related courses in teacher training for upper secondary level teachers and a new Reference Framework of Digital Competences (*Cadre de référence des compétences numériques*), defining goals for primary, secondary and tertiary education with end-of-cycle assessments. To ensure their ability to foster students' ICT skills, new teachers can obtain a corresponding certification via the self-assessment tool *PIX-EDU*, although this is not a mandatory requirement. In addition, a mandatory three-day training course for all lower secondary teachers was introduced in 2016 and a new programme aims to develop specialist ICT teachers.[29]

The reform of the national curriculum is another lever through which France indirectly try to foster teachers' digital literacy. Across all levels of education, the ministry has updated the national curricula with the integration of specific uses of digital technology in class and established the acquisition of digital competencies as a learning outcome. In their end-of-lower-secondary-school exam (the *diplôme national du brevet*), students must now take and pass the *PIX* self-assessment to get a digital certification.

Governance of data and digital technology in education

As in other EU countries, the largest part of France's regulation around the protection of data and privacy, in education as well as in other sectors, is a translation in national law of the EU General Data Protection Regulation (EU GDPR). In education specifically, the ministry has produced specific rules about the protection of personal data and privacy of students, teachers, and school staff as part of its *Code de l'éducation* ("Education code").[30] As of 2023, those rules are stricter than the GDPR, as they restrict the use of personal data collected by subcontractors and impose their anonymisation throughout their use

cycle. Data cannot be processed and utilised to an end different from that for which they were initially collected.

Beyond data protection, France has policies related to the use or management of education data. The ministry works closely with the French Data Protection Authority (*CNIL*). Initiatives led by the National Union of Publishers (*SNE*) or by the ministry itself, such as the *reference framework for access to learning resources via a mobile device* (*CARMO*), promote the digitalisation of existing resources and their use in the classroom. Specific legislations guarantee that students can take their exams on a digital device should they need it.[31] However, the *CNIL* still discourages the use of proctoring methods to monitor exams. Similarly, the law forbids the use of any automated decision-making system in education. Digital platforms such as *Parcoursup*, the post-secondary student admission management system, rely on algorithm only to produce automated matching *recommendations*, but in the end the decision is always taken by humans.

Additionally, France has rules about equitable access to, and use of, data in education for researchers. In 2021, the national research agency (*ANR*) financed the development of the *Innovations, Données et Expérimentations en Éducation* ("Innovations, Data and Experimentations in Education" [*IDEE*]) programme to facilitate the access to, and use of, administrative educational data for researchers under fair and equal conditions.

France has also set up rules to promote interoperability between the different digital tools of the publicly provided ecosystem. Interoperability is one of the key elements of the country's digital education strategy for 2022-2027. Although not entirely planned out yet, France's roadmap towards interoperability relies on the use of open standards for technologies and educational data. While giving priority to open-source tools has been enacted as a rule within French government services, as of 2023 it remains a non-binding guideline for schools and teachers, who can still choose proprietary tools that are not open source if they so prefer. France also promotes the use of semantic standards, such as the *ScoLOMFR* taxonomy for teaching and learning resources (see above), and technical standards such as the *HTLM5* and *LTI* (*Learning Tools Interoperability*) norms for digital learning tools.[32] Finally, the ministry engage in international initiatives to promote and facilitate interoperability, notably by participating in the *AFNOR* committee meetings, a French association that develops and certifies national and international standards and accompanies firms in their adoption.[33]

France proactively enforces its rules on data protection. Depending on their roles and areas of expertise, the French Data Protection Authority (*CNIL*) – at the national level – and the inspectorates – at the regional level – may monitor, advise, and sometimes sanction educational actors in line with the ministry's governance on data and digital technology in education. The CNIL conducts regular audits to check EdTech firms' compliance with the GDPR; and, on a case-by-case basis, a ministry-dependent "ethics committee on data" arbitrates legal issues related to data use.

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

Developing a national education technology ecosystem presents challenges both to develop appropriate tools and resources and to incentivise stakeholders to innovate. Providing incentives, supporting R-D, and funding education technology start-ups are part of countries' typical innovation policy portfolio.

France supports academic research about digital technology in education through several means. First, it funds research programmes specifically on digital education and education data use. For instance, the national Digital Education Agency (*DNE*) supports *Digital Thematic Groups* (*GTnum*) to conduct research on digital education for three years, including on the evolution of teaching practices and training, on access to resources, on the role of AI, and more.[34] These groups are led by one or more research centres and supported by regional delegations for digital education (*DRANE/DANE*). Their aim is to produce studies, surveys, experiments, and research papers documenting the transformation of practices and strategic

directions in the field of digital education. For the 2022-2025 period, four Groups work on topics at the intersection between digital education and i) sustainable development challenges, ii) applied research, iii) competencies for lifelong learning, and iv) 21st century skills. In line with the newly released digital education strategy, four new groups will be assembled for the 2023-2026 period.

Second, France clearly communicates its public research and development (R-D) priorities regarding digital education. Through the ever-evolving *Priority Research Programmes and Equipment* (*PEPR*), the National Agency for Research guide and incentivise R-D to accelerate the deployment of France's various national strategies – including its strategy for digital education, as exemplified by the National Research Institute for Science and Digital Technologies' (*INRIA*) programme on "Education and Digitalisation".[35] Those projects, together with other academic papers on the use of digital technologies to improve learning, student engagement, and assessment, to support teaching, and to help students with special needs, are listed on the "Monitoring and Promotion Notebook for Academic Research on digital education" maintained by the Digital Education Agency (*DNE*).

The French government also conducts studies to monitor its schools' digital infrastructure. Most notably, the ministry monitored the deployment of LMSs (*ENT)* across *départements* and educational levels. For instance, this mapping exercise showed that, as of 2022, 47 *départements* (out of 101) reported to have rolled out LMSs in more than 50% of their primary schools; and that nationwide, virtually all lower and upper secondary schools are now equipped with one. *EVALuENT* further evaluated the *uses* of LMSs (*ENT)* in schools. In 2019, it showed that most teachers and school principals (77%) were satisfied with their LMS, and that 49% of them used it at least one a week (against 46% of students – noting that 25% never use it). Teachers and students pointed out that the Internet connectivity in their schools, as well as the platforms' ergonomics, hindered their efficient use. It also highlighted that the use of the LMS platform has not led to more teacher collaboration within their school – let alone between schools. Way more school principals than teachers or students report that learning resources are easily accessible on their digital working environment, probably highlighting the gap between availability and use.[36] Statistics on the procurement and use of digital teaching and learning resources are collected on the *Digital Resources Access Manager* (*GAR*) website and are supplemented by surveys undertaken by the ministry's department of evaluation, prospective studies, and performance (*DEPP*) at the national level, and by statistical reports on hardware infrastructure collected by regional and local authorities.[37]

In addition to conducting its own research on the use of digital resources and tools, the ministry has established formal relationships with other education stakeholders, including those from the private sector, to support digital innovation in education. First, the ministry formally engages with the EdTech sector through different initiatives, such as the *partenariats d'innovation* ("Innovation partnerships") that bring together EdTech firms, research labs and schools in a co-construction model.[38] EdTech France, the country's association of EdTech firms, is an interlocutor in this partnership.[39] Then, the ministry supports collaboration across sectors through non-monetary and monetary incentives. For instance, it facilitates public procurements from start-up companies by applying selection criteria that are less stringent for them than for other companies (on criteria such as cash flow, turnover, or business reputation). The ministry also mobilises public funding that are earmarked for the development of digital learning resources by EdTech organisations, either through public procurements (EUR 41 million were spent until 2022, and EUR 36 million were planned to spend for the years to come) or through subsidies, for instance via the *Edu-Up* scheme mentioned above.

In its future activities, the ministry envisions to extend and strengthen the provision of online education platforms and digital resources, and to develop classroom analytics tools.

Notes

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[4] Direction interministérielle du numérique: https://www.numerique.gouv.fr/dinum/

[5] France Stratégie: https://www.strategie.gouv.fr/thematiques/numerique

[6] Onde & SIECLE Vie scolaire: https://eduscol.education.fr/1081/l-application-onde & https://eduscol.education.fr/1084/siecle-vie-scolaire

[7] Schéma Directeur des ENT: https://eduscol.education.fr/1559/schema-directeur-des-ent-sdet-version-en-vigueur

[8] Affelnet: https://www.oriane.info/tout-savoir-sur-affelnet

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[16] Édu-up: https://eduscol.education.fr/1603/le-dispositif-edu | P2IA: https://eduscol.education.fr/1911/l-intelligence-artificielle-pour-accompagner-les-apprentissages-des-fondamentaux-au-cycle-2

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[18] Education Continuity Stories: https://oecdedutoday.com/wp-content/uploads/2020/09/France-Banks-of-educational-digital-resources.pdf

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[20] ScoLOMFR : https://www.reseau-canope.fr/scolomfr/quest-ce-que-scolomfr

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[23] The GAR : https://gar.education.fr/

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[25] Edu-Up: https://eduscol.education.fr/1603/le-dispositif-edu

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[37] At the national level, see for instance « Le numérique éducatif : que nous apprennent les données de la DEPP ? », Synthèse de la DEPP, n°3, septembre 2021, DEPP ; at the regional level, see for instance the *Paris Academie*'s « Sondage sur les usages du numérique».

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12 The French Community of Belgium

This note provides an overview of the French Community of Belgium's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how the French Community of Belgium supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how the French Community of Belgium engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In the French Community of Belgium, the Wallonia-Brussels Federation, its public agencies and the educational networks publicly provide a multiplicity of digital tools for system and school management as well as digital resources for teaching and learning. Schools and teachers receive central and local guidance for using those tools and resources, and they are also incentivised to use them, but still have freedom to acquire and use those from other providers.
- The 2018 forward-looking Digital strategy for education has outlined and guided the actions of the Wallonia-Brussels Federation towards the digitalisation of the education system at all levels. Aiming for establishing a comprehensive, multi-faceted public digital ecosystem in education, the Federation has implemented policy mechanisms that support the access to and use of digital tools by all education stakeholders, with specific attention given to disadvantaged schools and students. A Digital strategy for adult learning and higher education has also been adopted in 2020.
- As per a 2019 Decree on Digital Governance and the *Pacte pour un Enseignement d'excellence* ("Pact for excellence in Teaching"), the Wallonia-Brussels Federation has set up a host of relationships with all types of education stakeholders, including researchers, and teachers to support research, development, and innovation in digital education. Through rules and guidelines, for instance respectively on teacher training requirements or on the encouraged use of standards, the Federation aims at fostering, supporting, and engaging all educational actors in an effective digital transition in education.

General policy context

Division of responsibility

In Belgium, the public responsibility for providing education is split across the country' three linguistic communities: Flemish, French, and German.

The Wallonia-Brussels Federation (W-B Federation) is the Ministry of Education in charge of outlining general education strategy in the Belgian French Community.[1] It devises policy, prepares and implements legislation, issues regulations, sets curricula frameworks (declined by each educational network into school programs), and plans reforms – from pre-primary to secondary education, including VET, as well as for higher education and lifelong learning (referred to as "*promotion sociale*" in Belgium).[2] The Wallonia-Brussels Federation share public responsibilities for special education institutions, and psycho-socio-medical institutions. The educational networks gather and represent the school organising authorities.

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follow this division of responsibility. In the French Community, the Wallonia-Brussels Federation is the sole provider of digital tools and resources for the whole education system management. The W-B Federation supports the different educational networks, the school organising authorities and provide digital s for institutional management as well as digital resources for teaching and learning. Schools and teachers can use and complement teaching and learning resources at their discretion, in full autonomy.

Digital education strategy

In 2018, the Wallonia-Brussels Federation adopted a "*Stratégie numérique pour l'éducation*" ("Digital education strategy") for primary and secondary education in the French Community of Belgium, in line with the initiatives promoted by the Belgian Federal government and regional authorities.[3] The adoption of the 2018 Digital Education Strategy resulted from the 2015-2017 design of the *Pacte pour un Enseignement*

d'excellence ("Pact for excellence in Teaching"), the Community's systemic reform of primary and secondary education.[4] The 2018 Strategy identified five complementary lines of action: defining digital learning content and resources; training and supporting teachers and school principals; equip schools; sharing, communicating and disseminating (platform and ecosystem of tools); and developing digital governance.

The COVID-19 crisis has sped up both the implementation and uptake of the measures initiated by the 2018 Digital Education Strategy, which will be updated and revised in the coming years. In terms of equipment, the 2018 Strategy has fostered the collaboration between the Wallonia-Brussels Federation and regional authorities who share responsibility for providing hardware infrastructure (including broadband connectivity) to schools. Recent investments have focused on improving broadband connections in schools and on distributing computers and digital devices to schools and to children with special needs.[5] Several formulas exist to fill in the gaps across students, schools, and regions – from flat subventions given to educational networks through to discount prices on device renting or buying for (parents of) secondary school students.[6] In 2020, the French Community government has also launched a call for donations for firms and individuals to give laptops they would no longer use, to be refurbished and distributed to schools.

Beyond the education sphere, the Wallonia-Brussels Federation has identified digitalisation as one of its priorities in the 2019-2024 Policy Declaration and has established several institutions to support the 2018 Digital education strategy across different policy areas and levels of government.[7] At the level of the French Community of Belgium, the General Service for Digital Education, set up in 2019 by the *Pacte pour un Enseignement d'excellence*, ensures a coherent implementation of the 2018 Strategy across the whole education sector.[8] Across policy sectors, the *Agence du Numérique* ("Digital Agency") has been designing, implementing, and monitoring a Digital Wallonia strategy, whose actions are promoted by Wallonia's government minister of digitalisation. Similar initiatives have been taken by the Brussels-capital's government. Finally, at the level of Belgium as a whole, the Federal government has appointed an assistant secretary of state in charge of digitalisation to coordinate efforts within the Flemish, French- and German-speaking Communities.

The public digital education infrastructure

The French Community of Belgium government provides several components of the public digital ecosystem in education. Schools and teachers can choose to acquire additional elements to their digital ecosystem, either directly from the private sector or from other education stakeholders that release tools and resources for free (e.g. the educational networks, philanthropists, education publishers, universities). This section reviews two aspects of the public digital infrastructure in the French Community of Belgium: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

More than 60 software applications facilitate system and school management in the French Community of Belgium. This section categorises the main applications as per their purpose and functionalities.

Student information and learning management system

To manage student information across levels and educational networks in the French Community of Belgium, the Wallonia-Brussels Federation uses the *SIEL* application ("*Signalétique des Élèves*", i.e. a student register).[9] With *SIEL*, schools in the French Community of Belgium can keep track of the school population and transfer this information to the steering level of their respective administration. *SIEL*'s student data are combined with other datasets, such as the ones about schools from the *FASE* application

("*Fichier Signalétique des Établissements d'enseignement*", i.e. the school register) or those from the civil registry, to allow for the government to compute statistics, fundings, enrolment rates, etc. at the levels of the Community, regions, and schools. This application, as many others in the French Community of Belgium, has been developed by *ETNIC*, the Community's digital services public company.[10]

As of 2023, *SIEL* is more akin to a central student database, whose data are pushed and pulled through a web application, than to a proper student information system. The features that one would expect from such a student information system, including analytics dashboards, data visualisation tools and longitudinal coverage of student and education data, are spread out across different management applications.

However, *ETNIC* and the Wallonia-Brussels Federation aim to gradually integrate all management applications, their databases and their data visualisation dashboards, into a single, longitudinal information system for education management.

Schools can use *SIEL* to fill in some of the functionalities of a learning management system (LMS), typically to collect and manage their own student data. However, schools also tend to use other types of learning management systems, instead of or in addition to *SIEL*. Schools may use a particular LMS imposed by their educational network, or a set of commercial tools like Microsoft 365. The Wallonia-Brussels Federation provides Moodle-based applications for free, like *Happi*, but those applications are not made for managing and transferring student data, even though *Happi* is interoperable with *SIEL* to some degree. Beyond that, such platforms are generally used as learning management and content repository, offer communication tools with students and parents, and also display analytics dashboards.

Admission and guidance

The Wallonia-Brussels Federation also provides several applications to manage student admission across the French Community of Belgium. For instance, parents can use *CIRI* to register their children to secondary schools online, whose admission will depend on multiple legally established criteria (e.g. localisation, study record and envisioned study path, number and order of other students' applications). Parents can also visit a government website to check whether primary (and pre-primary) schools in their area have any free place left.[11]

Students (and parents) have access to a range of study and career guidance portals to navigate the education system. Generally speaking, the Wallonia-Brussels Federation's Education Portal contains a wealth of relevant information and guidance in education.[12] For more specific information, students can visit dedicated website such as *Mon Ecole, Mon Métier* ("My School, My Job") in VET for instance.[13]

Teachers and aspiring teachers have their own study and career guidance portals. "*Pourquoi pas prof*" ("Why not a teacher?") aims at providing guidance and inspiration to those who hope to develop their career as a teacher; while the in-service teachers can log in on the platform of the *Institut de formation professionnelle continue* (*IFPC*, "Continuing Professional Development Institute") for training and professional development and guidance at the inter-networks level.[14]

Other tools

The Wallonia-Brussels Federation uses and provides primary and secondary schools with other applications, to supplement *SIEL* or to serve different purposes. Several of those additional applications support exam administration or digital credential management. For instance, schools can use *DADI*, an application developed by *ETNIC* to encode and authenticate diplomas. In the future, it's planned that *DADI* use blockchain technology to further raise its security standards. Schools can also use *TESS* to manage upper secondary education diplomas; *CEBSI* to register their students for the end-of-primary-education exam, ask for specific exams for students with special needs, collect results, and communicate decisions to the government; or *CPU* to manage and deliver the qualifications of VET students.[15]

Other applications serve as part of school management and administration function systems; i.e. *GALE*, another application developed by *ETNIC*, supports the management of school funding and subsidies.

Digital ecosystem for teaching and learning

The Wallonia-Brussels Federation provides digital resources for teaching and learning, which schools, teachers and students are free to use according to the educational freedom principles for teachers.

Open-access resources

Many of the publicly provided resources are openly available to anyone in the French Community of Belgium. For instance, together with the *RTBF* (the Francophone Belgian Radio and Television), the Wallonia-Brussels Federation offers TV and social media channels for education. Since the COVID-19 crisis, they produced and broadcast programmes like "*Y'a pas école on revise*" ("School's off, let's study") focused on mathematics, French language and technology for primary school students; or "*C'est la base*" ("Nuts and bolts"), focused on mathematics, French language, sciences, and history for secondary school students.[16] Anyone can watch and rewatch those videos online on the *RTBF* Auvio platform or directly on YouTube. Since of 2022 "*Y'a pas école on revise*" has been transformed in a sustainable format named "*Viens, je t'explique*" ("Come on, here is the thing").

Similarly, in 2021 the Wallonia-Brussels Federation, supported by *ETNIC*, partnered with France to deploy *Pix*, a French public platform for self-assessment in digital literacy.[17] *Pix* is free, open-sourced, and accessible to anyone. It allows people to self-assess and improve their digital competences.

Educational platforms and closed-access resources

The Wallonia-Brussels Federation also provides digital resources exclusively for teachers and students enrolled in the education system through *e-classe*, the Wallonia-Brussels Federation educational platform provided by the government specifically for teachers.[18] The platform *e-classe* has been created by the *Pacte pour un Enseignement d'excellence* and is managed by the General Service for Digital Education. It provides more than 8 500 qualitative pedagogical resources. Those resources are typically curated on online education platforms that serve some of the purposes of a learning management system, as detailed above. Other resources are produced specifically to support teachers in the implementation of the school curricular reform.

The upcoming, second version of the platform, *e-classe 2*, will allow teachers to co create and share their digital resources, to communicate on digital spaces, to develop their teaching practices. *E-classe 3* will later offer e-learning modules linked to the IFPC teacher training platform described above.

Another platform provided is the already mentioned *Happi*, a Moodle-based platform developed by *ETNIC* and the General Service for Digital Education to serve as a distant learning management system, apart from the functionalities of an information system. Teachers can use *Happi* to create and share static or interactive learning resources with their students and monitor their progress, while students can use it to access online courses created by their teachers and communicate with them.[19] Designed as a distance learning platform, *Happi* also integrates a virtual classroom environment licenced to a commercial vendor (Webex by Cisco). It also curates resources for teachers, such as online interactive training programmes on hybrid teaching; and more teaching content will become available when *Happi* will be linked with *e-classe*.

Other examples of educational platforms provided by the government include another e-learning platform, whose specificity is to propose an online tutoring platform for home-schooled students that matches teachers with students from primary through to secondary education; or the *Centre de Ressources*

Pédagogiques, that curates learning resources specifically geared towards secondary VET students and adult learners.[20]

Taxonomy

The Wallonia-Brussels Federation has classified the publicly provided digital teaching and learning resources on *e-classe* according to *ScoLOMFR*, an international taxonomy applied in the French Community of Belgium but initially developed and used in France.[21] For instance, teaching resources curated on *e-classe* are classified in line with the *ScoLOMFR* standards, encoded through a given XML format and characterised by a common set of descriptors (Learning Object Metadata, or LOM), like the type of resources, interactivity level, typical age range, language, etc., so that teachers can more easily retrieve them.

Similarly, the W-B Federation's educational platforms index their keywords and contents as per the *MOTBIS* thesaurus, which is also developed and used in France.[22] Those classifications cover fundamental subjects and skills as well as more specific entries.

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

Ensuring access and supporting use

Equity of access

The Wallonia-Brussels Federation has issued rules and guidelines about equity of access to digital tools and resources in public schools. As per its 2018 Digital education strategy (specifically, points 1.4 and 4.1), the government promotes the importance to provide "quality digital resources for all", notably through the development of education platforms that are accessible to everyone.

Particular attention is also given to certain groups of students. The 2018 digital education strategy, for instance, provides for the availability of digital guidebooks to support teachers in the accommodation of students with special needs. The 2018 Strategy also identified as a priority the need to accommodate long-term hospitalised children through a systematic and concerted approach. More recently, as a consequence of the COVID-19 crisis and the inequalities in access to digital resources across students and schools, the government has launched the *Mes Outils Numériques* ("My Digital Tools") project.[23] This project intends to support the equipment of all secondary education students with a digital device on a one-to-one basis. To that effect, the Government have set up two main funding formula. One of the formulas is endowed with a EUR 10 million budget, targeting secondary schools, while the other, endowed with a further EUR 15 million budget, targets directly students in upper secondary schools (through their parents). On top of that, the W-B Federation has set up a solidarity funds to support parents from socio-economically disadvantaged background, or schools with a high proportion of disadvantaged students, so that they could buy or rent digital devices at a discount price.

Data collected by the OECD TALIS study across the 2017/18 school year illustrate the pre-pandemic access to digital hardware infrastructure across schools in the French Community of Belgium.[24] Before the COVID-19 outbreak, 49% of lower secondary principals reported that their schools' capacity to provide quality instruction was hindered by shortage or inadequacy of digital technology for instruction (compared to 25% on average across the OECD countries), and 44% of them noted that it was hindered by insufficient Internet access (while 19% was the average across the OECD countries).

However, having equitable access to hardware infrastructure does not necessarily lead to equity in the use of software. Sections below describe what efforts the French Community of Belgium deploys to measure and bridge the gap between the availability and uptake of digital tools and resources.

Supporting the use of digital tools and resources

The Wallonia-Brussels Federation uses direct and indirect incentives to support the access to and use of digital tools and resources at the system, school, and classroom levels.

First, the W-B Federation mandates the use of some of the tools it directly provides or procures, typically when it concerns tools for education system management (e.g. *SIEL*, *FASE*, *GOSS*, *PRIMVER*).

Second, while schools (and teachers) have the autonomy to procure additional digital tools and resources at their discretion, the W-B Federation supports them in various ways. The W-B Federation provides guidance to schools related to their procurement practices. Additionally, from January 2020 onwards, an Act has established that part of schools' subsidies is earmarked for the purchase of products from pre-authorised providers of educational resources, including digital resources, as a way to further guide their procurement practices.[25]

Finally, the W-B Federation provides central and local assistance on the use of the digital tools. Techno-pedagogical advisors based in the educational networks, designated teachers in schools and teacher trainers can accompany school staff in the uptake of new technologies. The Federation also offers professional learning opportunities for administrative (government and school) staff to improve their use of data and digital management tools, and for teachers to improve their use of digital resources in their teaching. Teachers are incentivised to take professional development trainings, as it helps them advance their career progression and they are compensated for their missed class hours.

Cultivating the digital literacy of education stakeholders

The Wallonia-Brussels Federation aims to engage all education actors in the digital transformation of the French Community of Belgium's education system and develop teachers' digital literacy. As per a 2021 Decree, the W-B Federation requires that teachers acquire competencies regarding the use of digital technology for teaching as part of their pre-service training.[26] Similarly, another Decree from 2021 recommends that teachers take part in professional development activities around digital technology as part of their in-service training.[27] This last Decree has been accompanied by the release, through *e-classe* or other channels, of guidelines and practical guidebooks that support teachers in understanding and complying with data protection law (e.g. the EU GDPR) in class, in applying the flipped-classroom method or hybrid and distance teaching, etc.

The reform of the national curricula is another lever through which to foster students' and – indirectly – teachers' digital literacy. In primary and lower secondary education, a common core curriculum is being gradually deployed across school years from 2022 to 2029.[28] The update of curricula includes a transversal integration of the uses of digital technology in class in all disciplines as well as a new subject dedicated to the acquisition of digital competencies as a learning outcome by the end of the third year of secondary school. This reform builds on the framework developed by the European Commission *(DigComp Citizen*) and on the work conducted by Belgium's *Conseil Supérieur de l'Éducation aux Médias* ("Higher Council on Education to Media") on digital literacy.[29] While a similar reform of the upper secondary education curricula is being completed, guidelines promoting the development of digital skills were published.

Governance of data and digital technology in education

As is the case across EU countries, the largest part of the French Community of Belgium's regulation around the protection of data and privacy, in education as well as in other sectors, is a translation in national law of the EU General Data Protection Regulation (EU GDPR). In education specifically, the Wallonia-Brussels Federation has produced specific rules about the protection of personal data and privacy of students, teachers, and school staff in the form of a Decree of Digital Governance, enacted in 2019.[30] A set of guidelines has accompanied the enactment of this Decree, such as memorandums on the use of

the *SIEL* and *SENS* digital tools for the management of students and teachers' information respectively, or practical guidebooks on the application of the GDPR in class.

Beyond rules on data protection, the Wallonia-Brussels Federation has issued rules or guidelines related to the use or management of education data in the French Community of Belgium. the 2019 Decree on Digital Governance ensures equitable access to, and use of, data in education for researchers, and corresponding guidelines were circulated. Article 17 of this Decree establishes some degree of accountability for digital technology in education, in the sense that the Government evaluates the Decree's implementation every five years.

The W-B Federation has also set up rules to promote interoperability between the different digital tools of the publicly provided ecosystem. Article 7 of the Decree on Digital Governance defined measures to follow in order to promote interoperability between tools developed at the Community level and those developed (or acquired) by the educational networks. The Government declaration fosters the use of open standards on educational technologies and on educational data, as well as of specific technical standards – without specifying which. These policy efforts are supported by the *SOAP Web Services*, a technical documentation shared by ETNIC that facilitates the exchange of data cross software tools.[31] The French Community of Belgium further benefits from the work of the e-Wallonia-Brussels Simplification initiative that has developed a "*Banque Carrefour d'Échange des Données*" (a "Hub Bank for Data Exchange"). Data and data sources curated in this bank are certified as authentic by the government, thereby simplifying and homogenising their use across French Community, and fostering interoperability.

The W-B Federation has proactive mechanisms to enforce those rules at the level of the education system administration, such as regular inspections, ad-hoc audits in case of non-compliance, and continuous revision of its action plan for digitalisation.

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

Developing a national education technology ecosystem presents challenges both to develop appropriate local tools and to incentivise relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

In 2017, the Wallonia-Brussels Federation established the "Consortium Project" to support research and development (R-D) on education, including digital education, and to support the use of research results in education practices. In this project, a hundred of teachers and researchers from the French Community of Belgium study and evaluate a set of digital resources to constitute tagged quality-assured resources disseminated on the *e-classe* platform. Eight consortia have been established to assess and characterise each digital tool or resource according to their use, purpose, mode (the extent to which they rely on digital features), learning objective, and relevance – as per scientific validation studies conducted in class.

The W-B Federation also engages in R-D on the evolving roles of teachers in the age of digitalisation. In 2021, the participatory framework of the *Pacte pour un Enseignement d'excellence* ("Pact for excellence in Teaching") organised activities about the digital transition: education researchers put together discussion and focus groups with teachers to sustain a continuous dialogue on the impact of digitalisation on the teaching progression and teacher training. This dialogue aims to leverage diverse insights from different actors in the field to identify common tools and to inform decision-makers and projects implemented through the *Pacte pour un Enseignement d'excellence*.

Finally, the French Community of Belgium, in collaboration with the Walloon Digital Agency, *perspective.brussels,* and the German speaking Community, has also been monitoring the uptake of digital technology in the Community with its *Baromètre Digital* ("Digital Barometer").[32] Although this is a cross-sectoral review set up to monitor the cross-sectoral *Digital Wallonia* strategy, the 2018 Barometer

specifically covered the education sector to take stock of the digitalisation of the education systems.[33] It recommends strengthening five complementary areas: digital infrastructure in schools, teacher pre-service and in-service training, pedagogical support around digital initiative, technical and logistical support, and peer-learning between educational actors.

In addition to conducting its own R-D on digital technologies, the Wallonia-Brussels Federation has established relationships with other education stakeholders, including those from the private sector, to support digital innovation in education. First, the W-B Federation collaborates with ETNIC to develop EdTech tools as seen above. Second, it provides monetary incentives for the development of teaching and learning resources by organisations as well as by teachers and trainers outside of compulsory education, such as for adult learning. For instance, it subsidises research and development in EdTech firms through competitive educational grants; and the *Centre de Ressources Pédagogiques* (curating learning resources specifically geared for adult learners) compensates individuals who contribute resources to the platform. Finally, to bring together all types of education stakeholders, the W-B Federation has established a *Comité interréseaux du Numérique éducatif* (CINE, or "Inter-networks Committee for Digital Education") as per the 2019 Decree on Digital Governance. Building from the 2018 Federation's digital education strategy, the Committee has the mission to design, implement and monitor a six-year digital *action plan* for schools, focusing on digital training, equipment, and cross-network diffusion of digital resources for schools.

In its future activities, the Wallonia-Brussels Federation envisions to strengthen the provision (or its support to the provision) of a student information system and learning management systems, of a digital system for the administration of national student assessments, and of online education platforms and digital resources. Several digital projects have been initiated: *MODE*, to delegate access permissions to provide data in applications for designated persons in the education system; *DAccE* (*Dossier d'Accompagnement de l'Élève*), a digital tool for school staff (and parents) to track student record and their special education needs;[34] and *Portail de l'Orientation* ("study guidance portal", in English), a digital portal that will centralise all existing information on study guidance. Although the Federation may pilot the implementation of such tools and resources for one specific education level, in the longer run their development may permeate all education levels.

Notes

[1] "Wallonia-Brussels Federation" is the name used for communication of the federate authority "French Community of Belgium".

[2] The five educational networks are the Federation of organising authorities of Municipalities and Provinces for primary education (http://www.cecp.be) and for secondary education (http://www.cpeons.be/), the organising authority Wallonie-Bruxelles Enseignement (https://www.wbe.be), the Federation of Independent Subsidised Free Schools (http://www.felsi.eu) and the Catholic education (http://enseignement.catholique.be).

[3] Digital Education Strategy: http://www.enseignement.be/strategienumerique

[4] Pacte pour un Enseignement d'excellence: https://pactepourunenseignementdexcellence.cfwb.be/

[5] Expenditures in digital devices and connectivity:

By Wallonia-Brussels Federation, see: https://mes-outils-numeriques.cfwb.be/
By Wallonia, see: "Ecole numérique", "Projet Connectivité"

By Brussels-Capital, see: “Fiber to School”, “Branche ton école”

[6] Hardware infrastructure investments: https://mes-outils-numeriques.cfwb.be/

[7] 2019-2024 Policy Declaration: https://www.codef.be/wp-content/uploads/2019/09/DPC-2019-2024.pdf

[8] General Service for Digital Education: http://www.enseignement.be/index.php?page=27935&navi=4444

[9] SIEL: https://www.etnic.be/realisation-1-1-1-2/

[10] ETNIC: https://www.etnic.be/nos-realisations/

[11] CIRI: https://inscription.cfwb.be/ ; http://www.placesecolesmaternellesetprimaires.cfwb.be

[12] Wallonia-Brussels Federation’s Education Portal: http://enseignement.be

[13] Mon École, Mon Métier https://monecolemonmetier.cfwb.be/

[14] http://enseignement.be/index.php?page=28105; https://ifpc.cfwb.be

[15] https://www.gallilex.cfwb.be/document/pdf/49648_000.pdf; http://www.enseignement.be/index.php?page=26558; http://www.enseignement.be/index.php?page=23827&do_id=11090&do_check=; https://www.etnic.be/realisation-1-1-1-1/

[16] https://auvio.rtbf.be/emission/y-a-pas-ecole-on-revise-16657; https://auvio.rtbf.be/emission/c-est-la-base-19119; https://www.youtube.com/channel/UC61gisXi6F0nM0FeV9hw2Mg

[17] Pix in the French Community of Belgium: https://pix.org/fr-be/

[18] E-classe: https://www.e-classe.be/

[19] Happi: https://www.happi.cfwb.be

[20] https://elearning.cfwb.be/; https://crp.education/nos-missions/

[21] ScoLOMFR : https://www.reseau-canope.fr/scolomfr/quest-ce-que-scolomfr

[22] MOTBIS Thesaurus: https://www.reseau-canope.fr/motbis/presentation-generale

[23] *Mes Outils Numériques*: https://mes-outils-numeriques.cfwb.be/

24 TALIS : Mending the Education Divide: https://www.oecd-ilibrary.org/sites/d8a3978a-en/index.html?itemId=/content/component/d8a3978a-en#section-d1e11602

25 Decree of 07-Feb-2019 on the acquisition of school textbooks, digital resources, teaching tools and books, within schools governs the acquisition of digital resources by schools through a labelling procedure.

26 Decree of 02-Dec-2021 amending the Decree of 07-Feb-2019 defining the initial training of teachers.

27 Decree of 17-Jun-2021 establishing Book 6 of the Code of primary and secondary education about continuous professional training of all educational staffs in schools and psycho-socio-medical centres.

28 See https://pactepourunenseignementdexcellence.cfwb.be/mesures/le-tronc-commun/

29 EU Framework: http://www.enseignement.be/index.php?page=23827&do_id=17242&do_check=CNEJLFQGEC; Higher Council on Education to Media: https://www.csem.be/eduquer-aux-medias

30 Rules and guidelines specific to student and teacher data: Decree of 25-Apr-2019 on the digital governance of the school system and the transmission of digital data in primary education. https://www.gallilex.cfwb.be/document/pdf/47164_001.pdf

31 SOAP Web Services: https://extra.etnic.be/catalogue-de-services/solutions-applicatives

32 Digital Barometer: https://www.digitalwallonia.be/fr/publications/digital2018/#:~:text=Le%20secteur%20du%20num%C3%A9rique%20en%20Belgique&text=Le%20chiffre%20d'affaires%20du,conseil%20et%20autres%20activit%C3%A9s%20informatiques%22.

33 2018 Digital Barometer in Education: https://content.digitalwallonia.be/post/20180322084629/Barom%C3%A8tre-2018-Digital-Wallonia-Education-Num%C3%A9rique.pdf

34 DAccE: http://www.enseignement.be/index.php?page=25703&ne_id=7244

13 Hungary

This note provides an overview of Hungary's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Hungary supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Hungary engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Hungary, the government plays a central role in providing a vision, a strategy and digital tools and resources to the education system. Digitalisation efforts for education are well underway, with student information and learning management systems provided to a significant part of the school system, a varied offer of digital education resources, and a defined strategy for the provision of digital infrastructure to schools.
- This 2021-2030 strategy is aligned with European Union-wide goals and goes beyond the provision of infrastructure and aims at leveraging digital tools to foster equity within the system by focusing on socio-economically disadvantaged students and schools, on learners with special educational needs, and by preventing school dropouts. On the latter, early warning systems are in place and partially leverage the information available through existing information systems.
- The Educational Authority, a dedicated agency overseeing public education in Hungary, plays a central role in providing digital tools and resources, organizing national assessments, administers matriculation and secondary school entrance exams, as well as supporting co-ordination and co-operation between stakeholders such as school district centres and other school maintainers, schools, universities, and non-profits. Nevertheless, its efforts in disseminating education data, broader collaboration with the private sector could be explored with a view to foster educational technology (EdTech) start-ups and support further innovation.

General policy context

Division of responsibility

Governance over the school system is shared at the central government in Hungary – the Ministry of Interior is responsible for overseeing public primary and secondary education, while the Ministry of Culture and Innovation is similarly responsible for secondary and post-secondary vocational education and training (VET) (albeit with select profiles such as agriculture, security and defence managed by other relevant ministries) as well as higher and adult education. The central school maintenance institute (Klebelsberg Centre) is an agency under the Ministry of Interior that oversees the organisation, maintenance, and curriculum for state owned primary and secondary schools throughout 60 school district centres. Other maintainers exist like municipalities (only for maintaining kindergartens), national minorities, churches, public and private higher education institutions, funds, associations, non-profit and for-profit firms.[1] State owned vocational education institutions are maintained by VET Centres, national offices under the Ministry of Culture and Innovation that are in charge of a number of VET educational institutions. Also, other school maintainers exist.

The central government and associated agencies such as the Educational Authority (*Oktatási Hivatal*) and the above-mentioned Klebelsberg Centre are responsible for provisioning digital technologies.[2] While the central government provides financial resources for procurement, the former agency provides central institutional management tools and resources, the latter provides local tools to primary and secondary schools, while both produce and provide digital resources for teaching and learning.[3] Indeed, the Educational Authority is Hungary's main provider for resources and access to digital tools supporting teaching and learning notably through the National Public Education Portal.[4] These materials can be complemented by resources provided by other institutions. For instance, the Klebelsberg Centre provides digital resources through the e-Kréta platform to schools providing a grading platform, while the state treasury provides a platform for administrative procedures.[5] [6]

Regulations and guidelines regarding access and use of digital tools are provided by the central government, mandating which tools and minimum infrastructure must be present while allowing a degree

of autonomy to educational institutions adopting digital tools and resources that might be available. Said rules are directly enforced in public primary and secondary institutions, while allowing some latitude for privately-run institutions to set their own digital tools and resources, and for public schools themselves to procure additional resources. On data collected on digital tools and resources, a legal framework (via legislation and government decrees) exists regarding the privacy and protection of student, teacher, and school staff data, as well as portability and access to said information.[7]

Digital education strategy

Digitalisation is central to the public education strategy adopted in August 2020 by Hungary for the 2021-2030 period.[8] The strategy aims to develop digital competences of students and teachers as well as digital services in order to ensure public education responsive is to the challenges of the 21st century, and envisions specific interventions aimed at developing digital content and resources and the further development of a public education learning management system (LMS).

The strategy is aligned with the European Union's target of a maximum of 15% low-achieving eight graders in computer and information literacy by 2030, which prompted a renewed focus on students with special educational needs (SEN), and students with low socio-economic status or at schools located in low socio-economic areas.[9]

This focus was accompanied by significant changes to digital education policies and expenditures throughout the education system. Indeed, the Ministry of Education invested significant resources on the education system's ICT infrastructure, notably on connecting schools through broadband, wireless or mobile connections, providing devices such as laptops or tablets, or ICT tools, with particular emphasis on equipping secondary students with their own devices on a one-to-one basis.

The public digital education infrastructure

The Hungarian government provides quite a significant part of the public digital ecosystem for primary and secondary schools, including tools for the management of student information, student admission, proctoring and support platforms for assessments, a platform for system-level assessments themselves, platforms for facility and financial management, and early warning systems.

Digital resources for teaching and learning are also provided by the government via the Educational Authority, and occasionally by other stakeholders such as philanthropies. This section reviews two aspects of the public digital infrastructure in Hungary: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management system

In line with Hungary's central governance and oversight of the educational system, the government provides several system management tools and resources to educational institutions, especially but not restricted to those providing primary and secondary level education.

Two tools work in tandem: the publicly owned information system of public education, maintained by the Education Authority by law, and the e-Kréta platform, which is licensed by the government from a commercial provider[10]. Both platforms combine to provide the functionalities of a student information system and an institution management system, with the latter used mainly for documenting the day-to-day processes at school such as grading, assigning homework, and attendance among others, using a unique educational identification number. While most of the information at the institutional level and from grade 4

to 11 standardised assessments are available through the portal maintained by the Education Authority, most of the day-to-day data entered by schools and that can be reported in real time goes into the e-Kréta platform.

An Application Programming Interface (API) is in place to push the data to the central information system managing all of public education data. This allows the aggregation of the information from both platforms, which is then displayed in analytics dashboards for teachers and that can be made available to parents, and provided to the National Public Education Portal for further uses. Albeit use and data entry to the e-Kréta platform is mandated, teachers have embraced the use of the comprehensive e-Kréta platform for some of these tasks, as well as communicating with parents, with usage ramping up during the onset and aftermath of the COVID-19 global pandemic.

The publicly owned National Public Education Portal (NKP) is the main public educational learning management system in Hungary, featuring free digital content produced or provided by the Educational Authority or other entities such as the National Audio-visual Archive or museums, which can be used without registration but there is a possibility for students and teachers to register and therefore reach protected contents or functionalities. The portal contains learning materials, tests and other interactive activities and exercises, as well as interactive dashboards. Teachers can also use the platform to assign tasks or assessments to, and communicate with, students, and create their own content for use in their classrooms. In addition, some schools, notably primary and secondary institutions managed by school district centres, can complement the content from the portal with LMS functionalities from the e-Kréta platform as needed. In addition to materials produced by the Educational Authority for free, several stakeholders such as philanthropies and publishers made resources available for free, especially during the disruption caused by the global pandemic.

Admission and guidance

Although free choice of school for all students is enshrined in Hungarian legislation, upper secondary general or VET schools are allowed to organise admission exams based on their needs and relevant regulations[11]. A student admission management system administered by the Education Authority manages student enrolment, processing of applications, submitted digitally by parents, and the decision process. Admission to primary and lower secondary education is based on enrolment at nearby institutions or a decision by institutions should parents or students exercise their right to enrol at other institutions.[12] Additionally, as education is mandatory until age 16 in Hungary, students who opted not to go through the admission process are assigned to an upper secondary school.

Career guidance is available to students in lower secondary education through a digital platform maintained by the Education Authority under the auspices of a Human Resources Development Operational Programme (*Emberi Erőforrás Fejlesztési Operatív Program* – EPOP 3.2.13-17) aimed at supporting and expanding career guidance at schools with a view to foster interest in STEM (Science, Technology, Engineering, and Mathematics) careers. This career guidance measurement and support tool (*Pályaorientációs Mérő- és Támogatóeszköz* – POM) consists of a self-assessment component to assess interest, and a STEM component, and provides a comparative outlook of a student given profile and related career prospects.[13] In addition, a mandatory career guidance study has been conducted in the 2022/2023 school year through an examination of 8 grade students via a similar platform also set up by the Education Authority.

Exams and assessments

The National Assessment (formerly known as the National Assessment of Basic Competences) is a national standardised assessment that is sat by students enrolled in primary, secondary and VET institutions at grade 6, 8 and 10 in literacy and mathematics, and, from 2007, allows longitudinal student tracking across grades. Results from the assessment are used for system and school-level diagnostics, to

inform policy, and in secondary analyses.[14] The assessment is managed by the Educational Authority and has been administered in digital format since the 2021/2022 school year and extended in the 2022/2023 school year to a fully digital exam for students between grade 4 and 11 in literacy, mathematics, natural sciences, and foreign languages, with historical thinking and digital culture components foreseen to be incorporated. Results from the national assessment are associated with a student's unique identifier and made available to teachers, schools, and parents.

In addition to standardised summative assessment, regular formative assessments are also associated to students and aggregated with other information such as attendance in the above-mentioned e-Kréta institution management system, where it remains available for consultation and visualisation through reports and dashboards. Primary education institutions can also employ the instruments and digital resources developed for teachers made available in the *eDia* platform developed by researchers at the University of Szeged and funded by dedicated public funds.[15]

Other tools and resources

In alignment with its policy vision of reducing the ratio of early leavers, Hungary has developed and uses an early warning system maintained by the Educational Authority (the reporting system for early school leaving – ESL) that leverages student data that is currently collected and aggregated to flag students at risk of dropping out. Information from classroom-based assessment performance, attendance, grade repetition and feeling of belonging for particularly vulnerable groups, refugees and asylum seekers, is combined and used to inform interventions and direct students towards support programmes.[16]

Primary and secondary institutions themselves can also self-assess their digital competences, as well as obtain guidance through a "digital namecard system" (DNR) in areas related to the use of digital education resources and ICT infrastructure[17].

Digital ecosystem for teaching and learning

The provision of digital resources for teaching and learning is a public responsibility in Hungary and made available in open and closed access forms to teachers, learners and the broader society depending on use.

The above-mentioned National Public Education Portal (NKP) platform acts as the primary source for open education resources (OER) for primary and secondary public education.[18] The portal contains a range of static and interactive digital learning resources, much of it accessible to students with special education needs. Its contents are openly accessible without a need for registration, but a private area is available upon registration. Students registering with their unique identifier have access to further functionalities for the platform, such as direct communication with teachers, virtual workspace where students and teachers can work together, and individually assigned exercises and tests. Similarly, teachers can register to the platform, communicate with students and create their own teaching or assessment materials and they also can access copyright protected content to use for educational purposes.

Tools and resources available within the NKP portal are complemented by the e-Kréta platform for all primary, lower and general upper secondary schools , which in turn offers a digital assessment system for primary, secondary, and VET students, and is expanding to provide digital collaboration spaces. Besides locally developed resources, schools can also use tools developed by, for example, Google (such as Google Classroom, data privacy issues notwithstanding) or Microsoft, such as Microsoft Teams for communication and the Office 365 suite, for which a license is provided, with servers kept within Hungary or the European Union for compliance with relevant data privacy regulations.[19]

Beyond dedicated materials and resources for use in the classroom, there is also a wide offer of digital educational resources. There are educational programmes that are produced by M5, a public TV channel, offering openly available resources related to the national assessment, school subjects such as

mathematics, literacy, history, natural sciences, and foreign languages, and culture in general.[20] Additional audio-visual educational content is openly provided by the National Audio-visual Archive (NAVA) within the remit of its recording, hosting, and cataloguing nationally produced content.[21]

Educational content in written form is also produced and disseminated to the general public through the Sulinet News Magazine, while a range of technical materials such as books, technical journal articles and other learning materials for higher education can be accessed at a Digital Library (Digitális Tankönvytár) maintained by the Educational Authority.[22] [23]

In addition to its other roles, the Educational Authority acts as the main public education textbook publisher in Hungary, a de facto national taxonomy exists for primary and secondary education materials based on the groups and subjects for which materials are published. Almost all the portfolio, including supplementary materials, is accessible in digital portable formats (such as PDF).[24]

Indeed, the materials available at the above-mentioned National Public Education portal contains at least one smart textbook per age group or school grade – from grade 5 – for each school subject, which implies a classification. Further classifications are induced in practice by how textbooks are acquired in Hungary – earmarked resources exist for the purchase of educational resources, digital, or otherwise, but purchases go through the state-run Könyvtárellátó Nonprofit Kft. (KELLO), which classifies materials according to subject, age, grade, and religious denomination when pertinent.[25]

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

Ensuring access and supporting use

Equity of access

Students with special education needs, from disadvantaged socio-economic backgrounds, and enrolled in schools located in areas with low socio-economic status are groups of policy priority for the Hungarian digital education strategy for 2021-2030.

In addition, a focus on digital education is likely to be well received by Hungarian school-level stakeholders. Data collected during the 2017/2018 school year before the COVID-19 global pandemic through the OECD's Teaching and Learning International Survey (TALIS) indicated that 36% of school principals in Hungary felt that the school's capacity to provide quality instruction was hindered (by "quite a bit" or "a lot" in their responses to TALIS) by a shortage of digital technology for instruction. These findings are in excess of the average of 25% of principals throughout OECD countries, albeit no statistically significant difference was observed between advantaged and disadvantaged Hungarian schools, in line with TALIS findings for other survey participants.

Observed or perceived lack of resources for digital education notwithstanding, Hungarian teachers might be particularly poised to leverage said resources when available – TALIS also shows that 79% of teachers in Hungary reported that they could effectively support learning through digital technologies (by "quite a bit" or "a lot"), against 67% of teachers in average for OECD countries, albeit their regular use of digital technologies is less frequent than in other OECD countries (48% of teachers reported letting students use ICT resources for school work against the 53% OECD average), which might be due to a less available digital infrastructure.

Supporting the use of digital tools and resources

The central government, either directly or through specialised agencies, plays a rather significant role in the provision and support of digital tools and resources in Hungary, especially for primary and secondary educational institutions in alignment with its central role in the education system. Procurement for digital

technologies and learning resources for institutions is performed by institutions for low-value items, but by their respective maintainers for all needs carrying a significant financial cost. For instance, the Klebelsberg Centre aggregates school district centres' demands, which in turn were aggregated from schools by the school district centres and leads the procurement process for digital tools and resources requested by primary and secondary educational, public institutions.

Price regulation, as well as the setting of criteria or requisites for purchase of digital tools and resources vis-à-vis their effectiveness fall within the remit of a specialised agency, the Digital Governmental Agency (DKÜ) under the cabinet of the Prime Ministry in charge of unifying and harmonising IT procurement processes.[26] Although the DKÜ itself does not negotiate prices, it nonetheless regulates the amount of latitude procuring institutions can have when negotiating in each process. Along with price, compatibility with existing tools and resources also plays a decisive factor in procurement decisions. Albeit a possibly long and laborious process, this semi-centralised procedure can provide a degree of harmonization and equality of access to digital resources to schools.

As above-mentioned, student information systems and learning management platforms are provided by the central government through the direct provision of a publicly owned platform maintained by the Educational Authority, and a commercially licenced platform (*e-Kréta*). Data entry into the platforms and its use are mandated, which assures their widespread adoption. Guidance and training regarding its use is provided through dedicated sections of the platform.

Although the latter platform also acts as a repository of digital resources for teaching and learning, schools also have a degree of autonomy when it comes to textbooks, whose purchase is funded by earmarked subsidies and guided by a state owned non-profit, which offers an approved selection of traditional or digital textbooks.[27] Schools with additional discretionary funds can also adopt lists outside of the endorsed list. Professional development is available for the use of digital resources, but the responsibility of implementing it lies with Pedagogical Educational Centres of the Educational Authority.

Cultivating the digital literacy of education stakeholders

The development of digital literacy is a policy objective in Hungary, figuring on its reformed national primary and secondary education curriculum and present in teacher training and continued professional development. [28]

Strengthening digital competences is among the objectives of national digitalisation initiatives and included in the framework for teacher competences. The acquisition of said competences is mandatory for initial teacher education and optional, albeit strongly incentivised, for continued professional development since the teacher competence framework is central part of the government Decree regulating teacher career progression. [29] Such strong incentives are likely to bring teachers closer to formal instruction on how to incorporate ICT to their teaching – in the latest TALIS, 51% of teacher in Hungary reported that this use was included in their formal education or training.

Students are expected to be in contact and literate in several aspects of digital competences, such as algorithms and people-system interfaces supported by a dedicated Digital Culture curriculum – which took the place of Informatics – mandatory instruction time. In addition, results from TALIS collected in 2017/2018 indicate that teachers in Hungary might be well poised to support students acquiring digital competences: 79% of teachers feel capable to support student learning using digital technology ("quite a bit" or "a lot" in TALIS instruments), more than the average of OECD TALIS participants of 67%.

Moreover, students are also stakeholders in the implementation of digital education policy through consultations to the National Student Council (*Országos Diáktanács*), which was established in 2017 and that was consulted by the government in key topics related to digital education, such as elements of the national core curriculum reform, Internet connectivity at schools, and student experience during the disruption and following remote learning caused by the COVID-19 pandemic.

Governance of data and digital technology in education

Similar to other European Union member countries, Hungary adopted the EU-wide General Data Protection Regulations (GDPR), which prompted changes to the Hungarian 2011 Data Protection Act amended in 2018 to incorporate provisions included with the GDPR to the national legal landscape regulating data privacy and protection. [30] Albeit no specific provisions exist for education data privacy or protection, much of its collection and management can be understood within those afforded for data collected in the public interest, or statistical purposes.

With the GDPR and Data Protection Act as backdrop, the dissemination and exercise of data rights and access to information collected for education purposes is managed by the Education Authority, which provides information on the protections afforded to student, teacher, and school staff data, as well as its access and use for research purposes. Beyond the data collected as part of the managed learning management system, digital tools provided by Microsoft or Google are available for voluntary use at schools, eventual GDPR compliance issues notwithstanding.

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

The existing digital education platforms supported by Hungary can set the scene for the development of more tools and resources adapted to its local context and foster an environment where innovation can flourish into a richer digital education ecosystem. The provision of financial or non-financial incentives to dedicated R-D, and the incubation or support of education technology (EdTech) start-ups are some of the policy levers that can be considered when building a more diversified innovation portfolio.

As with other aspects of Hungary's implementation of its digitalisation strategy for education, the Educational Authority plays a central role. In alignment with the goals communicated in the 2021-2030 digital strategy, the Educational Authority has specific funding for research on digital education and education data, some of which is provided by the European Union and in collaboration with local universities and non-profits.[31]

Despite these efforts, access to education data can be further incentivised with more thorough documentation of available datasets, especially at the student level, and innovation fostered with clear rules for development and piloting of digital education technology. This could also leverage Hungary's emerging start-up landscape into more EdTech companies, thus improving the potential for innovation. The OECD Going Digital Toolkit illustrates this potential – 40.7% of all businesses in Hungary are start-up firms in the information industry. [32] Such an approach could also complement more directed, already existing, partnerships with the private sector for the provision and support of digital tools to schools such as the Vodafone Digital School Programme, which has a focus on equality and digital competences.

In alignment with its Public Education Strategy document for the upcoming 2021-2030 period, Hungary's digital education policy aims to prioritise the development of online education platform, the provision of digital resources for teaching and learning and to collect and fully leverage data sources at the classroom level.

These efforts aim to build on ongoing efforts on the development and implementation of a digital competence framework for students and teachers and on increasing investments on digital infrastructure. Development of digital education resources, textbooks, and other materials are in order to match the revised curriculum and desired competences, for which an expansion of the capabilities in the e-Kréta platform are also in order, not only to better leverage the richness of education data that is collected, but to also increase system resilience in case of possible disruptions in the future.

Notes

[1] Klebelsberg Központ, accessible at http://kk.gov.hu/

[2] Oktatási Hivatal, accessible at https://www.oktatas.hu/projects_educationalauthority

[3] Information System of Public Education, available at https://www.oktatas.hu/hivatali_ugyek

[4] Nemzeti Köznevelési Portálon, accessible at https://www.nkp.hu/

[5] https://www.e-kreta.hu/

[6] Magyar Államkincstár, accessible at https://www.allamkincstar.gov.hu

[7] In particular, Decree No 121 of 2013 (available at https://njt.hu/jogszabaly/2013-121-20-22) outlining the tasks of the Education Authority, and Act 89 of 2018 (available at https://njt.hu/jogszabaly/2018-89-00-00) and its Annex 1 regarding the information systems serving public education.

[8] Digital Strategy for the European union 2021-2030, available at https://2015-2019.kormany.hu/download/d/2e/d1000/K%C3%B6znevel%C3%A9si%20strat%C3%A9gia.pdf, in Hungarian.

[9] With the standard of achievement derived from student performance in the International Computer and Information Literacy Study (ICILS). Student performance is considered to be low achieving if their score falls below the level 2 in the ICILS scale, interpreted as possessing only a functional working knowledge of computers as tools, applying conventional software commands to perform basic research tasks, and to add simple content to information products.

[10] Educational Authority is the operator by law of the information system of public education which has a central database of all the actors of PE like school maintainers, schools, educators, pupils, experts etc. This database is accessible through the homepage of the Educational Authority, https://www.oktatas.hu/hivatali_ugyek

[11] Within the framework of the 2011 CXC Act on Public Education, available at Köznev. tv. - 2011. évi CXC. törvény a nemzeti köznevelésről - Hatályos Jogszabályok Gyűjteménye (jogtar.hu) (in Hungarian).

[12] Further information on the admission process and system can be found at https://www.oktatas.hu/cimke_lista?keyword=k%C3%B6z%C3%A9pfok%C3%BA+beiskol%C3%A1z%C3%A1s, and https://kifir2.kir.hu/JellapKitolto/egyeni, respectively.

[13] Available at https://pom.oktatas.hu

[14] Notably, through a dedicated analysis software (*FIT elemző szoftver*) that is interoperable with the database.

[15] Available at https://edia.hu/

[16] Such as the 1997 Child Protection Act, available at https://net.jogtar.hu/jogszabaly?docid=99700031.TV (in Hungarian).

[17] Digital Readiness Evaluator System , from the Hungarian acronym for *Digitális Névjegy Rendszer*, available at https://www.digitalisnevjegyrendszer.hu/page.php?pid=77#mi

[18] Available at https://www.nkp.hu/

[19] As Google's compliance to General Data Privacy Regulations (GDPR), especially within schools is being scrutinised throughout the European Union, with countries such as Denmark ruling against its use in the classroom (https://www.datatilsynet.dk/afgoerelser/afgoerelser/2022/jul/datatilsynet-nedlaegger-behandlingsforbud-i-chromebook-sag-, in Danish).

[20] https://mediaklikk.hu/m5/

[21] From the Hungarian acronym for Nemzeti Audiovizuális Archívum, and available at https://nava.hu/ (in Hungarian).

[22] Available at https://hirmagazin.sulinet.hu/hu

[23] https://dtk.tankonyvtar.hu/

[24] Available at www.tankonyvkatalogus.hu

[25] https://www.kello.hu/

[26] From the Hungarian acronym for the Digital Governmental Agency - *Digitális Kormányzati Ügynökség Zrt, https://dkuzrt.hu/*.

[27] The Könyvtárellátó Nonprofit Kft., or KELLO. More detail is available at https://www.kello.hu/rolunk (in Hungarian).

[28] In particular, the materials created for the new Digital Culture subject can be found at https://www.tankonyvkatalogus.hu/site/kiadvanyok?SearchForm%5BschoolType%5D=&SearchForm%5BschoolYear%5D=&SearchForm%5BschoolSubject%5D=2353&SearchForm%5Bauthor%5D=&SearchForm%5BproductId%5D=&SearchForm%5Btitle%5D=&SearchForm%5Bnat%5D=&yt0=, while information for in-service teacher training can be found at https://pedakkred.oh.gov.hu/PedAkkred/Catalogue/CatalogueDetails.aspx?Id=8131

[29] Regulated by Decree 326 of 2013, available at https://njt.hu/jogszabaly/2013-326-20-22

[30] Act CXII of 2011 on the Right of Informational Self-Determination and on Freedom of Information, available at https://www.venice.coe.int/webforms/documents/default.aspx?pdffile=CDL-REF(2012)021-e.

[31] Such as projects aiming to incorporate digital education tools and resources into classroom practice (RRF-1.0.0-2021-00003, available at https://www.oktatas.hu/kozneveles/projektek/rrf100, in Hungarian).

[32] From the OECD Going Digital Toolkit, based on the OECD Structural and Demographic Business Statistics (SDBS), and available at https://goingdigital.oecd.org/

14 Iceland

This note provides an overview of Iceland's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Iceland supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Iceland engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Iceland, the government publicly provides some of the digital tools and resources available in the country's digital infrastructure for education. However, their use is rarely mandated. Schools and teachers, supported by municipalities in primary and lower secondary education and by the ministry in upper secondary education and VET, have all freedom to acquire additional digital tools and resources.
- In this largely devolved context, the central government aims to ensure equal access to a digital ecosystem of tools and resources for everyone by providing guidance and support on procurement and by integrating digital components into the national curricula. Other policy levers to foster the (homogeneous) uptake of digital tools are in the hands of municipalities, especially as regards teacher training requirements.
- Iceland incentivises the development and uptake of digital tools by awarding competitive grants to individuals and organisations, subsidising the EdTech sector and facilitating its collaboration with schools. However, digitalisation is not central in the government's strategy in education, and the regulation of digital technology and data in education to improve data protection, privacy, interoperability or use in the academic research is limited.

General policy context

Division of responsibility

In Iceland, the Ministry of Education and Children is responsible for outlining general education strategy and devising policy, preparing, and implementing legislation, issuing regulations, setting curricula, and planning reforms from pre-primary to secondary education, including VET. While the ministry is also responsible for the operation of schools in upper secondary education and VET, this responsibility is devolved to municipalities (through municipal school boards) in primary and lower secondary education.[1]

Public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education follows this devolved context, with part of the digital education infrastructure provided centrally and large bits acquired locally. The ministry is the only public provider of the few available digital tools for system management, whose use is generally compulsory in upper secondary education and VET; but providing access to public tools for institutional management or for teaching and learning purposes is a responsibility shared between the central government in upper secondary education and VET, and municipalities in primary and lower secondary education. Schools and teachers can use and complement teaching and learning resources at their discretion, in full autonomy.

Regulation around the access to and use of digital tools and data in education generally falls within the remit of the central government, although specific rules (see teacher requirements for instance) and further guidelines may exist for primary and lower secondary education at the municipal level.

Digital education strategy

Digitalisation ranks high on the policy agenda in Iceland. The country has long embraced a global vision for its digital transformation, with its government striving to digitise all public services. Digital Iceland, an agency operated by the Ministry of Economic Affairs, works towards these goals and ensures a coherent development and use of digital technologies across all ministries and ministries' agencies.

Given that educational institutions operate with a high degree of autonomy from the central government – even in upper secondary education and VET, where the central government maintains overall responsibility for their operations – Iceland has not devised a digital strategy specific to education nor has it significantly

changed its expenditures in hardware equipment for schools in recent years. The last White Paper on education reform, published in 2015, does mention that "digital technologies must be incorporated into teaching" and that their integration in the classroom should be paired with a profound review of teaching practices – but digitalisation is not a central feature of subsequent proposals/policies introduced by the ministry. This does not mean that the digital transformation of the education sector lags behind that of other public services, as evidenced by the high levels of digital hardware infrastructure that schools in the country enjoy; however, it does highlight the limited role that the central government plays in the public provision, governance, and regulation of digital infrastructure in education.

The public digital education infrastructure

The Icelandic government provides few components of the public digital ecosystem in education. Schools and teachers can then choose to acquire additional elements to their digital ecosystem, either directly from the business sector or from other education stakeholders that release tools and resources for free (e.g. philanthropists, education publishers, universities, teachers). This section reviews two aspects of the public digital infrastructure in Iceland: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management system

As the responsibilities for governing the operations of primary and lower secondary schools are entirely devolved to municipalities, it is only in upper secondary education and VET that the central government provides a digital infrastructure of tools to support system management.

The cornerstone of this infrastructure is *INNA*, a digital tool that combines the functionalities of a student information system, a learning management system, a student admission management system, a customer relationship management system, a digital system for exam administration and a digital credential system.[2] *INNA* is made up of several modules provided online as a web system, making it available to a large span of education stakeholders anywhere, anytime, from any type of device (including smartphones). For students, *INNA* is mostly an interface where they can access an overview of their courses, view their attendance, submit assignments, and see their grades. After graduation, students can download their school certificates and study records. For teachers, *INNA* is a platform where they can share resources and communicate with their students, manage their teaching, and make use of the *project and exam* module to send group or individual assignments and grade them. For schools, *INNA* is a learning management system that supports day-to-day operations (e.g. timetables), offers communication resources with students and parents, and manages the accounting of school fees. Finally, for the ministry's National Institute of Education at the central level, *INNA* functions as a student information system that assigns students with a national identification number and collects longitudinal data (e.g. study records, attendance, grades, diplomas), links them with their teachers, as well as with teacher-given grades and with their standardised assessment results (in VET), and stores all data on the institute's *enrolment portal* (a central student register). *INNA* provides information in real time and displays analytics dashboards at the school and system levels. Those dashboards are not publicly available, but some data are aggregated and publicly published by Statistics Iceland.

In primary and lower secondary education, the central government does not operate a student information system hence schools cannot use *INNA* as their learning management system. Instead, schools use learning management systems that are generally procured by their municipalities. The government does not require schools to use an LMS, but it requires them to keep track of their students' information, and in particular their grades, so that such information can eventually be pushed into *INNA*. *InfoMentor* and

Námfús are two commercial examples of learning management systems commonly used across the country's primary and lower secondary schools.[3]

Admission and guidance

In upper secondary education and VET, *INNA* also serves the purpose of a student admission management system.[4] When students apply for a new school online, after they graduate or relocate, they can readily download an "educational resume" of their studies prepared by *INNA* and attach it to their application. Instructions and guidance on the admission process are available on the National Institute of Education's webpage, in Icelandic and in English; and other educational institutions or business associations maintain websites to help students find the study tracks or jobs of their choice.[5] Building on this, the institute is developing a digital portfolio that will accompany the launch of a digital credential system.

Such a unified admission management system does not exist in primary and lower secondary education, where schools are operated by municipalities. Instead, parents fill in separate application forms for their children directly on the websites of those schools.

Other tools

Icelandic schools also have access to additional digital tools for system and school management that are not publicly provided by the central government. The knowledge management systems that most schools use is an example, as it often consists of an iLibrary linked with a physical library in their local vicinity.

Digital ecosystem for teaching and learning

Providing access to some digital resources for teaching and learning is also partly a public responsibility, although the lines of responsibility for providing such resources between the central and lower levels of government are not as clearly defined as for system and institutional management.

The central government provides certain types of teaching and learning resources freely and openly to the public, like TV and radio education (not broadcast anymore, but available online), for all levels of education, as well as open educational resources (OER) targeting primary and lower secondary education levels – but available to everyone. Also, the central government provides static and interactive digital learning resources to primary and lower secondary schools, a digital assessment system for VET (e.g. a bank of assessment items), and an online platform for teacher development at all levels of education.[6]

Municipalities can also provide additional resources for teaching and learning, but the exact offer differs across municipalities. As in most other OECD countries, no statistical report formerly attests to the uptake of digital tools and resources in the field, whether they are centrally provided or locally or independently procured. However, government officials estimate that a sizeable majority of teachers and students, across all levels of education, have access to static and interactive digital learning resources, including resources for students with special needs and virtual classroom environments.

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

Ensuring access and supporting use

Equity of access

In Iceland, as in other Nordic countries, the government aims to provide equal access to education and educational resources to everyone – therefore no specific student groups or school types are marked as a policy priority.

Data collected by the OECD TALIS study across the 2017/2018 school year provide some evidence of the equity of access to digital infrastructure across Iceland, at least in terms of access to hardware infrastructure (OECD, 2022[1]).[7] Before the COVID-19 outbreak, only 5% of lower secondary principals reported that their schools' capacity to provide quality instruction was hindered by shortage or inadequacy of digital technology for instruction, and 3% that it was hindered by insufficient internet access (compared to 25% and 19%, respectively, on average across the OECD).

However, having equitable access to hardware infrastructure does not necessarily lead to equity in the use of software tools. Sections below describe what efforts Iceland deploys to measure and bridge the gap between availability and uptake.

Supporting the use of digital tools and resources

The ministry uses direct and indirect incentives to support the access to and use of digital tools and resources at the system, school, and classroom levels, especially in upper secondary education and VET as governance of these education levels falls within its remit.

First, the ministry mandates the use of some of the tools it directly provides or procures, typically when it concerns tools for system and school management (e.g. *INNA*, the student information system). It has also integrated the use of digital resources for teaching and learning into the curriculum requirements of primary and lower secondary education.

Second, while the ministry gives schools and teachers full autonomy to procure additional digital tools and resources at their discretion, it supports them in doing so in various ways. In upper secondary education and VET for instance, the ministry negotiates with suppliers the price and contractual conditions of the largest, or most common, digital tools that schools want to acquire; and it allocates earmarked subsidies for their purchase; and in primary and lower secondary education, it mandates another organisation, the Directorate for Education ("*Menntamálastofnun*"), to assist schools with procurement.

Finally, the ministry provides guidance on the use of its centrally provided tools. It also provides professional learning opportunities for administrative staff to improve their use of data and digital management tools, and for teachers to improve their use of digital resources in their teaching. To ensure a smoother navigation between the different pieces of the public-side of this ecosystem, the ministry has deployed *Digital Iceland's login*, a single sign-on (SSO) service hosted by Amazon Web Services.

Cultivating the digital literacy of education stakeholders

Iceland aims to engage all education actors in the digital transformation of the system and developing teachers' digital literacy is one way to achieve this. However, the central government does not decide what competencies teachers must acquire in their pre-service training as this decision falls within the remit of teacher training institutions that set their own curriculum – provided that it amounts to a master's degree. TALIS data from 2018 show that using ICT for teaching featured in less than half (46%) of lower secondary teachers' pre-service training in Iceland – a proportion 10 points below the OECD average. Similarly, the central government does not decide what competencies teachers must develop as part of their in-service

training. In fact, only municipalities can impose standards on teacher recruitment. This prerogative gives them a key policy lever for cultivating teachers' digital literacy as they can provide incentives towards certain types of training, such as training in teaching with digital technology. In the year 2017, 63% of teachers in Iceland reported that they took part in professional development in ICT skills, on par with the OECD average (60%). This was statistically more often the case in schools with a low proportion of disadvantaged students.

Another lever through which to foster students' and – indirectly – teachers' digital literacy is reform of the national curricula. In primary and lower secondary education, the curriculum has been updated to impose specific uses of digital technology in class and to integrate the development of student skills to use and understand digital technology as a learning outcome (both through a dedicated subject of study and as an interdisciplinary learning outcome); and upper secondary and VET curriculum will follow in the years to come. Municipalities can add their own guidelines to the national requirements.

Governance of data and digital technology in education

The European Union General Data Protection Regulation (EU GDPR) applies to Iceland, a member of the European Economic Area. Translated into the national legislation under the 2018 Act on Data Protection and the Processing of Personal Data, it defines the largest part of Iceland's regulation around the protection of data and privacy, although it is not specific to education.[8]

Beyond general rules on data protection and a few requirements integrated into curriculum requirements by the ministry, Iceland has issued other rules concerning the management of data and digital technology at the central level. There are rules to ensure a certain degree of data portability between pre-primary and primary schools so that personal information (in particular as regards possible students' special needs) are well protected during the transfer. Other rules govern the access to, and use of, educational administrative data in upper secondary education and VET for public and private research, as long as full confidentiality can be ensured and that procedures comply with data protection laws.[9] Municipalities do have the legal capacity to set up their own regulations on some other aspects that relate to data and digital technology, for instance to ensure equitable access to digital technologies for students in their schools through their own mechanisms; but in general, regulation at the local level is limited.

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

Developing a national education technology ecosystem presents challenges both to develop appropriate local tools and to incentivise relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

Iceland's support for academic research is not focused on digital education. Anyone can access and use the aggregated education datasets that are publicly made available by Statistics Iceland. In upper secondary education and VET, access to and use of educational administrative data are even regulated to ensure equitable conditions for researchers; but those databases are not publicly documented, and they do not contain information specific to aspects of digital education.

The government has not set up mechanisms that would facilitate the use of education data and technology for R-D and, reciprocally, it does not prioritise R-D on digital technology and education data use over other fields of research. With Rannis, the Icelandic Centre for Research that manages a number of specialised research funds, like the Education Research Fund or the Icelandic Research Fund, the government commissions academic papers and coordinates research programmes on education but digital education is not a priority research area.

However, one of the funds, the Educational Materials Development Fund ("*Þróunarsjóður námsgagna*"), established in 2008 and coordinated by Rannis since 2013, is a key instrument for the central government to incentivise, guide and sponsor the development and release of both learning materials and education software by people and organisations, be they teachers, academics, freelance workers or publishing companies.[10] Anyone can submit a project – provided that it is supported by digital technology and pertains to the curriculum of primary and secondary education – and apply for two types of grants, whose attribution is decided by the Fund's board on a competitive basis. Beyond a first type of "general development grant" of up to EUR 12 500, every year the Fund's board awards a "development and publication grant" (for up to EUR 25 000) to a maximum of two projects, subject to stricter criteria on their work plan, purpose, and use. Interestingly, the Funds' allocation priorities vary from year to year: in 2023 for instance, increased consideration is given to learning materials focusing on i) Icelandic language for immigrants, ii) social and natural sciences, and iii) strengthening Icelandic vocabulary.

Iceland also engages with well-established EdTech companies to nurture innovation for education, notably by providing monetary (e.g. start-ups can submit a project to get grants from the Education Materials Development Fund mentioned above) as well as non-monetary incentives (e.g. co-organised events, fora) to support collaboration between schools and the EdTech sector. This responsibility was devolved to the Ministry of Higher Education, Science, and Innovation in 2022.

In its future activities, the central government envision to provide – or support the provision of – more advanced types of digital tools, such as a centralised online education platform and classroom analytics technology in primary and lower education, and a centralised system for student admission management that will be operable across all levels of education.

References

OECD (2022), *Mending the Education Divide Getting Strong Teachers to the Schools That Need Them Most*, OECD Publishing, Paris, https://doi.org/10.1787/92b75874-en. [1]

Notes

[1] Compulsory School Act: https://www.government.is/media/menntamalaraduneyti-media/media/law-and-regulations/Compulsory-School-Act-No.-91-2008.pdf & Upper Secondary School Act: https://www.government.is/media/menntamalaraduneyti-media/media/law-and-regulations/Upper-Secondary-Education-Act-No.-92-2008.pdf

[2] INNA: https://inna.is/

[3] https://www.infomentor.is/um-okkur/ and https://namfus.is/#/

[4] https://www.inna.is/framhaldsskolaumsokn/default.jsp

[5] Examples of non-governmental study and career guidance websites: http://www.namogstorf.is/; http://www.næstaskref.is/; http://nemahvad.is/; http://www.mbl.is/vidskipti/fagfolkid/

[6] https://mms.is/namsefni

[7] TALIS : Mending the Education Divide: https://www.oecd-ilibrary.org/sites/d8a3978a-en/index.html?itemId=/content/component/d8a3978a-en#section-d1e11602

[8] 2018 Act on Data Protection and the Processing of Personal Data: https://www.personuvernd.is/media/uncategorized/Act_No_90_2018_on_Data_Protection_and_the_Processing_of_Personal_Data.pdf

[9] Confidentiality procedures when accessing personal data: https://www.althingi.is/lagas/nuna/2008091.html

[10] Educational Materials Development Fund: https://www.rannis.is/media/throunarsjodur-namsgagna/log_nr_71_2007.pdf and https://www.rannis.is/media/throunarsjodur-namsgagna/reglugerd_nr_1268_2007.pdf

15 Ireland

This note provides an overview of Ireland's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Ireland supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Ireland engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Schools enjoy a very high degree of autonomy in Ireland with the central government and related agencies providing a wide variety of funding, incentives, and guidance.
- Comprehensive and evidence-based digital education strategy documents and digital competence frameworks have been produced in collaboration with researchers and drafted in consultations with a wide variety of stakeholders.
- Data privacy, security and governance are very present in the education system, thanks to effective dissemination of data privacy regulations and inspections.

General policy context

Division of responsibility

Responsibility for the educational system in Ireland is shared between the government and private philanthropic entities or individuals who are recognised as "patrons" of schools under Ireland's Education Act, 1998.[1] Central government is responsible for regulation of the system (including curricular content), the funding of most schooling at primary and secondary levels, planning for and providing additional school capacity, and the provision of a range of supports to schools, including supports to private actors in the public interest.[2]

This leads to a model of mixed provision where the Government, through the Department of Education (DE) and its agencies, supports and funds schools and sets the overall operational rules for schools, with the day-to-day management of the schools the responsibility of boards of management of schools. This organisation is then reflected in the provision of institutional and system management tools and resources.

Digital education strategy

Ireland has had a focus on digital education, competences, and infrastructure for quite a few years, as reflected in its digital education strategy documents. The most recent 2020 to 2027 Digital Strategy for Schools provides an update to its 2015-2020 counterpart reflecting on lessons learnt from the significant disruption to schools caused by the global COVID-19 pandemic, while also addressing topics such as Artificial Intelligence (AI) in education, coding, and computational thinking.[3] The document, along with a broader, government-wide digital strategy and the EU-wide Digital Education Action Plan for 2021-2027, was developed in a wide consultation with stakeholders within the education system, including focus groups composed of students.[4] [5]

The strategy document is centred around three main policy pillars. The first pillar focuses on supporting the embedding of digital technologies in teaching, learning, and assessment as well as supporting the development of digital competencies for both teachers and students. It also highlights the potential of digital technologies as a significant facilitator for inclusion and states the goal of utilising Universal Design for Learning (UDL) principles when developing curricula, materials, activities, and assessments.[6]

Supporting the goal of leveraging digital tools and resources at school, the second pillar aims to maintain investment in digital technology infrastructure, including computing and connectivity devices, educational software, technologies to support inclusion, and the provision of services supporting a variety of school-based activities such as school administration. This pillar aligns with the government-wide strategy to provide adequate connectivity to schools in rural settings and is complemented by dedicated funding for schools located in disadvantaged areas, with earmarked complementary funding aimed at improving ICT infrastructure.[7] [8]

The public digital education infrastructure

The government does not directly provide institutional or school management systems for educational institutions in Ireland but supports the incorporation of ICT into teaching and learning through targeted initiatives such as the dedicated Digital Technology Division of Oide, the professional development service for teachers.[9]

Digital ecosystem for system and school management

Student information system and learning management system

Institutions in Ireland have full autonomy to choose and procure school learning management systems provided that they comply with national data privacy regulations and data collection protocols for national statistical databases. Student data must be collected by schools and provided to the Department, which maintains national databases for primary and post-primary education, respectively, by October of each year. The data are then used for the national school census and for funding allocation purposes.[10] Schools use direct, non-earmarked funding, as well as earmarked funding for ICT infrastructure from the central government to choose suitable learning management systems, and the government provides guidance and support regarding those that are integrated or interoperable with different commercially available learning management systems.

Given the importance of timely and efficient student data collection and transfer, there is a niche market of private custom learning management systems that comply with the national data collection and privacy regulations. As no single student or institutional management system is provided by the central government, schools are autonomous to employ both earmarked and non-earmarked funding to choose systems that are either integrated or interoperable with platforms of digital learning resources, for which guidance and support is more widely provided.[11] Regardless of which tool is chosen, schools are bound to comply with data privacy regulations and must provide data for the primary and post-primary databases (POD and P-POD, respectively) by the month of October of each year.[12] [13]

Proposed digital tools and resources, as well as earmarked funding to support remote teaching and learning in case of partial or complete school closures were already in place during the COVID-19 global pandemic and guidance was provided in the period for schools to expedite the adoption of enhanced learning management systems that allow communication with and between school staff, and remote classrooms, work assignment, feedback, and assessment[14] [15]. Most used platforms that provide communication functionalities with students and parents (such as Google Classroom or Seesaw at primary education, or a combination of Google Classroom and the Microsoft Office 365 suite for post-primary), thus playing the role of a customer management system and also including rostering, assessment and analytics functionalities. Although only broad directives to adopt a learning management system exist and schools are free to adopt a LMS of choice with no preferred or provided system, guidance is provided by Oide on preferred tools or resources.[16]

Admission and guidance

Schools are responsible for their own enrolment and admission procedures provided that such procedures are clear, public, and free of charge, among other requirements outlined in relevant legislation.[17] There is no centrally provided digital platform to support the student enrolment process. Local admission procedures for primary and secondary education notwithstanding, a unified digital platform for a points-based admission system into higher education is provided and maintained by the Central Admissions Office, a non-governmental not-for-profit organisation.[18]

Digital tools for career guidance are available and partially funded by the central government in Ireland. Notably, the OECD Observatory on Digital technologies in Career guidance for Youth (ODiCY) lists two digital resources: the *Careers Portal*, and the *Exit Entry* skill matching app.[19] The first consists of a freely available "one stop shop" with self-assessments, information on work opportunities and further training. It also contains bespoke career guidance programmes, with some public and others privately funded for secondary education alumni, adults, and young people in detention. The second is a mobile app that leverages two self-assessments (of skills and interests) to provide bespoke career and further training recommendations, including micro-credentials from IBM and Google in specialised fields.

Exams and assessments

While the end of secondary education exams in Ireland are administered as paper-based tests, the State Examinations Commission (the national body in charge of secondary education high-stakes assessments) is using a digital support platform for grading where trained staff can remotely grade open-ended items and essays.[20] [21]

Albeit optional, digital assessments for schools are provided: online versions of the Drumcondra tests, that is, standardised, low-stakes assessments that are available for students in primary and secondary for reading (English and Irish) subjects, and mathematics, are both prepared and administered by the Educational Research Centre (ERC), who also offers machine coding services for those taking the Drumcondra in paper form.[22]

Other tools and resources

An Early Warning System (EWS) exists in Ireland, the School Completion Programme (SCP), which is a central element of the Delivering Equality of Opportunity in Schools (DEIS) initiative, operated by the Child and Family Agency (TUSLA) under the central government that leverages collected student data for flags groups at risk for interventions.[23]

Digital ecosystem for teaching and learning

Support for the integration of digital technologies in teaching and learning in Ireland is provided by the central government through a specialised digital education and infrastructure initiative, the Digital Technology Division of Oide, the independent teacher professional development agency.[24] The agency plays a central role in the provision of digital resources for teaching and learning as well as a wide variety of policy advice on the development and use of digital technologies. Support for students with special educational needs is provided by a dedicated agency, the National Council for Special Education, supporting the implementation of assistive technology in schools among other things.[25]

Open educational resources

There is a wide and varied provision of digital resources for teaching and learning in Ireland. The most comprehensive Open Educational Resources (OER) repository is Scoilnet (https://www.scoilnet.ie/), which provides resources for a wide variety of school levels, subjects, and subclassifications. There are also dedicated repositories associated with Scoilnetin the context of teaching and learning foreign languages, art and data literacy.[26] Further – or vocational – education and training resources are also available through a dedicated platform with thematic courses (eCollege, https://www.ecollege.ie/), containing several ICT-themed tracks including one in Data Science.

More specific resources are also openly available but more directed at the school community, such as a portal aimed at fostering autonomous and safe use of the Internet (Webwise, https://www.webwise.ie/), and a platform with resources produced to support schools implementing the Irish Digital Learning

Framework (DL Planning, https://www.dlplanning.ie/), with the use of the latter often complemented with the use of the EU-funded and -developed SELFIE tool.[27] [28]

Besides bespoke platforms, resources are also made available online by the Professional Development Service for Teachers through broader video-sharing sites such as YouTube and promoted through social media platforms.[29] Beyond the Internet, educational resources were also produced by the agency for TV in partnership with the Irish National Public Service broadcaster RTÉ (RTÉ Learn, https://www.rte.ie/learn/home-school-hub/) through a dedicated portal aimed at the school community at different levels.

Resources for formal and inclusive teaching and learning

In addition to its role as a prominent OER for Irish teachers and students, Scoilnet also contains static and dynamic digital learning resources for teacher and students in formal education. In particular, digital textbooks can be accessed through the portal without an additional licence, and learning can be complemented through interactive resources such as simulations and quizzes, drawing both from commercial resources procured by the central government to the entire system, or through those created by teachers themselves.

The teaching and learning of students with special educational needs is also of particular importance. In addition to financial support for educational institutions through differential resource allocation, the National Council for Special Education (NCSE, https://ncse.ie/) also maintains a wide variety of resources on its website, such as a curated list a recommended tools (such as apps for vision impaired or dyslexic students), video tutorials for supporting parents and teachers, and dedicated applications for the purchase of inclusive technology for schools.

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

Ensuring access and supporting use

Equity of access

Increasing equity of access to digital technologies and the development of digital competences, both for students and for teachers, are key objectives present in Ireland's Digital Strategy for Schools to 2027, which aims to leverage the use of digital technologies to foster inclusion, equity, student participation and learning personalisation. Reliable and safe access to the Internet is instrumental for fully leveraging digital tools and resources, so Ireland aims to increase minimum connection speeds for schools, including expanding access to rural and otherwise remote areas, while supporting safe navigation through the Internet via dedicated technical support through the Schools Broadband Programme.[30, 31]

In alignment with Ireland's efforts towards equality of access, there are also significant goals and initiatives related to inclusion. Schools serving students with disadvantaged socio-economic backgrounds benefit from supplementary funding and from support programmes under the Delivering Equality of Opportunity in Schools (DEIS) initiative, that is also complemented by an additional allocation of earmarked funding under the ICT grant scheme.[32] The agencies responsible for teacher professional development and special education, respectively, also actively collaborate to bring the Digital Learning Framework to special education and to provide advice to schools and parents on the use of assistive technologies.[33] The equality of access to professional learning opportunities in the context of digital competences is also addressed in the strategy and remains a policy goal, prompted both by the outcome of the preceding consultations and by the intent of aligning the Irish strategy with the European Digital Education Action Plan 2021-2027. [34] Increased investment on existing resources and initiatives in this area are foreseen.

Supporting the use of digital tools and resources

The central government directly and indirectly supports the use of digital educational tools and resources at all education levels. Subsidies and autonomy notwithstanding, the adoption and choice of digital tools are set by binding regulations on adoption and compliance (e.g. capabilities, data privacy compliance). In addition, the use of digital technology is observed during school inspections and is required from schools through an obligation for institutions to prepare a digital learning plan.

In addition, digital tools and resources are procured and recommended by the Department of Education or agencies under its aegis. Choice and adoption of learning management systems or similar tools are left to schools, with the notable exception of the administrative system used by schools to inform teacher attendance and substitutions to the government (Online Claims System – OLCS).[35] This exception derives from Irish teachers being directly compensated by the government: the system allows for salaries and appointments to be accurately assigned. Guidance and training to use the system is provided by the Department of Education.

A significant source of centralised support comes in the form of guidance to schools when searching for, procuring, and implementing digital educational tools and solutions. Comprehensive guidance is provided by the Digital Technology Division of Oide (a wide range of topics related to the implementation of digital infrastructure within schools, from information on how to benefit from the ICT grant schemes available and curated lists of endorsed digital tools and solutions, possible options recommended based on appropriate procurement, and more day-to-day issues such as managing technical support and printing operations).[36] Local guidance is also available from digital technology advisors that provide online or in-person support upon demand from schools, with similar, albeit more specialised guidance provided by the agency responsible for special education, the National Council for Special Education.

Given the autonomy afforded by educational institutions in Ireland, procurement of digital educational tools and resources can be performed directly by the central government, by education and training boards managing multiple schools, or by schools themselves. Procurement processes for the government are performed through the Office of Government Procurement (OGP), a division under the Department of Public Expenditure and Reform. Framework contracts negotiated by the OGP, by the Department of Education, and by the Higher Education Authority Network (HEAnet) are in place with ICT equipment suppliers, resulting in an approved selection of suppliers that are recommended for schools to procure. In addition, schools and boards can profit from brokerage services in order to negotiate prices with suppliers available by partnering with organisations with expertise on the ICT procurement market and processes such as the government funded HEAnet.[37] Furthermore, the Department of Education has also established single provider framework contracts to provide schools with a variety of ICT equipment.

Nevertheless, the range of ICT goods and services covered by this guidance and aggregated or brokered procurement procedures remains limited and schools will often need to conduct procurement on their own for other purchases for which there is guidance and direct support available from the Digital Technology Division of Oide.[38] [39]

Cultivating the digital literacy of education stakeholders

Digital literacy for students and teacher capacity to integrate digital education tools and resources into their teaching are present as goals in Ireland's Digital Learning Framework for primary and secondary education. The document describes competences in terms of effective desired practices of students and teachers while leveraging digital technologies. The Framework is divided into four domains both for primary and secondary: two related to students – Learner Outcomes, and Learner Experiences, and two for teachers – Teachers' Individual Practice, and Teachers' Collaborative Practice – where good practices are outlined, including continued in-service professional development for teachers in the context of acquiring digital competences.

Digital competences are also included and mandatory in initial teacher education, and guidelines exist related to the assessment of proficiency in digital competences.[40] Dissemination is further supported through opportunities for teacher professional development, notably through courses on relevant topics such as coding and computational thinking, and artificial intelligence, among others.[41]

The Department of Education has released information on data collection for the national student databases as well as provided guidance on data collection for schools, who are mandated to publicly communicate their data collection and protection information.[42]

Governance of data and digital technology in education

Data privacy and data protection are regulated in Ireland through the Data Protection Act 2018, which gives further national effect to the European Union's General Data Protection Regulations (GDPR), along with some preceding Irish and EU-wide legislative frameworks.[43]

The Data Protection Act frames most of the broader Irish data protection regulations, and school-specific guidance has been shared by the government to the school community to guide schools towards GDPR compliance.[44] This guidance aims to support schools vis-à-vis their accountability towards the students and parents, and to facilitate the exercise of data rights from students or their guardians, including the GDPR-assured right to data portability.

As a result, schools in Ireland are required to have public, clear and GDPR-compliant data privacy policies in their websites. In addition, school staff are also data subjects and thus under the same legislative framework, meaning the same (or similar) data rights apply. This implies that GDPR-compliant schools must also have clear teacher and school staff data protection procedures and clarity on which data is collected and processed, and for which purpose.[45]

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

Government, academia, and the private sector have worked together regarding digital education in Ireland, with active collaboration from academics and researchers in government agencies providing research on digital education and representatives from the private sector contributing to policy debates and providing additional resources on occasion.

Within the frame of privacy and other data protection policies, a wealth of education data is made available to researchers and other stakeholders by the central government, notably via its Central Statistics Office and through a central register of statistical data that contains several education datasets, including documented microdata in a publicly available and searchable portal, the Ireland's Open Data Portal.[46]

Research commissioned by the government is used to inform and monitor significant digital education policy. Notably, the implementation of the Digital Learning Framework has been monitored by researchers of the governmental Educational Research Centre, who authored the baseline report and follow-up longitudinal reports.[47] Researchers from the same centre have also performed the last ICT census of Irish schools, in 2013.[48] In addition, baseline reports have been commissioned from researchers to ground the development of the Digital Strategy for Schools document and evaluate its implementation over the 2015-2020 period.[49]

Interaction with the private sector is also present, and collaboration exists in informal and formal ways. On the former, industry representative groups were part of the consultation process that led to the development of the 2020-2027 Digital Strategy for Schools document.

As implementation of the 2020-2027 digital strategy is underway, future areas of interest are personalisation tools to support learning and provide real-time feedback, such as intelligent tutoring systems. Further development of online education platforms and digital resources for teaching and learning are also of interest, as is the development of learning and institution management systems for further education training students as well as a digital credentials system for primary and secondary education. Educational assessment in Ireland may also transition to digital in the near future, with first experiments with computer-based testing and on online grading already underway.

Notes

[1] Ireland's Education Act 1998, available at https://www.irishstatutebook.ie/eli/1998/act/51/enacted/en/html

[2] Notably in Article 42 of the Constitution of Ireland (*Bunreacht na hEireann*, available at Irish Statute Book)

[3] Digital Strategy for Schools to 2027, available at https://www.gov.ie/en/publication/69fb88-digital-strategy-for-schools

[4] Harnessing Digital – The Digital Ireland Framework, available at https://www.gov.ie/en/publication/adf42-harnessing-digital-the-digital-ireland-framework/

[5] Digital Education Action Plan (EU DEAP) 2021-2027, available at https://education.ec.europa.eu/focus-topics/digital-education/action-plan

[6] The UDL framework comprises a set of principles that aim to provide equal opportunities to learn to all students, including those with special needs. An introduction and guidelines can be found at https://www.ahead.ie/udl-framework

[7] Namely, through the Delivering Equality of Opportunity in Schools (DEIS) initiative, which focus on disadvantaged communities with a focus on literacy, numeracy, parental engagement and capacity building for school staff. Available at https://www.gov.ie/en/policy-information/4018ea-deis-delivering-equality-of-opportunity-in-schools/

[8] Through school year-based grant schemes for ICT infrastructure aiming to provide funds to implementing the Digital Strategy for Schools. Available at https://www.gov.ie/en/circular/e1f8e-grant-scheme-for-ict-infrastructure-20212022-school-year/

[9] The Professional Development Service for Teachers (PDST) and PDST Technology were merged with other organisations to form Oide, a new comprehensive professional development service for teachers in mid-2023.

[10] This data is consolidated on the Primary Online Database (POD) and Post-Primary Online Database (P-POD), more information is available at: https://www.gov.ie/en/service/66258-primary-online-database-pod/ and https://www.gov.ie/en/service/43ddb5-post-primary-online-database-p-pod/ respectively.

[11] Irish schools receive direct funds (*capitation*) form the government on a per-student basis that is destined for the funding of day-to-day costs of running the institution and for the acquisition of teaching materials and resources. Capitation grants can also vary depending on the provision of special education, and be

complemented through earmarked (e.g., for books, minor repairs) funds, or equity programmes such as the DEIS initiative.

[12] Those October Returns are central for the compilation of educational data in Ireland and for funding allocation decisions and requisites, as well as data privacy compliance information is shared with schools as to steer the process. An example Circular from the Department of Education and Skills on the matter can be found at https://www.gov.ie/pdf/?file=https://assets.gov.ie/195181/c984e552-bf4e-4e73-9792-5de4bcf084fc.pdf#page=null

[13] With tools and resources often incorporating learning management or administrative systems features, such as Compass (https://www.compass.education/ie) or Alladin (https://www.aladdin.ie/start.html) respectively.

[14] Namely through Circular 0074/2020 from the Department of Education and Skills, available at https://www.gov.ie/pdf/?file=https://assets.gov.ie/94740/7bcd4972-7538-4944-b8a9-c6c027e1410c.pdf#page=null

[15] Dedicated ICT Grant Schemes are put in place during every school year to fund the Irish Digital Strategy for Schools and can be used for learning and teaching resources. The most recent (2021/22) scheme can be found at https://www.gov.ie/pdf/?file=https://assets.gov.ie/221273/fc227609-879a-4232-94a6-25d2d83bd1c3.pdf#page=null

[16] Available at https://www.pdst.ie/DistanceLearning/DigTech

[17] In particular, in the Education (Admission to Schools) Act 2018, available at https://www.irishstatutebook.ie/eli/2018/act/14/enacted/en

[18] The platform and criteria are available at https://www.cao.ie/index.php

[19] Available at https://www.oecd.org/stories/odicy/, and both digital tools are available at https://careersportal.ie/ and https://www.exitentry.com/ respectively.

[20] The SEC operates under the Department of Education and Skills and is charged with the development, assessment, and accreditation of secondary-level education for Ireland, available at https://www.examinations.ie/

[21] Currently being rolled out for certain Leaving Certificate Examination subjects as of Circular S10/23 of the SEC, available at https://www.examinations.ie/schools/cs_view.php?q=238a154ef156a06a46fda325212df8a2d85a6912

[22] The ERC is an independent agency under the Department of Education and Skills aiming to support schools with assessment, and to perform independent education research. Available at https://www.erc.ie

[23] More information on the SCP is available at https://www.tusla.ie/services/educational-welfare-services/scp/.

[24] More detail on the PDST can be found at https://www.pdsttechnologyineducation.ie/about-us/

[25] Available at https://ncse.ie/

[26] The latter (Census At School, https://censusatschool.ie/about/) consisting of a partnership between Maths content experts from PDST, and Irish Central Statistics Office.

[27] Webwise is the Irish Internet Safety Awareness Centre which is co-funded by the Department of Education and the European Commission.

[28] The SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies) consists of a free tool aimed to assist schools adding digital technology into their teaching and learning. The tool and details are available at https://education.ec.europa.eu/selfie

[29] Particularly by the PDST, that producing contents ranging from general digital technology videos and tutorials (available at https://www.youtube.com/@PDSTDigitalTechnologiesTeam/featured) to the specific, such as leaving certificate chemistry (available at https://www.youtube.com/channel/UCyw6QeQSOn3vcXU1c4xFPTg).

[30] The Schools Broadband Programme, available at https://www.pdsttechnologyineducation.ie/technology-infrastructure/schools-broadband-programme/

[31] Indeed, the national strategy *Harnessing Digital – the Digital Ireland Framework* aims to achieve "the delivery of connectivity to even the most remote rural locations; facilitating the joining up of national networks, for example libraries, to Broadband Connection Points and Connected Hubs; and supporting the development of networks of regional innovation hubs".

[32] Guidance on the use of earmarked resources from the ICT Grant Scheme can be found in the Department of Education Circular 0027/2022, available at https://www.gov.ie/en/circular/e1f8e-grant-scheme-for-ict-infrastructure-20212022-school-year/

[33] The Digital Learning Framework is a set of good practices for schools to embed digital technologies into their teaching and learning, accessible at https://www.dlplanning.ie/

[34] EU Digital Education Action Plan (EU DEAP 2021-2027), available at https://education.ec.europa.eu/focus-topics/digital-education/action-plan

[35] The Online Claims System (OLCS), maintained by the Department of Education and Skills, and available at https://www.gov.ie/en/publication/50405-online-claims-system-olcs/

[36] A complete list of available guidance can be found at https://www.pdsttechnologyineducation.ie/technology-infrastructure/

[37] More on the HEAnet, framework contracts, and other services supporting ICT procurement can be found at https://www.heanet.ie/brokerage-products-suppliers

[38] A list of products and services for which there is guidance and support can be found at https://www.pdsttechnologyineducation.ie/technology-infrastructure/technical-and-purchasing-considerations/

[39] Specific advice and support for schools for procurement issues generally, including ICT infrastructure, is also provided by the Schools Procurement Unit, a Department agency at www.spu.ie

[40] Said guidelines relate to the Standards for Initial Teacher Education available at https://www.teachingcouncil.ie/en/teacher-education/initial-teacher-education/ceim-standards-for-initial-teacher-education

[41] Both supported by the PDST Technology in Education/ A list is available at https://www.pdsttechnologyineducation.ie/courses-practice/

[42] Department of Education and Skills for data collection in POD and P-POD can be found at https://www.gov.ie/en/circular/2d80bc3eb36a4ed582f8a331d16a43d8/ and https://www.gov.ie/en/circular/f83ef-fair-processing-notice-to-explain-how-the-personal-data-of-students-in-post-primary-schools-on-the-post-primary-online-database-ppod-will-be-recorded-processed-and-shared/ respectively.

[43] The Data Protection Act 2018 is available at https://www.irishstatutebook.ie/eli/2018/act/7/enacted/en/html

[44] Through a dedicated website https://gdpr4schools.ie/ with guidance and document templates for schools.

[45] An example of a school-level data protection policy is available at https://www.croomns.ie/data-protection-policy/

[46] The Central Statistics Office (CSO) is an independent agency in charge of collecting data for statistical purposes in Ireland (https://data.gov.ie/). Available at https://www.cso.ie/en/ /

[47] The latest longitudinal report can be found at https://www.erc.ie/2021/06/16/erc-publishes-second-report-on-its-longitudinal-evaluation-of-the-digital-learning-framework-dlf/

[48] *The 2013 ICT Census in Schools*, available at https://www.erc.ie/documents/ict_cencus2013_mainreport.pdf

[49] Baseline Report: Towards a Successor Digital Strategy for Schools to 2027, available at https://www.gov.ie/pdf/?file=https://assets.gov.ie/221291/2bf1c705-9aae-4356-a6b1-b0ef37fbf5a4.pdf#page=null

16 Italy

This note provides an overview of Italy's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Italy supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Italy engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- The central government publicly provides several digital solutions for system and institutional management, including a centralised, single sign-on platform that connects to several applications used for different management functions. INDIRE (*Istituto Nazionale di Documentazione, Innovazione e Ricerca Educativa*), the ministry's educational research agency, also develops and provides some digital resources to support teaching and learning. However, few of the publicly provided digital solutions and resources are mandatory, and schools have significant autonomy to choose and acquire additional components of their digital infrastructure.
- Since 2015, Italy has invested significant resources into the digitalisation of their education system, guided by a comprehensive digital strategy. The country's National Recovery and Resilience Plan, financed by the EU, will further supplement digitalisation efforts over the coming years.
- Due to the somewhat decentralised and highly devolved nature of governance, ensuring the equity of access and use of digital infrastructure and solutions in schools is a challenge. However, the public provision of several digital solutions as well as the provision of a centralised procurement platform with authorised providers may help to provide at least a homogenous access to the main components of a digital education infrastructure – even if gaps may remain in practice.
- Significant attention has been devoted to supporting educators to use digital technologies in their classrooms through a multitude of initiatives, including developing practical guidelines, creating networks of teacher champions, increasing opportunities for professional development and, more recently, mandating in-service training on digital education. Several curriculum-based projects have also promoted the development of students' digital skills.
- Italy has general rules on data protection and privacy, as well as rules that govern the access to and use of educational data. Statistical data collected by the ministry are also publicly accessible via an open data portal.
- The Agency for Digital Italy specifies rules and guidelines on the use of specific technical standards for all technologies developed by the government, and the ministry has recently launched a project to create a certified, interoperable system in which data between different local (private) and central (public) digital solutions can be shared easily and securely.

General policy context

Division of responsibility

In Italy, the governance of the education system is shared between government authorities at central and lower levels (regional offices). The central Ministry of Education and Merit (*Ministero dell'Istruzione e del Merito*) defines the general rules and fundamental principles of the education system that the regional offices must respect, and it determines the essential conditions that must be guaranteed throughout the country (e.g. institutional funding, teacher salaries). While the central and regional authorities share responsibility for primary and secondary education, regional authorities exclusively govern vocational education and training (VET). However, at all levels of education, schools have significant pedagogical, organisational and research autonomy.

Public responsibilities for providing access to and use of digital technologies in education follow this shared governance model, with some of the digital education infrastructure provided centrally and some provided at the regional or municipal levels. Given the high degree of school autonomy, significant portions are also acquired independently by schools – although private providers must be added to the central procurement platform provided by the ministry (and therefore approved by the government) before schools are able to

purchase solutions from them. Among the digital solutions and resources provided by government authorities, only a minority are mandatory for schools and/or teachers to use.

Digital education strategy

The "National Digital School Plan" (*Piano Nazionale Scuola Digitale;* hereafter referred to as the Digital Plan), introduced as part of a 2015 educational reform, is the main strategic and operational document focused on the digital transformation of Italian schools.[1] The Digital Plan was adopted in 2016 and sets out several actions grouped into 4 key activity areas: (1) ensuring connectivity; (2) providing innovative learning environments with digital tools and technologies; (3) enhancing students' digital skills and developing quality content for digital teaching; and (4) providing professional training and development on digital education. Since its implementation, an estimated EUR 1.9 billion has been invested in digitalisation efforts (with a significant proportion derived from European Union funding). A new version of the Digital Plan is being developed and will reportedly focus on systematising the use of new technologies in teaching.

The Digital Plan has improved access to hardware infrastructure in schools across the country. The National Ultrabroadband Plan – led by the Ministry for Economic Development (and Action 1 of the Digital Plan) – aims to ensure that all schools have access to high-speed broadband by 2023.[2] The ratio of digital devices to students in the country also halved since 2013, from 1:8 to 1:4 in 2020, and additional funding was made available to schools to purchase digital devices to loan to students during the COVID-19 pandemic. Beyond increased access to devices, over 14 000 "innovative learning environments" (e.g. classrooms augmented with technology, mobile laboratories and digital workspaces) have also been created through the Digital Plan. The country's National Recovery and Resilience Plan (*Piano Nazionale di Ripresa e Resilienza*; hereafter referred to as the Recovery and Resilience Plan), financed by the European Union, will supplement this effort with EUR 2 billion to create 100 000 innovative classrooms by 2025.[3]

The more recent "Digital School 2022-2026" programme – another component of the Recovery and Resilience Plan – consists of four initiatives: (1) migrating the services and applications of educational institutions to qualified cloud solutions; (2) improving the usability of digital services offered by schools through adaptation to a standard model; (3) accelerating the adoption of a centralised platform for accessing digital services and making payments to public administrations; and (4) promoting the adoption of single sign-on systems to facilitate access to digital services provided by the government.[4]

In terms of broader digital strategy, the national "Digital Administration Code", managed by the Agency for Digital Italy (*Agenzia per l'Italia digitale*), provides a binding framework for the digitalisation of the whole of government. Accordingly, the ministry has established a Digital Transition Manager who is responsible for the reorganisation and digitalisation of the ministry and educational institutions in the country.[5]

The public digital education infrastructure

In Italy, the central and regional governments share responsibility for providing the public digital education infrastructure. Given the significant autonomy of schools, institutions are also able to acquire their own digital solutions and (mostly) choose which of those to use that are publicly provided. This section reviews two aspects of the public digital infrastructure: digital solutions for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and school information system

Schools at all education levels are obliged to share certain student data with the ministry (e.g. demographic data, number of students per class, student grades) via the *Sistema Informativo Dell'Istruzione* (*SIDI*). The *SIDI* platform enables school principals and administrative staff, as well as government offices, to use various applications needed for acquiring, verifying and managing the data collected and processed by the ministry (e.g. operational data on schools, student data, financial and accounting data), and thus it essentially functions as a student information system (SIS).[6] Student data inputted by each school are stored in a national student register where all students in the system have a unique and longitudinal identifier. Annual surveys are also carried out in all schools by INVALSI (the education agency in charge of evaluation and assessment), and that data is collected through the *SIDI* platform and integrated with the national student register data. Together, these datasets enable the ministry to monitor the education system and to define school policies.

These data are also aggregated at the school level and made publicly available via a data portal and the *Scuola in Chiaro* website.[7] The data portal provides a wealth of (comparative) aggregate data about students, schools, school staff and the national evaluation system; it enables individuals to freely explore the data and conduct their own analyses, as well as display data in an analytical dashboard. The *Scuola in Chiaro* website rather functions like a publicly accessible school information system, where individuals can search for information about specific schools and vocational institutes.

Admission and administrative management systems

Since 2014, the ministry provides a centralised student admission management system called *Iscrizioni Online*.[8] Online enrolment is compulsory for all first-year students in state schools at primary and secondary levels (whereas it is optional for private schools). For vocational institutes, only some regions have adopted the same online registration process. In order to use the service, parents must use their single sign-on (SSO) credentials associated with one of the country's national digital identity systems (e.g. the Public Digital Identity System or the Digital Identity Card) that provides citizens with secure access to public digital services. Parents can refer to the *Scuola in Chiaro* website to find information about schools they are interested in as well as to identify the schools' code (required to complete an admission application).

At the central level, the ministry also uses and provides schools with some administrative function systems. For example, *Monitor440* (accessible via the *SIDI* platform) supports both government offices and educational institutions with the planning, management, and monitoring of funding from the government.[9] For the management of school staff, the *POLIS Online Instances* platform is used by government offices and educators for a range of functions including processing applications for vacancies and transfers, registering staff in the ranking system, and collecting data about teachers' professional development and activities.[10] Regional governments also share responsibilities for administrative and management processes, some of which may be carried out using locally-acquired digital solutions.

Learning management systems

The ministry does not provide a centralised learning management system (LMS) for schools to use, but they may authorise solutions licensed from commercial providers that schools can independently acquire. Ministry officials estimate that the majority of schools at all education levels in the country do use an LMS (which often includes a customer relationship management system, a learning content repository, and an analytics dashboard). These learning management systems are also sometimes used for administrative management functions, i.e. as a student register at the institutional level. Indeed, as part of the Digital Plan, the ministry prioritised equipping all primary school classrooms in the country with a digital school register.

The ministry provided funding for schools to choose and acquire their own solutions for this function rather than publicly providing one. As of 2020, 96.5% of primary schools had an electronic student register.[11]

Self-evaluation and institutional management systems

INVALSI (the education agency in charge of evaluation and assessment), in collaboration with the ministry and INDIRE (the education agency in charge of educational research and innovation), provides schools with three key tools to facilitate self-evaluation, improvement and institutional planning. All educational institutions must define a three-year plan that describes their curricular and extracurricular offerings, as well as their organisational planning over that period. The *PTOF platform* (accessed via the *SIDI* portal) provides schools with a digitised common reference template that they can customise to create their three-year plan.[12] The platform also integrates a self-improvement plan that schools are expected to define following a self-evaluation exercise.[13] The *Rapporto di Autovalutazione* ("Self-Assessment Report") *platform* is used to conduct these self-evaluation exercises and functions similarly to the *PTOF platform* by providing schools with a customisable self-assessment template.[14] Schools can directly publish their three-year plans and self-assessment reports on the *Scuola in Chiaro* website.

Examinations, digital student profile and career guidance

Some parts of the high-stakes end-of-year examinations for upper secondary and VET education are conducted online. To facilitate the management of the examinations process, the ministry has developed the *Commissione Web* application for secondary education examinations and the *Gestione Esami ITS* application for state examinations in VET.[15] As for the low-stakes annual assessments managed by INVALSI for the monitoring of learning outcomes for all education levels, these have been conducted online since the 2017/18 school year.

To better document students' experiences in school (e.g. their study paths, examinations), one action of the Digital Plan focused on creating a digital student profile.[16] All students in secondary school are now equipped with a student card, "*IoStudio*" ("I study"), that they can use to register their digital profile. The profile provides students with additional services, for example the possibility to apply for merit-based or means-based funding and opportunities to certify their skills (acquired both during and outside of school). A similar initiative has been carried out to equip teachers with a digital teacher profile, where both their teacher file (career path, responsibilities) and professional development activities can be documented.[17]

To help students make decisions about their schooling and future careers, the ministry offers the careers guidance website *Orientarsi,* targeted at students in upper secondary and VET education.[18] The website provides information on different educational paths for upper secondary, vocational, and tertiary education, as well as links to other useful information resources and websites. The Ministry of University and Research has a similar website, *UniversItaly*, targeted at students in or interested in higher education.[19]

Digital ecosystem for teaching and learning

Teaching and learning resources in formal education

In Italy, schools choose and buy their own resources for learning – with the exception of primary education, where the ministry funds the purchase of textbooks via local offices. Many publishers provide digital content as a standard accompaniment to their textbooks, meaning that schools at all educational levels have access to some form of static digital learning resources, and ministry officials estimate that schools regularly use static (and to a lesser extent interactive) digital learning resources. Officials also estimate that most classrooms are equipped with digital tools or learning supports for students with special educational needs (e.g. assistive technologies). While the ministry ensures that each school has a

dedicated teacher for students with special educational needs, as well as specific funding, it is at the discretion of schools whether and how to use their budget to purchase such digital supports.

One specific action of the Digital Plan managed by INDIRE is the "Innovative school libraries" (*Biblioteche scolastiche innovative*) project. The project aimed to create digital libraries for schools across the country that they could integrate with their own IT services and use to promote broader information literacy skills (as well as loan out digital texts to students).

During the COVID-19 pandemic, virtual classroom environments were used significantly by schools across the country. A survey on a representative sample of schools found that nearly 80% of schools had acquired some sort of virtual classroom environment; however, it is unclear to what extent such solutions continue to be used in schools.[20] The INDIRE website and social media channels were also particularly visited during the pandemic as the agency heavily focused on providing information and support to teachers for remote learning.

Finally, both INDIRE and INVALSI produce and/or publicly provide some digital resources for teaching and learning in schools. For example, INDIRE have developed the *EdMondo* virtual world environment that is only available to teachers and students in formal education, and INVALSI provides digitised versions of previous national tests that teachers can use to support formative assessment.[21]

Open educational resources to support teachers

The government also supports the development of digital resources for teaching and learning outside the context of formal education. For each research project managed by INDIRE, it collects and provides open educational resources targeted at all education levels. While these resources are not stored in a single repository, they are organised by thematic or curriculum area on the INDIRE website. For example, the *Scuola2030* portal contains open resources and research on education inspired by the values and vision of the 2030 Agenda (although some materials are only accessible to teachers using their national digital identity credentials).[22] The majority of INDIRE projects focus on specific methodologies and/or core subjects and skills, particularly STEM subjects, but there are also some cross-disciplinary areas of focus (e.g. citizenship). INDIRE also provides information about different pedagogical practices, research and some educational content for learners through its social media channels.[23]

The ministry also partners with *RAI Scuola*, the TV education branch of the national broadcaster, to produce freely accessible educational videos on a range of topic areas for students in primary and secondary school.[24] In the past, materials produced by the channel were limited to specific topics but since the COVID-19 pandemic its content is organised in a way that reflects standard school subjects. While most of the content is produced for online viewing, some is broadcast directly on the *RAI Scuola* TV channel. *RAI Scuola* also produces educational content targeted at university students and adult learners, as well as content for educators themselves.

In addition to the above, ministry officials describe an active community of teachers in the country who engage in producing and sharing their own open educational resources. However, this occurs on a more ad hoc basis and is not formally incentivised or organised by the ministry or its agencies.

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

Providing some kind of public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

Italy does not have specific rules to ensure the equity of access to its digital education infrastructure. The government does publicly provide several digital solutions for system and institutional management as well as some for teaching and learning, in principle ensuring equitable access to components of the digital education ecosystem in a homogenous way across education levels. However, few are mandatory for schools to use – therefore potentially resulting in gaps in their use in practice.

Schools can use non-earmarked, operational funding (no means-based formula) provided by the government via regions and municipalities for expenditure related to ICT, and other operational funding (i.e. grants) may also be obtained through specific projects or local organisations. In general, schools can use these funds to acquire additional components of their digital infrastructure at their discretion, which again may lead to possible disparities and inequities in digital infrastructure access and use across institutions. However, one way that the ministry facilitates schools' access to additional digital solutions is through a centralised procurement application called *Protocolli In Rete*. The application is accessible via the *SIDI* platform and enables schools to browse among and choose private solutions approved by the ministry, as well as apply for ministry funding for specific projects detailed in the Digital Plan. Private providers use the same application to obtain ministry approval and make available their goods and services to schools.

The ministry also addresses equity through some targeted actions. For example, one initiative of the Digital Plan identifies "at risk" schools (on the basis of dropout rates and indicators of learning deprivation) and provides them with an economic subsidy of up to EUR 35 000 to create digital learning environments.[25]

Supporting the use of digital solutions

Two of the four central pillars of the Digital Plan focus on supporting stakeholders to use digital technologies in schools. For example, Action 23 produced guidelines for teachers on the use and production of open educational resources.[26] The guidelines classify different types of digital resources, provide a schema to map their content to the curricula, and advise on best practices for managing shared resources. Additional guidelines focus on helping educators to evaluate, choose and use resources effectively, and to create and validate the quality of their own resources. During the COVID-19 pandemic, the ministry also published rules and guidelines on the use of technology in class.[27]

Action 28 of the Digital Plan created a network of "digital animators" across the country: every school now includes one teacher who, together with the school management team, has a strategic role in proliferating digital innovation at their school.[28] These digital animators have undergone dedicated training on the initiatives promoted through the Digital Plan, and their role is to support its overall vision and implementation "on the ground". They do so by organising internal trainings, involving the wider school community (e.g. parents, students) in workshops and trainings, and identifying sustainable digital solutions to integrate in their school. Each school is allocated EUR 1 000 for such activities. In a similar vein, the Digital School Award was created to showcase good practices of digital teaching around the country.[29] Other components of the Digital Plan focus on providing technical training to wider school staff to help immediately troubleshoot and internally resolve problems with digital technology.[30]

In addition to providing different practical supports and guidelines, the Digital Plan also mandates the systematic monitoring of digitalisation in schools. The Digital School Observatory (*Osservatorio per la Scuola Digitale*) monitors the didactic, technological and innovation progress of the school system, and seeks to understand: how schools buy or procure the digital solutions they require; how digital technologies are used in schools to aid teaching and learning; and how to encourage and/or remove obstacles to whole-of-school innovation.[31]

Cultivating the digital literacy of education stakeholders

Italy has both rules and guidelines about the development of teachers' digital competencies as part of their pre-service training, for all education levels.[32] The ministry also recently introduced rules to mandate in-service training on digital education from the 2023-24 school year.[33] The Recovery and Resilience Plan provides EUR 800 million towards supporting the digital teaching skills of 650 000 educators, in part by creating a new integrated platform, *Futura*, to deliver online training to school staff on topics related to digital teaching and the digital transformation of schools.[34] The *Futura* platform complements the *S.O.F.I.A* platform that teachers can use to find and access online professional development courses on a range of topics from various (government-approved) providers.[35]

These tools build on earlier initiatives to support (voluntary) professional learning and development on digital education, including the "Future Labs" initiative. Nearly 30 "Future Labs" – modelled as future classrooms with innovative training environments for robotics, augmented reality and digital fabrication activities – were created across all of the Italian regions to provide educators with experiential training on digital teaching methods.[36]

Italy also has rules (for primary and lower secondary) and guidelines (for upper secondary and VET education) on the development of students' digital competencies, which are viewed as part of the cross-curricular set of skills underpinning citizenship.[37] Several initiatives of the Digital Plan have translated these rules and guidelines into curriculum frameworks at different educational levels. For example, a new digital civic education syllabus was developed to complement the national curriculum, guiding schools to integrate relevant digital citizenship content and themes into their educational offers.[38] Another initiative, the "*Programma il Futuro*" ("Programme the Future") project, focused on developing students' computational thinking skills by integrating 10 hours of programming for students in primary education.[39] Over 300 000 students participated in the project in its first year (2014/15), and by 2020, the ministry reported that over 75% of primary schools offered at least 10 hours of computational thinking courses. A third initiative focused on promoting digital entrepreneurship in secondary education; based on a short national curriculum developed centrally, regional governments – in collaboration with local actors (e.g. foundations, universities, companies) – organised entrepreneurship competitions for students. Those with the best projects were given opportunities to participate in "accelerator" workshops and collaborate directly with universities and digital businesses to further develop their ideas.[40]

Beyond developing new curricula and educational offers, the ministry also created and funded the Digital Careers Plan in collaboration with Italian universities and research centres to promote university offers in innovative STEM sectors and experimental pathways to align students with future digital careers.[41]

Governance of data and digital technologies in education

In Italy, general rules on data protection and privacy are provided for under the European Union's General Data Protection Regulation (GDPR). National rules on data protection and privacy also exist and, while the rules are general, the authority charged with supervising them has a website with dedicated sections on aspects that are relevant to minors and school contexts.[42] Schools then write their own data protection and privacy rules based on these national laws. In addition, each school engages an external Data Protection Officer who supports their compliance with data protection and privacy rules. However, accountability over the use of digital technologies in schools. including if used for decision-making purposes, ultimately lies with each school's principal.

There are also national rules governing the equal access to educational data for public and private research.[43] Statistical data collected by the ministry – including data on schools budgets, the national evaluation system, the school building registry, the number of teachers in schools, and aggregated data from the student register – are made freely accessible through the "Single School Data Portal" or the National Statistics Institute (*Istituto Nazionale di Statistica*).[44] Due to the provisions of the general data

protection and privacy laws concerning minors, this data can only be communicated to the ministry via each schools' principal. Digital solutions of private companies used in education are therefore not allowed to use or make available data pertaining to minors.

To facilitate interoperability across digital systems, and particularly that of the *SIDI* student information system with local solutions used in schools, the ministry launched the "Integrated School Information Systems" (*Sistema informativo integrato delle scuole*) project.[45] The project aims to improve the SIDI infrastructure by creatine an interoperable system in which data between different local (private) and central (public) solutions can be shared easily and securely. More generally, the Agency for Digital Italy has rules and guidelines on the use of open and specific technical standards for technologies developed by the government (though not explicitly in education), and similar guidelines exist about the use of open standards on data collected by the public administration.[46]

Italy also has rules and guidelines related to data portability in education. Teachers and students can transfer data from their digital teacher and student profiles respectively into the SIDI system.

Supporting innovation, research and development (R&D) in digital education

In Italy, public research objectives are defined through the triennial National Research Plan (*Piano Nazionale di Ricerca*), to which all public research bodies align their research priorities and agendas. Both INDIRE and INVALSI conduct research on various aspects of digital education (among other areas), but there is no specific education agency or funding programme dedicated to researching digital education nor has the ministry directly commissioned any academic research on the topic within the last five years. INVALSI also co-founded and participates in the *FLIP*+ e-assessment community, an international forum where interested stakeholders in digital assessments share research, discuss common challenges in computer-based assessment, engage in peer-learning, and co-develop content.[47]

Both INDIRE and INVALSI directly engage in the development of digital solutions that are then publicly provided to schools for system management or for teaching and learning (e.g. *EdMondo*, or tools for assessment and self-evaluation).[48] The ministry also financially incentivises research and development of EdTech solutions through tax credits or through direct investments in start-up companies. Beyond financial incentives, the Digital Plan created a "Stakeholders Club for the Digital School" to encourage collaboration and to formalise partnerships among the ministry (and its agencies), individual schools and private EdTech companies.[49] Partnerships (usually formalised by Memoranda of Understanding) between interested parties are facilitated through the *Protocolli in Rete* application.

Finally, the ministry has created a secure crowdfunding platform, *IDEArium*, to facilitate innovation in Italian schools.[50] Schools can use the platform to publish project ideas and seek financial support from private individuals or companies via the government's secure online payment systems.

Notes

[1] https://scuoladigitale.istruzione.it/pnsd/

[2] https://scuoladigitale.istruzione.it/iniziative-conn/piano-scuola-cobul/

[3] https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/scuola-4-0-scuole-innovative-nuove-aule-didattiche-e-laboratori.html

[4] https://www.istruzione.it/responsabile-transizione-digitale/migrazione-cloud.html

[5] https://www.istruzione.it/responsabile-transizione-digitale/chi-e-rtd.html

[6] https://www.miur.gov.it/-/sidi

[7] Single School Data Portal: https://dati.istruzione.it/opendata/opendata/catalogo/elements1/?area=Studenti; Scuola in Chiaro: https://cercalatuascuola.istruzione.it/cercalatuascuola/

[8] https://www.istruzione.it/iscrizionionline/index.html

[9] https://www.istruzione.it/monitor440/ilprogetto.html

[10] https://www.istruzione.it/polis/Istanzeonline.htm

[11] https://scuoladigitale.istruzione.it/pnsd/ambiti/ambienti-e-strumenti/azione-12-registro-elettronico/

[12] https://snv.pubblica.istruzione.it/snv-portale-web/public/ptof/ptof

[13] https://www.indire.it/progetto/supportomiglioramento/piano-di-miglioramento/

[14] https://snv.pubblica.istruzione.it/snv-portale-web/public/scuole/rav

[15] https://www.istruzione.it/esame_di_stato/commissione-web.shtml; https://www.miur.gov.it/-/gestione-esami-i-1

[16] https://scuoladigitale.istruzione.it/pnsd/ambiti/ambienti-e-strumenti/azione-9-profilo-digitale-studente/

[17] https://scuoladigitale.istruzione.it/pnsd/ambiti/ambienti-e-strumenti/azione-10-profilo-digitale-docente/

[18] http://www.orientamentoistruzione.it/

[19] https://www.universitaly.it/

[20] https://www.indire.it/wp-content/uploads/2022/02/Didattiche-Durante-il-Lockdown_10_01.pdf

[21] EdMondo virtual world environment: https://www.indire.it/progetto/didattica-immersiva/ ; INVALSI test items: https://invalsi-areaprove.cineca.it/index.php?get=static&pag=precedenti_strumenti, https://invalsi-areaprove.cineca.it/index.php?get=static&pag=esempi_prove_grado_2

[22] https://scuola2030.indire.it/

[23] INDIRE Facebook: https://www.facebook.com/IndireSocial/videos/?ref=page_internal ; INDIRE YouTube channel: https://www.youtube.com/user/indirericerca. STEM refers to science, technology, engineering and mathematics.

[24] https://www.raiscuola.rai.it/

[25] https://scuoladigitale.istruzione.it/iniziative-ambienti/ambienti-digitali-nelle-aree-a-rischio/

[26] https://scuoladigitale.istruzione.it/pnsd/ambiti/competenze-e-contenuti/azione-23-produzione-di-risorse-educative-aperte/

[27] https://www.miur.gov.it/documents/20182/0/ALL.+A+_+Linee_Guida_DDI_.pdf/f0eeb0b4-bb7e-1d8e-4809-a359a8a7512f

[28] https://scuoladigitale.istruzione.it/pnsd/ambiti/accompagnamento/azione-28-un-animatore-digitale-in-ogni-scuola/

[29] https://scuoladigitale.istruzione.it/pnsd/ambiti/ambienti-e-strumenti/azione-5-challenge-prize-per-la-scuola-digitale-ideas-box/

[30] https://scuoladigitale.istruzione.it/pnsd/ambiti/accompagnamento/azione-26-assistenza-tecnica-per-il-primo-ciclo/

[31] https://scuoladigitale.istruzione.it/pnsd/ambiti/accompagnamento/azione-33-osservatorio-per-la-scuola-digitale/

[32] https://www.orizzontescuola.it/legge-13-luglio-2015-n-107-riforma-della-scuola/ ; https://www.infoparlamento.it/Pdf/ShowPdf/9712 (see page 28)

[33] https://www.infoparlamento.it/Pdf/ShowPdf/9712 (see pages 31-32)

[34] https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/didattica-digitale-integrata-e-formazione-sulla-transizione-digitale-del-personale-scolastico.html; Futura: https://scuolafutura.pubblica.istruzione.it/

[35] https://sofia.istruzione.it/

[36] https://scuoladigitale.istruzione.it/pnsd/ambiti/accompagnamento/azione-25-formazione-in-servizio-per-linnovazione-didattica-e-organizzativa/ ; https://scuoladigitale.istruzione.it/iniziative-formaz/future-labs/

[37] https://www.miur.gov.it/documents/20182/0/Indicazioni+nazionali+e+nuovi+scenari/; https://www.gazzettaufficiale.it/eli/id/2018/12/31/18G00172/sg (see paragraph 175).

[38] https://scuoladigitale.istruzione.it/iniziative-competenz/sillabo-sulleducazione-civica-digitale/

[39] https://scuoladigitale.istruzione.it/pnsd/ambiti/competenze-e-contenuti/azione-17-portare-il-pensiero-computazionale-a-tutta-la-scuola-primaria/

[40] https://scuoladigitale.istruzione.it/pnsd/ambiti/competenze-e-contenuti/azione-19-un-curricolo-per-limprenditorialita-digitale/

[41] https://scuoladigitale.istruzione.it/pnsd/ambiti/competenze-e-contenuti/azione-21-piano-carriere-digitali/

[42] https://www.garanteprivacy.it/; https://www.gpdp.it/temi/scuola

[43] https://www.gazzettaufficiale.it/eli/id/2015/07/15/15G00122/sg (see paragraphs 136-141).

[44] Single School Data Portal: https://dati.istruzione.it/opendata/opendata/catalogo/elements1/?area=Studenti; National Statistics Institute educational data: https://www.istat.it/it/istruzione-e-formazione?dati

[45] https://www.miur.gov.it/documents/20182/0/locandina_siis/ac884859-bdc0-4c8b-905e-dfeb5cd0b1e5

[46] Rules/guidelines on technology standards: https://trasparenza.agid.gov.it/archivio28_provvedimenti-amministrativi_0_123008_725_1.html; Guidelines on data standards: https://www.dati.gov.it/linee-guida-valorizzazione-patrimonio-informativo-pubblico

[47] https://flip-plus.org/

[48] https://www.indire.it/progetto/didattica-immersiva/

[49] https://scuoladigitale.istruzione.it/pnsd/ambiti/accompagnamento/azione-30-stakeholders-club-per-la-scuola-digitale/

[50] https://idearium.pubblica.istruzione.it/crowdfunding/

17 Japan

This note provides an overview of Japan's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Japan supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Japan engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Japan has a rather decentralised digital education policy, and leaves to its prefectures and municipalities most of the decisions related to the country's digital infrastructure. It is one of the few OECD countries that does not maintain a national student information system.
- Two major national initiatives have provided incentives for the digitalisation of its education system. The *Global and Innovation Gateway for All* (GIGA) school digital learning programme provides all students in compulsory education (primary and lower secondary) a digital device (tablet or laptop) on a 5-year lease. The MEXT's new computer-based testing system (MEXCBT) also provides incentives to all municipalities to comply to certain interoperability standards. While both programmes are optional, all prefectures and municipalities have opted in.
- The government-supported ICT supporter scheme allows for "supporters" employed by private companies to be dispatched to public schools to offer teachers professional support regarding the use of computers and software for teaching.

General policy context

In Japan, public responsibility for managing the education system is split between central, prefectural, and municipal governments.[1] The national Ministry of Education, Culture, Sports, Science and Technology (hereafter MEXT) sets the national curriculum, promotes and regulates the use of digital technologies in education, and funds local governments – 47 prefectures and 1 719 municipalities (which include 23 special wards of Tokyo). However, it is the prefectures and municipalities that make most decisions on school management, from procuring infrastructure to providing learning resources.

Division of responsibility

Public responsibilities for offering schools with access to digital tools and resources follow this devolved context. Part of the infrastructure is provided centrally (e.g. computer-based testing system), but a larger proportion is procured locally or by schools themselves. For instance, prefectures and municipalities maintain their own student information system, and procure for schools some privately developed tools and resources for school management such as learning management system. Generally, prefectures are responsible for upper secondary schools (which includes vocational schools at the upper secondary level), and municipalities are in charge of primary and lower secondary schools.[2] Schools then procure by themselves other tools and resources for school management, such as administrative function system. They also acquire digital teaching and learning resources from education stakeholders, for example universities and education technology (EdTech) companies.

The central government plays a more prominent role in supporting and promoting the uptake and in regulating the use of digital education infrastructure. MEXT provides various guidelines to help schools make well-informed decisions regarding their procurement of digital infrastructure. In addition, the central government enacts the rules governing the access to and use of data and digital technologies in education. The *Act on the Protection of Personal Information* governs the handling of personal data, including education data when they constitute personal information.

Digital education strategy

In 2021, the Japanese government established the *Digital Agency*, a government agency aimed at coordinating digitalisation and ensuring a coherent use of digital technologies across sectors. The agency recently approved the *Priority Policy Programme for Realising Digital Society*, which outlines Japan's plan for digital transformation of the country.[3]

In line with this programme, and taking stock of the COVID-19 experience, the *Digital Agency* (along a few other ministries) published in January 2022 the *Roadmap for Utilising Education Data*.[4] Its mission is to build "a society where anybody, at any time and place, can learn with anybody in his/her own way". Therefore, this roadmap aims to create an environment that promotes the use of education data and incorporates digital technologies as a tool for supporting learning, while ensuring the interoperability across the technology used in education.

Such innovation is built against the country's digital education infrastructure, which has been enhanced gradually over the past years. Particularly during the pandemic, MEXT made changes in their digital education policies and expenditure to enhance the digital infrastructure in schools, improving Wi-Fi and mobile coverage in all schools as well as broadband connection in vocational institutions. According to a recent MEXT survey, the average rate of Wi-Fi adoption across all levels of schools in the country has shown a steep increase – from 48.9% in 2020 to 94.8% in 2022.[5]

MEXT has also further reinforced the *Global and Innovation Gateway for All* (GIGA) school digital learning programme.[6] This programme was first launched in 2018 as a nationwide initiative, and as part of a broader government strategy towards a post-information society (called *Society 5.0* initiative in Japan). One of the major objectives of the GIGA programme is to provide a digital device for all students, and build a school infrastructure for ICT-supported teaching and learning, to optimise and standardise the educational data collection (see *Equity of access* section later for more details).

In future years, MEXT will continue investing in hardware infrastructure, including improving the broadband and Wi-Fi connections in schools, and providing digital devices for student to use in schools and at home.

The public digital education infrastructure

This section reviews two aspects of the public digital infrastructure in Japan: digital tools and resources for system and school management, and digital resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management system

In Japan there is no centralised education database or student information system managed at the central system level. For calculating educational statistics, MEXT therefore distributes to schools annually a questionnaire about school and student information (e.g. gender, number of students, etc.). Schools are then required to complete the questionnaire and submit it back to MEXT.

While no education database or student information system is operated at the central level, generally each local government – prefecture and municipality – has its own database and a student information system, so that they can manage information about the schools and students for whom they are responsible.[7] The local governments collect various types of data, ranging from administrative data (such as student lists and attendance records) to learning-related data (such as computer/device usage logs). However, the exact kinds of data collected across different local governments may vary from one to another. Whether a student is allocated a unique identifier in the system is also a decision made differently at local government-level.[8]

A vast majority of schools in Japan use a learning management system (called *Gakushu e-Portal*, meaning *Learning e-Portal*) to help organise teaching and learning. Examples of these systems are *Open Platform for Education, L-Gate*, and *Manabi Pocket*.[9] These systems vary in detailed functions, but they are all cloud-based and single sign-on (SSO) enabled platforms, and offer access to the MEXT's new computer-based testing system (MEXCBT).[10] Some of them also display analytic dashboards, offer tools for schools to communicate with students or parents, and are interoperable with system-level administrative systems.

However, there is no direct MEXT involvement in providing, procuring, or subsidising one of these learning management systems.[11] These systems are developed by private companies (such as NEC Corporation or Uchida Corporation) and procured for schools by local governments – typically by municipalities (for primary and lower secondary education) or prefectures (for upper secondary education).

Other management support systems and assessment systems

Many schools procure and use further tools and resources for school management, such as customer relationship management systems and administrative function systems, to help teachers deal with academic affairs, keep students' health records, and so forth. Although not all schools are using these systems, their usage has increased over the past years. For instance, the proportion of schools using an administrative function system has increased from 48.7% in 2017 to 81.0% in 2022.[12]

While MEXT does not provide either kind of system, it promotes the use of administrative function systems. It also provides the National Assessment of Academic Ability (*Zenkoku Gakuryoku Gakushuu Joukyou Chousa*), a low-stake annual national standardised assessment of mathematics and Japanese language, taken by all students in the final years of primary and lower secondary education.[13] The assessment has so far been primarily paper-based, yet part of the assessment will be administered digitally from 2025 on. Although taking this assessment is optional in principle, all municipalities have opted for it, making it a de facto comprehensive system-level assessment.

In addition, in 2021 MEXT introduced MEXCBT, a computer-based testing system that students may use for self-assessment, covering many fundamental subjects at the primary and lower secondary levels including mathematics, Japanese and English language. Subjects at the upper secondary level will also be covered in the near future. Like the National Assessment of Academic Ability, MEXCBT is also optional. However, MEXT has been promoting its use for a wide range of purposes, for instance, for regular classes and home study, for annual nationwide academic achievement and learning situation surveys, and for local governments' own academic ability surveys.[14] As of June 2023, 25 000 schools and 8 million students and teachers were registered on MEXCBT.

Digital ecosystem for teaching and learning

Schools in Japan have a good degree of autonomy regarding their choice and use of digital educational resources, and they may autonomously procure various resources from private vendors, as well as other stakeholders. Still, there are several digital resources for teaching and learning that are publicly provided. All those publicly provided resources are classified according to a national taxonomy (at all educational levels) and tagged with codes specific to each subject of the curriculum. Teachers can thus search for the appropriate contents easily.

Several of the public digital teaching and learning resources are openly accessible to anyone in the country. The Japan Broadcasting Corporation (*Nippon Hōsō Kyōkai, NHK*), the country's main public broadcaster, delivers educational contents at the primary and secondary levels via their public radio and television channels. While those contents are neither created nor guided by MEXT, a large proportion is curated in accordance with the national curriculum. Information on these resources as well as other learning materials and educational programmes has been curated and offered on the Children's Learning Support Website.[15] Some municipalities also created and deliver educational contents via their own YouTube channels.[16]

Some digital teaching and learning resources are available only to those enrolled in formal education, and accessible through one of the learning management systems mentioned above (e.g. *Open Platform for Education, L-Gate,* and *Manabi Pocket*). These resources include both privately developed materials and applications – such as *Surala Drill,* an AI-powered, adaptive and interactive lesson drill – as well as publicly developed resources – such as MEXCBT.[17] Teachers can also add their own questions on MEXCBT and make them available to other teachers and students. In addition, a system-level online platform for teacher

professional development is forthcoming in April 2024, which will curate the contents offered by various educational stakeholders – from the National Institute for School Teachers and Staff Development and local boards of education to universities and EdTech companies – so that teachers can take necessary training anytime and anywhere.[18]

Beyond MEXT, other government ministries also have contributed to the digital teaching and learning resources. Under the *Learning Innovation* project, the Ministry of Economy, Trade and Industry (METI) has developed and launched several initiatives.[19] The *STEAM Library is* for example a collection of digital educational materials that are accessible by all students, teachers and parents, and used for learning in classes and for self-study at home.[20]

Enabling the use of digital tools and resources

Providing a public digital education infrastructure or funding to use digital resources does not necessarily mean that schools and teachers will use them. Different rules and guidelines are thus in place to support access to, and use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

While the Basic Act on Education (*Kyoiku Kihon Ho*) guarantees equal opportunities for receiving education for all citizens of Japan, no binding rule exists that *specifically* governs the equitable access to digital education and use of technologies in education. Nonetheless, the Japanese government has undertaken several efforts to enhance digital equity. Since 2019, a JPY 481.9 billion (USD 3.2 billion) investment has been made for the GIGA school digital learning programme, with a view to ensuring that students have access to digital education in a sustained and equitable way. As part of the GIGA programme, all students in compulsory education (primary and lower secondary) are offered a digital device (tablet or laptop) on a 5-year lease. For students with special educational needs and disabilities, assistive technologies are also offered, such as braille display, speech-to-text technology, or eyegaze system.[21] MEXT is also promoting the distribution of devices to students in upper secondary education, aiming to ensure that all upper secondary students will have received a device by 2024.[22]

The funding for the GIGA programme comes from the central government – from MEXT but also other ministries, such as the Ministry of Economy, Trade and Industry (METI). Until 2022, METI had subsidised EdTech businesses that provide services and contents to local governments and schools (e.g. learning management systems). Yet, making the actual choice of a digital device for students falls under the remits of municipality (for primary and lower secondary schools) and prefecture (for upper secondary schools), reflecting the varying regional priorities. On these publicly provided digital devices, students can access educational resources, such as learning management systems (e.g. *Manabi Pocket*) and MEXCBT. While providing a device to students is, technically, not mandatory, all local governments have opted to do so, creating a level playing field in terms of access to digital devices.

Besides the GIGA programme, MEXT's digital education strategies do not target a particular group, and the public responsibility to provide schools with access to the digital education ecosystem (software) is devolved to municipalities and prefectures, as already highlighted. Independent private schools are also in the same scope of the government, though. MEXT provides subsidies to private schools to partly cover the cost needed for preparing the necessary ICT equipment, including tablet devices for students. The way the support schemes for private schools operate may differ from those for public schools though.

To some extent, uneven access to digital learning platforms and resources in schools may remain an issue given that MEXT does not proactively monitor how schools internally manage and allocate their operating

budget for digital infrastructure. Nor does MEXT has the right to designate the use of funds held by municipalities and prefectures. Yet, MEXT conducts various surveys to ascertain the status of digital environment in schools and, where necessary, advises local governments on the use of their budgets for schools' digital infrastructure.

Supporting the use of digital tools and resources

All publicly provided or procured digital tools and resources, such as computer-based testing system (MEXCBT) and learning management systems (Learning e-Portals), are used on an opt-in basis. None of these tools and resources are mandated for use, though there is a reference on procuring and using a learning management system that complies with the government's standards, such as *Open Platform for Education, L-Gate* and *Manabi Pocket*.[23] Using these compliant systems allows end-users to access a wide variety of learning materials through a single sign-on (SSO) service without having to create separate credentials. MEXT also maintains a support website for MEXCBT to promote its use among students and schools.[24]

On digital teaching and learning resources, generally schools in Japan have practically approving authority regarding the choice, use, and procurement of the resources. The only exception is (paper and digital) textbook, as MEXT authorises and compiles a list of textbooks (*Textbook Catalogue*), which may then be adopted by local authorities. From this list, municipalities and prefectures choose one for public primary and secondary schools; for private schools, this decision is made typically by school principals. The central government bears the cost of textbooks for compulsory education (primary and lower secondary education).

From 2019, it has become possible to use digital textbooks in place of paper textbooks for parts of the curriculum. In addition, in 2023, MEXT has provided some digital textbooks (e.g. for English language) to all primary and lower secondary schools, and conducted surveys to assess whether they are being used effectively.[25] Findings from a recent MEXT survey shows that whereas only 7.9% of public schools used at least one digital textbook for students in 2020, the figure has risen to 36.1% by 2022.[26]

MEXT has also created an in-house ICT advisory board comprising highly qualified teachers, intellectuals, and experts in primary and secondary education. The board delivers lectures, seminars and webinars, as well as study tours for educational committees, schools and teachers, and explains how the stakeholders can use digital tools and resources and resources for education. In addition, at the municipal and prefectural levels, there are staff dedicated to supporting teachers to integrate digital resources into their teaching.[27] These supports are intended to support everyday use of ICT in education, and not limited to the publicly provided or subsidised resources.

Cultivating the digital competence of education stakeholders

In accordance with the Act for Enforcement of the Educational Personnel Certification Law, MEXT has stipulated key competences for the minimum level of practice expected of primary and secondary teachers, including their digital skills and competences. For instance, this comprises skills about the pedagogical use of digital technologies and managing educational data (e.g. study logs) as well as about teaching students how to use digital devices (including assistive technologies).[28] Universities providing teacher-training courses set up their teacher education curriculum based on these competences. Teachers then take competitive exams before they embark on teaching, and sometimes these exams include elements about digital competences (although this decision is made differently at the prefectural level).

For in-service teachers, as of 2023 there is no obligation to develop their digital competences. This may relate to the findings that around 30% of Japanese teachers are not confident in using ICT in class and nearly 15% of them do not use ICT for resource development, class preparation, assessment, or academic affairs.[29] MEXT has therefore developed the ICT supporter scheme. These "supporters" are employed by

private companies but dispatched to public schools by the government, to offer teachers professional support regarding the use of computers and software for teaching. Generally, one supporter is assigned to four schools. In addition, during the COVID-19 pandemic, extra measures were introduced to further enhance teachers' digital skills and ensure that teachers have the technique to teach students how to use digital devices and learn online.

In parallel, developing students' digital competences constitutes a core objective of the national curriculum, both in primary and secondary education. This may provide indirect incentives for teachers to develop their own digital skills and competences. The curriculum sets forth the fostering of "information literacy" of all students – defined as the abilities to search, organise, compare, share and use information, using appropriate technologies.[30] At the upper secondary level, the curriculum also underlines the need to develop students' broad understanding of network infrastructure, artificial intelligence (AI), and their economic and social consequences. While teachers in Japan are largely responsible for how the curriculum is actually taught in class, MEXT has published a *Handbook on Digitalisation of Education* to provide teachers with guidelines on using digital technologies in class, including their pedagogical use.[31]

The best practices of using digital technologies – by both students and teachers – are introduced and have been updated regularly since December 2020 on the MEXT's StuDX Style website, with a view to further encouraging the everyday use of digital device.[32]

Governance of data and digital technologies in education

Supporting the use of digital technology in education and the data it generates can only work if stakeholders recognise that this use will not work to their detriment. There are thus rules about governing their use in schools, protecting the data of education stakeholders, and promoting the interoperability across digital education ecosystem. No specific policy effort exists to regulate the use of automated decision-making, AI-powered algorithms, or digital proctoring in education. As of 2023 their use was very limited.

Protecting data and privacy of education stakeholders

In Japan, the *Act on the Protection of Personal Information* (APPI) is the primary data protection law that governs the handling of personal information (including education data when it constitutes personal information).[33] Enforced by the Personal Information Protection Commission (PPC), an independent government body, the APPI regulates the treatment of personal information – from identity data such as name and date of birth, to sensitive information such as ethnicity, medical history and criminal records.[34]

Until 2022, the APPI regulated only the personal information held by the private sector. The personal information held by the government bodies and incorporated administrative agencies were governed by two different laws, i.e. the *Act on the Protection of Personal Information Held by Administrative Organs* (APPIHAO), and the *Act on the Protection of Personal Information Held by Incorporated Administrative Agencie*s (APPIHIAA). An amendment in May 2021 has integrated those two acts into the APPI and stipulated a mandatory reporting of data leakage while placing more severe penalties for the non-compliance of PPC's orders.

Until 2023, the APPI only covered the handling of the personal information held by the government bodies and incorporated administrative agencies, but not the handling of personal information held at the prefectural and municipal level – such as the personal information held by local boards of education for the management of student name lists. With the 2021 amendment, however, local authorities have adopted the nationwide principles, and set up ordinances for implementing guidelines and executing the Act to optimise the administration of national data protection regulations.

With regard to the handling of educational data (including administrative data) containing personal information for research purposes, some exceptions are allowed under the APPI, such as the provision of

personal data necessary for academic research, upon request, by academic research institutions (except in cases where there is a risk of unjustly infringing on individual rights and interests). In addition, for statistical surveys conducted under the Statistics Act, third parties are not permitted to access raw data, except for the cases stipulated in the Statistics Act.

In terms of non-binding regulations, MEXT provides guidelines about the protection of data and privacy of students, teachers, and school staff, and continues to discuss the use of education data in expert meetings with various stakeholders (e.g. teachers, boards of education, researchers).[35]

Enhancing interoperability

While there is no binding regulation regarding the interoperability of digital technologies and data they generate, this is a crucial issue in Japanese education system given the diverse digital tools and resources developed by different companies. As part of the efforts to enhance interoperability, MEXT has therefore formulated the *Standard Model for Learning e-Portal*, a specific technical standard, which private companies providing learning management systems can follow.[36] Data can be transferred from one school to another as long as they use a system complying with this standard.

In addition, by aligning the meanings of education data, MEXT has sought to enhance the (semantic) interoperability of education data, such as personal information of students and teachers (e.g. gender, date of birth, teacher license date), information about schools (e.g. number of students, intellectual property rights), and the specific code assigned to schools and course curricula.[37] In establishing those interoperability standards, MEXT has engaged in international interoperability initiatives: for instance, when formulating the aforementioned standard model for Learning e-Portals, it referred to international standards such as the Learning Tools Interoperability (LTI) and Experience API (xAPI) standards.

Although schools are not mandated to use a learning management system compliant with MEXT's standards, many of them are (indirectly) incentivised to do so. For instance, MEXCBT is accessible through compliant learning management systems, and part of the National Assessment of Academic Ability will be conducted as a computer-based assessment, also via one of those systems. Still, there are a few schools using a non-compliant system.[38] Moreover, several upper secondary schools do not use a learning management system, because they are not part of the National Assessment of Academic Ability and so less incentivised to use such system.

Supporting innovation, research and development (R&D) in digital education

MEXT itself does not conduct academic research on digital education, nor does it have formulated research priorities in the field of digital education. Nor is there a specific research funding programme or rules on piloting technologies. That said, the National Institute for Educational Policy Research, MEXT's in-house research agency, established the Education Data Science Centre in October 2021, to conduct research and analysis on educational data use. In limited occasions, MEXT also provides monetary incentives to EdTech companies among others for developing educational software. For instance, they invested around JPY 600 million (USD 4 million) to commission the development of remote education model using advanced digital technology (such as Augmented Reality and Virtual Reality) for vocational education in the fiscal year 2022.[39]

As there is no centralised education database in Japan, no documentation of administrative data sets is available for the research community. However, as noted in the preceding section, some education data can be made available to the research community upon request, such as the data from the National Assessment of Academic Ability (subject to rigorous examination).

While there are no formal processes for the government to engage with EdTech companies, it does support and foster collaborations across schools, companies and other stakeholders. For instance, to accelerate the ICT development in schools, MEXT has allocated JPY 1.1 billion (USD 7.4 billion) to support selected schools in joining the Science Information Network (SINET), an academic network of more than 800 universities and research institutions in Japan.[40] In addition, the Ministry of Economy, Trade and Industry (METI) also runs several initiatives to promote partnerships between schools and the private sector. For instance, they subsidise small and medium-sized enterprises that develop and pilot education technologies for primary and secondary schools, so that schools can use them for free for a fiscal year. Albeit not specific to EdTech sector, METI*J-Startup* programme supports selected start-ups (e.g. through subsidies measures). METI also incentivises private sector innovation through R-D tax credits, while supporting the overseas expansion of domestic technology start-ups.[41]

Notes

[1] In Japan, the term “province” refers to an old administrative classification of regions, and it is thus no longer commonly used. Instead, the term “prefecture” is used to describe the current administrative classification of regions.

[2] In Japan, Vocational Education and Training (VET) is provided at the upper secondary and tertiary levels, in addition to being provided in various other situations through the cooperation between the relevant ministries and agencies. MEXT is mainly responsible for VET at schools and universities.

[3] Digital Agency: https://www.digital.go.jp/. For the policy document, see:

https://cio.go.jp/sites/default/files/uploads/documents/digital/20211224_policies_priority_package.pdf#58

A truncated English translation is also available at:

https://www.digital.go.jp/assets/contents/node/basic_page/field_ref_resources/0f321c23-517f-439e-9076-5804f0a24b59/20211224_en_priority_policy_program_02.pdf.

[4] The involved ministries are MEXT, the Digital Agency, the Ministry of Internal Affairs and Communications, and the Ministry of Economy, Trade and Industry. For the roadmap, see:

https://www.digital.go.jp/assets/contents/node/information/field_ref_resources/0305c503-27f0-4b2c-b477-156c83fdc852/20220107_news_education_01.pdf

[5] https://www.mext.go.jp/content/20221027-mxt_jogai02-000025395_100.pdf

[6] https://www.mext.go.jp/en/content/20200904_mxt_kouhou01-000008961_1.pdf

[7] As noted above, typically prefectures are responsible for upper secondary education including VET institutions at the upper secondary level, and municipalities are responsible for primary and lower secondary education – unless stated otherwise.

[8] In Japan, there is a national social security ID number system for all individual residents (both Japanese and foreign), under which they are allocated “My Number”, a unique individual number. While this number is used to track income, social security, taxes, welfare and benefits, it is not used in education system or linked with education data.

[9] Open Platform for Education: https://jpn.nec.com/educate/ope/index.html; L-Gate: https://www.info.l-gate.net/; Manabi Pocket: https://manabipocket.ed-cl.com/.

[10] See slide 26 from: https://www.digital.go.jp/assets/contents/node/information/field_ref_resources/0305c503-27f0-4b2c-b477-156c83fdc852/20220107_news_education_01.pdf

[11] MEXT is *indirectly* involved, however; for instance, by setting the previously mentioned standards or providing incentives. For more details, see the later section on *Ensuring access and supporting use*.

[12] See: https://www.mext.go.jp/content/20220908-mxt_jogai02-000024927_001.pdf for the figures on usage. For more detailed information on administrative function systems, see:

https://www.mext.go.jp/component/a_menu/education/micro_detail/__icsFiles/afieldfile/2018/08/30/1408684-001.pdf.

[13] They are 6th and 3rd years in primary schools and lower secondary schools, respectively. In addition, assessments of science and English language are conducted every three year, taken by all students in the same grades.

[14] https://www.mext.go.jp/a_menu/shotou/zyouhou/mext_00001.html#header1

[15] https://www.mext.go.jp/a_menu/ikusei/gakusyushien/index_00001.htm

[16] For instance, Sumida City and Yamagata Prefecture:

https://www15.j-server.com/LUCSUMIDA/ns/tl.cgi/https%3a//www.city.sumida.lg.jp/kosodate_kyouiku/kyouiku/school/oshirase/GIGA-school.html?SLANG=ja&TLANG=en&XMODE=0&XCHARSET=utf-8&XJSID=0

https://www.yamagata-c.ed.jp/ICT%E6%B4%BB%E7%94%A8%E3%83%BB%E6%83%85%E5%A0%B1%E6%95%99%E8%82%B2/

[17] https://surala-net.com/

[18] https://support2.mexcbt.mext.go.jp/files/04_%E5%95%8F%E9%A1%8C%E4%BD%9C%E6%88%90%E7%94%A8%E3%83%9E%E3%83%8B%E3%83%A5%E3%82%A2%E3%83%AB.pdf

[19] https://www.learning-innovation.go.jp/

[20] https://www.steam-library.go.jp/. STEAM is an acronym for Science, Technology, Engineering, Arts and Mathematics.

[21] MEXT does not directly fund schools themselves, but prefectures and municipalities. Then the local governments make decisions on which device they would buy

[22] https://www.mext.go.jp/content/20220324-mxt_shuukyo01-000020467_001.pdf

[23] There are learning management systems that do not comply with the government standards, such as *LoiLoNote* (https://n.loilo.tv/ja/), and schools are free to use them.

[24] https://support2.mexcbt.mext.go.jp/

[25] The law is *Act to Partially Revise the School Education Law* (学校教育法等の一部を改正する法律) formulated in 2019; while the guideline was first published in 2018 and revised in 2021. For further details, see: https://www.mext.go.jp/a_menu/shotou/kyoukasho/seido/1407731.htm.

[26] https://www.mext.go.jp/a_menu/shotou/zyouhou/detail/mext_00026.html

[27] For the examples of the supports, see:

https://www.mext.go.jp/studxstyle;
https://www.youtube.com/playlist?list=PLGpGsGZ3lmbBASFWjlRb6OAekj81r16K1

[28] https://www.mext.go.jp/content/20210630-mxt_kyoikujinzai01-000016500-14.pdf. See also the survey on teachers' ability to use digital devices: https://www.mext.go.jp/content/20221027-mxt_jogai02-000025395_100.pdf (p. 26-32).

[29] https://www.mext.go.jp/content/20221027-mxt_jogai02-000025395_100.pdf

[30] For the curriculum for different levels of education, see the followings:

Primary education: https://www.mext.go.jp/content/20230120-mxt_kyoiku02-100002604_01.pdf

Lower secondary education: https://www.mext.go.jp/content/20230120-mxt_kyoiku02-100002604_02.pdf

Upper secondary education: https://www.mext.go.jp/content/20230120-mxt_kyoiku02-100002604_03.pdf.

[31] https://www.mext.go.jp/a_menu/shotou/zyouhou/detail/mext_00117.html

[32] https://www.mext.go.jp/studxstyle/

[33] However, the Act does not apply to persons that do not fall under this definition (e.g. individuals handing personal information).

[34] https://www.cas.go.jp/jp/seisaku/hourei/data/APPI.pdf

[35] https://www.mext.go.jp/a_menu/other/data_00007.htm

[36] https://ictconnect21.jp/ict/wp-content/uploads/2023/03/learning_eportal_standard_V3p00.pdf. The latest version is 3.00, published in March 2023.

[37] https://www.mext.go.jp/a_menu/other/data_00001.htm. The latest version is 3.0. For the categories and codes in this standard, see: https://www.mext.go.jp/content/20221227-mxt_syoto01-000010374_10.xlsx.

[38] For instance, *LoiLoNote*: https://n.loilo.tv/ja/.

[39] https://www.mext.go.jp/content/20220418-mxt_syogai01-000022040_3.pdf

[40] https://www.sinet.ad.jp/en/aboutsinet-en

[41] J-Startup programme: https://www.j-startup.go.jp/

R&D Tax credit: https://www.meti.go.jp/policy/tech_promotion/tax.html

18 Korea

This note provides an overview of Korea's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Korea supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Korea engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- The Ministry of Education and its public agency, the Korea Education and Research Information Service (KERIS), own, provide and oversee a number of digital tools for system and school management, and a range of digital resources for teaching and learning. Three core infrastructure are: (1*) National Education Information System* (*NEIS*) that handles personnel affairs, teacher and school staff salaries, school and educational affairs as well as school meal plans, and provides students and parents with access to education-related information and school certificates; (2) *K-EduFine*, a budgeting, accounting and administration system; (3) *Edunet Teacher-Curriculum, Learning, Evaluation and Activity Resources* (*Edunet T-Clear*), a national teaching-learning centre responsible for providing digital teaching and learning resources.
- 17 local (metropolitan, municipal, provincial) Offices of Education also share some responsibility, along with the ministry, for providing digital infrastructure for system and school management (e.g. local maintenance of hardware infrastructure, managing day-to-day operations and financially contributing to the development and upgrade of digital systems).
- The access to, and use of, data and digital technology in education is regulated mainly by the ministry. The use of publicly provided tools for system and school management is mandatory, whereas the use of publicly provided teaching and learning resources is not. Schools and teachers may choose whether they will procure and use additional teaching and learning resources from commercial providers and other stakeholders. Some commercial tools (e.g. *Google Classroom, Microsoft Office, Naver Whalespace*) are procured by the local Offices of Education.[1]
- The Korean government has long pursued a digital education strategy. In 2023, the ministry of education established a new bureau dedicated to digital transformation of education. It also launched the *Digital Transformation of Education Initiative*, which targets the integration of advanced technologies like artificial intelligence (AI) to foster personalised learning experiences for every student within school settings. The initiative includes the development and dissemination of AI-embedded digital textbooks and the professional development of teachers to transform classes via digital technology.[2]

General policy context

Division of responsibility

In Korea, the Ministry of Education and its public agency, the Korea Education and Research Information Service (KERIS), are primarily responsible for providing access to the digital education infrastructure at all levels. They provide access to, and regulate and enforce the use of, digital tools for system and school management, while providing and promoting the use of digital teaching and learning resources. However, 17 local (metropolitan, municipal, provincial) Offices of Education also share some of this responsibility for both primary and secondary education, including managing day-to-day operation of the digital tools and resource platforms, locally maintaining hardware infrastructure, making financial contributions, and implementing guidelines and by-laws about access to, and use of, digital technologies in education within their jurisdiction.[3]

Compared to many other OECD countries, Korea seldom entrusts the responsibility for providing the digital education infrastructure to the private sector. The Ministry of Education owns and provides the majority of tools and resources prevailing in the country's schools. However, teachers may choose to acquire and use additional software or teaching and learning resources from private vendors and other educational stakeholders that provide them for free, such as KERIS, public broadcasting stations, universities, and the Korean Federation of Teachers' Associations. In addition, public school teachers in Korea transfer to

different public schools every 4-5 years, and they form peer study groups within and across the schools where they share with other teachers some of those resources and software.

Digital education strategy

Since 1998, the Korean government has been developing digital strategies for education, annually publishing (via KERIS) white papers on digital education.[4] Several local offices of education have also regularly published their own digital strategies, promoting the regional priorities.

During the COVID-19 outbreak, the Korean government made several changes to their digital education policies and expenditures, with a view to providing and enhancing digital hardware infrastructure. This had manifested in their efforts to improve broadband, Wi-Fi coverage in schools, and to furnish digital devices to schools and students. Specifically, a special COVID-19 fund, collected from the national treasury and local offices of education, was set up within the budget of the ministry to help students from low-income families. To ensure remote learning is available for all, the ministry also reallocated its budget for school outdoor activities and in-person events (e.g. field trip, sporting event) to the provision of hardware for students from disadvantaged groups (e.g. low-income and single-parent families, students in remote areas, etc.). In addition, early in the pandemic, the government set up public-private partnerships with the country's telecommunications service providers and private companies (e.g. KT Corporation, LG, Samsung Electronics, SK Telecom), renting 316 000 digital devices for free to the disadvantaged students, and supported them with a free mobile data plan for accessing education platforms (e.g. e-Learning Site, Educational Broadcasting System (EBS) online class) as well as with subsidies for Internet subscription. These supports are still ongoing with a view to promoting educational innovation.

Although improving hardware provision has long been a priority, and especially so during the pandemic, the country's most recent digital education strategy, published in 2023, pays a greater attention to (1) supporting the transition of teacher's roles from traditional lecturers to learning designers, coaches, and mentors, and (2) building an EdTech ecosystem that promotes the co-development of education and the EdTech industry.[5] *AI Digital Textbooks* that is to be introduced in 2025 will provide teachers with the data of learning process and outcomes of students, and provide students with intelligent tutoring systems and more personalised education.

To help enhance students' digital skills, the government has announced that coding class will become a compulsory subject for students at primary and lower secondary levels as of 2025, and the time dedicated to digital competence courses will double.[6] "AI pilot schools" that provide a diversity of AI-related education activities (e.g. teaching students how to programme AI) will continue to expand (their number increased from 247 in 2020 to 1 095 in 2022).

The public digital education infrastructure

Digital ecosystem for system and school management

Student information and enrolment system

In Korea, the central government maintains a central education database to generate educational statistics and a publicly available school information dashboard, the Education Information Disclosure System (*Hakgyo Allimi*).[7] To run the database and dashboard, the government uses a multi-faceted system called the National Education Information System (*NEIS*). The government provides and mandates the use of *NEIS* in both public and private schools at all levels of education.[8] *NEIS* combines the features of a student information system, a school administrative function system, a customer relationship management system, and a digital credential system, which are often separated in most other OECD countries. Therefore, *NEIS*

provides a large variety of functions. It assigns a unique longitudinal identifier for students and teachers, tagged with their Resident Registration Number (although RRN will no longer be collected from the summer of 2023).[9] In addition, it helps teachers and school staff to manage student admission and enrolment, record the students' standardised test results and teacher-given grades, track student progress and learning trajectory throughout the school year, and transfer student qualifications to other educational institutions (including colleges and universities) in the country. *NEIS* also contains some information about teachers and school staff (e.g. their salaries, expenses, and training and development records).

Due to the size and complexity of the system and its mandated use, *NEIS* provides different sign-in pages according to each user's role and position. The functions mentioned above are confined to teachers, school staff or officials in the ministry and local offices of education, and the type of information and function they can access varies depending on their entitlements.[10] *NEIS* also runs two public interfaces for managing relation with students and parents: *NEIS for students* and *NEIS for parents*, where students and parents can find or request information about, *inter alia*, their transcript, timetable, meal plan, school facilities, etc.[11]

Administrative management, online exam administration, and other support systems

While *NEIS* covers the widest range of functions for system and school management, the ministry additionally provides a tool called *K-EduFine*. This system combines formerly dispersed school administration and finance systems, and its use is mandated for budgeting, accounting, and several other administrative tasks, including the approval and transfer of official and work-related documents (e.g. manuals, information conferences, etc.), management of teacher and staff's schedule, and so forth.[12] The local offices of education are legally required to use *K-EduFine* too, but for different purposes, such as allocating funding to schools. A fraction of the information processed through *K-EduFine* is made available publicly via the Local Education Finance Information Disclosure System (*Jibang Gyoyuk Jaejung Allimi*), similar to the way (some) information from *NEIS* is made available publicly through the Education Information Disclosure System.[13]

Beside the digital tools to facilitate system and school management, the Ministry of Education also contributes to other components of the digital education ecosystem in Korea. For example, they conduct annually a National Assessment of Educational Achievement, which has been administered entirely as a computer-based assessment since 2022. This is a low-stake assessment, as the score does not contribute to the students' final mark, and it is taken only by students in certain years in sampled secondary schools; though, other schools can choose to opt into the assessment.[14]

The ministry has also set up two career guidance platforms. One of them is the Guidance for Dreaming Children (*Ggoomgil*), offering students enrolled in formal education at all levels with an opportunity to "try out" various careers; the other is *HIFIVE*, a guidance platform specifically for those planning to proceed to, or enrolled in, vocational education and training (VET).[15] In addition, there is another publicly provided career guidance platform, *CareerNet*, developed by the ministry and run by the Korea Research Institute for vocational education and training, providing anyone with a mapping of various universities, departments and related careers, and a career aptitude test.[16] Some local offices of education also provide their own career platforms for regional students (e.g. Incheon Cyber Career Institute).[17]

Digital ecosystem for teaching and learning

Compared to the provision of digital tools for system and school management, the ministry plays a less prominent role in the public provision of digital resources for teaching and learning. While it does offer such resources for free, schools have varying degrees of autonomy as regards their choice of providers and may prefer to use other resources. Still, many publicly provided resources are commonly used by schools and teachers. The vast majority of such public resources is provided via *Edunet T-Clear*, a platform through which multiple educational applications, including one of the two publicly provided learning management systems, can be accessed.[18] This system is *e-Learning Site* (e-*Hakseupteo*), which is used mainly by

primary and lower secondary school students.[19] Another publicly provided learning management system, not provided via *Edunet T-Clear*, is *EBS Online Class*, which has been set up jointly by the ministry and the Educational Broadcasting System (EBS), and used chiefly by secondary school students.[20] Both public learning management systems provide various static and interactive learning resources, real-time video classes, as well as an analytic dashboard that records students' learning trajectory. Meanwhile, the ministry of education plans to introduce AI-enhanced digital textbooks as of 2025, distinct from existing textbooks, to cater to individual students' capabilities and learning pace. These AI digital textbooks are developed by the private sector and approved by the government.

Examples of other *Edunet*-based applications include *Digital Textbooks* that provides e-textbooks, and *Wedorang*, an online learning community where teachers can share learning materials with students, have group discussions, and assign homework.[21] All tools and resources in this publicly provided and widespread digital ecosystem are available for free for teachers and students to use, and accessible through an *Edunet T-Clear* SSO service with a single *Edunet T-Clear* credential.

As remote learning became a new norm during the pandemic, however, the ministry and KERIS launched additional platforms for facilitating teaching and learning. They added more applications to *Edunet T-Clear*, such as the ICT-based Teacher Development Assistance platform (*ITDA*, meaning *to connect*), an online repository of public and private educational resources designed to help teachers create learning contents, and *Knowledge Spring* (*Jisik Saemteo*), a personalised and flexible teacher-training platform.[22]

Despite the remote learning features included in *Edunet T-Clear*, during the COVID-19 outbreak other private tools (e.g. Google Classroom, Zoom) proved to be the most widely used platforms by teachers for organising remote learning – illustrating the exercise of teachers' pedagogical autonomy and the idea that public provision and actual use are not always correlated.

Responsibility of local governments

While a large proportion of digital teaching and learning resources is provided by the ministry, local offices of education also contribute. They manage the day-to-day operation of *Edunet T-Clear* platforms, create some of the educational contents offered, make financial contributions to its central budget, maintain the hardware servers, and so forth. Some offices also provide their own platforms for supporting teaching and learning: for example, Incheon Metropolitan City offers the Incheon Education Platform to its students at all levels of education, and the Gyeongsangbuk-do province provides the Self-recognition of Academic Achievement platform for students at upper primary (3-6 grades) and lower secondary levels to self-assess their knowledge and obtain corresponding digital badges.[23] Using the local educational platforms requires a student to register with their (local) school information, keeping students from other regions from joining the platforms.

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily mean that schools and teachers will use them. Different rules and guidelines can therefore support access to, and the use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

Korea has made several efforts to ensure an equity of access to digital tools and resources in education. The public and centralised provision of digital tools for system and school management and resources for teaching and learning enables students, teachers and schools to access the digital education ecosystem

in a sustained and equitable way across all education levels. In the case of administrative tools, all schools have an equal access to the government tools, some of which they must use (e.g. *NEIS*).

Regulation on equitable access to educational opportunities at all levels of education provides an equity framework in the case of digitalisation, too. The digital divide is addressed through the provision of financial and educational support for the disadvantaged groups. For instance, from prior to the COVID-19 pandemic, the Korean government has long been providing disadvantaged students with access to relevant hardware. Between 2014 and 2018, around 733 000 students from the disadvantaged backgrounds (e.g. from low-income, single parent, North Korean refugee families) were supported with USD 1.6 billion. Students with special educational needs and disabilities have been offered customised support, such as alternative text, screen reading, sign language and subtitles, and assistive technologies (e.g. alternative mouse, digital therapy programme) to improve their accessibility to educational contents. In addition, albeit not specifically in the education context, the Intellectual Information Basic Act stipulates that the central and local governments may subsidise digital skills courses for the disabled, the elderly, or those from low socio-economic backgrounds (including students); or provide financial and technological supports to individuals or companies developing digital and information products, or enhancing their inclusivity, for the same groups.[24]

To ensure an even distribution of the digital infrastructure for education across schools and students (e.g. one device per student) while considering the regional variances, the ministry carries out consultations with local offices of education and schools. However, the responsibility for creating device purchase contracts and making decisions about distribution is shifted to the local offices of education (or sometimes schools), which can result in different devices being distributed across districts and schools. For instance, each office has its own procurement guidelines and specification requirements for the devices, leading to different decisions that may result in the distribution of varying types of devices across regions and schools (e.g. iPad or Galaxy Tabs vs. budget tablets).

Supporting the use of digital tools and resources

The Ministry of Education and KERIS directly provide a vast range of publicly owned digital tools and resources to support system and school management, as well as teaching and learning. The use of the publicly owned system and school management tools (e.g. *NEIS*, *K-EduFine*) is mandated across all schools (except for higher education and a few small-sized alternative schools): this ensures a universal use of the systems and makes the tools more efficient from a central perspective. The use of publicly provided resources for teaching and learning (e.g. *Edunet T-Clear*), on the other hand, is not mandatory. The ministry and local offices of education encourage their use in several ways, notably by providing guidance to teachers on how to use such resources, professional learning opportunities, and giving awards to teachers for exemplary use of such resources.

The ministry also supplements the publicly owned digital tools and resources with commercial licensed software, procured by the local offices of education. They typically negotiate special education pricing and contracts on several software. However, public procurement is reserved only for software that the offices of education consider of general importance (e.g. *Google Classroom*, *Microsoft Office*); for most other private resources for teaching and learning, schools procure them by themselves, using their own budget (planned and distributed by each local office of education).

Cultivating the digital competence of education stakeholders

In Korea, teacher-training institutions autonomously develop training courses in accordance with the ministry's detailed 'Teacher Training Certification Standards', which includes a knowledge area on digital education. The ministry also supports local offices of education by providing (non-binding) guidelines on the specific uses of digital technology in classes and on the further development of teacher digital competences as part of their in-service training (from which each local office develops and implements a

teacher training plan). Since the pandemic, the ministry has expanded their support for teacher training and the development of digital competences: for instance, they established *Knowledge Spring*, an Edunet-based teacher-training platform where teachers can voluntarily upload training courses and take courses uploaded by colleagues to strengthen their digital capability and remote teaching competence.[25] However, there is no obligation to use it. The ministry also operates a section within the *Knowledge Spring* platform focused on providing training on specific EdTech tools. Furthermore, as part of the *Digital-Based Education Innovation Plan* announced this year, Korea plans to train teachers who are to be at the forefront of digital pedagogical innovation. The plan will start by training 400 teachers in 2023, with a goal to expand this number to 2 000 by 2025.

Cultivating students' digital competences constitutes a key part of the national curriculum. The aforesaid digital competence courses are one of the compulsory subjects both in primary and lower secondary education, covering a range of topics – from computational thinking and AI to software use.[26] While this subject is not compulsory for students in upper secondary education and VET, a variety of elective courses about, *inter alia*, informatics, AI basics, information science, etc. are offered to them. During the pandemic, the ministry provided further supports, such as the EduTech Mentoring and Digital Tutorship schemes, which put pedagogical and digital leaders (such as qualified individuals and (under)graduates majoring in education) in touch with students in need of support. The inclusion of a digital competence subject provides incentives for teachers to develop their own digital competences as well.

Governance of data and digital technologies in education

National data protection and privacy rules, both in general (via the Personal Information Protection Act) and regarding student data and privacy specifically at all levels of education (via the Elementary and Secondary Education Act), regulate the use and sharing of education data. For instance, students' personal information, such as their health records, cannot be transferred to third parties without the consent from students, regardless of their age. The consent from parents (and legal guardians) is also additionally required for students under the age of 14.[27] Teachers and school staff's data and privacy, on the other hand, are protected by the general rule alone, but they have an obligation to take trainings related to the protection of their own data and privacy. The ministry also provides various guidelines to schools on data protection, privacy and online security, and carries out an annual inspection of schools' legal compliance as well as diagnosis of data protection conditions to ensure that personal information is kept secure and protected against unauthorised or unlawful processing.

The use of automated decision-making, AI-powered algorithmic model, or digital proctoring currently remains inexistent or limited.[28] Therefore, little policy effort or regulation governs these aspects. Yet, a new bill addressing the governance, human resource development, ethical guidelines, and other essential components for advancing AI education has been presented to the National Assembly (AI Education promotion Act). In August 2022, the Ministry of Education announced the world's first Ethical Principles of AI in Education.[29] In addition, there are non-binding guidelines about the efficiency and minimum performance standards of digital technologies used in education.[30]

To facilitate data portability across systems, the ministry provides guidelines that explain in detail the use of the single sign-on (SSO) system for *Edunet T-Clear* applications.[31] Rule governing the interoperability of digital technologies exist for all public institutions (and apply to public educational institutions as well).[32]

Supporting innovation and research and development (R&D) in digital education

In the last five years, the ministry has supported innovation, research and development in digital education in various ways. They have encouraged teachers to develop digital educational materials through *ITDA* and *Knowledge Spring*, and commissioned research in diverse areas of digital education to universities

and public research agencies (e.g. KERIS, KEDI).[33] For example, improving learning outcomes and student engagement, optimising student assessment and school management, supporting teaching, and helping students with special educational needs.[34]

In addition, under *the Act on Special Cases Concerning the Disclosure of Information by Education-Related Institutions* and relevant decrees, some education data can be made available for academic use to the wider public and private research community, including the publicly documented education data on the *Education Information Disclosure System* and the *Korean Educational Statistics Service*.[35]

In Korea, associations composed of EdTech companies are collaborating with the ministry of education and the ministry of trade, industry, and energy to promote the development of the EdTech industry and the use of technologies in education. One of their events, the EdTech Korea Fair, seeks to bring together a community of entrepreneurs, businesses, ministry officials and educators.[36] However, the ministry of education has mostly contracted research and development projects, as well as the development of specific digital tools for education, to public agencies (e.g. KERIS), and supported the industry through indirect and non-monetary ways. In response, the ministry established the *EdTech Promotion Plan* in September 2023 under a consensus that private-sector technology is essential for a successful digital transformation of education.[37] The plan aims to create an ecosystem where public education and the EdTech industry grow together on the basis of public-private partnership. Major tasks of the plan include (1) promoting the use of EdTech in schools, (2) fostering the EdTech industry in conjunction with public education, (3) expanding Korean EdTech exports, and (4) establishing a national-level EdTech support system. It is anticipated that private sector innovation and development in the digital education field will be incentivised.

Notes

[1] *Naver Whalespace* is an educational platform developed and serviced by the Naver Corporation, the Korean internet conglomerate.

[2] Please note that the ministry's most recent efforts may not be reflected in the following contents.

[3] For the full list of Offices of Education, see: http://english.moe.go.kr/sub/info.do?m=0803&s=english

[4] The English translation for the white paper has changed from "Adapting Education to the Information Age" (1998-2012) to "White Paper on ICT in Education" (2013-now). However, the original Korean title remains the same. These papers can be retrieved at: https://www.keris.or.kr/main/na/ntt/selectNttList.do?mi=1244&bbsId=1104#none

[5] This strategy is aligned with the Digital Transformation of Education Initiative and EdTech Promotion Plan of the Ministry of Education.

Digital Transformation of Education Initiative:

https://english.moe.go.kr/boardCnts/viewRenewal.do?boardID=265&boardSeq=94073&lev=0&searchType=null&statusYN=W&page=1&s=english&m=0201&opType=N)

EdTech Promotion Plan:

https://english.moe.go.kr/boardCnts/viewRenewal.do?boardID=265&boardSeq=96607&lev=0&searchType=null&statusYN=W&page=1&s=english&m=0201&opType=N

[6] Currently a minimum of 17 hours for primary school students, and 34 hours for lower secondary school students, and it will become 34 and 68 hours, respectively.

[7] https://www.schoolinfo.go.kr/Main.do

[8] The following laws and rules provide the legal basis for the operation and use of *NEIS*: (1) Article 23 of the Framework Act on Education (informatisation of education); (2) Article 25 of the Elementary and Secondary Education Act (school records); (3) Article 30-4, 5, 6, and 7 of the Elementary and Secondary Education Act (the development and operation of educational information systems); (4) the Ministry of Education's "Rules for Early Childhood Education Information System and Operation of Education Information System". In Korea, independent private schools are still (at least partly) funded by the government, and so considered as part of "public education" sector. Only a few small-sized alternative schools are exempt from the requirement to use *NEIS*.

[9] Resident Registration Number is akin to National Identification Number, issued to all residents of South Korea. This unique identifier on *NEIS* differs from their Resident Registration Number.

[10] For instance, ministry officials cannot check students' personal data, such as exam records.

[11] https://www.neis.go.kr/pas_mms_nv99_001.do

[12] The following laws provides the legal basis for using K-EduFine: (1) Local Education Subsidy Act; (2) Elementary and Secondary Education Act; (3) Framework Act on Education. Also, due to a corruption scandal over the account of several private kindergartens in 2018-2019, *K-EduFine* has since been mandated to be used by private kindergartens as well.

[13] https://eduinfo.go.kr/portal/main.do

[14] The sample is three per cent of all third-year (final-year) students in lower secondary schools, and of all second-year students in upper secondary schools.

[15] Guidance for Dreaming Children: https://www.ggoomgil.go.kr/front/index.do; HIFIVE: https://www.hifive.go.kr/index.jsp

[16] https://www.career.go.kr/cnet/front/main/main.do

[17] https://cyberjinro.ice.go.kr/intro

[18] http://www.edunet.net/nedu/main/mainForm.do

[19] https://cls.edunet.net/

[20] https://www.ebsoc.co.kr/. As a media company, the EBS is not classified as a public institution, but as an institution under the jurisdiction of the Korea Communications Commission, the country's media regulation agency. Although the EBS is not regulated by the Ministry of Education, it conducts *EBS Online Class* with funding from the ministry.

[21] Digital Textbooks: https://webdt.edunet.net/; Wedorang: https://rang.edunet.net/main.do

[22] ITDA: https://itda.edunet.net/intro.do; Knowledge Spring: https://educator.edunet.net/

[23] Incheon Education Platform: https://edu-p.ice.go.kr/index.do?sso=ok; Self-Recognition of Academic Achievement: http://edu.gyo6.net/onlinetest/info/main.do

[24] See https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EC%A7%80%EB%8A%A5%EC%A0%95%EB%B3%B4%ED%99%94%EA%B8%B0%EB%B3%B8%EB%B2%95

[25] This platform is expected to provide teachers with the opportunity to further their own development without being restricted by time, space and standardised institutional-led training modules, as they can flexibly select courses and training time to suit their own schedule and needs.

[26] Currently 17 hours for primary school students, and 34 hours for lower secondary school students, which will double from 2025. There is no rule for upper secondary school students.

[27] Unless required for law enforcement or public audit purpose, or the information is anonymised fully and provided for public research.

[28] Interestingly, the country's Open University has adopted digital proctoring methods for exams; but this is just an exception.

[29] The Ethical Principles of AI in Education:

https://english.moe.go.kr/boardCnts/viewRenewal.do?boardID=265&boardSeq=92458&lev=0&searchType=null&statusYN=W&page=3&s=english&m=0201&opType=N

[30] Smart School Environment Guideline 2.0:

https://keris.or.kr/main/ad/pblcte/selectPblcteETCInfo.do?mi=1142&pblcteSeq=13633

[31] Only the Edunet T-Clear applications (e.g. *e-Learning Site*, *Digital Textbooks, Wedorang*) can be accessed via this SSO service.

[32] The *Electronic Government Act*.

[33] See, for instance, Korean Educational Statistics Service: https://kess.kedi.re.kr/index;

KEDI: https://www.kedi.re.kr/eng/kedi/main/main.do

[34] See, for instance: Kim, Hyesook (2014) The effect of ICT utilisation on academic achievement – focusing on PISA 2012 data for Korea. Available at:

https://keris.or.kr/main/ad/pblcte/selectPblcteRMInfo.do?mi=1139&pblcteSeq=10980

[35] See https://law.go.kr/LSW/eng/engLsSc.do?menuId=2&section=lawNm&query=Act+on+Special+Cases+Concerning+the+Disclosure+&x=0&y=0#AJAX

[36] For instance, the website for 2022 fair: https://www.edtechkorea.or.kr/fairDash.do

[37] EdTech Promotion Plan:

https://english.moe.go.kr/boardCnts/viewRenewal.do?boardID=265&boardSeq=96607&lev=0&searchType=null&statusYN=W&page=1&s=english&m=0201&opType=N

19 Latvia

This note provides an overview of Latvia's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Latvia supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Latvia engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Latvia, in general, the responsibility for managing digital tools and resources for education is decentralised. The central government does develop and subsidise some centrally provided system management tools for all educational levels, including VET, but the municipalities are responsible for providing institutional management tools for school education and adult learning.
- The country's Digital Transformation Guidelines 2021-2027 define four main directions for transforming education in Latvia: 1) digitalisation of the learning process; 2) digitalisation of administrative processes (education management); 3) providing digital services based on data analytics; and 4) ensuring openness of educational data.
- Among others, the central government's priority is to develop an early warning that integrates learning analytics data to provide support to learners and prevent drop-out. The Digital Transformation Guidelines 2021-2027 also envision introducing Artificial Intelligence-based tools to support learning and assessment (e.g. distance learning).
- Providing every child with a digital device is an initiative that has a high priority on the educational policy agenda. The memorandum of co-operation "Computer for Every Child", signed in 2021, aims to provide a computer to each student and teacher in the country as well as establish computer libraries in schools.
- In terms of education stakeholders' data protection, there is the Personal Data Protecting Law, based on the EU General Data Protection Regulation (GDPR). Additionally, the State Data Inspectorate has developed guidelines about data protection of children and students in pre-school institutions and schools.

General policy context

Division of responsibility

In Latvia, the public responsibility for providing the digital education infrastructure is split between the central government and municipalities. The central government provides and subsidises digital tools for system management for all levels of school education and vocational education and training (VET), and it is also responsible for funding the acquisition of other digital tools (e.g. for institutional management or for teaching and learning) for VET and special education institutions. Municipalities are primarily responsible for providing or subsidising tools for institutional management and digital resources for teaching and learning for both school education and adult learning. In general, municipalities provide funding to schools, and schools can autonomously choose and acquire their chosen digital tools and resources. Despite this relatively decentralised approach to managing Latvia's digital education infrastructure, in recent years some aspects of the management and provision of digital tools have been centralised – for example, the provision of some teaching and learning resources by the National Centre for Education (a subordinate agency of the Ministry of Education and Science).[1]

Digital education strategy

There are several strategic documents guiding the implementation of digital transformation in Latvia. The National Development Plan 2021-2027 explicitly calls out education and digital skills as one of its priority education and science focus areas.[2] The Education Development Guidelines 2021-2027 consider digital transformation as a cross-cutting or horizontal priority in education, emphasising the added value of opportunities provided by technology and digitisation for transforming learning.[3] Finally, the Digital Transformation Guidelines 2021-2027 define four main strategic directions for transforming education in Latvia: 1) digitalisation of teaching and learning processes (e.g. simulations, virtual labs); 2) digitalisation

of administrative processes (e.g. by creating a modular Information System architecture); 3) enabling digital services based on data analytics (e.g. personalised learning); and 4) ensuring the openness of educational data.[4] In line with these strategic directions, the ministry is focusing on transitioning to digital state examinations, developing digital tools for system management (e.g. an early warning system, tools to forecast teacher supply and demand, etc.), bridging the digital divide between different regions of the country, and providing public and easily accessible information on educational institutions. The strategy also envisions introducing artificial intelligence (AI)-based tools to learning and assessment, for example via distance learning. A pilot project in collaboration with Riga Technical University was established in 2023 to conduct research in this area.

In the past five years, the central government has made significant changes to its policy on providing digital hardware infrastructure to schools. Providing every school child with a computer is a high priority on the educational policy agenda. The memorandum of co-operation “Computer for Every Child”, signed in 2021 between relevant stakeholders in the country including several Ministries, the Association of Local and Regional Governments and the country’s President and Parliament, aims to provide each student and teacher in the country with a computer by 2025 as well as establish a computer library in schools.[5] The REACT-EU (Recovery Assistance for Cohesion and the Territories of Europe) support measure "Digitisation of Educational Institutions" provides EUR 11 million towards funding the initiative, and in 2022, the government purchased 26 000 laptops for students primarily in lower secondary education (grades 7-9). The European Recovery Fund will also provide financial resources to purchase portable computers for vulnerable student groups (e.g. students from socio-economically disadvantaged backgrounds, students with special needs, etc.).

The ministry is also supporting municipalities in their education digitalisation processes by training educational IT administrators. Local governments are required to have a centralised digital administration, and they must now develop digitalisation plans to be included in their local education development strategies.

The public digital education infrastructure

The section below describes two aspects of the public digital infrastructure in Latvia: digital tools for system and school management, and digital resources for teaching and learning. In Latvia, the central ministry develops and subsidises some tools for system management, whereas the municipalities are generally responsible for providing and subsidising tools for school management and digital resources for teaching and learning.

Digital ecosystem for system and school management

Student information system

The ministry, supported by other government institutions, provides a centralised student information system (SIS) called *Valsts izglītības informācijas sistēma* (*VIIS*).[6] *VIIS* contains educational data related to school and VET education to facilitate policy planning and ensure children are registered in the education system. Based on *VIIS* data, municipalities (and the ministry) can develop and implement measures to improve the quality of teaching, and coordinate the establishment, reorganisation or closure of municipal educational institutions. *VIIS* comprises several databases including a register of educational institutions, a teacher register and student register for all students in compulsory education, as well as others related to tertiary education. Dashboards are accessible online. Students have a unique and longitudinal identifier in the student register (that is also connected to the digital personal database of the Office of Citizenship and Migration Affairs), and data from the student register can be connected to information in the other databases via students’ learning records.

Administrative and admission management systems

The *VIIS* system can also be used to facilitate administrative management functions. For example, the central government allocates funding to schools through *VIIS* and municipalities use the same system to pay salaries to teachers.

The ministry is developing an early warning system, *Risku identificēšanas rīks* as well as a demand-and-supply forecasting system to manage teacher demand called *Pedagogu pieprasījuma – piedāvājuma prognozēšanas rīks*.[7] Municipalities mainly provide schools with student admission systems (but these are not integrated within any central system).

Learning management systems

Most schools in Latvia acquire their learning management system (LMS) from private companies (e.g. *e-klase* in schools or *mykoob* in VET institutes).[8] The *e-klase* LMS allows students and parents to see student grades in all subjects, read teacher reports, see important reminders, follow students' classes, homework assignments and lesson topics, as well as communicate with teachers and other parents via a customer relationship management functionality. *Mykoob* similarly enables authorised users to follow student classes, grades, homework and attendance, and communicate with other users. These learning management systems are not necessarily interoperable with publicly provided management systems, but they allow the transfer of student data on assessments and attendance, as well as some teacher-given grades, to Latvia's student information system (*VIIS*). Privately acquired LMS tend to be interoperable with other private platforms that produce teaching and learning materials.

The National Centre for Education (a subordinate institution under the ministry) does however publicly provide a Moodle-based virtual learning environment for students at all educational levels, *skolo.lv,* that contains learning content mapped to the curriculum. The platform enables students to create portfolios of their work and teachers can provide feedback and view analytics data on their students' engagement. All schools that implement the general curriculum have access to *skolo.lv*. However, *skolo.lv* does not enable teachers to grade students' work nor does it provide a customer relationship management function. As such, many schools choose to acquire additional tools from private companies (like those described above).

Examinations, digital credentials and career guidance

The National Centre for Education currently provides an AI-based proctoring system, *ProctorEdu.com*, for online exams for various Olympiads (competitive but low-stakes) for secondary education student that is integrates into the Moodle LMS system used to organise the online Olympiads. The monitoring tool features desktop, audio and video recording, as well as biometric verification of users' identity and real-time behavioural monitoring of sessions (among other features). However, the system currently is not designed to be used for larger-scale, high-stakes state examinations. While some national examinations are currently administered online, the ministry plans to significantly increase the share of computer-based assessments in the country.

The State Education Development Agency (also housed within the ministry) maintains the *National Educational Opportunities Database* (*NIID.lv*), a careers guidance platform that provides information to students about study programmes of schools at different educational levels and VET institutes.[9] It also offers relevant articles, infographics and career choice tests.

Digital ecosystem for teaching and learning

Digital teaching and learning resources for formal education

The ministry is less active in the public provision of digital resources for teaching and learning, although the Moodle-based virtual learning environment, *skolo.lv*, provided by the National Centre for Education contains learning content (in both static and interactive formats) is mapped to the curriculum.[10] Teachers can readily use resources designed by experts, or modify and create their own. Additionally, teachers can access guided and self-directed professional development content on the platform.

The National Centre for Education also publicly provides the *tavaklase.lv* study platform that is accessible to the general public.[11] This platform contains video-based learning materials for school subjects, mostly targeted at the primary level but including some at the secondary level. It was initially developed as a public resource to support distance learning during the COVID-19 pandemic, but the ministry subsequently decided to allocate additional funding to further develop the platform into an online learning environment.

A different open-source platform provided by the National Centre for Education, *mape.skola2030.lv*, provides teachers with digital teaching and learning materials and sample tests, as well as practical guidance on teaching.[12]

Self-assessment tools

The European Commission's *MyDigiSkills* tool targeting the self-assessment of digital skills has been translated into Latvian and made openly available by a non-governmental IT organisation, the Latvian Information and Communications Technology Association.[13] The tool enables individuals to evaluate their skills in the areas of information and data literacy, communication and collaboration, digital content creation, online safety and problem solving.

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

Providing a public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

The 1998 Education Law defines rules around the provision and accessibility of teaching aids including electronic resources, interactive learning platforms, digital and online games, learning management systems, and learning and communication software.[14] The Law defines that the central government is responsible for the overall regulatory framework while local governments are responsible for ensuring the accessibility and availability of digital technologies to schools. However, as described above, in some cases the central government also provides digital tools and resources to schools.

The government in Latvia aims to implement policies and support programmes that will improve the equitable access to digital tools and tools for all students, teachers and schools around the country. For example, the "Computer for Every Child" initiative aims to provide each student and teacher in the country with a computer by 2025. Within the framework of the government's broadband Internet network implementation programme, schools without optical Internet can also be provided with access.

Supporting the use of digital tools and resources

Municipalities provide information resources and advice to schools and teachers on the use of digital tools and teaching and learning resources. The National Centre for Education in co-operation with municipalities across the country also aim to create a network of digital "teacher champions": by the end of 2022, about 1 370 "IT mentors" had been trained to support other teachers with integrating digital technologies into their teaching practices[15].

Various non-governmental stakeholders also support the use of digital tools in education. Ventspils High Technology Park, in co-operation with Ventspils University College and the Latvian Electrical and Electronics Industry Association (LETERA), offers the "Future Class" as a prototype for schools and educational technology developers, providing an opportunity to model a technology-based process in a real classroom environment within practical lessons.

The procurement of public digital technology for schools by the ministry is organised in compliance with the Public Procurement Law.[16] In addition, the Ministry of Environmental Protection and Regional Development has developed public procurement guidelines in the specific context of Information and Communication Technologies.[17] These regulations and guidelines include criteria with regard to the interoperability, sustainability and security of publicly procured digital tools and resources. Educational institutions have full autonomy over the procurement of additional digital tools and resources, but the government also provides institutions with procurement guidelines.

Cultivating the digital skills of education stakeholders

In Latvia, there are rules related to the digital competencies of teachers, which are described in the national "Standards of the Teaching Profession".[18] The Standards define expected teacher competences in the context of using digital technologies for teaching. Various government institutions or agencies have also developed guidelines and recommendations for teachers and schools on specific uses of digital technologies in class, notably on the use of technologies in different contexts or providing methodological recommendations for strengthening students' digital skills.[19] The Latvian government also subsidises continuous professional development courses for teachers focused on information and communications technology (ICT).[20]

Latvia has a national target to ensure that at least 70% of adults have basic digital skills by the end of 2027. The laws covering State Basic Education Standards and Programmes and State General Secondary Education Standards and Programmes both explicitly identify digital literacy as one of six, core transversal competencies that should be developed through education, and the broader field of technology (design and technology, computers and engineering) represents one of the seven fields of study that should be offered to students.[21] The regulations came into force in September 2020 and the National Centre for Education defined learning outcomes in digital competencies for students in the 3rd, 6th, 9th and 12th grades respectively.

Governance of data and digital technology in education

The country's Personal Data Protection Law, based on the EU General Data Protection Regulation (GDPR), provides for the general protection of personal data and privacy in Latvia.[22] In the context of education specifically, the State Data Inspectorate has developed guidelines on data protection for children and students in pre-school institutions and schools.[23] The Association of Certified Personal Data Protection Specialists of Latvia has also identified common problem situations on the use and protection of children's data in schools and has developed public guidelines on data processing in educational institutions.[24]

In Latvia, the law on State Information Systems requires a certain level of interoperability and openness in public information systems, including those used in the education system.[25] Regarding openness, the law

stipulates that certain aspects of data from such systems must be classified as generally available information and published in the Latvian Open Data Portal.[26] The central government aims to engage in international initiatives to facilitate interoperability between different digital systems, for example by joining the Nordic-Baltic project on cross-border data exchange.[27]

More broadly, the Ministry of Environmental Protection and Regional Development (the main body responsible for digitalisation and digital governance in the country) is currently developing general ICT policy and governance principles for digital governance in all public areas, from the development of common national strategic development principles to operational co-ordination and maintenance policies. This includes the development of regulations and recommendations on the accountability of digital technologies and standards of performance of digital technologies.[28]

Proactive mechanisms for enforcing the rules on the use of education data and digital technology are enacted through the Regulation on the State Education Information System.[29] The Regulation enforces the use of VIIS, the centrally provided information system in education, by all education institutions for reporting statistical data as well as providing data that are used to calculate state funding for teachers' salaries.

Supporting innovation and research and development (R&D) in digital education

The Digital Transformation Guidelines 2021-2027 acknowledge that public-private partnerships are required to achieve the goals of the strategy, namely co-operation between the ministry and its agencies, EdTech entrepreneurs, higher education institutions and international organisations.[30] One example of such a partnership is the collaboration between government institutions under the ministry with the IT Education Foundation (e.g. collaboration to develop a new computer science curriculum).[31] The government provides monetary incentives for the development of digital learning resources for all educational levels by public or private organisations. In the context of VET, it also provides monetary incentives for the development of digital learning resources by individuals, as well as the development of educational software. It also incentivises research and development on educational technologies through a general tax credit scheme for business R-D costs.

There is no specific public agency that specialises in monitoring or conducting research on digital education in Latvia. During the COVID-19 pandemic, the ministry surveyed schools on the availability of digital equipment but such surveys are no longer being conducted.[32] The Central Statistical Bureau does however provide statistics on the digital infrastructure of general schools that are publicly available.[33]

The education faculty of the University of Latvia also actively conduct research and organise conferences on the digital transformation in education. Educational specialists from European countries are invited to present on a variety of related topics, including online media literacy, AI and learning analytics, educational robotics, virtual and augmented reality in teaching and learning, and gamification, among others.[34]

Notes

[1] https://www.visc.gov.lv/en

[2] https://www.pkc.gov.lv/sites/default/files/inline-files/NAP2027_apstiprin%C4%81ts%20Saeim%C4%81_1.pdf

[3] https://likumi.lv/ta/id/324332-par-izglitibas-attistibas-pamatnostadnem-20212027-gadam

[4] https://likumi.lv/ta/id/324715

[5] https://www.baltictimes.com/memorandum_of_co-operation__computer_for_every_child__signed_at_riga_castle/ ; https://www.president.lv/lv/media/90946/download

[6] https://www.viis.gov.lv/

[7] https://www.izm.gov.lv/lv/jaunums/veidos-izglitibas-kvalitates-risku-identificesanas-sistemu

[8] https://www.e-klase.lv/par-e-klasi/buj/lv/vecakiem ; https://login.mykoob.lv/#/lv

[9] https://niid.lv/

[10] https://skolo.lv/

[11] https://www.tavaklase.lv/

[12] https://mape.skola2030.lv/

[13] https://mydigiskills.eu/lv/

[14] https://likumi.lv/ta/en/en/id/50759-education-law

[15] https://www.skola2030.lv/lv/skolotajiem/izglitibas-tehnologiju-mentori

[16] https://likumi.lv/ta/en/en/id/287760-public-procurement-law

[17] https://www.iub.gov.lv/lv/jaunums/izstradatas-publisko-iepirkumu-vadlinijas-informacijas-un-komunikacijas-tehnologiju-joma

[18] https://registri.visc.gov.lv/profizglitiba/dokumenti/standarti/2017/PS-138.pdf

[19] Latvian Safer Internet Centre: https://drossinternets.lv/lv/materials/download/metodiski-ieteikumi-skolenu-digitalas-lietpratibas-stiprinasanai, https://drossinternets.lv/en/info/about-us;
IT learning guidelines produced by University of Latvia: https://www.siic.lu.lv/fileadmin/user_upload/lu_portal/projekti/siic/Kolektiva_monografija/8-nodala-Macisanas_Lietpratibai.pdf;
Others on use in sport and for well-being: https://skola2030.lv/lv/jaunumi/blogs/digitalas-tehnologijas-sporta-un-veseliba

[20] Example of professional development on ICT: https://zrkac.lv/index.php?view=projekti&id=21

[21]https://likumi.lv/ta/en/en/id/303768-regulations-regarding-the-state-basic-education-standard-and-model-basic-education-programmes ; https://likumi.lv/ta/en/en/id/309597

[22] https://likumi.lv/ta/en/en/id/300099-personal-data-processing-law

[23] https://www.dvi.gov.lv/lv/bernu-dati-skolas-un-bernudarzos

[24] https://datueksperti.lv/site/images/Skolu_Vadlinijas_FINAL_31-10-2019.pdf

[25] https://likumi.lv/ta/en/en/id/118986-general-technical-requirements-of-state-information-systems ; https://likumi.lv/ta/en/en/id/62324

[26] https://data.gov.lv

[27] https://vm.fi/en/world-s-smoothest-cross-border-mobility-and-daily life-through-digitalisation

[28] https://www.varam.gov.lv/lv/ikt-arhitekturas-vadlinijas.

[29] https://likumi.lv/ta/id/307796-valsts-izglitibas-informacijas-sistemas-noteikumi

[30] https://likumi.lv/ta/id/324715-par-digitalas-transformacijas-pamatnostadnem-20212027-gadam

[31] https://www.startit.lv/lv/about-foundation

[32] https://edurio.lv/izm-gada-nosleguma-aptaujas

[33] https://data.stat.gov.lv/pxweb/en/OSP_OD/OSP_OD__sociala__izgl__vispskolas/IZG150.px/

[34] https://www.ppmf.lu.lv/fileadmin/user_upload/lu_portal/projekti/ppmf/Konferences_Seminari_Lekcijas/LU_80.konference/Programmas/Program__Digital_Transformation_of_Education.pdf

20 Lithuania

This note provides an overview of Lithuania's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Lithuania supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Lithuania engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Lithuania, the government provides some of the components of the country's digital infrastructure for education. Except for system management tools, their use is rarely mandated. Schools and teachers have freedom to acquire additional digital tools.
- Public responsibility for operating primary and secondary schools are devolved to municipalities – excluding secondary VET schools, operated at the central level. The central government focuses on reducing the equity gaps across municipalities, by ensuring equal access to the digital ecosystem of tools, providing both open-access and free licensed resources, offering guidance and support on procurement, and targeting specific schools or groups of students. Other policy levers to foster the uptake of digital tools are in the hands of municipalities and schools, especially as regards curriculum implementation and teacher training requirements.
- Lithuania incentivises the development and uptake of innovations by bridging the research, EdTech and education sectors, awarding competitive grants to organisations, subsidising EdTech companies and facilitating their collaboration with schools.

General policy context

Division of responsibility

In Lithuania, the Ministry of Education, Science and Sport (hereinafter "the ministry") is responsible for outlining the general education strategy, devising education policy, preparing relevant legislation, issuing regulations, and planning reforms across all levels of education. While the ministry is entirely responsible for the operation of VET schools, this responsibility is shared with municipalities in primary and secondary education. This devolved context has shaped how public responsibilities for providing access to, supporting the uptake of, and regulating the use of digital technologies in education are assigned. Part of the digital education infrastructure is provided centrally, but a large proportion is acquired locally at the municipal level. Though, the central ministry is the sole public provider of digital tools for system management (e.g. student information system, admission management system), whose use is compulsory across all levels of education. Conversely, providing access to tools for institutional management or resources for teaching and learning is a responsibility shared between the central government (for VET) and municipalities (for primary and secondary education). Schools and teachers also have full autonomy to use and complement the publicly provided tools and resources at their discretion.

Regulation around the access to and use of digital tools and data in education generally falls within the remit of the central government, although specific rules and further guidelines may exist at the municipal level for primary and lower secondary education.

Digital education strategy

In Lithuania, the Ministry of Economy and Innovation is in charge of the digital transformation of the country. Based on the Lithuanian *Industry Digitisation Roadmap 2019-2030*, the government has established *Pramonė 4.0* ("*Industry 4.0"* in English), a national digitalisation platform that stimulates dialogue about digitalisation between stakeholders across different sectors (e.g. the industry, the research community, education and the government).[1,2] This 2019-2030 Roadmap looked at digitalisation as an integral component of education that is expected to help improve the current and future employees' digital skills and equip them with better (digital) skills for the (future) labour market. Recently, a State Digitalisation Development Programme has updated those objectives for the 2021-2030 period.[3]

In terms of education-specific digital strategy, the Ministry of Education, Science and Sport has recently released a White Paper on EdTech describing the government's ambition for the sector's digitalisation.[4] The strategy sets out national objectives to be achieved in the next years, sets indicators to monitor progress and envisions possible futures. Its release was accompanied by the production of guidelines for digital education.[5]

Beyond devising strategic plans, the central government is also responsible for ensuring schools have sufficient hardware infrastructure – although, similarly to software tools and digital resources, schools ultimately decide to use the equipment provided or not. As in many other OECD member countries, during the COVID-19 outbreak the Lithuanian government made substantial investments in hardware infrastructure in schools across all levels of education, including expanding Wi-Fi and mobile connection, providing computers and mobile devices in schools, and offering computers, tablets or mobile devices for students with special education needs. Together with longer-term investments towards enhancing Internet access and speed in institutions or more advanced digital teaching equipment (e.g. interactive whiteboards, simulation tools), those are policy efforts the central government aims to sustain in the years to come through specific programmes, partly supported by procurements made at the municipal levels.

The public digital education infrastructure

As a combined result of the decentralised provision of digital infrastructure in education and the autonomy granted to educational institutions in Lithuania, only a part of the digital ecosystem to which schools have access is *publicly* provided, let alone by the central government. Instead, except for the system management tools, schools, teachers and students tend to use digital tools and resources that are provided by private EdTech companies or made available freely by universities, teachers and teacher unions (and, to a lesser extent, by philanthropists, education publishers and companies).[6]

This section reviews two aspects of the public digital infrastructure in Lithuania: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management system

ŠVIS (*Švietimo Valdymo Informacinė*), the central government's student information system, is the cornerstone of the public digital infrastructure for system management in Lithuania. Although *ŠVIS* is built from *IBM Cognus*, a commercial tool, it is publicly owned by the government and the data are stored on the ministry's servers. *ŠVIS* exchanges data with databases from the student register system that contain statistical information related to all levels of education, including higher education, with data about schools, teachers, and students. Teacher and student data are pseudonymised: individuals are linked to their national personal ID number, which is unique, longitudinal and confidential, but different from their personal educational ID. The system stores students' standardised assessment results, as well as teacher-given grades in upper secondary education and VET (from non-standardised exams). *ŠVIS* is updated in real time so that authorised users, be they administrators, school principals, or teachers, have access to analytics dashboards quickly after the information is collected.

The government uses *ŠVIS* primarily to manage and monitor the education system, compute statistics and derive indicators for supporting educational reform discussions in Lithuania. *ŠVIS* data can be linked to data coming from other central registers that use the same unique and longitudinal ID, such as the population register, the health system register, or the social insurance system register.[7] Some of those data, pseudonymised, are also openly available on public dashboards (such as the *open data portal*), while other parts are only available upon request from government officials or researchers. The central

government also uses the information collected though *ŠVIS* to report and announce job opportunities for teachers and school principals. As of 2023, government officials estimate that *ŠVIS* is yet to be used at its full potential.

No learning management system (LMS) is publicly provided to schools. Instead, schools acquire learning management systems sold by commercial providers. The most widely used learning management systems are *Google Classroom*, *Microsoft 365 for Education*, and the Lithuanian tools *TAMO*[8] and *Mano dienynas.*[9] Those tools fulfil the core functionalities of a learning management system (student management, calendar, content repository, etc.), but also other functionalities, such as that of an administrative function system or of a customer relationship management system (CRMS). For instance, *TAMO* includes functions such as lesson scheduling, gradebook, homework assignments, attendance tracking, data storage, calendar, analytics, etc. Additionally, *TAMO* provides a mobile application that tracks student progress in real time, including school activities, and provides statistical analysis of data, showing positive or negative trends in their learning. Other schools use *Mano dienynas*, which is more of an electronic diary that allows to see class schedule and daily events. Parents can access it to see their child's learning progress, compare it with the class average via analytics reports, and communicate with different school staff. Alternatively, schools have also access to a version of *Moodle* that was customised for them by Kaunas University of Technology under the publicly funded Digital Transformation of Education Consortium.[10]

There is a protocol to make the various learning management systems interoperable with *ŠVIS* to facilitate data transfers. Agreements were made on the transfer of student grades from *TAMO* or *Mano dienynas* to *ŠVIS*.

Admission, study guidance and career opportunities

The Association of Lithuanian Higher Education Institutions for Centralised Admissions *(Lietuvos aukštųjų mokyklų asociacija bendrajam priėmimui organizuoti* or *LAMA BPO*), the student admission management system used in VET (and in higher education) is another example of a digital tool developed by a private vendor but managed by the central government at the system level.[11] Students use *LAMA BPO* to apply for their admission to VET institutions, as well as to higher education institutions. Institutions also use it to select and process students' applications against their own criteria. The platform provides information about the institutions and programmes to which students can apply, such as entrance exams, required application documents and application deadlines.

Students interested in VET can find study and career guidance on *Atvira Informavimo Konsultavimo Orientavimo Sistema*, or *AIKOS*.[12] *AIKOS* is another platform at the central level operated by the ministry's National Agency for Education (*Nacionalinė Švietimo Agentūra*, or *NŠA*). Via a search engine, *AIKOS* hosts counselling services and general information about VET-related professions, qualifications, study, and training programmes, and about VET institutions and their admission rules.

In primary and secondary education (except VET), municipalities provide schools with their own student admission management systems. Starting from 2024, the government has planned to develop a central system for school admission management at all levels of education that will allow tracking students' data and make their transition easier when they move from a school in one municipality to another.

Exams and assessments

The ministry has been engaged in the digitalisation of both the national student evaluations and the end-of-course exams.

As of 2022, several parts of the national student evaluations – which are low-stakes for students and carried out every two years in grades 4, 6, 8 and 10 (primary and secondary education) for system monitoring – are administered online, mainly in mathematics and in Lithuanian. Similarly, some parts of

the final exams in upper secondary education and VET – high-stakes for students – are administered online.

In both cases, the ministry uses the *NECIS* (national examination centre information system), an open-source digital system for assessment administration provided by TAO ("*Test Assisté par Ordinateur*", or computer-based assessment), a Luxembourgish service provider known for its open assessment technologies that are now used in 194 countries.[13] By 2026, after the end of the pilot phase, the objective is to fully digitise both types of assessments, so that exams and evaluations are entirely administered, taken and graded online through digital assessment platforms such as *TAO*.

Digital ecosystem for teaching and learning

In Lithuania, teachers have full autonomy in terms of choice and use of digital tools for teaching and learning, as much as schools have autonomy in terms of choice and use of digital tools for institutional management (see the example of the LMS above). In this context, the ministry still provides teaching and learning resources though. Part of those resources are made openly available to anyone, while others are restricted to individuals enrolled in the education system. In either case, there is no obligation to use them.

In terms of openly accessible resources, the ministry's national agency for education maintains *Svietimo Portalas*, a repository of open educational resources targeted at primary and secondary education levels and available to everyone.[14] On *Svietimo Portalas*, interested actors can also find information to develop their own educational resources and make them available for free. To add to those resources, during the COVID-19 pandemic the government also offered state TV education for secondary students, whose content is still available online at *lrt.lt*.[15] Finally, the ministry also openly provides a comprehensive digital self-assessment system, *Informacinę testavimo sistemą*, that targets primary and secondary education levels and covers a wide range of subjects (mathematics, languages, history, biology, information technology, etc.).[16] Those resources are a mix of static (e.g. textbooks) and interactive digital resources (e.g. adaptive assessments, simulations), including support tools for students with special needs (e.g. assistive technologies);[17] and a mix of publicly developed (e.g. by the ministry) or publicly procured (e.g. from private vendors) resources.[18]

In addition, the ministry publicly provides digital teaching and learning resources that are only accessible to individuals enrolled in the formal education system. Most notably, the ministry has secured access to the *Microsoft 365 for Education* tools for all public schools. Anyone in those schools, from school principals to teachers and students, have free access to a wide range of digital tools for teaching and learning covered by *Microsoft 365*, including virtual classroom environments, which they can decide to use or not.

The ministry has also developed an online platform for teacher development that also features teaching vacancies in schools.[19]

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

Ensuring access and supporting use

Equity of access

In Lithuania, the government has set up several policy mechanisms to ensure that everyone has equitable access to the digital education ecosystem, or at least to the ones that are publicly provided.

First, the tools that the government uses or publicly provides, such as the tools for system management (e.g. the student information system, the student admission management system in VET), or the digital resources for teaching and learning (e.g. free licences to *Microsoft 365* resources), are made available to all schools, public or private (and, in fact, to anyone interested in the case of open education resources).

Second, in some situations where it is not the government's responsibility to publicly provide a specific digital tool, as is the case with schools' choice of learning management systems for instance, the government may nonetheless ensure that there is a public or open alternative available, such as the open version of *Moodle* that the public Kaunas University of Technology has designed to meet the needs of Lithuanian schools.

Further to providing equal access, the government has identified students with special needs, students from low socio-economic background, and schools in rural areas, as three priority targets in terms of ensuring equity of access to education, including digital education. The *Millennium Schools* programme is an illustration of the government's aspiration to tackle student achievement gaps.[20] First implemented in 2022 in smaller schools and expected to be rolled out over a four-year timeline, the programme aims at ensuring equal and high-standard conditions for learning for every student in every municipality of Lithuania through differentiated investments in the modernisation of schools.

Finally, the central government regularly invests in hardware infrastructure to improve Internet speed and access in schools. During the COVID-19 crisis, those investments benefitted public and private schools alike, and also targeted students with special needs. However, government officials acknowledge that there remains a large variance between schools in terms of the access to digital technology (for instance, between rural and urban schools). As the government's attempts to ensure equitable access and use in class are taking the form of guidelines, rather than being mandated as rules, achieving equity still depends on school principals.

Having equitable *access to hardware* infrastructure does not necessarily lead to equity in the *use of software* tools either. The sections below describe what efforts Lithuania deploys to measure and bridge the gap between the availability and uptake of digital technologies in education.

Supporting the use of digital tools and resources

The ministry uses both direct and indirect incentives to support the use of digital tools at the system, school, and classroom levels.

First, the ministry mandates the use of the tools for system management that it directly provides, through binding regulation. Schools are required to use *ŠVIS* to transfer their student data to the central databases for instance, which incentivises them to collect and process student information in a digital format accepted by *ŠVIS* in the first place, ultimately incentivising the use of digital tools at the institutional level.

Second, the ministry gives schools and teachers full autonomy to procure additional digital tools and resources at their discretion, and supports them in doing so in various ways. Together with the Central Procurement Agency ("*Centrine Perkancioji Organizacija*"), the ministry either directly procures digital tools and resources on behalf of schools (e.g. *Microsoft 365* licences) or assist schools in all medium-to-large procurements.[21] For instance, it negotiates with suppliers the price and contractual conditions of the digital tools that schools want to acquire through grants, financial incentives, or non-earmarked subsidies (schools' operational budget in the case of publicly funded schools); and it provides guidance on procurement processes and lists of recommended – rather than pre-authorised – tools for schools to procure on their own.

Third, the central government supports the use of digital tools for system and school management, as well as the use of digital teaching and learning resources, by offering central guidance and professional learning opportunities. For instance, the ministry offers online courses aimed at developing the digital competences of teachers and students, and organises competitive projects based on digital technologies. In the case of teaching and learning resources, the ministry also takes advantage of its student information system – *ŠVIS* – to administer surveys and monitor the uptake of digital resources to conduct research and development (R-D) and support their use.

Developing teachers' digital literacy is one way to engage education stakeholders in the digitalisation of the sector. However, in Lithuania, the ministry does not decide what competences teachers must acquire in their pre-service training, as this decision falls within the remit of teacher-training institutions that set their own curriculum – following a set of ministerial guidelines on teacher-training programmes.[22] OECD TALIS data from 2018 show that using ICT for teaching featured in less than half (45%) of lower secondary teachers' pre-service training in Lithuania – a proportion 11 points below the OECD average. Similarly, the central government does not decide what competences teachers must develop as part of their in-service training. Municipalities can impose standards on teacher recruitment and professional development. This prerogative gives municipalities a key policy lever for cultivating teachers' digital literacy as they can provide incentives towards certain types of training, such as training in teaching with digital technology. In 2017, 69% of teachers in Lithuania reported that they took part in professional development in ICT skills, on par with the OECD average (60%).

Another lever through which to foster students' and – indirectly – teachers' digital literacy is reform of the national curricula. In 2022, the ministry updated the national curriculum to integrate, as a learning outcome, students' skills to use and understand digital technology. In lower secondary education, the integration of digital competences into other compulsory subjects is enforced by a rule, making Lithuania the European country where lower secondary students have the largest amount of instruction time dedicated to digital competences (152 hours a year).[23] Here also, municipalities can add their own guidelines provided that they do not contradict the national curriculum.

Finally, the ministry provides students and their parents with information about the use of digital technology and data in education. For instance, parents receive reports generated from *ŠVIS* data where they can check, for instance, the number of computers used in their children's schools, the frequency of use by teachers, etc.

Governance of data and digital technology in education

As is the case across European Union countries, the EU General Data Protection Regulation (EU GDPR) defines the largest part of Lithuania's regulation around the protection of data and privacy, in education as well as in other sectors. The government complements this general regulation with further rules and guidelines that are specific to the education context, such as the ones that protect specifically the privacy and personal data of students and school staff. In practice, those specific rules do not go much beyond what the EU GDPR imposes, though; and any non-traditional use of student data, for instance, would require parental approval.

Lithuania has also set up rules and guidelines to ensure that authorised researchers can access and use education data under equitable conditions, and to allow public or private research and development (R-D) agencies to access and use educational administrative data – providing that data re-identification is almost impossible. There are different rules and practices in place in terms of data use for different registers, and each register has its own internal rules. For example, the databases related to the student information system – *ŠVIS* – and all other related registers, have their own internal rules.

Beyond rules around the access to, and use and protection of, data in education, Lithuania has issued a handful of other rules concerning the management of data and digital technology at the central level. One example concerns the use of specific technical standards across all levels of education as a means to improve the interoperability between *ŠVIS* (the government's student information system) and the various schools' learning management systems. As of 2022, however, there is no specific legislation around the accountability, interpretability or efficiency of any automated decision-making digital technologies acquired by schools, as the use of such tools remains minimal for the time being.

Government officials also report that schools use *SELFIE*, a free digital tool provided by the European Commission to help them assess where they stand with their digital transformation.[24] Once schools run their self-assessment, *SELFIE* provides them with personalised guidance and recommendations – i.e. no rules – about digital tools they could consider acquiring to improve their use of technology for teaching and learning.

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

Developing a national education technology ecosystem presents challenges both to develop appropriate local tools and to incentivise relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

Lithuania supports academic research on digital technology in education through several means. To facilitate the use of education data (within the legal framework to protect data and privacy), all interested researchers can request access to documentation of the datasets collected by the ministry and the National Agency for Education (in large part via *ŠVIS*), which are publicly available on the *open data portal*. In addition, the ministry clearly and publicly communicates its R-D priorities (and digital education is now one of it); it funds research programmes specific to the topics of digital education, such as the ones pursued by the Research Council of Lithuania;[25] and it directly commissions academic research papers, on an ad-hoc basis. The commissioned research topics so far have covered the use of digital technologies to improve learning outcomes, to improve student engagement, to support teaching, to improve school management functions and to improve assessment.[26] For instance, one of the current research projects relates to the use of AI-based learning analytics in Lithuania.[27]

Further to that, Lithuania maintains public-private relations with the EdTech sector and private partners to support the development of innovations in education. The government provides monetary incentives in the form of public tenders for the development of digital tools and learning resources by public or private organisations, as well as by teachers and individuals. The government also invests in start-up companies in the EdTech sector, subsidises R-D through competitive grants, and develops its own EdTech tools thanks to funds granted by the European Commission as part of the post-COVID-19 *Recovery and Resilience Facility* programme.[28] There are also non-monetary incentives put in place to support innovation and cross-sector collaboration. For instance, the government organises (or delegates the organisation of) conferences and forums to encourage the collaboration between EdTech companies, often regrouped under the EdTech Lithuania association, and educational institutions; and it invites innovators to test and improve their educational technologies through testbed events.[29]

Looking forward, Lithuania aims to support in priority the development of online education platforms and digital teaching and learning resources; to continuously improve the digital tools it already provides, such as *ŠVIS* (the student information system), *LAMA BPO* (the student admission management system), and *NECIS* (the digital system to support assessment administration); to allow for automatic data exchange between learning management systems through common standards, and; to connect the digital credential system used in higher education with the credentials awarded in VET institutions.

Notes

[1] See also the dialogue of the National Digital Coalition here: https://www.skaitmeninekoalicija.lt/en; and the Roadmap here: https://industrie40.lt/wp-content/uploads/2019/03/Lithuanian-Industry-Digitisation-Roadmap-2019-2030_final.pdf

[2] Industry 4.0: https://industrie40.lt/platform-pramone-4-0-structure/. The highest level of platform is managed by the National Industrial Competitiveness Commission that consists of the representatives from: the Ministry of the Economy and Innovation, Lithuanian Robotics Association (LRA), the Lithuanian Innovation Centre (LIC), Lithuanian Business Confederation (ICC LITHUANIA), Government of the Republic of Lithuania, Ministry of Education, Science and Sport, Ministry of Social Security, Labour, the Centre for Physical Sciences and Technology (FTMC) and others

[3] 2021-2030 State Digitisation Development Programme: https://www.e-tar.lt/rs/lasupplement/13206c504e8d11ec862fdcbc8b3e3e05/339e03904e9511ec862fdcbc8b3e3e05/

[4] White Paper: https://e-seimas.lrs.lt/rs/lasupplement/TAD/39632357b9cf11ec9f0095b4d96fd400/696cd1430f5511ee9ac6bb8cb9c06455/

[5] Guidelines for digital education: https://emokykla.lt/upload/media/public/Kita-aktuali-medziaga/Skaitmeninio%20%C5%A1vietimo%20gair%C4%97s%20_%20galutinis%20(2).pdf

[6] See for instance: 1) Digital tools about cyber security from Telia, Kibernetinio saugumo žaidimas „Spoofy“ and 2) Digital tool about coding from Infobalt association Angis.net - lietuviška Python programavimo platforma (lrt.lt)

[7] Social insurance system: https://www.sodra.lt/?lang=en

[8] https://www.tamo.lt/

[9] https://www.manodienynas.lt/

[10] https://en.ktu.edu/projects/digital-transformation-of-education-edtech/

[11] https://lamabpo.lt/

[12] https://www.aikos.smm.lt/en/Pages/Default.aspx

[13] TAO: https://www.taotesting.com/

[14] https://www.emokykla.lt/

[15] https://www.lrt.lt/mediateka/rekomenduojame/mokykla

[16] Self-assessment system: https://beta.etestavimas.lt/

[17] Examples of resources for students with special needs: Skaitmeninių priemonių rinkinys įtraukiajam ugdymui „EduSensus“ | Emokykla

[18] Examples of publicly developed resources: Courses for primary schools (abroad) https://nsa.vma.lm.lt/course/index.php?categoryid=25; Lituanistinio švietimo įstaigoms. Pradinis ir pagrindinis ugdymas (emokykla.lt); History 9-10 grade: SMP – Istorija 9–10 kl. (emokykla.lt).

[19] Online platform for teacher development: https://rsvis3.emokykla.lt/cognos/bi/?perspective=authoring&pathRef=.public_folders%2FBendroji%2Binformacija%2FPedagogai%2FPedagog%25C5%25B3%2Bporeikis&id=iCB246C0CDDA742D2A7643E546DD5CF1B&objRef=iCB246C0CDDA742D2A7643E546DD5CF1B&action=run&format=HTML&c

[20] Millennium Schools programme: https://tukstantmeciomokyklos.lt/en/home-en/

[21] Centrine Perkancioji Organizacija: https://www.cpo.lt/

[22] Guidelines on teacher training programmes: https://www.e-tar.lt/portal/en/legalAct/TAR.239675132D8A/sZBluFrbLQ

[23] Digital education at school in Europe: https://op.europa.eu/en/publication-detail/-/publication/d7834ad0-ddac-11e9-9c4e-01aa75ed71a1

[24] SELFIE: https://education.ec.europa.eu/selfie

[25] Research Council of Lithuania: https://www.lmt.lt/en

[26] Selection of commissioned academic papers: Creating an environment conducive to learning: finding the enablers of the school community https://spektras.lmt.lt/anotacija.php?JbW8fqIwMqA9XRVHeisYcub1DPgcJCyYp7oQ2DAvqz0; Artificial Intelligence in schools: scenarios for the development of learning analytics in the modernisation of general education in Lithuania https://spektras.lmt.lt/anotacija.php?JbW8fqIwMqA9XRVHeisYcub1DPgcJCyYp7oQ2DAvqz0; Emotional and educational difficulties experienced by pupils and their coping in inclusive education: the COVID-19 context https://spektras.lmt.lt/anotacija.php?X8d0PhdqYVGpiUk+I2g6RCXnJryx2heCjMQdwYzBTnk=

[27]Artificial intelligence in schools: scenarios for the development of learning analytics in the modernization of general education in Lithuania*:* https://www.sietuvos.vilnius.lm.lt/2021/09/15/dirbtinis-intelektas-mokyklose-mokymosi-analitikos-pletojimo-scenarijai-modernizuojant-bendraji-ugdyma-lietuvoje/

[28] For instance, see https://www.bitdegree.org/about-us/eu-projects or https://www.vedliai.lt/es-projektai

[29] See: https://edtech.nsa.smm.lt/edtech-sprendimu-isbandymas/

21 Luxembourg

This note provides an overview of Luxembourg's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Luxembourg supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Luxembourg engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- The central government owns, develops and provides a widespread digital infrastructure of software and applications for system and school management at all levels of education: student information systems, exam administration systems, administrative and facility management systems, learning management system, etc.
- The central government also provides various digital resources for teaching and learning, developed in-house or procured from commercial providers, but school staff use them at their discretion and in competition with privately supplied resources.
- At a lower level of government, municipalities are further responsible for acquiring and maintaining hardware digital infrastructure in primary schools; this remains the responsibility of the central government in secondary education and VET.
- The access to and use of data and digital technology in education is only partially regulated – and solely by the central government. Using the publicly provided tools for education management is often mandatory by law, but using specific teaching and learning digital resources is not as schools have significant pedagogical autonomy, especially in primary education – albeit, in practice, teachers must meet certain requirements as regards certain digital competences, which are themselves inscribed into the national curriculum.
- The country strategy for digital education has long focused on hardware infrastructure; since 2019, it turns towards preparing the education system for the future society, developing more advanced digital tools (e.g. digital credentials, intelligent tutoring systems), equipping students and teachers with the relevant set of digital skills, and setting up mechanisms of collaboration between schools, researchers and EdTech companies.

General policy context

Division of responsibility

In Luxembourg, the public responsibility for providing education is split between the central government and municipalities in primary education while it lies entirely with the central government in secondary education and VET. This mostly centralised system has some consequences on the distribution of public responsibilities for providing access to, encouraging and regulating the use of, digital technologies at both levels of education. In primary schools, besides a set of digital tools provided by the central government to manage mostly administrative functions, the rest of the digital ecosystem is made available at the discretion of municipalities. Municipalities are endowed with central government funding based on a formula that mitigates socio-economic disparities across municipalities. In secondary schools, including vocational education and training, however, the entire digital learning infrastructure is provided and maintained by the central government.

Private education institutions are relatively out-of-scope of the government's digital strategy and responsibility, be it government-dependent or independent private schools. While the former are co-financed by the state, they acquire their hardware infrastructure (Internet connection and devices) with their own budget, but can freely access any of the management and learning tools publicly provided to schools by the ministry of education. The few independent private institutions of the country have no access to the ministry's tools and are fully responsible for their entire digital learning infrastructure.

Whereas the provision of digital infrastructure to schools is partly decentralised, the regulation and governance of digital education is centralised. Built on the European Union General Data Protection Regulation (EU GDPR), the legal framework that governs the access to, and use of, data in education is

enacted by the central government and applied aside from the division of responsibility between educational levels.

Digital education strategy

The government of Luxembourg published its first digital education strategy in 2015, *Digital4Education*, supplemented in 2019 by a new initiative, *Einfach Digital*.[1] These action plans have led to changes in the digital education policy and expenditures related to most aspects of the country's hardware infrastructure: broadband connectivity, Wi-Fi and mobile connectivity, devices in schools and for students, intranet servers. This has strengthened a digital learning ecosystem that already allowed for comparatively high levels of ICT access and use across all sectors of the economy in Luxembourg.[2] However, the scope of Luxembourg's digital action plan in education is somewhat limited by the autonomy granted to municipalities over the public digital learning infrastructure provided to primary schools. To account for the lessons learnt during the pandemic, the country's digital education strategy will be further updated in 2023.

A cornerstone of the country's digital education strategy is the *one2one* programme that enables secondary schools to provide access to one tablet per student in the secondary classes that choose to opt for this programme. In such classes, students can lease a tablet for a low price (and for a further reduced price if they come from a disadvantaged socio-economic background). The *one2one* programme has gained traction since its introduction in 2018, reaching more than 40% of secondary school students as of 2021.[3]

The public digital education infrastructure

In Luxembourg, the government assumes most of the responsibility for providing and maintaining the digital infrastructure in education – much more than in many other OECD countries. As part of Luxembourg's Ministry of National Education, Children and Youth (hereinafter, the ministry), both the Centre for Education Digital Management (CGIE) and the Service for Coordinating Research and Innovation in Pedagogy and Technology (SCRIPT) provide a panoply of digital tools and resources to the country's schools.[4] However, schools in Luxembourg do have a large pedagogical autonomy so they can choose to acquire additional elements to the publicly accessible digital ecosystem, whether from the business sector or from other education stakeholders that make digital tools and resources available for free in Luxembourg, such as philanthropic organisations (e.g. the Up foundation), universities and teachers. This section reviews two aspects of the public digital infrastructure in Luxembourg: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information systems and learning management systems

To support system and school management, collect data and generate statistics, the ministry has developed and owns two student information systems: *Scolaria* in primary education, and *Fichiers Eleves²* in secondary education. All public schools must use them. From a school perspective, they have many of the common administrative functionalities of a learning management system (LMS). They help school staff manage student enrolments, enter and consult individual and class data, link students to their teachers, track student advancement and progression throughout the years, and facilitate the appointment of substitute teachers. In both systems, all students and teachers are identified through a unique and longitudinal identifier (ID) – despite the separation of the primary and secondary education systems (and corresponding databases). Both systems store teacher-given grades and provide real-time information and analytics dashboards to teachers, school leaders and ministry officials. While different stakeholders have

different access to these students information systems, the ministry and all public schools use an integrated system.

Other digital tools publicly provided by the ministry to both primary and secondary schools supplement these functionalities: the Ministry's customer relationship management system to communicate with parents and students and various other tools with administrative functionalities (*Webuntis* for timetables and study plans, *Tera* for Teacher Requirements and Assignments, *Recorps* for providing support to students with special needs, *Syclope* for human resources management, *Edvance* for supporting the school development management, *Seredi* for managing requests for the recognition of a foreign diploma or qualification) and facility management systems (*Ereservation* for rooms and resources, *Ecopy* for printers).

Secondary schools also have access to publicly provided content management and learning management system (LMS) focusing on learning content called *eduMoodle.lu*. While primary schools can choose their preferred additional content or learning management system, secondary schools must use *eduMoodle.lu* to ensure interoperability with other system-level systems like the student information system. It provides learning and content repositories, recommendation and communication tools, as well as analytics dashboards that provide key learning information to users. The CGIE has developed and launched in September 2022 a new tool called e-bichelchen that is some sort of online agenda that informs teachers and educators about homework given by teachers. It allows teachers (in schools) to communicate with educators (in day care structures) and parents (at home) (www.ebichelchen.lu).

The ministry also provides its secondary schools and students with additional tools, notably *edupass.lu,* a digital credential system that stores both formal and informal educational badges that was being rolled out in lower secondary education in 2022 in the newly opened "Digital sciences" track.

Exams and assessments

The ministry also requires schools to manage exams with two digital tools for exam administration: *PFS* supports the management of the national assessments at the end of primary education, and *BAC*, the national end-of-secondary-school exam (namely registrations, grading, students' progress). Those two national exams (which are perceived as "high-stake" for students as they influence the decision on the track where students will continue their studies) are not digitised. They receive paper diplomas.

While commissioned by the ministry, the assessment is managed by the University of Luxembourg (LUCET). Students take the computerised questions on the *Oasys* platform, developed by LUCET in close collaboration with the ministry. Some parts of the standardised student assessment administered at the system level (*EpStan*) are digitised. The individual results of this national assessment, which takes place for entire cohorts of students in years 1, 3, 5, 7 and 9, are stored in a database which is separate from the ministry's information systems (and databases), although the results can in principle be linked to students' unique identifier. Provided in a sufficiently aggregated format to preserve anonymity, the results are an important source of comparative feedback for schools on their students, and for families on their children.

Admission and guidance

Building on the architecture of its two student information systems, the ministry provides both primary and secondary schools with a range of web applications that serve other system management purposes. A central system to manage student registration in school simplifies the enrolment procedures of students to their local school (where primary students are mandated to go), school transfers, as well as the admission process to secondary schools. It is the IAM (Identity and Management) system, which is only directly accessible to the CGIE, which is fed with data from the two systems "*Fichiers élèves*" and "*Scolaria*". The enrolment of pupils is done via the two systems "*Fichies élèves*" and "*Scolaria*". Neither system uses algorithms to process students' applications and match them with their desired educational institutions. It

also plays no role in admission to the desired secondary school. It is only accessible to the administrative staff and the school staff, but not to the students.

To help students navigate their studies, submit their application to the student admission management system and find their future career, the ministry has set up two study guidance platforms: *Meng Schoul,* hosted by the *Maison de l'orientation, is* a website that provides a mapping of secondary and VET schools to help primary school students make a choice as well as career and study guidance to general and VET secondary students.[5]

Likewise, teachers have access to a career management platform, *Eformation*, which is also maintained by the ministry to make its training offer available to teachers, help teachers keep track of their mandatory training, and for the ministry to validate their training with the linked *EPI* application.

In this rich public digital education ecosystem, all tools are accessible via a single sign-on (SSO) service called *IAM* (Identity and Access Management). An IAM account is automatically allocated to all secondary education students, to teachers, school leaders and to all ministry agents needing access to deliver some of the ministry's services. The IAM is used as a basis for developing further web applications.

In a late stage of development is for example the so called "*eduGuichet*", a one-stop-shop for students and parents where they can find all necessary documents (exam results, diplomas, school restaurant information, timetables, etc.). Its launch is planned for 05/2023.

Digital ecosystem for teaching and learning

Compared to the provision of digital tools for the management of systems and institutions, the ministry plays a less prominent role in the public provision of resources for teaching and learning – not because it does not offer such resources, but because it gives varying degrees of autonomy to schools as regards their choice of providers.

In secondary education, the procurement for private digital learning resources (or devices) is contracted at the central level: the CGIE (in charge of digital technologies) and the SCRIPT (in charge of learning resources) negotiate their prices with suppliers, roll them out in schools and monitor their use and effectiveness. In primary education, schools procure resources on their own, choosing between a private and a public offer. The SCRIPT has indeed developed or acquired a large offer of learning applications (e.g. mathematic.lu or learning applications from profax.ch) which primary schools can choose to use for free or not. The ministry also provides them with guidelines on the recommended steps to a good procurement process.

As mentioned above, secondary education teachers have access to some public resources that support their teaching through a public learning/content management system like *eduMoodle.lu*. In addition, the ministry has contracted Microsoft to allow every agent in the ministry, every teacher in public primary and secondary education, and every student in secondary education to access their *Office 365* suite. The licence was negotiated at the central level.[6] During the COVID-19 crisis, the universal access to *Office 365* allowed a relatively fast transition to distance learning during school closures – which in turn accelerated the uptake of its resources by all concerned actors. *Teams* was used as the main virtual classroom environment tool. This may remain the case in the coming years.

During the pandemic, the government also set up a platform enabling students, teachers and parents to access a variety of static and interactive learning resources targeted at all educational levels: *Schouldoheem.lu*.[7] This platform is now an integral part of the digital learning infrastructure available to students, teachers and families in Luxembourg. It includes a large and growing panel of learning resources available for free, in five languages, covering a variety of subjects at all levels of education. It also hosts thematic remedial courses, to be taken after class or during the summer break as part of the *Summerschool*

programme that was initiated to mitigate some of the impacts of school closures. *Schouldoheem.lu* also offers two dedicated helplines, including one that offers mental and psychological support.

Finally, the ministry provides a range of other online didactic resources and self-assessment tools. Some are made openly available to the general public (e.g. on *heydoo.lu*, *oli.education.lu*, *edudocs.lu*) and allow anyone to explore and shop all sorts of didactic resources available in Luxembourg, browsing contents by grade, subject, language, format (printed and digital books, audio, video, apps, etc.). Others, however, are only accessible for individuals enrolled in education through their *IAM login*. This is the case for instance with *MathematTIC.lu*, a personalised learning platform that houses various curriculum-based exercises in mathematics that feature real-time feedback, differentiated instruction and actionable data for teachers and students. Some of those resources are specifically addressed to students with special needs.

Whether digital or not, the ministry has no monopoly over the provision of most didactic resources in Luxembourg – and, especially in primary education, limited control over their use. The resources that the SCRIPT develops and offers to schools and teachers are made available in competition with those of non-governmental suppliers or editors. This mechanism is similar to the one that rules textbook provision, where primary and – to a lesser extent – secondary schools navigate between public and private provision. Since 2018, there is also an online platform for that, the *mybooks.lu* app, developed by the SCRIPT and the CGIE. It curates all mandatory textbooks (and their digital version, if any) and facilitates their free delivery to students in public and private government-dependent secondary schools.

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

Ensuring access and supporting use

Providing a public digital education infrastructure does not necessarily imply stakeholders will use it. Providing public funding for schools and teachers to use digital resources does not guarantee it will be used either. There are thus usually different policies to support the use of technology, for example mandating the use of (some) digital resources, supporting the acquisition and use of digital resources, or integrating their use in the curriculum.

Equity of access

Luxembourg' policies secure higher levels of digital equity than in many other OECD countries. In secondary education, the public, centralised provision allows for a sustained and homogenous access to the diverse components of the digital education ecosystem, thus ensuring equitable access to digital tools and resources for all students, teachers and schools. The optionality of their *one2one* programme makes it more efficient while providing equal opportunities to classes (if not individuals). However, the devolution of responsibilities regarding infrastructure to municipalities in primary education leads to possible disparities and inequities across municipalities. While the primary school funding formula could in principle partially correct for those disparities, it leads to an uneven access of hardware and learning resources at that level – and strong disparities of education technology access between the primary and secondary levels. Those disparities appeared more clearly when the COVID-19 crisis led to school closures and then partial remote education.

Supporting the use of digital tools and resources

The ministry mandates the use of some of its system and school management tools across all public institutions in the country, notably its student information systems, its school registration system, exam administration and national assessment systems. While other management systems must also be used in secondary education, this is not the case in primary education.

Given teachers' pedagogical autonomy, there is also no obligation for teachers or schools to use the public teaching and learning resources made available in the digital ecosystem. The government's resources are largely in competition with those offered by commercial providers, although they may be more attractive as they are provided free of charge for the end users. Some of them (e.g. *Microsoft Office 365*) really started to be used during the COVID-19 pandemic, although they were already available. As of 2023, there are no recent statistics about the actual use of digital tools and resources for education.

To effectively support the use of its public tools but also of private tools that schools may acquire, the ministry offers central and local guidance to teachers, as well as professional learning opportunities to use these resources as part of their pedagogy. The ministry appointed pedagogical and digital leaders (i.e. support teachers) at the regional level to support teachers in their online teaching, an expertise that was highly appreciated during the COVID-19 pandemic but that predated it and is still available.

Cultivating the digital literacy of education stakeholders

The National Institute for Teacher Training (IFEN) defines the key competences that teachers must develop as part of their in-serving training. After being employed as a teacher by the state, teachers have a two-year induction period with trainings, mandatory tutoring, classroom visits, etc. Those expectations have been updated in 2015 to include the use of digital technology in education.[8]

Developing student skills to "use and understand digital technologies" is an objective of the national curriculum, both in primary and secondary education.[9] Coding and computational thinking were added to transversal skills in primary education, and "digital sciences", in secondary education.[10] This provides an incentive to teachers to use digital devices and resources.

More generally, to inform parents and students and involve them in consultations about the use of digital technology in schools, the government has also set up two public websites (*beesecure.lu* and *roadmap.lu*) and launched initiatives to foster their participation in the broader political debate (see *jugendparlament.lu* or the CNEL).

In addition, in order to foster a digital culture among all stakeholders, in February 2023 Luxembourg has set up a blended 6-week course around the MOOC Elements of AI (EoAI), with a weekly webinar allowing participants to interact with an instructor (a PhD student from the University of Luxembourg). To this effect, the Ministry of Education and Youth (SCRIPT and IFEN), the University of Luxembourg (Department for Media, Connectivity and Digital Policy and Competence Centre) and the National Civil Servants Training Agency (INAP) as well as industrial federations are cooperating to promote the Luxembourg EoAI programme, willing to raise awareness about the AI topic to a broader audience, including students, the workforce and teachers.[11]

Governance of data and digital technology in education

Supporting use can only work if stakeholders recognise that the use of digital technology and the data it generates will not hurt them in the future. Part of country regulation is about generating trust in using digital tools in their local context.

Luxembourg regulate the access to and use of data and digital technologies in education. In education as in other sectors, as a member of European Union, data protection falls under the European Union's General Data Protection Regulation (EU GDPR), which was translated into national law. In addition, the government produced specific rules and guidelines about the protection of personal data and privacy of teachers and school staff, as well as about data portability in education. This dual objective is implemented through the government's single sign-on, secure identifier (*IAM*) that grants selected access to all stakeholders of the ecosystem's applications depending on their status in order to protect everyone's personal data. The ministry does not conduct any inspection or random control to enforce proactively the

rules that govern the protection of data and the use of digital technology in education. Their breach can be challenged in court though.

Given its non-existent to very limited use of automated decision-making and AI-based tools, no specific policy effort to regulate this aspect is in place. Generally speaking, the ministry would be held accountable in case of errors caused by the use of technology in education. To minimise the occurrence of such errors, though, the ministry has passed rules and guidelines that impose minimal standards of performance on the digital technologies used in education.

Similarly, as of June 2023, no regulation or guideline governed interoperability of the different tools that compose the digital ecosystem. The SCRIPT and CGIE applications use open standards (e.g. *XML, CSV, JSON, HTML, REST API, SAML*) that may serve as examples for other agencies and individuals – but there is no explicit guideline or regulation in this area yet.

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

Developing a national education technology ecosystem is a challenge for appropriate local tools to be developed. Providing incentives, supporting R-D, funding education technology start-ups are part of the typical innovation portfolio countries could consider.

The ministry of education has communicated clear research and development priorities about digital education and education data use to encourage academic research in this field. In the last five years, the ministry has commissioned academic research on the use of digital technologies to improve learning outcomes, to improve student engagement, to support teaching, and to help students with special needs. Digital education was also one of the two focuses of the 2021 National Report on Education co-edited by the SCRIPT and the University of Luxembourg, which compiled articles authored by over 70 researchers.[12] The report analyses the digitalisation of education in Luxembourg through multiple perspectives, from digital literacy to online and distance learning. It also reports the first observations of the monitoring of the *one2one* programme, and, in line with the OECD evaluation of Luxembourg's COVID-19 Response (OECD, 2022[1]), takes stock of the changes brought about by the pandemic to the education system as a whole – including how the country's digital infrastructure in education allowed for effective remote learning and mitigated the negative impacts of school closures.

Within the ministry, the SCRIPT develops some digital tools and resources, sometimes in collaboration with EdTech companies.

The government has no particular policy to support the development of an EdTech sector, for example through formal subsidisation mechanism, tax credit or R-D investment support targeted at EdTech companies. Incentives to foster collaboration between private companies and the public sector are thus mostly non-monetary: conferences organised by the SCRIPT to convene education stakeholders with EdTech companies is one example.[13] The launch of *TalentHub* in 2019, a start-up hub sat within a secondary school to introduce arts and crafts students to the field of entrepreneurship in EdTech, exemplifies this approach.[14] The CGIE and the SCRIPT also grant time credits to teachers to incentivise them to develop digital teaching and learning resources, either by themselves or in collaboration with the University of Luxembourg and/or private companies.

In terms of future priorities, the ministry aims to add to its public digital education ecosystem a digital credential system in upper secondary education and VET (building on *eduPass.lu*), to improve (or enrich) its online education platforms and resources in primary, secondary education and VET, by further developing the *Schouldoheem.lu* platform. It also considers providing Intelligent Tutoring Systems at all levels of education as well as classroom analytics tools.

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22 Mexico

This note provides an overview of Mexico's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Mexico supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Mexico engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- Mexico has a large and devolved education system where the federal government shares responsibility with states for providing and governing education. Typically, states provide institutional management systems to schools under their responsibility, while the federal government maintains and provides a comprehensive student information system for whole country and coordinates data collection from schools for management and statistical purposes.
- The federal government also provides digital resources for teaching and learning. Some of them are openly available to anyone in the country, most notably through a public repository of open educational resources and a MOOCs platform.
- Mexico's most recent digital education strategy, coordinated federally while states conserve large autonomy on their respective education systems, emphasises on the provision of Internet connectivity, digital equipment, and technical support to schools, with particular attention given to those located in socio-economically disadvantaged regions and rural areas, as well as to students with special education needs.
- The federal government also sets rules and offers guidance regarding the access, use, and protection of data. It also fosters the interoperability of the digital ecosystem by setting requirements on data exchanges with states' authorities, provides support for school procurement, and incentivises the development of digital competences for teachers and students.

General policy context

Division of responsibility

Mexico has one of the largest education systems in Latin America. Governance over schools is complex, not only due to its size – over 250 000 schools serving about 29 million students in basic education as of the 2022/23 school year – but also due to significant diversity in geographical, cultural, and socio-economic backgrounds within the country.[1] Education is compulsory for the first 12 years, comprising primary and secondary education, and the Mexican Constitution mandates the government – at the federal, state, or municipality level – to provide it secular and free of charge to all.[2]

Overall governance over the Mexican education system is one of the responsibilities of the Secretariat of Public Education (*Secretaria de Educación Publica* – SEP), acting as a federal ministry of education under the cabinet of the President of the Republic. Responsibility over public schools, which concentrate around 85% of student enrolments in basic education as of the 2022/23 school year, is split with sub-national governments of Mexico's federal entities with the exception of Mexico City, which is directly under the responsibility of SEP.[3] States are then autonomous to operate schools within their local education systems, including special education and schools serving the indigenous population.

This shared governance means that the provision and support of digital technology in education is also devolved, with states providing institutional management systems to schools under their responsibility. However, the federal government maintains and provides a comprehensive student information system (or education management platform), maintaining and connecting student, teacher, and school data. Responsibility for the provision of resources for teaching and learning is also shared, given the autonomy of state-level governments to adapt the curriculum to better fit their contexts, leading to local development and provision of resources.

Regulations regarding the access, use, and protection of data collected within the educational system are in place, falling within the remit of the federal government. Furthermore, a variety of rules exist regarding interoperability, albeit focused on providing data of sufficient quality for certifications, but several provisions

and proactive enforcement is exercised when it comes to compliance regarding data transfers within the national student information system.

Digital education strategy

Digitalisation is of central importance in Mexico, playing a significant role in government-wide and education-specific policy documents as a lever for equity and increased competitiveness in the 21st century. The national digital strategy co-ordination (*Coordinación de Estrategia Digital Nacional* – CEDN), an independent department under the federal government, oversees the implementation of Mexico's national digital strategy along strategic axes along its national development plan and across secretariats, ministries, and agencies. [4] [5] [6]

While states maintain significant autonomy over their educational systems, the federal government enacts top-down policy and sets the strategy and the regulatory backdrop for digital education in Mexico. Indeed, the production of a national digital education strategy – the *Agenda Digital Educativa* – has been enshrined into the legislation regulating education in the country, and a document for the 2020-2024 period has been produced. [7] [8] One of the axes of said strategy lies in the provision of connectivity, equipment, and technical support to schools, with a particular emphasis on those located in regions with less socio-economically advantaged backgrounds and in rural areas. The support of these students in remote areas, and those with special educational needs (SEN), are also of particular concern, being targeted by a specific national inclusive education policy, of which the use of digital technology in the classroom is one of the elements. [9]

The public digital education infrastructure

The Mexican federal government provides central components of the public digital education ecosystem, either directly or through partnerships with external stakeholders, notably universities. The latter results in the curation of open educational resource repositories, while the former consists of a comprehensive student information system directly provided by the Secretariat for Public Education to all schools. In addition to these notable examples, the present section reviews two aspects of public digital infrastructure in Mexico: digital tools and resources for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information system and learning management systems

Even though the responsibility for governing the operations of public schools is devolved to state-level authorities, the federal government provides significant infrastructure with respect to student information systems with accompanying obligations on data collection from schools for management and statistical purposes.

A focal point of this infrastructure is the *SIGED* (*Sistema de Información y Gestión Educativa*), a comprehensive digital platform containing data from the entire Mexican education system – students, teachers and school staff, and schools – as well as documents and information on credentials, thus serving as an institution management information system, a student information system, and a platform for digital credentials.[10] Data entry into the *SIGED* is mandatory, and interoperability standards are in place for data exchange between SIGED and other systems supported by the government, so data can be seamlessly and timely pushed into the information system.

A wealth of information is available through the *SIGED*, both for the general public and for administrators of the education system. The general public has access to a variety of education statistics for student and school data collected from schools through analytical dashboards, information on teacher and school staff

paid through public funds for education payroll (*Fondo de Aportaciones para la Nómina Educativa y Gasto Operativo, FONE*) as well as vacancies for positions under this funding regime, historical information on teacher career progression (through the *Unidad del Sistema para la Carrera de las Maestras y Maestros*, *USICAMM*), and other information on school funding. In addition, the *SIGED* is also interoperable with a module dedicated to the digital certification of students progressing through the education system (the *Módulo Eletronico de Certificacion, MEC*).[11]

Restricted access sections also exist for education authorities within the SIGED, allowing access to the management system collecting and managing education data for the SIGED education data collected for statistical purposed through the so-called 911 Questionnaires (including modules on computational and ICT infrastructure), and to administrative and financial data, such as staff payroll, related to schools within their responsibility.[12] The provision of learning management systems is more diverse in Mexican schools, as those tend to be adopted at the school level with some variation from state to state.

Admission and guidance

The federal government provides and maintains several portals related to student guidance and support towards further steps in basic education, as well as on career guidance. Support through physical and digital resources are available to prepare students for the lower secondary certification at the *Preparatoria Abierta* platform, allowing progress to upper secondary.[13] Notably, students at the latter stage are supported by several career guidance and support platforms. The choice of institution is central to student aspirations, as one can be directed through a general or a vocational upper secondary education, and a platform with institutions and vocational guidance has been put in place to support students, with dedicated resources in place for those willing to complement their vocational education with on-site apprenticeships.[14] [15] [16] For those that dropped out before or during the upper secondary cycle, there are also support options: the *Prepa en Linea* portal, for instance, offers an online self-paced course for students to catch up and obtain their upper Secondary certification, with access to digital resources and tutors.[17]

Digital ecosystem for teaching and learning

The federal government provides a wide variety of digital resources for teaching and learning in Mexico. Some of these resources are curriculum-based, initially prepared as means to support learning during the periods of school closure caused by the COVID-19 global pandemic, whereas others are broader, involving educational content for leisure. Regardless of purpose, access to all resources is open and free of charge not only for students but to the general population as well.

Said resources are offered in varied formats, reflecting the diverse means and capability to access it and existing on their intended audiences. In addition, the significant disruption caused by the global pandemic prompted the creation of digital resources to ensure continuity of teaching and learning during the period. A response at the federal level in Mexico was the *Aprende en Casa* programme, which combined the production of an open educational resources (OER) repository containing curriculum-based materials, week-by-week planning for remote studying and materials for teachers (via a dedicated portal, *Maestros y Maestras en Casa*) with TV and radio education, as well as social media channels for learners and teachers to reach students during school closures.[18] [19] The initiative continued after the end of the public health emergency and was expanded to also serve Mexican nationals abroad.

The programme added to an existing portfolio of initiatives led by the federal government. For instance, the *Jovenes en Casa* platform (http://jovenesencasa.sep.gob.mx) offers a similar approach to the pandemic-inspired programme but focuses more on culture, reading for leisure, and socio-emotional competences, while maintaining a similar approach of providing static learning resources, video content, and guidance for teachers. Static learning resources – mostly digitised textbooks and books – are also made available by the national commission for free textbooks (*Comisión Nacional de Libros de Texto*

Gratuitos – CONALITEG), a network of partners coordinated by the Secretariat for Public Education, that set up another OER platform with books on a wide range of subjects at https://libros.conaliteg.gob.mx/.

In addition to these initiatives, there is also a supported platform for Massive Open Online Courses (MOOCs): MexicoX (https://mexicox.gob.mx/). The platform offers courses for students but also doubles as a platform for teacher development. Beyond the general student population, dedicated initiatives also exist to provide accessible materials, textbooks, and other resources for students with special educational needs. Those are not necessarily openly available, but there are earmarked subsidies for their development, for instance through dedicated funding programmes mentioned in more details below.

States and municipalities can also provide additional resources for teaching and learning, but the exact offer differs across municipalities. As in most OECD member countries, no survey has been conducted on the adoption of digital tools and resources and resources at the school level. However, government officials estimate that the use of virtual classroom environments markedly increased during the pandemic and might still be on use today, especially freely available tools and resources such as *Google Classroom*.

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

Ensuring access and supporting use

Equity of access

Providing equal access to quality, inclusive education is a central policy goal in Mexico as outlined in its general education law, and digital technology and competences are seen as key catalysts to this end as per its digital strategy. The central objective of said strategy is to leverage technology to bring 21st century skills to all students, and ultimately all Mexicans, but there are some groups of interest given the country's wide diversity.

Indeed, the national general education law enshrines support to students with disadvantaged socio-economic backgrounds, mandating the creation of inclusive, cross-cutting policies prioritising those whose socio-economic disadvantage might hinder their access to education. Similarly, the law mandates the federal, state, or municipality governments to establish partnerships whenever suitable to support schools in regions with disadvantaged socio-economic conditions.[20] In addition, the government is mandated to support students and schools serving populations in remote locations, such as those in rural regions or within indigenous communities.[21] Finally, students with special education needs are also outlined under this general law, where teacher initial training is to include students with disabilities, and technology to be leveraged to include these students.[22] These policies focus on public schools.

Data collected by the OECD TALIS study across the 2017/18 school year (OECD, 2022[1]) provide some evidence of the equity of access to digital infrastructure across Mexico, at least in terms of access to hardware infrastructure. Before the COVID-19 outbreak, 63% of lower secondary principals in public schools reported that their schools' capacity to provide quality instruction was hindered by shortage or inadequacy of digital technology for instruction, and 53% that it was hindered by insufficient Internet access (compared to 25% and 19%, respectively, on average across the OECD). The latter statistic also points at a significant urban to rural divide in access to the Internet, with 37% of lower secondary principals of schools in urban areas reporting difficulties due to connectivity against 82% of lower secondary principals at schools in rural areas.

Even though having equitable access to hardware infrastructure and connectivity is not a sufficient condition to foster equity in the use of software tools and resources, a measure of availability is a necessary condition to achieve it. Sections below describe some efforts Mexico is implementing to address this connectivity and availability divide.

Supporting the use of digital tools and resources

The federal government plays a variety of roles, some direct, others indirect, to support the use of digital tools and resources. Notably, the federal government provides a universally used information system to collect data from students, staff, and schools in all Mexican educational institutions, while also procuring learning materials directly for all educational institutions that wish to use them. In addition, indirect incentives are in place, either financial or non-monetary, to foster the use of digital tools and resources.

Indeed, the Secretariat for Public Education mandates the use and data entry into the *SIGED* (i.e., the student information system used nationally) and the timely provision of other statistical information such as the "911 forms" that are pushed to other management systems and analytical dashboards. Schools are supported to fulfil this obligation through central guidance, via dedicated websites and helpdesks and on-demand technical support. In addition, the development of digital competences in students and teachers is mandated by the general education law in lesson plans and is a curriculum requirement for institutions funded or recognised by the government.[23]

Furthermore, the use of provided digital tools and resources can act as a financial incentive by increasing efficiency and thus decreasing costs. Namely, this gain can be realised through reduced costs and administrative overheads through the use of two digital certification modules – the *Módulo Electrónico de Certificación* (MEC) and the *Módulo Eletrónico de Titulos* (MET) – both interoperable systems with the *SIGED* that can streamline the emission of officially valid certificates for all levels of education.[24] [25]

Finally, the government also provides earmarked subsidies for the purchase of digital tools and resources, and creation or provision of digital materials and technologies that promote accessibility for students with special education needs through a dedicated grant-awarding programme.[26] In addition, the use of approved digital tools and resources might be fostered by the careful review and approval by mandated organisations that are able to set up procurement frameworks, approved lists of suppliers, or framework contracts. In Mexico, the national digital strategy co-ordination (*Coordinación de Estrategia Digital Nacional* – CEDN) reviews and approves all federal government projects about or involving information and digital technologies.

Cultivating the digital literacy of education stakeholders

As mentioned above, developing digital literacy of teachers is a central policy goal in Mexico. To achieve this goal, the federal government supports initiatives to foster teachers' digital competences, offering opportunities for professional in-service development and technical support for teachers weaving technology into their practice.

Teachers can acquire digital competences through several Massive Online Open Courses (MOOCs) provided by the federal government, often in co-operation with universities. Several courses on the basics of using digital technology in the classroom were made available in the above-mentioned *MexicoX* portal (https://mexicox.gob.mx/), but more directed courses aimed at teaching staff were also produced by the Secretariat for Public Education on more operational subjects using digital tools (e.g., *Microsoft Teams*).[27] In addition, static digital resources for teachers were prepared for use in the classroom, for instance on conflict resolution and socio-emotional competences, and on aspects of upper secondary teaching practice related to the school environment such as dealing with violence and conflict.[28] [29] In-person teacher training is available in a variety of themes related to the new Mexican school (*Nueva Escuela Mexicana*) paradigm, which included digital competences.[30] [31]

These initiatives build up on a teacher population that tends to receive pre-service ICT training but might not engage in much in-service ICT training. Indeed, TALIS 2018 data for Mexico show that 77% of lower secondary teachers report having received training in the use of ICT for teaching, above the OECD average of 56% among the 31 member countries that took the survey. Conversely, 64% of lower secondary teachers in Mexico reported ICT skills being included in professional activities undertaken at most 12

months prior to the survey. The figure is relatively close to the OECD 31 countries average of 60% but is 6 points below those of schools in private Mexican schools, a statistically significant difference indicating a possible difference in the profile of professional development activities.

Governance of data and digital technology in education

Access to information and communication technology, including the Internet, is enshrined in the Mexican Constitution, as are the responsibilities of the federal government in fostering digital competences.[32] Accordingly, rules and guidelines regarding equal access to digital technologies are echoed in education-specific legislation and guidelines – the education general law and the national digital education strategy both emphasise equal access to digital tools and resources and their use in all classrooms.

Similarly, the Constitution also enshrines the protection of personal data, and specific legislation has been passed to further outline the obligations of private and public controllers and processors of personal data. These two legislations, the federal law on data protection in the possession of particulars and the general law on data protection in the possession of obligated subjects such as the federal or state governments (*Ley Federal de Proteción de Datos Personales en Posesión de los Particulares*, and the *Ley General de Proteción de Datos Personales en Posesión de Sujetos Obligatos*, respectively) outline the exercise of individual data rights such as access, rectification, and removal, obligations of the respective controller, and the establishment of an independent Data Commissioner responsible for data protection and transparency.[33, 34] This role is played in Mexico by the national institute for transparency, access to information, and protection of personal data (*Instituto Nacional de Transparencia, Accesso a la Información y Protección de Datos Personales* – INEE).[35]

This legislation covers the data rights of students, school staff, and obligations from the government or private maintainer of a given educational institution, and even though no specific protection or role of education data is explicitly outlined for policy purposes, access to education data is afforded by broader transparency and official statistical data regulations.[36, 37] In addition, interoperability standards between *SIGED* and other information systems (e.g., those generating national statistical indicators, digital certification systems) are also outlined in existing binding regulation.[38]

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

The development and fostering of a national digital education technology is a complex endeavour, involving the development (or adaptation) of local tools and resources, the interaction of sometimes distant sectors (such as academia, government, the private sector), and directed policy and funds aimed at incubating innovation and disruption within educational technology (EdTech) startups or R-D in academia or specialised government agencies.

One notable example of said initiatives in Mexico is the programme for technological and educational innovation and investigation (*Programa de Innovación Tecnológica y Educativa*,). [39] The programme offers earmarked subsidies to teachers or teacher-led research teams on applied educational research on subjects of particular relevance for the policy agenda, which includes digital education. Indeed, the proposed research themes for 2023 include the use of technology in education for the improvement of teaching and learning, and the development of technology that solve problems, propose better processes, or otherwise improve productivity within the education sector.[40]

Access to several education datasets is open and made available by the Mexican national statistics office (*Instituto Nacional de Estadistica y Geografia* – INEGI) through an open data portal, while data collected through the *SIGED* information system is available on an interactive portal through analytical dashboards at a website maintained by the Secretariat for Public Education.[41, 42]

There is also ongoing, albeit informal, interaction with the EdTech sector, mostly through industry events in which government stakeholders participate, or via networks created by institutions developing tools and resources. Ongoing dialogue and collaboration with more established actors also exist, with a notable example of a partnership between the Secretariat for Public Education and the Carlos Slim Foundation for the production of education materials and learning platforms, including support for the above-mentioned *MexicoX* MOOC platform, but also supporting a Spanish version of the widely used *Khan Academy* learning platform. [43]

Looking forward as Mexico continues to develop its digital education agenda, the country looks to increase interoperability, further allowing data portability between education institutions and to further develop its offer of online digital education platforms and resources, while maintaining and expanding its data and information systems.

References

OECD (2022), *Mending the Education Divide Getting Strong Teachers to the Schools That Need Them Most*, OECD Publishing, Paris, https://doi.org/10.1787/92b75874-en. [1]

Notes

[1] As provided by the SEP in https://siged.sep.gob.mx/tableros/, consulted on 4 August 2023.

[2] As of its Article 3 (*Artículo 3o*, *Constitución Política de los Estados Unidos Mexicanos*, available at https://www.diputados.gob.mx/LeyesBiblio/pdf/CPEUM.pdf)

[3] Namely Mexico's 31 states and Mexico City, which will be collectively referred to as states for brevity henceforth.

[4] Mexico's government-wide digital strategy, *Estrategia Digital Nacional 2021-2024*, available at https://dof.gob.mx/nota_detalle.php?codigo=5628886&fecha=06/09/2021#gsc.tab=0

[5] National development plan 2019-2024 (Plan Nacional de Desarroyo 2019 – 2024) available at https://www.dof.gob.mx/nota_detalle.php?codigo=5565599&fecha=12/07/2019#gsc.tab=0

[6] More information on the CEDN can be found at https://www.gob.mx/cedn

[7] Article 85 of the General Education Law – *Ley General de Educación, Articulo 85*, available at https://www.diputados.gob.mx/LeyesBiblio/pdf/LGE.pdf

[8] Agenda Digital Educativa 2020-2024, available at https://infosen.senado.gob.mx/sgsp/gaceta/64/2/2020-02-05-1/assets/documentos/Agenda_Digital_Educacion.pdf

[9] *Estratégia Nacional de Educación Inclusiva*, available at https://cdnsnte1.s3.us-west-1.amazonaws.com/wp-content/uploads/2020/04/11073434/ENEI.pdf

[10] Available at https://www.siged.sep.gob.mx/SIGED/

[11] More information on MEC is available at https://www.gob.mx/sep/articulos/boletin-no-2-implementa-sep-sistema-de-informacion-y-gestion-educativa-para-disminuir-la-carga-administrativa-a-los-docentes

[12] Information on the 911 forms for education data collection can be found at https://www.f911.sep.gob.mx/

[13] Available at https://www.prepaabierta.sep.gob.mx/

[14] A list of institutions per field of vocational education is maintained by the SEP at https://educacionmediasuperior.sep.gob.mx/es_mx/sems/opciones_de_estudio

[15] Vocational self-assessment, as well as guidance to parents and students are available at the *Decide tus Estudios* portal, available at http://www.decidetusestudios.sep.gob.mx/

[16] *Educación Dual en Nivel Medio Superior*, available at https://educacionmediasuperior.sep.gob.mx/Educacion_Dual

[17] Prepa en Linea portal, available at https://prepaenlinea.sep.gob.mx/

[18] *Aprende en Casa*: https://aprendeencasa.sep.gob.mx, and *Maestros y Maestras en Casa*: http://cosdac.sems.gob.mx/web/pa_docentesencasa.php

[19] Adding to existing educational TV content already produced for Secondary education, for instance through the *Telesecondaria*, available at https://telesecundaria.sep.gob.mx/

[20] *Ley General de la Educación* (LGE), notably in fractions I and VI of its Article 9.

[21] LGE Articles 76 and 102, respectively.

[22] LGE, Articles 83, 96, 115 (IX), respectively.

[23] Notably, the Chapter 11 of the LGE, which is dedicated to regulation on the use of ICT, digital competence and digital learning, and Article 30 on requisites of study plans and curricula.

[24] MEC, available at https://www.sep.gob.mx/wb/sep1/mec_

[25] MET, available at https://www.sep.gob.mx/wb/sep1/Modulo_Electronico_de_Titulos

[26] Through the SEP-funded *Programa Atención de Planteles Públicos de Educación Media Superior con Estudiantes con Discapacidad (PAPPEMS)*, available at https://educacionmediasuperior.sep.gob.mx/es_mx/sems/Programa_Atencion_de_Planteles_Publicos_de_Educacion_Media_Superior_con_Estudiantes_con_Discapacidad_PAPPEMS

[27] With the latter available at the portal set up by the SEP at https://formacionycapacitaciondigitales.televisioneducativa.gob.mx/

[28] *Recursos para docentes*, *Aprende em Casa*: https://aprendeencasa.sep.gob.mx/recursos-para-docentes/

[29] Library of support material for upper secondary teachers: https://educacionmediasuperior.sep.gob.mx/bibliotecadigitaldocente

[30] The *Nueva Escuela Mexicana* (NEM) is an overall reform project for the Mexican education system, aiming to educate citizens with critical thinking and global competences. The NEM paradigm inspired several programmes mentioned in the text, and the production of resources, made available at https://nuevaescuelamexicana.sep.gob.mx/

[31] *Programa de Formación Docente de Educación Media Superior*: http://cosfac.sems.gob.mx/web/pa_enfc.php

[32] Namely, through Article 6 of the Constitution and fraction 10 of the Decree from 11 June 2013 amending it.

[33] Federal law on the protection of personal data in possession of particulars: https://www.diputados.gob.mx/LeyesBiblio/pdf/LFPDPPP.pdf

[34] General law on the protection of personal data in possession of obligated subjects: https://www.diputados.gob.mx/LeyesBiblio/pdf/LGPDPPSO.pdf

[35] INEE: https://home.inai.org.mx/

[36] The general law on transparency and access to public information (*Ley General de Transparencia y Acceso a la Información Publica*, available at https://www.diputados.gob.mx/LeyesBiblio/pdf/LGTAIP_200521.pdf) and the law on the national statistical and geographical information system (Ley del *Sistema Nacional de Información Estadística y Geografica*, available at https://www.diputados.gob.mx/LeyesBiblio/pdf/LSNIEG_200521.pdf) respectively.

[37] Agreements were in place affording education data collected within the SIGED information system the status of information collected in the national interest (*Información de Interés Nacional*) and thus binding the government to use it to produce indicators. As of this writing, said agreement has been revoked (*Diario Oficial de la Federación* from 10 April 2023, available at https://dof.gob.mx/nota_detalle.php?codigo=5685165&fecha=10/04/2023#gsc.tab=0)

[38] *Acuerdo número 07/03/18 por el que se emiten los Lineamientos generales del Sistema de Información y Gestión Educativa*, available at https://www.dof.gob.mx/nota_detalle.php?codigo=5516633&fecha=20/03/2018#gsc.tab=0

[39] Available at http://cosdac.sems.gob.mx/web/pa_innovacion.php

[40] The 2023 call for proposals is available at http://cosdac.sems.gob.mx/web/Investigacion/Prog_Innov_Inves2023/CONVOCATORIA_2023.pdf

[41] INEGI : https://www.inegi.org.mx/default.html

[42] SIGED: https://siged.sep.gob.mx/SIGED/#

[43] Available at https://es.khanacademy.org/

23 The Netherlands

This note provides an overview of the Netherlands' digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how the Netherlands supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how the Netherlands engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In the Netherlands, the independence of educational institutions is a constitutional right. This means that the government does not intervene in the type of administration and management of schools, nor in the delivery of education programmes. The role of education ministry is focused on guiding schools in making responsible decisions with regards to the use of technologies. The only requirement is that schools must have some form of pupil tracking system.
- There is no centrally managed student information system, and the government does not publicly own, provide, or directly subsidise digital tools for school management (e.g. student admission system, learning management system). The government only offers school budget and guidelines to inform schools' decision-making. Schools are primarily responsible for choosing and providing access to appropriate and quality digital infrastructure and resources, and for organising and developing both teachers' and students' digital competence.
- Private companies have numerous opportunities to provide schools with their digital tools and resources, and public-private partnerships in the educator sector are common. This includes collaborations between schools and companies where some of these collaborations are supported by public programmes and initiatives funding EdTech companies. Given the wide range of digital infrastructure developed by different stakeholders in the education sector, a key area for improvement concerns the interoperability of technologies and the data they generate.
- Regulatory issues, such as the equity of access to digital technologies and protection of data and privacy, are governed by binding rules set at the national and EU levels. While the government monitors and evaluates the adherence of schools to these policies, schools themselves are responsible for ensuring equal access and data privacy protection. Little regulatory effort has been made so far regarding more advanced technologies, such as AI-powered tools, although some initiatives are in the pipeline to tackle their increasing use in education.
- The Dutch digital education strategy has long focused on ensuring and improving connectivity, especially for disadvantaged groups of students and schools. Connectivity will remain a strategic concern, in addition to upcoming areas, such as digital safety, digital literacy, safeguarding public values within the digital transition, and building a public value-driven digital government.

General policy context

In the Netherlands, freedom of education is a right guaranteed under the Article 23 of the Constitution. This freedom refers to the freedom of anyone to found schools, determine the principles on which they are based (be that religious, philosophical, or pedagogical) and organise teaching and curricula autonomously. Therefore, while the government sets (and checks) quality standards and overall educational objectives, there is *no specific national curriculum* offered or approved by the government. In this respect, the Netherlands is an exception internationally. Schools themselves are expected to be responsible for the nature of education they deliver.

Division of responsibility

This distinctive circumstance has shaped how the digital ecosystem for primary and secondary education is structured in the Netherlands. The role of the national Ministry of Education, Culture and Science (*Ministerie van Onderwijs, Cultuur en Wetenschap*) is limited to providing funding to schools and setting quality standards and overall attainment targets. As long as schools ensure the quality of education and meet the government-set targets, they have autonomy and (primary) responsibility to find and provide access to appropriate and quality digital infrastructure for education.

Though, this high level of autonomy of schools does not mean that the government plays no role. To help schools make well-informed decisions, various guidelines are provided by the ministry and Kennisnet, the ministry's public agency committed to ICT innovation, as well as by various cooperatives of schoolboards and councils at different levels of education.[1]

The decentralised administration and management, in conjunction with responsibility devolved to schools, suggests that private vendors have significant opportunity to offer privately developed digital tools and resources for education. The co-existence of various tools developed by different companies and organisations implies that the interoperability of technologies and data is a crucial issue in the country.

Digital education strategy

In 2019, jointly with other ministries and public agencies, the Ministry of Education, Culture and Science published an education-specific digital strategy: *Digitization Agenda for Primary and Secondary Education*. Many key points of this strategy, such as digital inclusion and accelerating educational innovations, have been updated and reflected in a more recently published nationwide digital strategy: *Dutch Digitalisation Strategy 2021*, leading to several changes in the government's digital education policies and expenditures.[2] This manifested in the efforts, *inter alia*, to improve broadband, Wi-Fi, and mobile coverages in schools. In 2020, for example, the Dutch government invested approximately EUR 24 million to provide 75 000 devices to students for their participation in remote learning (Dutch Digitalisation Strategy, 2021).[3] Extra funding was also provided to disadvantaged groups of students and schools, such as students with special educational needs and from low socio-economic backgrounds, as well as schools within low socio-economic or rural regions (although schools can decide whether they would rather use the funding for non-digital forms of support). Relevant guidelines about ensuring connectivity and organising remote learning were also provided by Kennisnet and SIVON – the cooperative of schoolboards for procuring educational resources.[4]

In terms of future priorities, enhancing connectivity will remain one of the ministry's priorities, especially for the regions where connectivity still constitutes an issue (e.g. the Caribbean part of the Netherlands). Yet, in the upcoming strategy, the government aims to pay greater attention to the issues of digital safety, digital competencies, and teacher autonomy, as well as safeguarding public values within the transition to digital education. The example of the latter includes the Kennisnet's publication of the Ethics Compass, which educators can use as a practical tool for raising ethical questions about digitalisation in education.[5]

The public digital education infrastructure

In terms of software, the government provides only few components of the digital education infrastructure to education providers. Given the substantial autonomy of the education providers, generally they choose and acquire themselves digital tools for school management, as well as digital resources for teaching and learning from the private sector or other education stakeholders.[6]

Digital ecosystem for system and school management

Student information systems and learning management systems

In the Netherlands, there is no centralised student information system that the ministry uses to directly manage students' personal information. Instead, one of the ministry's executive organs, the Education Implementation Service (*Dienst Uitvoering Onderwijs*; hereafter DUO), compiles the information it receives from schools. Schools are mandated under the Register of Education Participants Act (*Wet Register Onderwijsdeelnemers*) to provide their data to DUO, and they do so through a link between their student administration systems and one of the DUO's registers: the Register of Education Participants (*Register*

Onderwijsdeelnemers). DUO then uses the received information to calculate educational statistics and school funding, while the Inspectorate of Education (*Inspectie van het Onderwijs*), another public agency of the ministry, uses it to evaluate school performance.[7]

DUO's various registers store a variety of information received about schools, ranging from the courses they provide (Register of Institutions and Programmes; *Registratie Instellingen en Opleidingen*) and the enrolments of students from primary to higher education, to the results of schools' compulsory assessments in primary education (Register of Educational Participants). DUO uses the citizen service number ("Burgerservicenummer", or BSN) as unique and longitudinal student identifier for its information system.Some types of the data, such as school address, schoolboards, number of students and teachers as well as amount of funding, are made openly available on DUO's webpage.[8]

As it is mandatory for schools to provide the information about themselves and students, they use one of the Pupil Tracking Systems (*leerlingvolgsysteem*), which are equipped with at least the administrative functionalities of most learning management systems. These Pupil Tracking Systems (referred to as learning management systems in this report) are developed by private companies for schools to administer assessments, monitor students, and manage and organise their learning. Primary schools are obligated to use a Pupil Tracking System to keep track of the progress and results of the students, such as their test outcomes, assignments, socio-emotional development, etc.[9] While using a learning management system is technically not mandatory for secondary schools, most also use one. However, there is no direct government involvement in offering, procuring, or directly subsidising a learning management system. Schools can also choose which specific system they use.[10]

Administrative management and other support systems

DUO's interface entails several features of student admission system, digital credential system, and administrative function system, in the sense that students can access their personal page on DUO to check their exam results for upper secondary education and vocational education and training (VET), retrieve digital credentials for secondary education and VET, have their credentials verified, and enrol themselves in higher education and submit scholarship application. DUO is also in charge of providing student loans and school expense allowances, collecting tuition and student debts, and administering state exams annually in secondary schools. Nevertheless, it is not fully-fledged as a student admission or school administration system, since schools cannot use it directly to register or enrol students, or manage their budgets or schedule. It mainly records the result of all these actions. Schools thus independently choose and procure their own digital tools from private vendors and other educational stakeholders to manage administration and student learning (e.g. learning management system, administrative function system).

Digital ecosystem for teaching and learning

Kennisnet, the ministry's public agency on ICT innovation, runs *Wikiwijs* (meaning "Wikiwise"), an open wiki service designed to facilitate the creation and sharing of teaching materials.[11] There is also *Schools TV*, a public television channel run by the public broadcaster NTR, delivering educational contents for primary school students.[12] In addition, some government subsidies are used for procuring digital tools to support students with special educational needs or support organisations that do so.

Apart from these few cases, however, the ministry gives schools full autonomy to procure on their own and use the digital (and non-digital) teaching and learning resources. Although a vast majority of schools use a learning management system to help organise teaching and learning, as well as various digital resources including a distinctive use of intelligent tutoring systems for teaching Dutch language and maths, none of these tools and resources are publicly owned, procured or directly subsidised.[13] The role of the ministry is therefore limited in providing components of the digital ecosystem for teaching and learning.

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

Although the ministry does not own, procure, directly subsidise, or mandate the use of digital tools for school management or specific teaching and learning resources, it provides funding to schools and makes efforts to support education providers in acquiring and using digital tools and resources.

Ensuring access and supporting use

Equity of access

The Dutch government has undertaken several efforts to secure digital equity in education. In secondary education, schools are responsible for the access and delivery of the free (digital) learning resources to every student. The ministry also provides guidelines to help students equitably access and use digital technologies at all levels of education. Such effort is manifest in the initiatives like the Equal Opportunity Alliance (*Gelijke Kansen Alliantie*), which works with schools, municipalities, and other stakeholders in education to better understand what they would need to foster equitable education, and to promote equal opportunities for all students.[14]

However, there is no binding regulation as regards ensuring digital equity across schools. Schools are thus expected to deal by themselves with arranging digital access for students from lower socio-economic backgrounds. Only during the COVID-19 outbreak did the government exceptionally subsidise digital devices for students to help them access education, and implement measures to encourage disadvantaged or vulnerable students to return to school after the school closures (OECD, 2021[1]). The devolution of responsibilities to schools regarding digital infrastructure might lead to possible inequities across schools, such as an uneven access of hardware, and to disparities in access to learning materials between primary and secondary levels, where the former is not covered by binding rules.

Supporting the use of digital tools and resources

Given the decentralised structure and high educational autonomy of schools, the Dutch government does not involve itself much in ensuring access to digital tools for school management or digital resources for teaching and learning. Neither does it mandate the use of specific tools or resources, nor provide criteria for procuring digital education infrastructure. Yet, to support the use of various private tools and resources that schools may acquire, Kennisnet has developed a step-by-step school guide to choosing digital learning resources.[15] In addition, together with schoolboards, it has created a database called the *Catalogue Information Connection Point* (*Koppelpunt Catalogusinformatie*), which provides an overview of available (digital) learning resources.[16] Via Kennisnet, the Dutch government also monitors the level of digitalisation in schools.[17] Schools can also join the cooperatives of schoolboards like SIVON to exchange knowledge and expertise, collectively organise demand bundling, jointly purchase ICT facilities, and ensure favourable conditions in price-quality and range of ICT products and services for the schools.

Cultivating the digital competence of education stakeholders

As with many other aspects of education, the main responsibility to provide training for developing teachers' digital competences falls within the remits of each school and schoolboard. Compared to the European average, there is indeed a higher share of primary and lower secondary schools in the Netherlands that promote the use of digital technologies in teaching and learning, as well as teachers' relevant professional development (European Commission, 2019[2]). Conversely, the ministry does not have system-level policies directing teachers' digital training and development programmes. The initial teacher training in the country is also implemented by higher education institutions, which determine the contents of training programmes autonomously.

However, there are several (non-binding) initiatives to help cultivate the digital competences of teachers and students. In early 2022, the Dutch government initiated the *Masterplan Basic Competencies* – a programmatic intervention to enhance teachers and students' basic skills (reading, writing, arithmetic, and digital literacy) through an integrated and sustainable long-term programme. The focus of this programme is on, *inter alia*, teacher training, developing effective teaching methods and learning resources, and strengthening the connection between school and the environment.[18] As digital competence is increasingly considered an essential part of the foundational learning for teachers and students, the ongoing curriculum reform in primary and secondary education will develop learning objectives about digital skills and literacy. This is expected to be implemented from the school year 2024/25.

In addition, through the programme Impulse Open Learning Materials (*Impuls Open Leermateriaal*), the ministry aims to support teachers in effectively using and developing open learning resources, and to improve the public infrastructure for using those resources.[19] Also, albeit not specific to education, the ministry-funded initiative *Network Media Literacy* (*Netwerkmediawijsheid*), comprising over 1 000 organisations, is committed to fostering the (digital) media literacy of Dutch citizens.[20]

Governance of data and digital technologies in education

Supporting the use of digital technology and the data it generates can only work if stakeholders recognise that this use will not work to their detriment. As schools are themselves responsible for the procurement of digital technologies, part of the regulatory efforts concerns offering guidelines to support schools in making adequate decisions, protect the data and privacy of stakeholders, and ensure the interoperability of digital education ecosystem.

In education, as with other sectors in the Netherlands, data protection falls under the European Union's General Data Protection Regulation (EU GDPR), which has also been incorporated into the domestic law.[21] Schools bear the primary responsibility in handling the data and protecting privacy of students, teachers, and school staff, and so they must ensure that their suppliers comply with the EU GDPR. Schools are also held accountable in case of errors related to the use of digital technologies. Many schools have thus worked on their privacy policy, appointed a Data Protection Officer, and sought to raise privacy awareness among the staff. When individual schools are not capable of doing so (e.g. auditing every supplier), they can unite in the SIVON cooperative and collectively approach private vendors and request a proper protection of data and privacy. In this regard, the role of the ministry and public agencies like Kennisnet is limited to providing relevant guidelines to support schools. For example, guidelines about evaluating the effectiveness of digital technology for education, specifically safeguarding the data and privacy of students and teachers in the education sector, and facilitating data transfer between schools.[22]

It is notable that education data and privacy protection in the Netherlands is implemented also through public-private partnerships. In 2018, backed by the government, public and private parties in the education sector (e.g. learning management system providers, education publishers, Kennisnet, schools, etc.) joined forces to draw up a privacy covenant, in which they agreed on how to handle students' data generated and exchanged through digital tools and tests, in accordance with the EU GDPR. This covenant has now translated into the deployment of *ECK-iD* – a unique, sectoral, non-longitudinal (hence limited in time) and encrypted educational ID number assigned to students to protect their anonymity. All schools can use the *ECK-iD* when transferring data with digital tools for system and school management or for learning, and almost all of them do so.

Another key area of improvement in the country concerns the interoperability of technologies and the data they generate, given the co-existence of a broad spectrum of digital infrastructure developed by different companies and stakeholders. To tackle this, several public and private parties have joined forces to establish norms which all public and private parties should adhere.[23] Schools are responsible for complying with these norms, while the government and public agencies provide relevant guidelines to support

schools. For instance, Kennisnet offers guidelines about the use of open standards and interoperability, and encourages schools to use the tools with specific characteristics so as to improving interoperability between tools across Dutch schools and organisations.[24] Although the ministry does not conduct any inspection or random control to proactively enforce the rules governing the data and digital technology in education, its public organ, the Inspectorate of Education, oversees schools' adherence to policies, visiting every school once every four years or so, to ascertain whether schools (both public and private) meet the general targets and provide the expected quality of education.

No specific domestic policy effort is in place to regulate the (so far limited) use of automated decision-making and AI-based tools in the education sector. However, as AI-powered platforms have recently become more and more used in school teaching (e.g. the use of intelligent tutoring systems for teaching maths and Dutch language), the ministry and Kennisnet have embarked on related policies. Relatedly, Kennisnet published reports mapping out the opportunities and threats of AI for education, and the Acceleration Plan for Educational Innovation with IT.[25] The ministry also collaborates with the Ministry of Economic Affairs and Climate Policy to enable the National Education Lab AI (*Nationaal Onderwijslab AI*), financed by the National Growth Fund, to work on human-centred advanced digital educational innovations, including AI.[26]

Supporting innovation and research and development (R&D) in digital education

In respect of educational independence, the ministry does not directly commission universities to research specifically about particular themes of digital education. However, it communicated clear research and development priorities about digital education technology and the use of education data to encourage research in this field. Many universities have identified their own research agenda to coincide with the ministry's priorities, ranging from using digital technologies to improve learning outcomes, assessment and student engagement, to developing early warning systems and supporting teaching. Part of the regulatory efforts also lies in setting up rules to ensure that researchers and research institutions can equitably access educational data for R&D purposes.

In parallel, several public agencies carry out research on digital education, including Kennisnet and the Initiative for Education Research (*Nationaal Regieorgaan Onderwijsonderzoek*), a taskforce of the Dutch Research Council delivering a long-term programme for scientific research – many of which come with a digital focus.[27] In addition, the ministry subsidises *Dedicon*, a foundation that develops innovative tools for students with visual and reading disabilities.[28]

Other key drivers behind the digital innovation in education in the Netherlands are the vibrant public-private partnerships and collaborations across the government, public organisations, schools, and EdTech companies. The Dutch government is one of few OECD systems that invests directly in EdTech start-ups. Their Seed Capital scheme is funded by the Ministry of Economic Affairs and Climate Policy and administered by the Netherlands Enterprise Agency (*Rijksdienst voor Ondernemend Nederland*), providing capital for investment funds backing innovative entrepreneurs in the technology and creative sectors. CapitalT Seed B.V. is a case within the Seed Capital scheme, a venture capital fund investing in early-stage software start-ups including EdTech such as *Scoodle* (which is an online tutoring platform allowing students to connect with tutors across the world). In addition, besides the direct investment in start-ups, sometimes the government also provides competitive educational grants and other monetary incentives to promote the development of digital learning resources and educational software, and non-monetary incentives to promote collaboration between schools and EdTech companies.

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OECD (2021), "Netherlands", in *Education at a Glance 2021: OECD Indicators*, OECD Publishing, Paris, https://doi.org/10.1787/5a37ecf5-en. [1]

Notes

[1] Kennisnet: https://www.kennisnet.nl/. The cooperative and councils include: SIVON (cooperative of schoolboards for procuring [digital] educational resources, https://sivon.nl/); PO-Raad (council for schoolboards in primary education, https://www.poraad.nl/); VO-Raad (council for schoolboards in secondary education, https://www.vo-raad.nl/); MBO-Raad (council for schoolboards in secondary VET, https://www.mboraad.nl/).

[2]https://www.nederlanddigitaal.nl/documenten/publicaties/2019/11/19/digitalisation-agenda-for-primary-and-secondary-education;

https://www.nederlanddigitaal.nl/documenten/publicaties/2021/06/22/the-dutch-digitalisation-strategy-2021-eng

[3] The devices were exceptionally distributed during the pandemic. Under the normal situation, schools themselves are responsible for ensuring the (digital) accessibility of their education.

[4] See, for instance, guidelines (https://www.lesopafstand.nl/lesopafstand/corona/draaiboeken/) and the General COVID-19 resilience plan for education (https://open.overheid.nl/documenten/ronl-ac5946d6c3245c238c16a8fcd53251fc2f923e8b/pdf)

[5] https://www.kennisnet.nl/artikel/11339/het-ethiekkompas-helpt-u-met-ethische-vraagstukken-over-digitalisering/

[6] A few companies (e.g., Google and Microsoft) provide some of these tools as 'freemium' models, i.e., providing some basic service free of charge, and charge for additional features.

[7] https://english.onderwijsinspectie.nl/

[8] https://duo.nl/open_onderwijsdata/

[9] https://www.rijksoverheid.nl/onderwerpen/basisonderwijs/vraag-en-antwoord/hoe-legt-de-basisschool-de-prestaties-van-mijn-kind-vast

[10] Examples of these systems are *Boom LVS*, *IEP-LVS*, *Dia-LVS* (in primary education); *Magister* and *Somtoday* (in secondary education).

https://www.boomtestonderwijs.nl/boomlvs; https://www.bureau-ice.nl/basisonderwijs/iep-leerlingvolgsysteem/; https://www.diatoetsen.nl/basisonderwijs/leerlingvolgsysteem-lvs/; https://www.magister.nl/; https://som.today/

[11] https://www.wikiwijs.nl/

[12] https://schooltv.nl/

[13] Examples include: *Gynzy, Muiswerk Educatief (Flexi), Prowise Learn (Rekentuin, Taalzee en Words&Birds), Snappet* and *Squla en ThiemeMeulenhoff (Got it)*.

[14] Equal Opportunity Alliance: https://www.gelijke-kansen.nl/

[15] https://www.kennisnet.nl/publicaties/stappenplan-voor-het-kiezen-van-nieuwe-digitale-leermiddelen/

[16] https://www.kennisnet.nl/diensten/koppelpunt-catalogusinformatie/

[17] Kennisnet is responsible for primary and secondary education as well as VET. For higher education, there is SURF, a cooperative association of Dutch educational and research institutions, and universities): https://www.surf.nl/. For monitoring and measuring the level of digitalisation, see the following links:

https://www.kennisnet.nl/app/uploads/kennisnet/publicatie/kennisnet-monitor-hybride-onderwijs-vo-1.pdf; https://www.kennisnet.nl/app/uploads/Kennisnet-ict-monitor-mbo-2021.pdf; https://www.kennisnet.nl/app/uploads/kennisnet/publicatie/vierinbalans/Vier-in-balans-monitor-2017-Kennisnet.pdf

The government also funds a website to provide information on remote learning: https://www.lesopafstand.nl/

[18] https://www.rijksoverheid.nl/documenten/kamerstukken/2022/05/12/kamerbrief-masterplan-basisvaardigheden

[19] https://www.openleermateriaal.nl/

[20] https://netwerkmediawijsheid.nl/

[21] https://wetten.overheid.nl/BWBR0040940/2021-07-01

[22] For instance, Kennisnet has an *Information Security and Privacy* (*informatiebeveiliging and privacy*) approach, which provides step-by-step plans and guidelines for good information security to minimise risks and protect privacy of citizens; SIVON provide guidelines for the schoolboards and schools that carry out Data Protection Impact Assessments; MBO Digitaal on the network information security and privacy.

[23] For instance, several councils in the education sector (PO-Raad, VO-Raad, MBO-Raad), the branch organisations of educational publishers (MEVW), distributers (KBb-e) and educational software developers (VDOD), as well as the Ministry of Education, Culture and Science.

[24] Kennisnet also provides guidelines on numerous topics related to schools, such as the use of education technology, digital testing, digital safety and data-usage and protection. For higher education, SURF is in charge. See the following guidelines as some examples:

https://www.kennisnet.nl/samenwerking/edustandaard/;
https://standaarden.surf.nl/index.php/Metadata_voor_interoperabiliteit_van_repositories;
https://www.kennisnet.nl/artikel/12352/waardenwijzer-in-gesprek-over-onderwijswaarden-en-digitalisering/

[25] https://www.kennisnet.nl/app/uploads/kennisnet/publicatie/Kennisnet-Technology-Compass-2019-2020.pdf;

https://www.kennisnet.nl/app/uploads/Kennisnet-surf-value-compass-english.pdf;

https://www.versnellingsplan.nl/en/

[26] For the knowledge exchange platform, see: https://kennisopenbaarbestuur.nl/thema/artifici%C3%ABle-intelligentie-en-publieke-waarden. For the National Education Lab AI, see: https://www.nationaalgroeifonds.nl/projecten-ronde-1/nationaal-onderwijslab. The National Education Lab primarily consists of a public workplace environment where public and private parties work together on a project basis on advanced digital educational innovations (such as AI) that address important challenges in education.

[27] https://www.nwo.nl/en/netherlands-initiative-education-research-nro

[28] https://www.dedicon.nl/

24 New Zealand

This note provides an overview of New Zealand's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how New Zealand supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how New Zealand engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- The central government publicly provides or funds digital infrastructure for system and institutional management at all levels of education for state and state-integrated schools, including providing Internet connectivity, laptops for teachers, a limited form of student information system that tracks compulsory sector enrolment, exam administration systems, and some administrative and facility management systems. The government also provides resources to support teaching and learning in primary and secondary education, including some that are centrally procured from commercial providers (e.g. Microsoft, Google) and made available to schools.
- Schools have significant autonomy in New Zealand to acquire and use their own digital infrastructure, both for institutional management and for supporting teaching and learning. Only a minority of (but not all) system management tools must be used by all public schools.
- Data protection and privacy laws regulate the management, use and access to student and education data in New Zealand. However, the access to and use of digital technologies in education is only partially regulated, due to the highly devolved nature of the education system.
- The country has invested in supporting access to digital technologies and infrastructure in educational institutions, particularly ensuring connectivity and providing or leasing digital devices to schools. During the COVID-19 pandemic, the country scaled up efforts in its Equitable Digital Access programmes (which are ongoing). In June 2023, a new strategy for education agencies was released – "Connected Ako: digital and data for learning" – as part of a major refresh of the country's digital education strategy, taking into account lessons learnt in the pandemic and advances in education technology and data analytics.
- In 2018, the New Zealand government published a new Digital Technologies and Hangarau Matihiko curriculum for primary and secondary education. To support its implementation, the ministry pursued a comprehensive suite of initiatives including professional development and programme financing, teaching and learning resources, and public and private partnerships.

General policy context

Division of responsibility

In New Zealand, the governance of the education system is shared between the central government (the Ministry of Education, hereafter "the ministry"), supported by various education agencies, and schools. Decision-making is highly devolved: schools and kura (Māori-medium public schools where teaching is based on Māori culture and values) have significant autonomy over their curriculum, assessment and resource allocation, whereas the ministry and government agencies focus on supporting teachers and education providers, developing national policy and curriculum frameworks, and calculating and delivering operational funding and staffing entitlements to all state-funded schools and kura.

Public responsibilities for providing digital technologies in education follow this devolved context, with part of the digital education infrastructure provided centrally and other parts acquired locally. Independent private schools fall somewhat outside the remit of the government's digital strategy and their provision and funding of digital infrastructure. While they are part-financed by the state, they must acquire their digital hardware infrastructure (Internet and devices) with their own budget and in some cases may not be able to access publicly procured software made available to public state schools by the ministry.

Whereas the provision of digital infrastructure to schools is partly devolved, the overarching rules that govern the access to and use of data and digital technologies in education, including data protection and privacy, are enacted by the central government and apply to all educational levels. Further guidelines may also exist at local or institutional levels.

Digital education strategy

The government has recently published a renewed 10-year strategy to guide the digital and data direction of the country's education agencies, "Connected Ako: Digital and Data for Learning", that takes into account lessons from the pandemic and advances in education technology and data analytics.[1] The strategy identifies 6 areas for ongoing work: 1) te ao Māori in digital design (agreeing processes to embed Māori language and culture); 2) using data to make a difference; 3) safe and effective digital services; 4) engaging widely and effectively with diverse stakeholders; 5) future-focused leadership to trial emerging technologies; and 6) transformed learning, teaching, assessment and research. Improving Internet speed, access and coverage, and providing devices to teachers all remain a priority. Based on the high-level strategy, the ministry, the New Zealand Qualifications Authority and the Tertiary Education Commission are developing plans of action and for monitoring the implementation of initiatives.

In 2018, the ministry published the "Digital Technologies and Hangarau Matihiko" curriculum (for primary and secondary education) and developed a package of supports available to schools and kura to assist with the introduction of the new content into their local curriculum.[2] The technology learning area is currently being refreshed and due to be released in 2024. Additionally, New Zealand has invested over NZD 700 million (USD 450 million) into public schools and kura at all education levels to support the country's digital hardware infrastructure, including providing devices for schools and students (particularly those with special education needs) and improving broadband, Wi-Fi and mobile connectivity via the ministry-funded school Internet service provider Network For Learning (N4L).[3] The ministry also provides a digital device leasing scheme, *TELA+*, for teaching staff in public schools (subject to certain eligibility criteria).[4]

As part of the government's COVID-19 response to address inequity during lockdowns and school closures, the ministry provided further support to schools and kura through the purchase and distribution of devices and financial assistance with costs related to the distribution of distance learning materials.[5] The ministry also scaled-up its *Equitable Digital Access* programmes focused on ensuring that households with school-aged students had Internet connections and digital devices for learning from home.[6]

More broadly, New Zealand has a national digitalisation strategy, the "Digital Strategy for Aotearoa and Action Plan", to modernise and transform its public services – although digitalisation of the education system does not explicitly feature in the strategy. The government has also created Chief Digital Officer, Chief Data Steward and Chief Information Security Officer roles to support a whole-of-government approach.[7]

The public digital education infrastructure

In New Zealand, the ministry provides various components of the public digital ecosystem available to education providers, particularly in primary and secondary education. A newly established education agency, Te Pūkenga, is responsible for vocational education and training and therefore for providing its own public digital infrastructure for VET. This section reviews two aspects of the public digital infrastructure in New Zealand: digital tools for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information and enrolment system

The ministry maintains a central student register, the *National Student Index (NSI),* that stores basic demographic data about students for computing education statistics and school funding. It allocates a unique identifier to students (*National Student Number*; *NSN)* so that they can be followed longitudinally

throughout the system. In addition, the ministry provides a central system management application called *ENROL* that all schools and kura must use and update as students enrol, change schools or leave the school system.[8] However, *ENROL* is not a typical student admission or enrolment system that schools (or parents) use to directly register or enrol students; rather, its purpose is to track students at the central system level and to collect and store student demographic and administrative data (including special education flags, teaching and learning notes, and information relating to school health checks).[9] Educators can only view a student's full record of information if they are currently enrolled at their school. The combination of the *NSI* nor *ENROL* systems represents a kind of limited centralised student information system that provides a consolidated record of student identity, demographic and enrolment information but does not replace the need for school-level systems for schools and kura.

Schools and kura must share basic student demographic data with the ministry for the centralised databases (e.g. birth date, gender, residential status). To facilitate this data sharing, the ministry compiles a list of school information systems that are approved for connecting with the central databases – although there is no ministry involvement in providing, procuring or directly funding schools' acquisition of such systems (used by 97% of schools and kura).

Administrative management and support systems

The ministry provides schools and kura with a range of web applications that serve other management purposes.[10] For example, the *Attendance Service Application (ASA)* is a system that schools can use to make absence referrals; once a referral is generated, a local service provider will allocate it to an advisor for action to reduce student absenteeism. [11] This data also feeds into a statistical predictive modelling tool used by the Ministry of Social Development that essentially functions as an early warning system to identify at-risk youth and ensure they have access to the Youth Service for young people Not in Education, Employment or Training (NEET).[12]

In addition, a new centralised education resourcing system, *Pourato,* is currently being developed to provide an accessible and real-time view of funding and staffing entitlements to schools and kura (replacing an existing offline system).[13] Other digital tools publicly provided or used by the ministry include those for executing administrative functions, such as *EdPay* (teacher payroll), or facility management systems, such as *Helios* and *School Evaluation of Physical Environment* (asset and property planning, management and evaluation). While the majority of the tools are used by school staff or the ministry, some are used by associated stakeholders (e.g. private transport companies). To access this ecosystem of publicly provided digital tools for system and institutional management, stakeholders require an Education Sector Logon (ESL).

Examinations and career guidance

Beyond the digital tools provided by the ministry to facilitate system and institutional management, other government education agencies contribute to the digital ecosystem at the central level. The agency responsible for administering examinations and qualifications, the New Zealand Qualifications Authority (NZQA), provides a digital platform to manage and administer assessments that form part of the examinations for students at upper secondary level. Students logon to the platform to view their marked digital or scanned paper exams online, as well as receive their results and order certificates and records of achievement.[14] Schools and contractors involved in the assessment process can also login to the platform via their ESL credentials to manage student information, online marking and exam supervision processes.

To help students find their future career, the Tertiary Education Commission (TEC) offers a careers guidance platform that provides information, tools and resources for secondary school students (e.g. on choosing subjects or orienting career decisions post-secondary education) as well as for adults in or seeking employment.[15] The platform also has a dedicated section on tools and resources for educators

implementing career guidance programmes in schools. A separate agency, the Teaching Council of Aotearoa New Zealand, provides a career website for teachers with a range of information resources on certification and teaching practices (but it is not a professional development platform).[16]

Digital ecosystem for teaching and learning

As with digital tools for system and institutional management, the ministry publicly provides various digital resources for teaching and learning that schools and kura may choose to use.

Digital teaching and learning resources

Static learning resources targeted at primary and secondary educational levels are made available through the websites *Te Kete Ipurangi* (for English-medium resources) and *Kauwhata Reo* (for Māori-medium resources).[17] Those resources cover a wide range of subjects and are all classified according to the relevant curriculum framework. An online curriculum hub has been launched in 2023 to integrate and rehouse the resources from both websites.[18] The ministry also funds *Te Kura*, a distance education provider that offers a wide range of personalised learning programmes for students from early childhood through to secondary education and that follows the national curriculum. Students can enrol part-time or full-time, for flexible time periods, and engage in offline and online courses supported by qualified teachers.[19]

Some digital teaching and learning resources are more widely accessible through public media channels. For example, the ministry runs a YouTube channel with content targeted at teachers and students, and during the COVID-19 pandemic the ministry partnered with TVNZ, a free-to-air television network, to deliver educational programmes for primary students (*Home Learning TV*).[20]

Formative assessment tools

Beyond the central provision of static teaching and learning resources, the ministry freely provides multiple digital tools for formative and continuous assessment. The online *e-asTTle* diagnostic assessment tool enables teachers to conduct formative assessments in their classrooms or (more recently) remotely on reading, mathematics and writing at the primary and lower secondary levels.[21] The tool and assessment modules are available in both English and te reo Māori. The *Progress and Consistency tool* (*PaCT)* is another formative evaluation tool provided by the ministry that assists teachers in making consistent judgements about student progress in reading, mathematics and writing.[22] It includes psychometrically calibrated measurement scales based on teachers' judgements of student achievement rather than direct assessments of the students themselves; each part of the scale is associated with a curriculum level. The PaCT system must be connected to a schools' LMS (or relevant school information system) and it can generate individual or cohort reports at various levels (e.g. class, school, etc.). A similar system, Te Waharoa Ararau, exists for teachers in kura to make consistent judgements about and track student progress in the Māori-medium curriculum.[23]

Publicly procured tools to support teaching and learning

In addition to the digital resources it owns and provides, the ministry publicly procures or has negotiated special education pricing on a range of commercial software licences.[24] These publicly procured resources are available to all fully state-funded schools and kura, but not necessarily private independent schools. The ministry periodically advertises opportunities for private companies to produce government-funded learning resources on the Government Electronic Tender Service (GETS), but private suppliers can promote and sell their own learning resources to schools and kura directly without government funding or approval.

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

Providing a public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

New Zealand has rules and guidelines on equitable access to educational opportunities at all levels of education, including distance learning – but not specifically on access to digital technologies. The ministry enforces the use of a minority of its publicly owned and provided digital tools for system and institutional management (e.g. data sharing requirements with *NSI*, and the use of *ENROL* and the *Attendance Service Application*) at all educational levels; most other centrally provided or procured digital tools and resources are used on an opt-in basis by schools and kura. The centralised provision of several digital tools and resources provides students, teachers and schools with equal access to the digital education ecosystem. The ministry also funds the government-owned *Network for Learning* (N4L) company that provides Internet connectivity and cyber security and safety services to all public schools.

Nonetheless, the devolution of responsibilities to education providers for ultimately using publicly provided or centrally procured digital solutions, as well as their discretion to acquire additional components of their digital infrastructure, leads to possible disparities and inequities across institutions. While the ministry's funding formula, in principle, partially mitigates disparities across schools and kura by taking into account socio-economic barriers, issues of uneven access to (digital) hardware and learning resources will likely remain given that there is no oversight of how institutions internally manage and allocate their operational budget.

The ministry also implemented a scaled-up *Equitable Digital Access* programme during the COVID-19 pandemic to provide connectivity and digital devices to students. The programme was not means-based, meaning all schools regardless of their socio-economic decile ranking were able to request devices, although the ministry identified students in upper secondary education in deciles 1-3 as priority learners. Teachers in each school reported the number of devices needed for students in their classrooms, and school leaders thus identified and communicated their school needs to the ministry; the ministry then provided as many devices as possible in line with needs. Over 49 000 devices were provided to students, including for all year 9 to 13 learners in need.[25]

Finally, while the development of digital competences is part of the national curriculum, schools and teachers can try to meet this objective with total pedagogical discretion – except for the mandatory course on digital competences that was included in the new curriculum. The only aspect of education in which the access and use of digital technologies is specifically regulated relates to digital examinations for students at the end of high school. This provides an incentive to schools and kura to acquire and use digital technology to some extent.

Supporting the use of digital tools and resources

Access to the publicly owned and centrally provided digital tools for system and institutional management is facilitated for teachers and administrators through the centralised Education Sector Logon (ESL) identifier, meaning that users do not need to create individual credentials for accessing and using different applications and that access to various functions within those applications is personalised according to user needs (or status). Users are provided with some basic training and guidance for how to use the tools, and the ministry also provides clear and easily accessible guidance on its website.

The ministry supports the use of the digital teaching and learning resources it provides through dedicated guidance for teachers via an e-learning hub, connected to the *Te Kete Ipurangi* website.[26] Guidance focuses on pedagogical practices using technology in general, both inside and outside of the classroom, and support for using specific technologies. The "Kāhui Ako" ("Communities of Learning") also de facto function as local communities of support and guidance for teachers, although their focus is much broader than digital education and the use of technologies for teaching.[27]

More generally, the ministry provides guidelines to schools and teachers on aspects of student well-being and safety that pertain to the use of digital technologies in the classroom in primary and secondary education.[28] The ministry also provides other related guidelines intended to support the evaluation and development of schools' capacity to deliver digital education (e.g. *e-Learning planning framework*) and to support the use of technology for inclusive education.[29]

Cultivating the digital skills of education stakeholders

In New Zealand, professional standards regarding teachers' digital competencies specifically do not exist, although initial teacher education (ITE) programmes are expected to develop teacher digital competencies and this aspect is included within ITE approval and monitoring requirements. The ministry does provide some guidelines on the uses of digital technologies in class as well as on in-service teachers' digital competencies (for both primary and secondary educators). Developing digital fluency, both as a user of digital technologies and a producer of digital content, constitutes one of the seven professional learning development (PLD) priorities underpinning the ministry PLD programme.[30] Applications for the regionally allocated PLD are made by teachers directly via an online platform provided by the ministry.

In 2018, the "Digital Technologies and Hangarau Matihiko" curriculum introduced new content areas in the curriculum including computational thinking and "designing and developing digital outcomes". By the time the curriculum came into force in 2020, NZD 38 million (EUR 21 million) had been spent to ensure schools and kura understood the new content areas and how they could be integrated into teaching and learning programmes. *Technology Online*, a site housed within the *Te Kete Ipurangi* website, showcases examples of contemporary teaching and learning in technology education and provides curriculum support materials to teachers.[31] The ministry also launched the 3-year *Digital Readiness Programme* in 2017 to support and embed the new curriculum in schools and kura.

In addition to their own initiatives, the ministry partnered with various organisations to support the roll-out of the new curriculum. The ministry worked with Auckland University to develop several online learning modules to support students and teachers at the senior secondary levels. In 2018, in partnership with the IT industry, the ministry launched the annual *123Tech Challenge* aiming to find regional and national 'tech' champions.[32] Students participate as individuals or teams to represent their school or kura, supported by a teacher, and demonstrate how digital technologies can be used to solve a local problem in their school community. Finally, to support the development of student competencies, two innovative programmes – *Raranga Matihiko* and *Digital Ignition | Mapura Matihiko* – were delivered in partnership with a museum and a private company respectively, providing access to specialised technologies and rich learning environments to primary and lower secondary students through free face-to-face and online workshops.[33]

More generally, to inform and involve parents, students and the general public in consultations about a host of education issues, the government has an active consultation website, *Kōrero Mātauranga.*[34] In 2017, the government launched a consultation on digital technology in education (specifically on the draft of the new curriculum), and publicly published both a summary and consultation process report.[35]

Governance of data and digital technologies in education

There is a range of legislation and a charter that apply to the governance of data and digital technologies in education including the Education and Training Act 2020, the Privacy Act 2020, the Data and Statistics Act 2022 and the Algorithm Charter for Aotearoa New Zealand.

The New Zealand government is a signatory to the *Algorithm Charter for Aotearoa New Zealand*.[36] The goal of the charter is to demonstrate a commitment to ensuring New Zealanders have confidence in how government agencies use algorithms, as well as demonstrating transparency and accountability. While not specific to education, one of the principles of the charter is that any system-level decisions impacting a given individual must have, at some point, been reviewed by or received input from a human. While the charter is non-binding, it does provide guidelines related to the development, use, interpretability and monitoring of algorithmic models at all education levels, as well as accountability of (some) digital technologies in education. In general, few (if any) automated decisions are made at the system-level in education by algorithms, but where they are (e.g. the *NEET analytics model* housed by the Ministry of Social Development), these are subject to the charter principles.

New Zealand has national data protection and privacy rules, both in general (via the Privacy Act 2020) and specifically regarding student data and privacy at all education levels (via the Education and Training Act 2020).[37] For example, national student numbers are not connected to other national identity numbers. The government also provides various guidelines and resources to schools and early learning services on data protection, privacy and online security, including resources for understanding responsibilities related to the law changes introduced in 2020.[38] Further guidelines about the use of student data and the protection of student privacy, as well as that of teachers and school staff, may be developed by individual schools or more local governance bodies. While the ministry does not enforce those rules proactively, the Education Review Office (the ministry's external evaluation agency) does conduct regular inspections of all schools and kura. Misuse of the national student number by schools is also explicitly considered an offence in New Zealand and punishable by a penalty of up to NZD 15 000 (USD 9 600).

In terms of access to student data, specific rules govern the access to and use of education data in New Zealand. Some of the data collected by the ministry is regulated under the Data and Statistics Act 2022, which provides for national statistics including education data.[39] Some education data are made available to researchers (subject to rigorous application processes and criteria) through data products such as the *National Census* and the *Statistics Integrated Data Infrastructure*, which is a large, longitudinal research database holding microdata about people and households from various government services and agencies. Researchers may also request to use data from the *PaCT* evaluation tool; in these cases, all identifying information about schools and students will be removed from *PaCT* data to ensure anonymity. The Data and Statistics Act also sets out new powers for the Government Chief Data Steward that apply in an education context and include adopting mandatory data standards, new accountability rules and improved scrutiny of algorithms.

To facilitate data portability across the system the ministry provides guidelines on managing student and teacher data, and it also publishes a list of school information and management software that can easily share student data collected in schools with the central NSI register.[40] While there are no rules governing the interoperability of digital tools within the national digital ecosystem in education, the ministry encourages the use of open and specific technical standards – for example actively participating in the Access 4 Learning community that uses SIF specifications (a standardised and well-defined infrastructure for integrating student-centric software applications). The *Access 4 Learning* community is a non-profit, collaborative and international community of schools, education policymakers, software vendors and consultants that focuses on data interoperability, management and privacy in the context of digital learning ecosystems.[41]

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

Although no public research priorities have been formulated in the field of digital education nor is there a specific research funding programme focused on the topic, the New Zealand Council for Educational Research (NZCER), an independent public research agency, is partly funded through a government grant and conducts research and analysis on a range of educational topics including the use of digital technologies to improve learning outcomes, teaching and assessment.

There are no institutionalised partnerships between EdTech companies and the government in New Zealand – the ministry and its agencies mostly contract research and development work including the development of specific digital tools to external partners, and there are no formal financial mechanisms (e.g. investment, subsidy) to incentivise private sector innovation and development in this field. However, the ministry does support and foster some forms of collaboration with EdTech companies indirectly or through non-monetary means. For example, it has established an effective relationship with The Education Technology Association of New Zealand (EdTechNZ), a satellite of the New Zealand Tech Alliance that represents over 500 organisations in the field of (education) technology.[42] The ministry also organises conferences with education and technology stakeholders and co-sponsors the *Techweek New Zealand* initiative, which seeks to build a community of entrepreneurs, businesses, government officials and educators and foster new connections among them.[43]

Notes

[1] https://www.education.govt.nz/digitalstrategy/introducing-connected-ako/

[2] https://www.education.govt.nz/our-work/changes-in-education/digital-technologies-and-hangarau-matihiko-learning/; https://www.education.govt.nz/our-work/changes-in-education/digital-technologies-and-hangarau-matihiko-learning/more-information-on-the-curriculum-change/

[3] https://www.n4l.co.nz/

[4] https://www.education.govt.nz/school/digital-technology/devices/tela-laptops-for-teachers-and-principals/

[5] https://www.education.govt.nz/school/funding-and-financials/school-finances/quick-reference-guide-for-new-ministry-funding-and-programmes/#devices

[6]https://www.education.govt.nz/school/digital-technology/your-schools-ict-network/enabling-home-internet-access-for-your-community/

[7] https://www.digital.govt.nz/digital-government/about-digital-government/introduction-to-nzs-digital-transformation/ ; https://www.digital.govt.nz/digital-government/strategy/digital-strategy-for-aotearoa-and-action-plan/

[8] https://www.education.govt.nz/school/managing-and-supporting-students/enrolling-students/

[9] https://assets.education.govt.nz/public/Documents/School/Managing-and-supporting-students/ENROL/ENROLSchoolsUserGuide-V4-0-v2.pdf

[10] https://applications.education.govt.nz/

[11] https://www.education.govt.nz/school/managing-and-supporting-students/managing-student-attendance/attendance-services/

[12] https://www.msd.govt.nz/about-msd-and-our-work/work-programmes/initiatives/phrae/youth-service-for-neet.html

[13] https://www.education.govt.nz/our-work/changes-in-education/pourato/

[14] https://www2.nzqa.govt.nz/login/

[15] https://www.careers.govt.nz/, although the website will soon be at: https://www.tec.govt.nz/focus/our-focus/careers-system-strategy/tahatu/

[16] https://teachingcouncil.nz/

[17] Te Kete Ipurangi has been renamed to Tāhūrangi with a new website (https://tahurangi.education.govt.nz/) / https://kauwhatareo.govt.nz/; https://www.tki.org.nz/

[18] https://assets.education.govt.nz/public/Documents/our-work/information-releases/Advice-Seen-by-our-Ministers/October-2021/12.-1269502-Update-Online-Curriculum-Hub-project_Redacted.pdf

[19] https://www.tekura.school.nz/learn-with-us/learn-with-us/about-te-kura/

[20] Ministry of Education NZ YouTube channel: https://www.youtube.com/channel/UCdFyjdfqmXgIPJ4wMsQd_Hg; TVNZ https://www.tvnz.co.nz/shows/home-learning-tv

[21] https://e-asttle.tki.org.nz/About-e-asTTle/Basics

[22] https://curriculumprogresstools.education.govt.nz/pact/learn-about-pact/

[23] https://tmoa.tki.org.nz/Mataiako/Te-Waharoa-Ararau

[24] https://www.education.govt.nz/school/digital-technology/software/

[25] https://www.educationcounts.govt.nz/__data/assets/pdf_file/0007/214468/Full-Report-Evaluation-of-Provision-of-Connectivity-and-Devices-A-Covid-19-Response.pdf

[26] https://elearning.tki.org.nz/

[27] https://www.education.govt.nz/communities-of-learning/

[28] https://www.education.govt.nz/school/digital-technology/ict-incidents/digital-technology-guide-for-schools/

[29] E-Learning planning framework: https://elearning.tki.org.nz/Professional-learning/e-Learning-Planning-Framework; Guidelines on technology tools for learning: https://inclusive.tki.org.nz/guides/technology-tools-for-learning/

[30] https://pld.education.govt.nz/regionally-allocated-pld/pld-priorities/

[31] https://technology.tki.org.nz/

[32] https://123tech.nz/

[33] https://www.tepapa.govt.nz/learn/for-educators/raranga-matihiko-weaving-digital-futures; https://www.digitalignition.co.nz/

[34] https://conversation.education.govt.nz/about/

[35] https://www.education.govt.nz/our-work/consultations/recent-consultations/digital-technology-consultation/

[36] https://data.govt.nz/assets/data-ethics/algorithm/Algorithm-Charter-2020_Final-English-1.pdf

[37] Privacy Act (2020): https://www.legislation.govt.nz/act/public/2020/0031/latest/LMS23223.html; Education and Training Act (2020): https://www.legislation.govt.nz/act/public/2020/0038/latest/LMS170676.html?search=qs_act%40bill%40regulation%40deemedreg_education+training+act_resel_25_h&p=1&sr=1

[38] Resources and guidelines include: https://www.education.govt.nz/our-work/changes-in-education/privacy-act-2020-resources-for-schools-and-early-learning-services/; https://www.education.govt.nz/school/digital-technology/ict-incidents/protect-your-school-from-cyber-attacks-and-cyber-security-breaches/; https://www.education.govt.nz/school/managing-and-supporting-students/sharing-information/

[39] Data and Statistics Act (2022): https://www.legislation.govt.nz/act/public/2022/0039/latest/whole.html

[40] https://www.education.govt.nz/school/digital-technology/data-and-information-management/managing-data/

[41] https://home.a4l.org/. For more on SIF specifications specifically: https://www.a4l.org/page/SIFSpecifications

[42] https://edtechnz.org.nz/about/

[43] https://techweek.co.nz

25 Slovenia

This note provides an overview of Slovenia's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Slovenia supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Slovenia engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Slovenia, the ministry assumes some responsibility for the public provision and governance of digital education to schools. Notably, it centrally manages a student information system and provides a selection of digital teaching and learning resources, including open resources. Schools have the autonomy to procure digital management tools as well as other types of digital resources they see fit. The ministry thus offers guidelines to assist them in making informed decisions regarding digital infrastructure procurement, while organising teacher training and development programmes on the pedagogical application of digital technologies.
- Slovenia's digital education strategy, codesigned with teachers and other educational stakeholders, prioritised five main areas: students' and teachers' digital proficiency; national co-ordination for digital education; digital divide; appropriate infrastructure for digital education.
- The ministry has enacted rules and provides guidelines to support access to and use of digital technology in education and offers earmarked fundings to schools upon request – notably to procure the commercial tools of their choice, such as their learning management systems. The EU General Data Protection Regulation (EU GDPR) dictates the standards for data protection and privacy, while specific guidance ensures third parties can access data for research under specific conditions.

General policy context

In Slovenia, the public governance of the education system is a collaborative effort shared among the central government (ministry), schools, and to a lesser extent, municipalities. While municipalities are responsible for certain aspects like funding and establishing in basic public schools (primary and lower secondary levels), their role in school governance and regulation remains limited. The ministry of education (*Ministrstvo za vzgojo in izobraževanje*) takes the lead in developing the national curriculum, formulating education regulations, and overseeing their implementation.[1] Schools themselves primarily manage resource procurement and allocation, and the Education Inspectorate (*Inšpektorat za šolstvo*), an agency of the ministry, conducts school inspections.

Division of responsibility

Public responsibilities for offering schools with access to components of the digital education infrastructure follow this somewhat centralised context. System-level digital tools, such as the central education register and student information system, are centrally managed. Conversely, school-level digital tools, like learning management systems, are typically procured by individual schools, supported by public agency ARNES (Academic and Research Network of Slovenia), with operating budgets and subsidies provided by the ministry of education.

Concerning digital teaching and learning resources, the ministry offers a selection, notably open educational resources. The ministry also assumes a significant role in supporting and promoting the uptake of the resources, offering comprehensive guidelines to assist schools in making informed decisions regarding digital infrastructure procurement, while organising teacher training and development programmes on the pedagogical application of digital technologies. Despite the relative centralisation of digital education infrastructure management in Slovenia, schools retain autonomy in selecting and using tools and resources that align with their specific needs. They engage in procurement from various educational stakeholders, including universities, EdTech companies, and teacher unions. The only exception to this autonomy pertains to system-level tools, which are mandatory for use.

The central government plays a pivotal part in facilitating and overseeing the utilisation of digital education infrastructure, establishing regulations governing access to and use of data and digital technologies within education. In tandem with the European Union General Data Protection Regulation (EU GDPR), Slovenia has specific rules safeguarding the data and privacy of students, as well as teachers and school staff.

Digital education strategy

In 2022, the ministry of education (then the Ministry of Education, Science and Sport) unveiled the *Digital Education Action Plan 2021-2027*, formulated through a collective effort with diverse education stakeholders.[2] This consortium included schools, universities, teachers, students, teacher unions, policy makers, and public entities. Recognising the ramifications of the COVID-19 outbreak, the Action Plan spotlighted several critical challenges within the current education landscape. Top priorities identified were addressing: students' and teachers' digital proficiency; national co-ordination for digital education; digital divide; appropriate infrastructure for digital education; among other concerns.

In 2023, the government adopted the Digital Slovenia 2030 strategy (*Digitalna Slovenija 2030*), a strategic roadmap charting the country's visions and aspirations for harnessing technology to spearhead a cross-sectoral digital transformation. Regarding education, this strategy emphasises the crucial need to keep education universally accessible, while fostering the comprehensive development of digital competencies among all education stakeholders. This aligns with the establishment of the Ministry of Digital Transformation (*Ministrstvo za digitalno preobrazbo*) in 2021, which oversees the progress of the digital transformation and coordinates and implements initiatives across all sectors, including education.

In the upcoming years, the Ministry of Education is committed to sustaining investments in both hardware and software infrastructure. This encompasses providing students and teachers with laptops and tablets, as well as amplifying Internet connectivity and speed throughout educational institutions at all levels. Complementing this, the Ministry of Digital Transformation has earmarked funds specifically for ICT equipment for students and schools. The Ministry of Education will introduce Augmented Reality and Virtual Reality (AR/VR) tools and 3D printers in many schools to support new approaches to teaching and learning. Equipping vocational education and training (VET) institutions with robotic arms is another focal point of investment. Concurrently, the government envisions innovating next-generation digital tools for system and school management. This will concern a new student information system, learning management systems, a digital credential system, and a digital exam administration system. Cutting-edge technologies, including intelligent tutoring systems and classroom analytics tools, are also planned for future development.

The public digital education infrastructure

This section reviews two aspects of the public digital infrastructure in Slovenia: digital tools for system and school management, and digital resources for teaching and learning.

Digital ecosystem for system and school management

Central education database and student information system

Under the *Organisation and Financing of Education Act* (*Zakon o organizaciji in financiranju vzgoje in izobraževanja*), the ministry of education owns and operates *CEUVIZ* (*Centralna evidenca udeležencev vzgoje in izobraževanja*), a central education database.[3] *CEUVIZ* serves various purposes, including monitoring key education objectives, informing school funding decisions, and providing data for scientific and statistical research.

For these purposes, *CEUVIZ* houses a diverse array of data about students and schools at all educational levels, spanning from pre-school, primary and secondary, to short-cycle higher vocational education and training (VET). The data encompasses student performance (e.g. grades and assessment scores), school timetables, academic calendars, indicators of school meal eligibility, and special educational needs and disabilities (SEND), among other data points. Within *CEUVIZ*, each student is tagged with an EMŠO (*Enotna matična številka občana*), a national-level unique, longitudinal identifier that is also used by other government ministries. In parallel, information about teachers, such as human resources, payments, and teaching qualifications, is stored and managed within *KPIS* (*Centralna evidenca zaposlenih na področju vzgoje in izobraževanja*), a central database of employees in education.[4] Within *KPIS*, each teacher is also tagged with an EMŠO.

Additionally, schools use *eAsistent*, which is licensed from a commercial vendor. Most public and private educational institutions are required to manually input into this system education-related information about students. While the bulk of the data is sourced from the educational institutions themselves, certain data, such as students' gender, date of birth, and place of residence, is imported from other government databases, including the *Central Population Register* (*Centralni register prebivalstva*), *Register of Institutions and Programmes* (*Razvid izvajalcev javno veljavnih programov vzgoje in izobraževanja*), *Register of Spatial Units* (*Register prostorskih enot*), and eVŠ, the *Records and Analytical Information System for Higher Education* (*Evidenčni in analitski informacijski system visokega šolstva v Sloveniji*).

At present, EMŠO serves as the key identifier, ensuring data consistency and accuracy when exchanging information between these databases. Nevertheless, to further enhance this exchange and boost system interoperability, the Slovene government has launched the *Smart School* (*Pametna šola*) initiative. This project envisions a next-generation student information system. Alongside this technical overhaul, efforts are underway to streamline the associated legislation.

Learning management systems and other support systems

During the COVID-19 outbreak, *eAsistent* offered a learning management system for providing feedback on student assessment. Since then, at the institutional level, *Skupnosti* (a Moodle-based platform) and Microsoft Teams stand out as the primary learning management systems in Slovenia.[5] Although the use of these systems is not mandated, *Skupnosti* is particularly endorsed by the ministry of education. To ensure its effective deployment, the ministry extends technical assistance and teacher training, and finances ARNES (*Akademska in raziskovalna mreža Slovenije*), the Academic and Research Network of Slovenia, to tailor *Skupnosti* to the country's school specifications. As for *Microsoft Teams*, the ministry has drawn a partnership with Microsoft to offer students with access to both Teams and the Office Suite on a maximum of five devices. Teachers also benefit from Microsoft-provided guidance and trainings on its optimal use. Notably, the prevalence of these learning management systems surged post the onset of the COVID-19 pandemic. For instance, the number of online classrooms on *eAsistent* increased from none to 36 946, registering a total user count of 86 961.

The Slovene government also provides a suite of applications available for schools to utilise for various administrative purposes. The e-Government platform, *eUprava*, features two central student admission systems, facilitating enrolment into both primary and lower secondary schools, as well as upper secondary and VET schools.[6] Other publicly offered digital tools includes *Mojaizbira*, a career and study guidance platform designed for VET students, and *COBISS,* a national library and information system linked to individual school libraries and databases.[7] While the ministry handles the procurement of these institutional management systems for primary and lower secondary schools, upper secondary and VET schools are responsible for their own acquisition process.

Digital ecosystem for teaching and learning

The Ministry of Education offers a range of digital resources tailored for teaching and learning, affording schools and teachers the latitude to select resources that best fit their needs. Several of these resources are openly accessible to the education community. For instance, the ministry manages *SIO* ("Slovensko izobrazevalno omrežje"), an Open Education Resources (OER) repository, which extends a wealth of learning materials, details about educational events and pertinent regulations, and a directory of available training programmes.[8] *RTV Slovenija* ("Radiotelevizija Slovenija"), the country's public broadcaster, delivers educational programmes for primary and lower secondary students. While most of this content does not strictly adhere to the national curriculum, an exception was made during the COVID-19 outbreak. In parallel, some digital teaching and learning resources are reserved exclusively for those who are enrolled in formal education. Examples include a Massive Open Online Course (MOOC) platform tailored for teacher training, complimentary digital textbooks (provided when schools purchase physical textbooks from publishers), and interactive resources.

All publicly supplied resources, barring TV content, are mapped to the national curriculum, covering a large spectrum of subjects and skills. While the ministry allocates school budgets for these resources, the final decision on purchases and usage rests with the schools themselves. Additionally, schools retain the autonomy to independently source extra resources from private vendors and other education stakeholders.

Enabling the use of digital tools and resources

While the provision of public digital education infrastructure and funding for digital resources is crucial, it does not automatically ensure their uptake by schools and teachers. To enhance the adoption and effective use of these tools and resources, various rules and guidelines are established to facilitate access to, and promote the use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

In Slovenia, comprehensive system-level policies are in place to promote digital equity in education. Through centralised public provision and procurement of digital tools for system and school management, the government ensures that educational institutions have sustained and equitable access to the digital education ecosystem. Key digital tools for system management, like *CEUVIZ*, must be used. Additionally, a specific portion of the school budget is earmarked for the acquisition of one of three privately-developed applications (*eAsistent, eSchool,* or *localis*), which schools are required to use to input data into the national student information system connected to *CEUVIZ*. This incentivises every school to possess a foundational digital system for school management and data reporting to the government.

To further bolster digital equity, specific rules and guidelines exist to facilitate equitable access to and use of digital technologies in education. Schools have the option to request additional funding earmarked for acquiring digital equipment, with allocations influenced by student enrolment numbers. In terms of policy, all schools are treated equally, but there is a particular emphasis on addressing the needs of students with special educational needs and disabilities (SEND). Since 2000, a dedicated budget has been in place for a special educational institution catering to blind students (but regular schools with such students may not necessarily access this budget).[9] Slovenia also benefits from REACT-EU funds from the European Commission, aimed at supporting students from low socio-economic backgrounds, particularly concerning the repercussions of the COVID-19 pandemic and ICT equipment requirements.

Apart from these efforts, the Slovene government's educational strategies do not target a particular group, and neither the Ministry of Education nor other government ministry proactively monitors or oversees the internal allocation or management of digital infrastructure budgets within schools. This might lead to some disparities in digital resource access, especially in upper secondary and VET schools, which have independent procurement responsibilities for school management tools. Nonetheless, with the array of support measures in place for disadvantaged students and the significant provision of digital tools and resources through public channels, the disparities in resource availability across institutions are considered to be relatively limited by government officials.

Supporting the use of digital tools

The Ministry of Education actively champions the adoption and use of publicly provided digital tools and resources through a range of strategic measures. As with most other OECD countries, it sets aside an operating budget for schools to purchase digital tools and resources. A specific segment of this budget is dedicated to the acquisition of digital tools, such as *eAsistent*, *eSchool*, and *localis,* as stated above. The ministry further extends support by providing guidance on system-level tools, and by coordinating professional development opportunities for educators. Concerning digital teaching and learning resources, schools and teachers in Slovenia enjoy a high degree of autonomy in their selection, use, and procurement. This freedom encompasses both resources made openly available by the ministry, and those created by other educational stakeholders. The ministry also strongly endorses the use of school management tools, such as the *Skupnosti* learning management system.

Beyond providing an operating budget and guidance, the ministry arranges professional development sessions to assist schools and teachers in using the digital technologies in education. It also complements the slate of public digital tools and resources with certain publicly procured commercial software, such as Microsoft Teams and Office Suite, for which the ministry negotiates special education pricing to ensure affordability. Additionally, the development of digital didactics and educational materials receives financial backing from REACT-EU funds as well.

Cultivating the digital competence of education stakeholders

In Slovenia, the ministry of education has taken some steps to enhance teachers' digital competence. It has appointed several mathematics teachers as ICT coordinators in schools and introduced roles of school ICT advisors based in municipalities. The national curriculum offers directives on employing digital tools, providing practical examples of using the tools in several subjects. Nevertheless, the ministry's primary focus remains to offer non-binding guidelines, which are meant to guide both pre-service and in-service teachers on digital competences, particularly regarding classroom technology integration.

However, the onset of the COVID-19 pandemic magnified the ministry's commitment to enhancing teacher training and digital competence. A salient example is the 2021 launch of a two-year initiative across 220 schools, emphasising the refinement of digital strategy and encouraging peer reflections among teachers. Moreover, as part of its national recovery and resilience plan, the ministry invited educational professionals and school leaders for specialised training, targeting the digital upskilling of 20 000 educators. Leveraging the European Structural Funds, the ministry also rolled out a suite of support programmes for schools in need, including initiatives designed to enhance the digital proficiency of school leaders.

Concerning the digital competence of students, unlike many OECD countries, digital skills and competence are currently not taught as part of the curriculum. However, this absence does not mean that there are no efforts to cultivate student's digital competence. Computer science is a compulsory subject in the first grade of upper secondary schools, and other levels offer it as an elective, alongside courses like data processing, programming, and computational thinking. Furthermore, in 2023, the ministry unveiled a public tender for proposal for innovative projects designed to foster digital competence and basic skills in computing and

informatics.[10] Co-financed by the ministry and the European Union's (EU) NextGenerationEU initiative, this call aimed at developing training programmes outside formal education for students at all educational levels, aligning with the European DigComp framework.

Finally, while not specific to education, the Slovene government has recently adopted the Promotion of Digital Inclusion Act ("Zakon o spodbujanju digitalne vključenosti").[11] This act aims at enhancing digital inclusion, incorporating measures like subsidising quality public educational programmes that foster public interest in digital technologies; collaborating with ministries on digital competence policies; launching campaigns to boost confidence in and safe use of digital technologies; and establishing a scheme where Slovene citizens and permanent residents can either obtain a digital voucher for tech equipment or lease it for free.

Governance of data and digital technologies in education

Effective support for the integration of digital technologies in education, as well as the management of the resulting data, hinges on the recognition by stakeholders that such adoption is not detrimental to their interests. Consequently, there exists a set of rules governing their use, safeguarding the data of education stakeholders. In addition, the government takes steps to involve students and parents in consultations and workshops regarding the implementation of digital technologies in educational settings. However, there are currently no specific policy initiatives in place to regulate the use of automated decision-making, AI-powered algorithms, or digital proctoring in education. As of 2023, their application remained limited.[12]

In Slovenia's education sector, as in other sectors, the EU General Data Protection Regulation (EU GDPR) dictates the standards for data and privacy protection. This has been adopted into the country's legislation through the *Personal Data Protection Act 2022*.[13] Additionally, the specific safeguarding of data and privacy for students, teachers, and school staff is outlined in the *Organisation and Financing of Education Act*. Together, these pieces of legislation oversee the collection, retention, and use of educational data.

Equitable access to and use of educational data, including information within the central education database (*CEUVIZ*) and the central database of employees in education (*KPIS*), are regulated by both the *Personal Data Protection Act 2022* and the *Organisation and Financing of Education Act*. The former, aligning with the EU GDPR, stipulates that personal data can be shared without individual consent when third parties engaged in scientific, historical, or statistical research that serves the public interest request the data. The latter introduces more specific provisions concerning the data of students and educators. It elaborates on the entities permitted to gather the data, the data collection methodologies, the type of data eligible for processing, and the exceptional circumstances under which certain data can be accessed and linked in a non-anonymised manner. This includes research about student progression to higher vocational and tertiary education, or analysing the job prospects of higher education graduates.

To enhance data portability across systems, the ministry offers guidelines for developing and sharing open educational resources that are compatible with other systems, in line with UNESCO's Open Educational Resources standards.

Supporting innovation, research and development (R&D) in digital education

Over the past five years, the Ministry of Education has actively championed innovation, research, and development in digital education. It has delineated clear research priorities in digital education, and launched public tenders for organisations to develop educational resources and software, as evidenced by the above-mentioned projects aiming to bolster students' digital competence and skills in computing and informatics. The ministry's agency, the National Education Institute Slovenia ("Zavod Republike Slovenije za Šolstvo"), delves into research spanning various educational facets, including digital learning

and creating didactics for diverse subjects.[14] The ministry has also forged collaborations with the Academic and Research Network of Slovenia (ARNES), a public entity that facilitates research and educational institutions in Slovenia by offering them a platform for networking and collaborative ventures, connecting them to global research networks.

In addition, the ministry announces annual calls for academic research to analyse the influence of digital technologies on student learning trajectories, allocating competitive research grants that universities can apply for. Examples of such research encompass projects about the use of digital technologies to enhance teaching, student engagement and assessment, as well as devising strategies that cater to students with special educational needs and disabilities.[15] In 2023, two projects – *AI in the classroom* and *Standards on blended learning* – were selected.[16] Moreover, Slovenia is among the eight countries collaborating on the EU-funded ATS STEM initiative, which endeavours to supply teachers and students with digital assessment approaches fine-tuned for nurturing students' transversal skills in STEM education.[17]

One of the catalysts for digital innovation in Slovenia's educational landscape is the synergy between public and private sectors, encompassing governmental bodies, educational institutions, and EdTech companies. Although the Ministry of Education does not directly invest in EdTech ventures or provide tax incentives, it does underwrite the R-D endeavours of these companies. In this setup, the companies are incentivised towards fostering partnerships with educational stakeholders – schools, universities, and public agencies – primarily because several public research tenders necessitate collaboration between educational entities and the private sector. While the Ministry of Education does not independently craft EdTech products, other governmental wings, such as the Ministry of Digital Transformation, also announce public tenders for product development. Amplifying this drive, the Chamber of Commerce and Industry of Slovenia, a non-governmental organisation for Slovene businesses, established in 2016 the Digital Coalition, a multi-stakeholder platform bringing together a range of organisations, thereby galvanising the development and update of ICT solutions across sectors.

Notes

[1] The Ministry of Education, Science and Sport has been recently renamed the Ministry of Education, with its mandate refocused. Research, innovation, and higher education are no longer within its purview. Instead, these responsibilities now lie with the newly established Ministry of Higher Education, Science, and Innovation.

[2] https://www.gov.si/assets/ministrstva/MIZS/SDIG/JR-NOO-usposabljanja-303-35/2022/Akcijski-nacrt-digitalnega-izobrazevanja-2021-2027.pdf

[3] http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO445#

[4] https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/JN-BMMB/Izhodiscne_specifikacije_Priloga_2_popis_zbirk_OP_K.docx

[5] https://skupnost.sio.si/

[6] Primary and lower secondary: https://e-uprava.gov.si/podrocja/vloge/vloga.html?id=2212

Upper secondary: https://e-uprava.gov.si/podrocja/izobrazevanje-kultura/srednja-sola/vpis-v-srednjo-solo.html

VET and higher education: https://e-uprava.gov.si/si/podrocja/izobrazevanje-kultura/visoka-in-visja-sola.html

[7] https://www.mojaizbira.si/; https://www.cobiss.si/

[8] https://sio.si

[9] Centre IRIS – Centre for Education, Rehabilitation, Inclusion and Counselling for the Blind and Partially Sighted. https://center-iris.si/o-nas/center-iris-en/

[10] https://www.gov.si/novice/2023-06-09-objavljen-javni-razpis-eksperimentalni-projekti-st-303-842023/

[11] http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO8516

[12] In 2017, the Jožef Stefan Institute and the Ministry of Education (previously the Ministry of Education, Science and Sport) jointly piloted METIS, an intelligent early warning system. METIS employs machine-learning algorithms to analyse students' grades and attendance, assisting teachers in identifying students facing challenges. However, due to various technical and legal hurdles, the system was never fully implemented.

[13] http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO7959

[14] https://www.zrss.si/

[15] See, for instance, the project *Innovative Pedagogy 1:1*, which lasted from 2017 to 2022: http://gu.puslapiai.lt/gu/wp-content/uploads/sites/2/journal/published_paper/volume-18/issue-1/V74qfqSw.pdf

[16] https://www.dobabusiness-school.eu/news/project-development-of-a-blended-learning-standard-in-slovenia

[17] https://www.atsstem.eu/

26 Spain

This note provides an overview of Spain's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Spain supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Spain engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Spain, the responsibility for providing digital infrastructure in education is largely decentralised and devolved to the governments of the autonomous communities – although the central ministry remains responsible for the autonomous cities of Ceuta and Melilla. In general, the relevant governing authority publicly provides digital tools for system and institutional management for schools within their jurisdiction, including a student information system, an admission management system and a learning management system. There is no centralised student information system or student register in the country.
- The central ministry, via the National Institute of Educational Technologies and Teacher Training, publicly provides significant digital resources to support teaching and learning that schools and teachers across all the autonomous communities can access (in addition to those provided by the educational authorities at lower levels of government).
- The National Recovery, Transformation and Resilience Plan, financed by the EU and implemented since 2021, includes several projects focused on the digital transformation of education. Several governments of the autonomous communities have also elaborated their own regional digital education strategies and initiatives.
- Due to the highly devolved nature of governance, ensuring the equity of access and use of digital infrastructure, tools and resources across schools is a challenge. However, most autonomous communities provide a minimum digital infrastructure that includes tools for system and institutional management, and the central government provides significant open educational resources to support teaching and learning. National initiatives also aim to connect all schools to high-speed Internet and to provide access to digital devices to vulnerable student groups.
- At the central level, the ministry provides significant resources to support teachers in using digital tools and resources in education and in developing teachers' digital competencies, including information resources, practical guidelines and open online courses. In 2022, the ministry published an updated framework for certifying in-service teachers' digital competencies. Each autonomous region has adopted the framework and committed to certifying the digital proficiency level of at least 80% of in-service primary and secondary teachers before the end of 2025.
- Spain has general rules on data protection and privacy, but further rules related to the access to educational data and uses of digital technologies in education are the prerogative of the governments of the autonomous communities. While the ministry promotes interoperability of its own publicly provided digital tools in addition to developing a national standard taxonomy of digital educational content, there are no national rules on the use of open or technical standards.

General policy context

Division of responsibility

In Spain, the governance of the education system is shared between the national government and that of each of the country's autonomous communities (political and administrative regions with the right to self-government, within the limits set forth in the Spanish constitution; hereafter "regions"). The national Ministry of Education and Vocational Training (*Ministerio de Educación y Formación Profesional*; hereafter "the ministry") defines compulsory education subjects and their assessment criteria at all education levels across the country, as well as academic and vocational qualifications. It is also directly responsible for governing the education system in the autonomous cities of Melilla and Ceuta (cities with the right to become autonomous communities but that have not exercised this right). Some of the regions offer different linguistic teaching models (those that have their own officially recognised languages), and all are

responsible for the allocation and distribution of funding on education within their regions. Schools in Spain have some autonomy, but schooling decisions are mostly decided by the regional governments.

Responsibilities for providing access to and supporting the use of digital technologies in public and government-dependent schools largely follows this devolved context, although the ministry directly provides tools for system and institutional management for the two autonomous cities of Ceuta and Melilla. Schools can also acquire additional digital tools and resources.

Digital education strategy

The "Educate in Digital" national initiative (*Educa en Digital*), established in 2020 as a partnership between the ministry, the Ministry of Business and Digital Transformation, and RED.es (an agency in charge of multi-sectoral digital projects), was created in response to the COVID-19 crisis and focuses on improving access to hardware and digital services for vulnerable students.[1] Over half a million digital devices have been provided to schools to loan to students in need; the provision of digital devices and improving connectivity will continue to be national policy priorities in the coming years. Other components of the initiative focus on supporting teachers to deliver digital education and building AI-powered platforms to facilitate personalised learning (although work towards this latter goal has not yet started).

The "National Recovery, Transformation and Resilience Plan" (*Plan de Recuperación, Transformación y Resiliencia*; hereafter the "Recovery and Resilience Plan"), introduced in 2021 and financed by the EU, is a more general national transformation strategy but focuses some actions specifically on digital education. These include implementing a comprehensive national plan for digital skills and certifying in-service teachers' digital skills, furthering the provision of portable devices to marginalised student groups, improving access to digital tools and teacher training in vocational education, and advancing the digitalisation of the education system at all levels (including pre-primary) through curriculum reform and upgrading digital infrastructure (equipment and resources).[2] These actions have also formally been articulated within a national digital education and digital competency strategy by the ministry ("Plan #DigEdu"), although their implementation is primarily the responsibility of the regions. Some regions (e.g. Galicia, Extremadura, Aragón, Canary Islands) have also further elaborated their own digital education strategies building on the national "Plan #DigEdu".[3]

The public digital education infrastructure

This section reviews two aspects of the public digital infrastructure: digital tools for system and institutional management, and digital learning resources for teaching and learning. In Spain, the regions are generally responsible for providing public system and institutional management tools, but the ministry and other national agencies publicly provide significant resources for teaching and learning. While schools must use some of the system and institutional management tools that are publicly provided, they can also acquire their own digital tools and resources.

Digital ecosystem for system and school management

Student information system and institutional management system

The National Institute of Educational Technologies and Teacher Training (INTEF; *Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado*), an agency of the national ministry, provides a comprehensive, multi-functional system called *Alborán* to public and government-dependent schools at all educational levels in the autonomous cities of Ceuta and Melilla. *Alborán* includes several institutional management and resource planning functionalities: school administrators use it to update their school details including specifying the school subjects and courses offered in different years as well as the

evaluations associated with each course, to manage teacher information and assign them to courses, and to create class groups and timetables. Teachers have profiles within the system where they can manage information about their professional background, access information about their classes and schedule, and also assign grades to students in their classes. *Alborán* also enables some customer relationship management functionalities: for example, parents, guardians and students can access some of the information that is stored in *Alborán*, such as student grades (teacher awarded and final grades in each subject), attendance and registration data, via the *Sede Electronica* portal of the ministry by using their ID number.[4] In addition, *Alborán* effectively functions as a student information system (SIS) in the education systems of Ceuta and Melilla, given it stores student information (e.g. name and identity documentation, age, address, class group) and facilitates the transfer of student data to the ministry.

For the rest of the country, there is no nationally provided SIS that integrates student information from across the regions in Spain. To compute national statistics on education, the ministry periodically communicates with and receives data from regional governments but there is no national student database where all student data from across the country is collected and where students have unique identifiers. However, within the cities of Ceuta and Melilla, *Alborán* does provide students with a unique and longitudinal student identifier meaning those students can be tracked across educational levels so long as they remain enrolled in schools within those territories; students can also be linked with their teachers in the *Alborán* system. Each autonomous community has its own equivalent multi-functional system that the regional ministry publicly provides to schools (including private schools in some regions), although the exact functionalities of each system may vary across regions depending on the solution provided. Examples of similar tools include *Seneca* (Andalucía) or *Pincel Ekade* (Canary Islands).[5] In the case that a student transfers from one region to another, their student information cannot be transferred digitally and must be re-entered manually in their new region.

Learning management systems

All schools are publicly provided with a learning management system (LMS). Currently all regions (and the national ministry for Ceuta and Melilla) provide *Moodle* as their official LMS platform, which provides both a learning and content repository and communication tools between students and teachers. However, the exact customisation and use of the platforms may vary from region to region. In Ceuta and Melilla, the *Moodle* and *Alborán* systems are interoperable meaning that teachers can create student classes in *Moodle* based on the data stored in *Alborán*; similar interoperability exists between the equivalent tools provided in most regions. In some regions, other commercial LMS tools may additionally be procured by the regional government and offered to schools. For example, in Extremadura, the regional government provides all schools with the *Rayuela* platform (a commercial solution) that also integrates *eScholarium*, an online tool to facilitate online teaching and learning, through a single sign-on service.[6] However, commercial LMS tools (procured by regions or by schools independently) may not be interoperable with the other publicly provided digital tools or resources for teaching and learning.

Other management systems

Across Spain, student admission management systems are publicly provided by the relevant governing ministry to manage the allocation of students to schools, but the tools vary across regions. In Ceuta and Melilla, parents apply for a place for their child in one or more schools via the ministry's *Sede Eletronica* portal. Schools also access the portal to transfer the data to *Alborán* and carry out the admission of prospective students.

Similarly, various administrative management systems are publicly provided across regions. For example, in the Canary Islands, the regional ministry provides the *APP Docente* system to facilitate teacher administrative and management functions, as well as communication between teachers and their institution. In Aragón, the regional ministry provides the *PADDOC* platform for teacher management.[7]

The national ministry also publicly provides a knowledge management system called *AbiesWeb* that schools can use to manage their library funds and resources, in conjunction with the relevant regional authority. For example, in Extremadura, the regional ministry has created its own version of the tool called *ABIEX*. These library management tools can be used by teachers, students and administrative staff.[8]

Digital ecosystem for teaching and learning

(Open) educational resource repositories

The ministry, along with the National Institute of Educational Technologies and Teacher Training (INTEF), provides various educational resource repositories to support teaching and learning at all education levels. The *Procomún* and *Agrega* platforms are essentially repositories of static and interactive digital resources created by the ministry, its agencies or those of the regional communities.[9] All content on the platforms are mapped to the relevant curricular area at different educational levels, according to a national standard taxonomy (LOM-ES), and both platforms include digital resources related to the whole curriculum (i.e. not only "core" subjects); *Procomún* also includes some cross-curricular resources that target the development of transversal skills (e.g. civic, intercultural or environmental educational resources) as well as those targeted for students with special educational needs. Content from both platforms can be downloaded and easily integrated into the *Moodle*-based LMS tools publicly provided to schools.

Although the resources in *Procomún* can only be accessed by teachers, who must register to use the platform, it additionally provides educators with information about creating digital content and serves as a professional networking platform. Educators can create their own profiles, join particular educational communities, and create, provide feedback on and share educational content of their own with others. The INTEF website also has its own dedicated section that was initially created during the COVID-19 pandemic to provide digital materials for online teaching and learning, including educational video content, (external) educational applications and lesson plans with integrated interactive resources.[10]

The ministry also promotes the creation of open educational resources (OER). The ministry, INTEF and the regional ministry in Extremadura have created the National Centre for Curriculum Development in Non-Proprietary Systems (*Centro Nacional de Desarollo Curricular en Sistemas No Propietarias*) whose aim is to promote the design and development of digital resources using free, open-source software. It does so via two main components: the EDIA project and the *eXeLearning* tool.[11] EDIA is another repository with digital resources mapped to the curriculum for all educational levels, as well as to the type of pedagogical approach (e.g. game-based or project-based learning). The *eXeLearning* tool is a free and open-source application developed by the ministry that facilitates the creation of digital educational content. The tool can handle a wide range of media types and interactive activities, creates content that has multi-device compatibility (e.g. computer, tablet, mobile), and allows creators to export and publish content in a range of formats.

Some autonomous communities have their own initiatives to promote the creation and use of OER. For example, in Extremadura, the "*Programa CREA*" supports teachers to use, adapt and create digital OER within the publicly provided *eScholarium* LMS platform.[12] Similarly to the *Procomún* and *Agrega* platforms, the digital resources created by teachers as part of the *Programa CREA* are mapped to the curriculum and different educational levels.

Other open access digital resources

Since 1992, the ministry has partnered with *Radio Televisión Española* (RTVE), the national broadcaster, to provide daily TV education on a range of topics for students in primary and secondary school.[13] Aired episodes can be freely accessed and viewed at any time from the RTVE website. The ministry and INTEF also provide updates, information and resources targeted at educators about various initiatives through their social media channels (as do some of the regional ministries).[14]

The ministry and INTEF also provide a range of Massive Online Open Courses (MOOCs) via the platform *aprendeINTEF*.[15] Most of the courses focus on developing digital skills, implementing pedagogies using digital tools or designing digital learning resources, but not all of them have an explicit digital component (e.g. courses on education for equality or developing global competence skills). Anyone can access the courses, but the majority are targeted at teachers; as such, it effectively functions as a platform for teacher development. Twice a year, teachers can also apply to participate in online tutored courses lasting two months, after which participants earn digital micro-credential badges that they can store, export and share via their social networks. Some regional governments may also provide their own platforms for teacher development, for example the *Doceo* platform in Aragón.[16]

Platform for student distance learning and online tutoring

The ministry has established the Integrated Centre for Distance Regulated Education (*CIERD; Centro Integrado de Enseñanzas Regladas a Distancia*) which provides a specialised *Moodle* platform for distance learning for students unable to continue their education in person (e.g. students residing temporarily outside of Spain).[17] The platform enables the full delivery of the curriculum at primary and lower secondary education level, as well as some components of upper secondary education and VET, using materials designed by teachers specialised in distance education. Students mainly complete activities asynchronously and send them periodically for evaluation by teachers, but students can also benefit from real-time mentoring from tutors; however, the platform does not deliver online examinations (these must be done in person).

Innovative classrooms

INTEF, in collaboration with regional governments and industry partners, coordinates the *Aulas del Futuro* initiative ("Future Classroom Lab") in Spain. The "Future Classroom Lab" is a project led by the European Schoolnet network and translated into national contexts in 15 countries by local education stakeholders. The goal of the project is to create and promote flexible and easily reconfigurable classroom spaces and foster teaching and learning through active methodologies using digital technology.[18] The project proposes to divide classrooms into six "zones" – Investigate, Explore, Interact, Develop, Create, and Present – that foster student-centred pedagogies. With this model, INTEF and regional educational authorities are creating a network of 20 *Aulas del Futuro* for teacher training and professional development across the country. Each of the zones include different tools and technologies to support learning activities, including digital whiteboards, tablets, virtual reality headsets, portable recording devices, and materials to facilitate research and computational thinking. Teachers can also find dedicated resources on innovative methodologies including modifiable activity plans and testimonials on the *Aulas del Futuro* website. Some regions have launched their own initiatives to support schools that want to create their own adapted *Aula del Futuro* with their own resources, including providing support via the network of regional collaborators called *Embajadores AdF* (Future Classroom Lab Ambassadors).

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

Providing some kind of public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

In Spain, students' rights to digital education in general are enshrined in law.[19] As the responsibility for education in Spain is decentralised and devolved to the autonomous communities, there are inevitably differences in terms of the specific digital hardware, management tools and resources publicly provided across the country. There is also little by way of centralised rules to ensure an equitable provision and use of digital infrastructure across regions, although the national ministry provides general strategic guidelines on the equitable access to and use of digital technologies in education (as do some regional ministries).[20] That being said, the central ministry and INTEF do provide significant digital resources for teaching and learning that are openly accessible, and most regions provide, at a minimum, similar system and institutional management tools to those publicly provided by the ministry in Ceuta and Melilla (e.g. an SIS, LMS, KMS and admission management system). Of the various tools and resources publicly provided by relevant authorities in the country, only the SIS and admission management systems in each region are provided as a minimum and mandatory for public schools to use (although there is no law stipulating the minimal provision and use of digital tools).

At the school level, schools can use non-earmarked, operational funding provided by their governing authority (which decides the allocation and distribution of funding autonomously) for expenditure related to ICT, inevitably leading to disparities and inequities in access and use of digital technologies across institutions and regions. Procurement practices also differ across the country for schools that wish to acquire additional digital tools or resources. For example, schools in Ceuta and Melilla must enter into a public procurement process and obtain approval from the national ministry to procure digital tools (although the ministry does not impose criteria on or provide guidelines to support procurement). In other regions, for example the community of Valencia, the regional government mandates another organisation to carry out procurement and it provides a list of pre-authorised tools. Some regions also impose specific criteria or provide further procurement guidance.

In general, students and institutions from low socio-economic backgrounds as well as rural institutions are considered priority groups in Spain's digital education policy and the ministry does address equity of access to digital infrastructure to those groups through some targeted actions. For example, since 2015, the national *Escuelas Conectadas* initiative (led by RED.es and in collaboration with several ministries) has focused on providing all schools with high-speed Internet; as of January 2023, the initiative had reached 100% of public schools in 12 of the 17 regions (and both autonomous cities).[21] Since 2020, the "Educate in Digital" initiative has also provided digital devices to schools to loan to vulnerable student groups. When distributing funding to the regions to implement the *Escuelas Conectadas* initiative, information related to these priority groups is taken into account (e.g. the proportion of students from low socio-economic backgrounds in a particular region).

Supporting the use of digital tools and resources

The *aprendeINTEF* platform provides a wide range of professional learning and development courses that are publicly available to all teachers in the country, including on how to use the teaching and learning resources publicly provided by INTEF. INTEF also provides specific online or face-to-face trainings to teachers in the cities of Ceuta and Melilla on how to use the digital tools for system and institutional management provided by the national ministry (e.g. *Alborán*). Some regional ministries also offer support such as dedicated guides or professional learning courses related to their own publicly provided digital tools or resources. For example, as part of the "Programa CREA" implemented in Extremadura, teachers can find guidelines, access trainings, and receive personalised support from staff at the regional ministry on how to design and use OER in their classrooms.

In general, most of the initiatives coordinated by INTEF that relate to digital teaching and learning resources provide educators with dedicated guidance and support. For example, the *Aulas del Futuro* (Future Classroom Lab) initiative integrates several support measures including: 1) at least one "ambassador" within each region that teachers in participating schools can contact for advice and support; 2) an interactive map with information about other participating schools and their specific projects; 3) dedicated trainings for teachers, provided by INTEF or the relevant regional body; and 4) guidelines and resources for different stakeholders (e.g. teachers, school leaders and policy makers) to facilitate the implementation of the project.

Beyond providing trainings on specific digital tools, resources or initiatives, the INTEF website provides more general information resources to teachers to support their use of digital tools. For example, the "Educational Technology Observatory" (*Observatorio de tecnología educativa*) is a website with articles written by teachers for their peers on new educational technologies.[22] The *ConectaTIC* platform is a dedicated support space that provides concrete and practical resources for educators related to digital education, as well as a space for peer support.[23]

In terms of system-level support, legislation enacted in 2020 stipulated that each school in Spain must elaborate a Digital School Plan detailing the school's strategy and actions related to digitalisation – both in terms of its use of digital tools for teaching and learning, and to facilitate school management processes.[24] The plan is updated annually and must take stock of the current digitalisation of the school (using the EU's *SELFIE* self-evaluation tool for schools), outline digitalisation objectives and a roadmap of concrete actions to achieve them.

Some regions have also developed their own system-level support networks. For example, in Aragón, the ministry coordinates a network of teacher champions called "digital mentors" to support schools with developing their digital school plans and to support their teacher peers in developing their digital competencies.[25] Similarly in Ceuta and Melilla, dedicated technical teacher advisor roles have been created to provide guidance to teachers and school leaders on digitalisation.

Finally, to facilitate in-person peer-learning across the different education systems within the country, the national ministry coordinates and convenes a working group with representatives from all of the regions several times a year to exchange information and best practices related to digital education and resources.

Cultivating the digital literacy of education stakeholders

Spain has a national digital skills plan, which explicitly refers to developing the digital skills of both teachers and students.[26] The country has had basic rules about the development of teachers' digital competencies as part of their pre-service training for all education levels since 2007 and universities must develop teacher training qualifications in accordance with these basic standards. In 2022, as a result of collaborative work of all educational administrations in Spain, the ministry published an updated Spanish Framework for the Digital Competence of Teachers, connected to the European DigCompEdu Framework, which establishes proficiency levels for teacher digital competence in a similar way to the ones in the European Union's language competency framework (e.g. proficiency levels ranging from A1 through to C2).[27] Each region in the country has adopted the framework and has committed to certifying the digital proficiency level of at least 80% of in-service primary and secondary teachers before the end of 2025. Each regional ministry is responsible for defining and implementing its own certification process according to their different context and resources, but this must be based on a set of common procedures with specific requirements for certifying teachers at each proficiency level and certifications issued by each regional authority are recognised nationally.

As already discussed, INTEF provides significant professional learning and development resources to teachers focused on developing their digital competencies, notably through its open online courses on the *aprendeINTEF* platform. As a further complement, it has also developed a micro-learning app called *EduPills*, accessible by tablet or mobile device, dedicated to developing teacher digital competencies.[28]

Some of the regional ministries additionally stipulate their own guidelines, publicly provide platforms and online courses for teacher training, or implement specific initiatives to foster the development of teacher digital literacy. For example, the ministry of education in Aragón has developed its own teacher digital competency strategy and established specific roles (digital mentor and tutors) to support teacher training and accreditation.[29] Once certified, data is stored in the region's teacher management platform, *PADDOC*, which recommends further training courses and materials to teachers via the region's teacher training platform *Doceo*. Elsewhere, the government of the Canary Islands has its own guidelines on teacher professional standards (including digital competencies) and provides a dedicated teacher training platform on digital education with various resources enabling teachers to access training modules, technical support and gain accreditation of their digital competencies.[30]

Spain also has rules related to the development of students' digital competencies in primary and secondary education, with digital competencies being seen as a key student learning outcome. For VET education, the content of the basic curriculum is defined according to the specific vocation studied. Basic digital competence is nonetheless considered to be an outcome of any VET programme.[31] To support the development of students' competencies, INTEF collaborates with the regional ministries to implement the "School of computational thinking and artificial intelligence" project, which offers educational resources on programming and robotics for teachers to integrate in various subject areas; the *Code.INTEF* website also offers similar resources.[32]

Governance of data and digital technologies in education

Data protection and privacy

In Spain, general rules on data protection and privacy are provided for under the European Union's General Data Protection Regulation (GDPR), translated into national rules that also reference data protection in the context of education specifically (see Organic Law 3/2018). To support teachers with the responsible use of technologies in their classrooms, the national ministry, INTEF and the national data protection agency provide resources and guidelines on data protection, digital proctoring and security and the use of digital technologies by minors via the *AseguraTIC* website.[33] Any further rules or guidelines concerning the access to or specific uses of technologies in classrooms, if they exist, are the prerogative of the regional governments.

There are no national rules or provisions governing the equal access to educational data for public and private research. Some educational data are publicly documented and available at the regional level: for example, data about students, teachers and schools are publicly available in the Canary Islands via an open data portal.[34] As above, rules or guidelines on the access to and use of educational data may vary depending on the region.

Similarly, there are no national rules or guidelines concerning the use of algorithmic models, the monitoring of algorithmic bias, or the explanation or interpretability of algorithmic-based decisions. While no public digital tools or teaching or learning resources provided at the national level currently use AI-based algorithms, the ministry has signalled that the development of analytics dashboards and platforms to facilitate personalised learning through AI applications are a development priority.

Interoperability and open standards

Although there are no explicit national rules or guidelines on data standards or the interoperability of educational technologies, the ministry nonetheless promotes interoperability across its publicly provided digital systems. For example, the mandatory system and institutional management tools it provides (e.g. *Alborán, Moodle*) are interoperable, and most of the digital teaching and learning resources created in the various OER repositories can be integrated within the *Moodle* LMS publicly provided across regions (and potentially others). The promotion of the *eXeLearning* authoring tool to create OER, as well as the

development of a national standard taxonomy of digital educational content (LOM-ES), also aims to facilitate interoperability of digital resources. INTEF provides guidelines on the use and application of the LOM-ES certification.[35] Some regions may impose further rules on the use of specific open and technical standards for digital solutions in their jurisdiction.

Supporting innovation, research and development (R&D) in digital education

There are no formally articulated national public research objectives on digital education in Spain, nor is there a specific funding programme dedicated to researching issues related to digital education. However, the ministry does occasionally contract and publish some research on topics related to digital education in the context of the various initiatives that it (or INTEF) coordinates. For example, recent research papers address the use of technologies to support teaching, improve learning outcomes and improve student engagement.[36]

The ministry does directly engage in the development of some of the digital tools that it publicly provides to schools for system management (e.g. *Alborán*, *AbiesWeb*), and INTEF does the same for some of the digital resources for teaching and learning that are publicly provided via various OER repositories (e.g. *ProComún*). Teachers voluntarily engage in the development of additional open educational resources made available through these platforms, but the ministry does not formally incentivise this engagement through monetary or other means. Sometimes external organisations or individuals are engaged to produce digital resources, but this is done via a contractual arrangement with the ministry.

Likewise, the ministry does not formally incentivise or invest in the research and development of EdTech solutions. However, it does support collaboration between EdTech companies and educational institutions through non-monetary means, for example through organising conferences. Some regional authorities may have their own processes for incentivising or investing in the development of EdTech.

Notes

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27 Sweden

This note provides an overview of Sweden's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Sweden supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Sweden engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Sweden, the public provision of digital infrastructure for education is almost entirely devolved to municipalities, especially when it comes to providing schools with institutional management tools and teaching and learning resources. The central government adds to the schools' digital ecosystem some digital resources for teaching, learning and assessment which are often made openly available. But it does not engage in system-level digital initiatives, except for the digitalisation of the national student evaluations.
- Schools and teachers have freedom to acquire additional digital tools, with the support from their municipalities (e.g. professional learning opportunities), the Swedish Association of Local Authorities and Regions (e.g. guidance on procurement) or the central government (e.g. general guidance, guidelines on interoperability, technical standards).
- Sweden's vision for digital education has been guided by the 2017-2022 *National Digitalisation Strategy for the School System*, and by the 2019-2022 *National Action Plan for Digitalisation of Schools* which was developed by the Swedish Association of Local Authorities and Regions. Developing digital competences, ensuring equal access to and use of digital tools, and conducting research and development on the uptake of digital tools, are the three objectives outlined by the central government. Municipalities hold most of the policy levers to pursue those goals, which may create equity challenges, despite the generally high levels of access to hardware infrastructure in schools.

General policy context

Division of responsibility

In Sweden, the Ministry of Education and Research (hereinafter "the ministry") is responsible for determining the policies and direction of the Swedish education system.[1] Among the different public agencies that the ministry is responsible for, the National Agency for Education prepares curriculum requirements, regulations, general recommendations, and national assessments, and is also responsible for official statistics in education. The National Agency for Education is also the *central* authority with most responsibilities concerning the provision of access to, supporting the uptake of, and regulating the use of digital technologies in education.

However, in education, as in many other sectors in Sweden, the direct responsibilities of central authorities are limited. Following the 1992 Swedish Local Government Act, many public decisions and activities have been devolved to the 290 municipalities of Sweden, which are deemed better placed for meeting the educational interest of stakeholders at the local level.[2] In addition, in Sweden, municipalities operate with a budget that is primarily raised from local taxes, in place of central government funding. The public provision of digital tools in education, as well as their financing, are thus largely decentralised.

Digital education strategy

As of 2023, Sweden's priorities in digital education has followed the lines of its 2017-22 *National Digitalisation Strategy for the School System*.[3] This strategy focuses on three priority areas: *digital competences for everyone*, meaning that all students must develop adequate digital skills; *equal access and use*, referring to both students and staff having good and equal access to digital tools and resources tailored to their needs to improve education activities, and; *research and development on the potential of digitalisation in education*. As we will see later in this note, given Sweden's division of responsibility, municipalities appear to hold many of the available public policy levers to advance the objectives set up by the central government. This is why Sweden has also adopted a *National Action Plan for the*

Digitalisation of Schools (*skolDigplan)* which was developed by the Swedish Association of Local Authorities and Regions (SALAR) for the 2019-2022 period, in order to increase equity within and across schools from different regions.[4]

To ensure a coherent uptake and use of digital technologies across different policy areas and levels of government, the Swedish government has set up the Agency for Digital Government under the ministry of finance.[5] As per its mandate, the Agency for Digital Government is responsible for coordinating, supporting, monitoring, and assessing the digitalisation of public administration and the whole of Swedish society. In that general mission, the 2017 *National Digitalisation Strategy for the School System* is one part of a broader, whole-of-government ambition whereby Sweden wants to be "the best in the world in making the most of the opportunities brought about by digitalisation".[6]

The public digital education infrastructure

In Sweden, the central government has devolved most of the responsibility for providing and maintaining the digital infrastructure in education to municipalities. Schools and teachers can choose to acquire extra components for their digital ecosystem, either by purchasing tools directly from private companies or by using freely available materials from other stakeholders, such as teachers and Swedish universities. This section reviews the provision of digital tools for system and school management and of digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Central register and educational statistics

Sweden collects information about all students and schools and records it in a central register, with data that the National Agency for Education's Statistics Department (through Statistics Sweden) receives from municipalities and independent education providers.[7] As of 2023, there is no student information system attached to this register (i.e., no system with an interface allowing some parties to access the data). However, the student register is longitudinal, and a unique ID number is assigned to student data, such as their results for the national assessment. This serves as a strong material for potential educational research. The data transfer from municipalities and independent education providers to the central government is conducted as a rule once a year, allowing the National Agency for Education to publicly release official statistics about students, school staffs, costs, and educational achievements. While it is mandatory to transfer information in a format that can be interpreted by Statistics Sweden, schools may resort to different means, from automated tools to more hands-on processes (e.g. sharing spreadsheets). Municipalities and independent education providers can support and manage their schools with the digital tools they see fit to reduce the data formatting burden.

Exams and assessments

The National Agency for Education has undertaken the digitalisation of the national student evaluation for students in grades 6 and 9 in primary and lower secondary school, as well as in upper secondary school (including VET). Since 2018, the answers to essay questions for the Swedish and English language assessments are taken as a rule on computers. By 2026, the objective is to have most national assessments entirely digitised.[8] To support this digital transition, the agency is developing *Skolverkets provtjänst* ("Test service"), a digital system for exam administration that provides a single environment for student's identification and assessments' design, delivery, grading (automatic and manual) and results. As mentioned above, the results of the national assessment do not only provide aggregate feedback on the education system, but they are also linked to individual students in the central student register. In the course of digitalising the assessments, the Agency expects to face challenges in taking on the role of a

service provider that offers a tool that aims to accommodate everyone in a decentralised education system. Together with the development of a nationwide career and study guidance platform that helps students navigate the education system, the digitalisation of assessments is one of the rare large-scale digital projects that are undertaken un the education sector by the central government in Sweden.[9]

Learning management systems and other institutional management tools

Other than the system management tools above, the central government leaves to municipalities the responsibility to provide schools with additional digital tools for institutional management. According to the Swedish Association of Local Authorities and Regions (SALAR), most municipalities procure learning management systems to help their schools manage administrative processes, have data about their students, and transfer the data to the municipality that, in turn, is transferred to the National Agency for Education's Statistics Department. Similarly, most (though not all) municipalities ensure that schools have access to customer relation management systems, administrative function systems, and their own digital systems for exam administration (e.g. *DigiExam*, *Exam.net*, *Trelson*), as evidenced by a 2019 report conducted by the National Agency for Education.[10] However, SALAR reports that the digital ecosystem to which schools have access can vary greatly across Sweden's 290 municipalities. This is at least partly explained by the facts that (1) municipal budgets vary as they are raised on local taxes, (2) the central government does not mandate the use of specific tools, and (3) schools have an autonomy to procure a large proportion of the digital education ecosystem on their own.

Digital ecosystem for teaching and learning

The central government has also devolved to municipalities the public provision of digital resources for teaching and learning. However, contrary to institutional management tools, it provides some resources that are available for free, sometimes openly, and can be used by schools, teachers, and students on an opt-in basis.

At the national level, the central government provides digital educational resources that are openly available to anyone across the country. For instance, the Swedish Educational Broadcasting Company (UR), a public entity, is mandated with the production and broadcast of television and radio learning resources targeted at students at primary and secondary levels.[11] Its programmes are broadcast live on public television and radio channels, and remain accessible later on *URplay*, a digital bank that contains more than 11 000 programmes.[12] Similarly, the National Agency for Education has designed social media channels that are accessible to anyone, but targeted primarily at teachers and education professionals.[13]

The National Agency for Education also maintains *Larportalen*, an online platform for teacher development.[14] This portal provides teachers and school principals with modules to co-develop their teaching practices, opportunities for participating in peer-learning activities, educational videos, and interviews with researchers in pedagogy and didactics. The portal's teaching modules span a variety of competences (e.g. digital skills), to be taught in various subjects (e.g. teaching mathematics with digital tools) at different levels of education.

In addition to this list of open resources, the agency has made several other resources accessible exclusively to those who are enrolled in formal education. On the agency's website, teachers can find a digital bank of assessments that cover all subjects and educational levels.[15] In the same spirit, it has created *SYV*, a portal where teachers can share their lesson plans about career guidance with other registered teachers, free of charge.[16] All lesson plans are reviewed by the agency before publication.

All those centrally provided resources are only one part of digital resources for teaching and learning to which Swedish schools have access. A larger proportion of resources is provided by municipalities or, albeit decreasingly the case, directly acquired by school principals and teachers. According to SALAR, primary schools tend to use digital resources for teaching and learning more than secondary schools do,

or at least in a more coordinated way. Innovative uses of digital resources tend to spread horizontally from one school to the others with no central authority supervising their uptake. Typically, in most municipalities, teachers and students would have access to static digital learning resources (e.g. digital textbooks, audio contents, research papers), including resources for students with special needs. Only in a few municipalities would teachers have access to more advanced digital learning resources (e.g. interactive tools, simulations, adaptive assessments).

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily imply that stakeholders will use them. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

As Sweden is among the leading OECD countries in Internet penetration rate as well as in broadband availability and affordability, the country's 2017 digital strategy did not focus on increasing expenditures or reforming policies for hardware infrastructure provision. These are also policy areas that mainly fall under the remit of municipalities (or of schools themselves, if private); hence, no significant changes are expected in the future at the national level.

Similarly, in Sweden, digital divides (along the lines of age, education or income) are narrower than in most OECD countries.[17] As in other policy sectors, and similarly to other Nordic countries, granting equal access to digital tools and resources has long been prominent in the education policy agenda. Therefore, today the ministry has not identified specific priority groups of students (or schools) that would need a differentiated treatment: rather, its 2017-22 strategy established that *all* students must develop adequate digital skills, and that *all* must have good and equal access to digital tools, "based on their needs and tailored to their conditions", as the 2017 digital strategy puts it.

Generally, the few elements of the digital education infrastructure that the national level provides are available equally to public and private schools. This is the same with the tools that are openly accessible to anyone, like the television programmes, as well as with all the tools and resources that are provided for stakeholders enrolled in the education system (e.g. all teachers can access the teaching resources from the online professional development platform). However, the bulk of digital tools and resources available to schools, teachers and students is not centrally provided. Municipalities are expected to provide digital tools to their public schools (and earmarked grants to their private schools), which they do through their own budget, primarily raised from local taxes. In this largely decentralised environment, both the funding and willingness to equip schools with digital tools vary greatly across municipalities; and across schools as well, as school principals and teachers are free to acquire the digital tools of their choice.

In any case, having equitable access to hardware and software infrastructure does not necessarily lead to equity in the use of digital tools. Sections below describe the efforts Sweden deploys to measure and bridge the gap between the availability and uptake of digital tools and resources in education.

Supporting the use of digital tools and resources

As the ministry does not mandate the use of specific (digital) tools for system and institutional management (except for the new national student evaluations) as well as teaching and learning resources, it uses other direct and indirect incentives to support the access to and use of digital tools at the system, school, and classroom levels.

While municipalities, schools and teachers are granted full autonomy to procure digital tools, the central government supports them in various ways. First, it provides municipalities with funding to complement the budget they raise from local taxes – although this funding is not restricted to the acquisition of digital tools. Second, when schools or teachers themselves want to purchase additional digital tools with their operational budget, they receive general guidance from, at the central level, the ministry's National Agency for Public Procurement, and, at the municipal level, the Swedish Association of Local Authorities and Regions (SALAR). The former provides general support and explanations around the rules and regulations for public procurement as framed in the Act on Systems of Choice (LOV),[18] while the latter offers more specific support to schools and teachers within the framework of the *Skoldigistöd* (School Digitalisation Support) initiative, in the form of customer support and seminars for successful procurement of digital tools.[19] As part of the *Skoldigistöd* initiative SALAR has collaborated with the National Agency for Education and with two limited companies wholly owned by Swedish regions and municipalities, *Adda* and *Inera*, whose missions are to offer business and digitalisation support for the public sector, respectively. . Beyond support for procurement, the initiative aims at supporting and guiding school principals towards the objectives outlined by the 2017 *National Digital Strategy for the School System*, in particular as regards access to digital resources and school development.

To support the good use of digital tools in schools, the National Agency for Education offers central guidance, notably through many of its support websites, via emails or hotlines; as well as professional learning opportunities for teachers and school staffs.[20] Part of the National Agency for Education's website is dedicated to this topic of digitalisation, displaying a catalogue of inspirational and support materials for teaching, many of which are specifically related to teaching with digital tools.[21] Finally, the Agency conducts research and development to monitor and evaluate the use of digital learning resources in schools. In 2022 the National Agency for Education released its second follow-up report on the national digitalisation strategy.[22] The report builds on the results of a 2021 survey addressed to teachers and principals to take stock of the recent advances made towards the digital strategy's objectives. The report shows that the access to digital tools in Sweden is generally good, for students in their learning as much as for school staffs in the management of school activities. However, the results also show that the COVID-19 pandemic has accelerated the digitalisation of the education system, underlining the need for further developing digital competences – notably for principals in terms of their use of digital tools for school management and for students in media literacy.

Cultivating the digital literacy of education stakeholders

Sweden aims to engage all education actors in the digital transformation of the system. Developing teachers' digital literacy is one way to achieve this aim. However, the central government does not decide what competencies teachers must acquire in their pre-service training, as this decision falls within the remit of teacher training institutions that set their own curriculum – provided that it meets the requirements of Sweden's higher education ordinance as regards digital competences. This is not a rule enforced nationally by the central government, however, which may lead to an uneven preparation for teachers to teach with digital tools. OECD TALIS data from 2018 show that using ICT for teaching featured in only 37% of lower secondary teachers' pre-service training in Sweden – the lowest in all 48 countries and economies that took part in the survey, and 19 percentage points below the OECD average. Teachers in rural schools, and those who teach in schools with a high concentration of disadvantaged students, reported significantly more often that using ICT featured in their pre-service training than their peers. Beyond pre-service training, municipalities may offer in-service training to teachers, or require that they participate in it, although it is also not mandated by the central government. Nonetheless, according to the same TALIS data, in the year 2017, 67% of teachers in Sweden reported that they took part in professional development in ICT skills (a form of in-service training), slightly higher than the OECD average (60%).

Another lever to foster students' and – indirectly – teachers' digital literacy is a reform of the national curriculum. Across different levels of education, the curriculum now imposes the use of specific digital

technologies in class and establishes the development of student skills to use and understand digital technologies as one key educational objective.

Finally, SALAR contributes to cultivating the broader population's digital literacy by involving municipalities, schools, parents, and teachers in the discussions about the use of data and digital technology in education. In 2023, SALAR was for example the national project manager of the *Agile-EDU* European Erasmus+ project, involving 7 countries and led by European Schoolnet.[23] Planned for the 2023-2025 period, this project will focus on how to use data for systematic school development.

Governance of data and digital technology in education

As is the case across EU countries, the largest part of Sweden's regulation around the protection of data and privacy, in education as well as in other sectors, is the EU General Data Protection Regulation (EU GDPR). In education, specifically, the Swedish Authority for Privacy Protection has transposed the EU GDPR into the Education Act, which protects personal student data and privacy, and aims to ensure equitable access to and use of digital technologies in education for all students.[24] Further to that, the central government has issued rules and guidelines to ensure that researchers can have access to education data and educational administrative data (collected by public authorities) in equitable conditions that comply with data protection regulation.

Municipalities also take part in regulating the access to and use of digital education technologies that are not covered by the national and EU-level laws. Some municipalities may, for instance, have rules or guidelines around the use of digital proctoring methods or automated decisions taken by algorithms, even though those tools are currently seldom used, according to SALAR. However, this partial devolution of responsibility for regulation may change, as the ministry's new national student evaluations will integrate some level of automated grading, which will call for a country-wide regulation. The National Agency for Education is also considering the automation of their teacher certification system, as a recent reform demanded its revision.[25]

Sweden's regulation of digital education places a strong emphasis on interoperability with a view to connecting the different tools that are available in the Swedish digital education infrastructure, whether they are provided by the central government, by municipalities, or by non-governmental stakeholders. At the central level, there exist guidelines about data portability. For instance, in education, the National Agency for Education recommends using the *Swedish Standard SS 12000 - Information management - Interface for information exchange between school administration processes.*[26] Even though the current digital tools are not necessarily always interoperable with one another, a common and open technical standard facilitates data exchange and widespread adoption. Another national requirement is to use the *Web Content Accessibility Guidelines* (*WCAG*) to ensure that people with special needs can access digital tools (e.g. using specific format for the subtitle of a video).[27] Beyond those central-level standards, the National Agency for Education leaves it to municipalities to implement guidelines that can facilitate interoperability among the digital tools they choose. SALAR calls for the establishment of national guidelines for both suppliers and users under the umbrella of the government.

Sweden has continuously taken part in international dialogues about interoperability. The National Agency for Education, being a member of the Swedish Institute of Standards and its technical committee for education (TK450), is actively involved in work with standardisation at the European and international levels.[28] In the country, recent discussions have focused on finding the right balance between integration, interoperability, and the technical *lock-ins* that such a unified system may create, making the use of alternative tools increasingly intricate.[29] On this point, SALAR's support to municipalities also focused on the issue of *lock-in* effects related to procurements practices, raising awareness on both the benefits and drawbacks associated with building a local digital ecosystem from a single provider's tools.

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

Developing a national education technology ecosystem presents challenges both to developing appropriate local tools and to incentivising relevant innovation by external stakeholders. Providing incentives, supporting R-D, and funding education technology start-ups are part of the typical innovation portfolio countries could consider.

Conducting research and evaluation on digital education was one of the three pillars of Sweden's 2017-22 *National Digitalisation Strategy for the School System*, as stated above. This included putting forward clearly communicated public research and development priorities regarding digital education and the use of education data. However, Sweden's support for R-D in education does not specifically target digital education. For instance, the Swedish Institute for Educational Research funds practice-based research on teaching and learning, which partly covers teaching and learning with digital technologies and resources;[30] but there is no agency or funding programmes dedicated specifically to the evaluation of digital technologies in education. Instead, the government prefers to commission academic research on an ad-hoc basis. In the past five years, the Swedish Institute for Educational Research has commissioned research on the use of digital technologies to improve learning outcomes and to support teaching.[31] In addition, the National Agency for Education conducted its own follow up study on the 2017 National Digitalisation Strategy, as described above.

In Sweden, collaborations between the public sector and the private market's EdTech firms mostly take place at the municipal level. There exists a formal relationship between the National Agency for Education and Swedish EdTech Industry, the association for EdTech companies operating in Sweden, to foster their collaboration with educational institutions. However, the role of the National Agency for Education in this collaboration is limited to coordinating non-monetary incentives (e.g. organising conferences and fora, offering training), while the provision of monetary or more substantial initiatives are devolved to SALAR and municipalities themselves. For instance, while *Vinnova*, Sweden's Innovation Agency, used to be responsible for financing *EdTest*, a test bed platform for schools to test private EdTech products, this project has recently been placed under SALAR's responsibilities. [32,33]

Looking forward, Sweden's policy priorities for its digital ecosystem in education will remain in line with the country's division of responsibility and with new tasks given to the National Agency for Education. The Agency has for example been tasked to propose changes to the pre-school curriculum to make it clear that the use of digital tools is not a requirement in pre-school, where children's exposure to digital screens shall be limited. However, no new digitalisation strategy for the education has been decided. Except for the development and large-scale implementation of the digital national student evaluation through their digital system for exam administration, most policy aspects related to the provision, governance, and regulation of digital technology in education will be developed at the municipal levels.

Notes

[1] Together with the broader government; legislative power is held by the *Riksdag* (Swedish parliament).

[2] Division of responsibility between levels of government in Sweden: https://www.government.se/how-sweden-is-governed/the-swedish-model-of-government-administration/

[3] 2017 National Digitalisation Strategy for the School System: https://www.regeringen.se/4a9d9a/contentassets/00b3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolvasendet.pdf [3] 2017 National Digitalisation Strategy for the School System:

https://www.regeringen.se/4a9d9a/contentassets/00b3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolvasendet.pdf

The National Agency for Education has presented a proposal for a new National Digitalisation Strategy for the School System for 2023-2027: https://www.skolverket.se/publikationsserier/regeringsuppdrag/2022/forslag-pa-en-nationell-digitaliseringsstrategi-for-skolvasendet-2023-2027

[4] National Action Plan for Digitalisation of Schools: https://skr.se/skr/tjanster/rapporterochskrifter/publikationer/nationellhandlingsplanfordigitaliseringavskolvasendet.65276.html

[5] Agency for Digital Government: https://www.digg.se/en

[6] OECD Going Digital in Sweden: https://www.oecd.org/sweden/going-digital-in-sweden.pdf

[7] Statistics Sweden: https://www.scb.se/en/

[8] One exception to this digitisation are the national assessments for Swedish for immigrants (SFI); and perhaps so parts of the assessments in mathematics. Additionally, it has not yet been formally decided whether these evaluations will continue to be paper-based for grade 3 students. See information in Swedish on the webpage of the NAE): Nationella prov i årskurs 3 digitaliseras inte - Skolverket

[9] Career and study guidance platform: Utbildningsguiden - Utbildningsguiden (skolverket.se)

[10] 2019 Report on uptake of digital systems for exam administration: https://www.skolverket.se/publikationsserier/rapporter/2019/uppfoljning-av-hantering-av-nationella-prov-lasaret-2018-19

[11] The Swedish Education Broadcasting Company (UR): https://www.ur.se/about-ur/

[12] URplay: https://urplay.se/

[13] Examples of social media channels: https://www.skolverket.se/om-oss/var-verksamhet/webbplatser-och-sociala-kanaler/skolverkspodden; https://www.skolverket.se/om-oss/var-verksamhet/webbplatser-och-sociala-kanaler/sociala-kanaler; https://www.skolverket.se/om-oss/var-verksamhet/skolverkets-prioriterade-omraden/digitalisering/sektorsansvar-for-skolans-digitalisering [13] Examples of social media channels: https://www.skolverket.se/om-oss/var-verksamhet/webbplatser-och-sociala-kanaler/skolverkspodden; https://www.skolverket.se/om-oss/var-verksamhet/webbplatser-och-sociala-kanaler/sociala-kanaler; https://www.skolverket.se/om-oss/var-verksamhet/skolverkets-prioriterade-omraden/digitalisering/sektorsansvar-for-skolans-digitalisering

[14] Larportalen: https://larportalen.skolverket.se/#/

[15] Digital assessment bank: https://www.skolverket.se/bedomningsstod-och-kartlaggningsmaterial#/

[16] SYV: https://syvspindeln.skolverket.se/

[17] OECD Going Digital in Sweden: https://www.oecd.org/sweden/going-digital-in-sweden.pdf

[18] Guidance on procurements at the central level: https://www.upphandlingsmyndigheten.se/en/.

[19] Guidance on procurements at the municipal level: https://skr.se/skr/skolakulturfritid/forskolagrundochgymnasieskola/digitaliseringskola/skoldigistod/stodforupphandlingtekniskalosningarochinfrastruktursamtforpedagogiskochtekniskstöd.57678.html

[20] Example of professional learning opportunities for teachers and school staff: Kurser och utbildningar - Skolverket

[21] Support materials for teaching with digital tools: https://www.skolverket.se/skolutveckling/inspiration-och-stod-i-arbetet/stod-i-arbetet?filterTheme=Digitalisering

[22] 2021 Agency's follow-up report on Sweden's digital strategy in education: https://www.skolverket.se/publikationsserier/rapporter/2022/skolverkets-uppföljning-av-digitaliseringsstrategin-2021?id=9385

[23] Agile-EDU: http://agile-edu.eun.org/

[24] Swedish Authority for Privacy Protection: https://www.imy.se/en/

[25] Teacher certification system: Skolverkets digitalisering - Skolverket

[26] Guidelines on data portability: https://www.skolverket.se/om-oss/press/pressmeddelanden/pressmeddelanden/2021-11-09-skolverket-rekommenderar-en-gemensam-teknisk-standard---ska-underlätta-för-skolor / standards: Standard - Information management - Interface for information exchange between school administration processes SS 12000:2020/korr 1:2022 - Swedish Institute for Standards, SIS

[27] Web Content Accessibility Guidelines: https://www.w3.org/WAI/standards-guidelines/wcag/ ; Lag (2018:1937) om tillgänglighet till digital offentlig service Svensk författningssamling 2018:2018:1937 t.o.m. SFS 2022:1492 - Riksdagen

[28] The Swedish Institute for Standards and examples of international initiatives: Swedish Institute for Standards, SIS - Swedish Institute for Standards, SIS | Standardutveckling - Informationshantering inom utbildningssektorn SIS/TK 450 - Svenska institutet för standarder, SIS | *ISO/IEC JTC 1/SC 36Information technology for learning, education and training* | ISO/TC 232 Education and learning services | CEN/TC 353 Technologies supporting education and learning processes

[29] Interoperability and lock-ins effect in Sweden: https://www.edu-digitalinequality.org/2021/04/15/interoperability-in-sweden/

[30] Swedish Institute for Educational Research: https://www.skolfi.se/other-languages/english/

[31] Research on digital tools and education: https://www.skolfi.se/other-languages/english/research-summaries/

[32] Vinnova: https://www.vinnova.se/en/about-us/

[33] Edtest: https://edtest.se/english/ ; Om Ifous | ifous.se

28 Türkiye

This note provides an overview of Türkiye's digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how Türkiye supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how Türkiye engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In Türkiye, the ministry holds most responsibilities for providing and maintaining digital infrastructure for system and school management, as well as digital teaching and learning resources for teachers and students. Most notably, the central government operates a student information system and provides learning management systems to schools, whose use if compulsory. It also maintains a comprehensive digital education platform (EBA).
- Türkiye's last digital education strategy, published in 2018, emphasised on the provision of digital hardware infrastructure (e.g. Internet connectivity). It has sets policies that addresses the needs of students from lower socio-economic backgrounds, from rural areas and in rural schools in priority.
- In 2022, the ministry introduced the *Teacher Information Network* (ÖBA*)* to support the professional development of teachers and cultivate all educational stakeholders' digital literacy.
- Data protection and privacy in education is a the KVKK, a data protection law issued in 2016. This regulation also ensures that researchers and third parties can have access to data for research under specific conditions.

General policy context

Division of responsibility

In Türkiye, education is mainly managed centrally. Decisions concerning its national education system are overseen and centralised by the Ministry of National Education (*MoNE*). The Provincial Directorates translate the national educational strategies into the context of the Turkish provinces by setting specific targets and plans, which are then implemented by District Directorates in schools. Overarching decisions about school management, budgetary concerns and investments are the responsibility of the ministry.

Private schools, religious schools and other specialised training schools also follow the central curriculum and educational objectives of the ministry, with limited autonomy to change the curriculum or to deviate from national education strategies.

The ministry is predominantly responsible for funding compulsory primary and secondary education including all religious schools, covering costs for teacher wages, non-teaching staff, instructional materials, and other essential equipment. It thus also funds schools' digital infrastructure. Schools can also secure additional funds from donations and contributions. Specific provincial administrations can allocate funds to projects, including digital ones. Moreover, the Parent-School Association (PSA) plays a key role in addressing school-related costs and educational expenses such as IT maintenance and updates.[1] The Parent-School Association gather funds through various events and initiatives, complemented by contributions from family associations and direct donations from families or students.

The central government is thus primarily responsible for providing digital infrastructure at all levels, while municipalities may share some responsibility for public access with various means of provision and support. Digital teaching and learning resources are mainly provided under the ministry, mainly via its digital education platform called Education Information Network (*Eğitim Bilişim Ağı* or EBA) which operates under the General Directorate of Innovation and Education Technologies (*YEĞİTEK*).

Digital education strategy

Integrating digital technologies into the education system has been a priority interest for Türkiye in the last decade. In 2010, the Turkish government introduced the *FATIH* project, aimed at integrating digital tools into the educational landscape. The core objective of this initiative was to enhance technology-driven

learning by ensuring high-speed broadband internet connections in all classrooms, installing interactive whiteboards in primary and secondary classes, and distributing tablets and computers to students from fifth grade onward. Additionally, the project aimed to equip teachers with the skills to use and create digital content.[2]

Türkiye's *2023 Education Vision* was launched in 2018 as a strategic plan to guide the development of the nation's education system. The vision represents a comprehensive framework of goals and reforms intended to enhance the quality and reach of education in Türkiye, including an emphasis on digitalising and modernising its education system for the digital age. Specifically, the *2023 Education Vision* aimed to build an ecosystem for developing digital contents and skills by establishing a National Digital Content Archive and to cultivate teachers' and learners' digital literacy.[3] The COVID-19 pandemic, which forced most countries to shift to online learning temporarily, gave momentum to projects just as *FATIH* in preparing a digital education system.

In 2021, the Directorate General for Innovation and Education Technologies (*YEĞİTEK*) launched the *Safe Schooling and Distance Education Project* (SSDE) in collaboration with the World Bank, with three key pillars: (1) enhancing the digital education infrastructure, including digital platforms, (2) crafting digital strategies and generating cutting-edge educational content and (3) supporting teachers' professional development and fostering interactions within the educational ecosystem. Funded by a USD 160 million World Bank loan, the SSDE project will complement existing initiatives like the FATIH project, and the digital education platform (EBA), Türkiye's publicly provided digital learning and teaching resources, in shaping the ministry's technology-driven educational strategies by December 2023. Notably, the concurrent access capacity of EBA was increased approximately 25 times compared to the pre-distance education period and reached 1 million by the end of 2020. Special attention was given to students with special needs, with video content being translated into sign language and audio descriptions prepared for visually impaired students (Vidal, 2022[1]).[4] Additionally, infrastructure improvements were made for the enhanced production of EBA content.[5] In the past five years, the ministry has increased its expenditures to provide for computers, tablets, or mobile devices for children with special education needs (*SEN*), improve broadband connections, Wi-Fi, and mobile connections, and provide digital devices in schools. Specifically, the ministry focused on providing interactive whiteboards to public schools, especially focusing on distribution to rural areas.

While the 2018 digital strategy had not been updated yet, workshops were organised to prepare for the 2024-2028 education strategy. Also, recently implemented plans or strategies include aspects of digital technology in education such as the Instrument for Pre-Accession Assistance (IPA II)*: Increasing Attendance and Schooling Rates in Secondary Education Project* (2021-2024), a project aiming to improve teaching methods and engagement in learning to increase school attendance. The project's methods mostly involve digital tools, such as interactive textbooks, digital question bank applications, and digital gamified workbooks.[6]

The public digital education infrastructure

All public digital tools and resources are provided by the Turkish government (system-level student information system, school-level learning management systems, exam administration portals). The highly centralised nature of Türkiye's education system and its centralised curriculum requires schools at all levels, whatever their status, to use the publicly provided digital tools and resources.

Digital learning resources are also provided by the ministry, mainly via the Education Information Network (EBA). In addition to the public materials produced by the government, materials are made available for free by different stakeholders such as EdTech companies, philanthropies, and publishers. This section

reviews two aspects of the public digital infrastructure in Türkiye: digital tools for system and school management, and digital resources for teaching and learning.

Digital ecosystem for system and school management

Student information and learning management system.

The National Education Information System (*Millî Eğitim Bakanlığı Bilgi İşlem Sistem*, or MEBBİS) is a centralised, web-based administrative system that acts as a student information system in Türkiye. *MEBBİS* is mainly used to manage a wide array of educational data at the administrative level and is designed to track and manage information about students, teachers, educational institutions, and other educational staff within the country and overseas organisations of the ministry. It allows the ministry to monitor enrolment rates, student progress, the allocation of resources to schools, etc. Moreover, the centralised system facilitates administrative tasks such as student transfers between schools. A single sign-on (SSO), generated from the central register, can be used in different government websites and functions. This central register is essential for the ministry to effectively manage, plan, and implement education policies and strategies.

In Türkiye, *e-Okul* ("e-School") is the central learning management system for schools that is used in all levels of education. *E-Okul* uses a web-based software to offer a digital platform for collecting, recording, analysing, reporting, controlling, monitoring, and managing various aspects of student data pertinent at the school level, such as student registration, transfer procedures, grade entries, absenteeism procedures, exam information, application processes for centrally held exams (*LGS*, *DPY-B*, etc.), document processes (appreciation, thanks, honour, etc.), weekly course programme entries, and report cards accessible digitally. The *e-Okul* system provides report cards, grade pass/fail, inter-school transfer, course grades and attendance records from students' first registration in primary (or pre-primary when relevant) education until their graduation from secondary education.

Students use the platform to have access to their grades, textbooks, daily study subjects, and school schedule. Students log into *e-Okul* using their unique and longitudinal national identity number (*T.R. Identity number*), which are assigned at birth. Parents use a separate log-in platform which requires the school identity number and the student national identity number, to access and monitor their child's academic achievements, examination results, and information about school announcements. Teachers access *e-Okul* to record students' grades and attendance, and student's overall behaviour in school, providing information in real time to the rest of the system. The system is accessible to all formal public and government-dependent private pre-primary, primary and secondary schools. Upon registration, students use *e-Okul* throughout their entire school journey until graduation.

Finally, *e-Okul* also serves as a digital credential system for students, where they can access their diplomas online via the platform. In the *e-Okul* system, the diploma or graduation details of individuals recorded as graduates are authenticated electronically through a web service, by signing data sharing protocols between the ministry and other ministries and public entities/organisations. Moreover, students can generate diplomas or graduation certificates with barcodes using the *MEB-High School Graduation Certificate Verification* service on the e-Government Gateway.

Generally, the data stored in the sub-modules of *MEBBİS* and *e-Okul* operate independently from one another. However, the data from *MEBBİS*'s sub-modules, such as School-Institution and Personnel-Personnel affairs, is systemically integrated where needed in the *e- e-Okul*'s sub-modules.

Administrative management and other support systems

Since 2017, the ministry provides a Document Management System ('*Dijital Yönetim Sistemi*", or DYS) to facilitate the communication of administrative texts, such as employment and resignation letters,

announcements, circulars, appointments, between the central government and local provinces or public schools. As part of a broader initiative to digitalise various parts of government, the platform allows an easier and more efficient streamlining of administrative and bureaucratic processes by enabling an electronic flow of administrative documents.[7] The Document Management System not only facilitates the seamless transfer of documents, but also ensures their secure storage and backup, in accordance with the determined archive rules and guidelines. The system allows archiving and management of all incoming and outgoing documents from their production to distribution, providing authorised individuals with quick and easy access to documents.

Digital ecosystem for teaching and learning

The provision of digital resources for teaching and learning is also a central responsibility in Türkiye. The *Digital Education Platform* ("Eğitim Bilişim Ağı" or *EBA*) maintains a portal serving educational content and educational materials such as interactive simulations, videos, animations, e-books, and quizzes, that both students and teachers can access. *EBA* stores student data and statistics, and they are linked with data from e-*Okul*,

EBA provides an interactive learning environment in which students can attend live lessons, engage in online discussions, receive feedback from teachers on their assignments. *EBA* holds about 1 060 courses accessible to both students and teachers. Also, teachers can create custom lessons, assign homework, and grade assignments in real-time, and parental access is allowed to monitor their children's academic progress. Within the *EBA* platform, learning resources are categorised according to the Turkish curriculum, making it easier for teachers and students to find relevant materials. Moreover, live sessions via *EBA* allow teachers and students to engage in real-time interactions. Additionally, the platform offers teacher development seminars.[8]

During the COVID-19 pandemic, the functionalities of *EBA* have expanded. In 2019, an academic support system was added, powered by artificial intelligence and machine learning, to assist students to prepare for university admission exams. *EBA's Academic Support System (ADES)* is designed for 11th and 12th graders preparing for their university entrance exam using an artificial intelligence system that tailors resources and digital content based on individual academic goals. *ADES* helps students to customise academic roadmaps based on the university programme they aim to enrol, providing information on required enrolment grades for those universities and specific programmes. Featuring a range of videos and a bank of over 240 000 questions, *ADES* allows students to organise their studies based on a smart suggestion system, which evaluates individual student's academic performance, trial exam scores and the difficulty of questions tackled and pinpoints areas to concentrate on, and then provides relevant academic resources to achieve one's desired goals.

Türkiye openly provides TV education through the *Turkish Radio and Television Association* (*TRT*) which broadcasts educational content on three *TRT EBA TV* channels. Since 2012, this represents a free online educational platform providing learning content to all levels of compulsory education (primary, lower secondary and upper secondary). During remote learning phases of the pandemic, the ministry utilised *TRT-EBA TV* channels to deliver educational content and digital learning materials such as videos, audio content, animations, enhanced books, and educational games for all academic levels.[9] All broadcast content is available on the *EBA* or *TRT* websites, increasing accessibility of the provided learning materials.

In addition to the publicly provided resources, teachers and students also have access to free, open resources distributed by different educational stakeholders. For example, the non-profit organisation *Khan Academy Türkçe*, sponsored by the *Foundation for Translation of Scientific and Technical Publications*, provides open digital content such as video lessons that are mapped against the Turkish curriculum.[10]

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

Providing a public digital education infrastructure or funding to use digital resources does not necessarily mean that schools and teachers will use them. Different rules and guidelines can therefore support access to, and the use of, digital technologies in education.

Ensuring access and supporting use

Equity of access

The digital divide in Türkiye is greatly driven by its geography: rural areas in the less industrialised eastern coastal regions have lower access to high-speed internet and thus digital resources.[11] Türkiye recognises inequality in access to digital tools and resources in education and responds by having their policies target students from lower socio-economic backgrounds, from rural areas and rural schools. Moreover, as a significant share of the population does not complete compulsory secondary education, the ministry started the Open Vocational High School in 2016, providing online textbooks.[12]

During the COVID-19 pandemic, the digital divide was the primary barrier to remote learning in Türkiye. According to a 2021 online survey involving 3 743 educators at all levels of education conducted by *Eğitim-Sen,* Türkiye's *Education and Science Workers' Union*, 71% indicated that less than half of their students attended virtual sessions due to inadequate technology infrastructure and significant problems with the Internet or device access.[13] To reach students from rural areas, the ministry utilised *EBA TV* contents, developing courses and programmes delivered via television. Moreover, to increase student participation on the *EBA* platform, in collaboration with *UNICEF Türkiye*, the ministry established *EBA Support Centres*, tech-equipped hubs in schools and other support facilities that supported students without personal Internet or computer access. For remote regions, mobile versions of these centres were designed. In addition, the ministry collaborated with local telecom companies to provide free 8 GB Internet data packages. For socio-economically disadvantaged students, the ministry distributed 25 GB Internet data packages and tablets to over 664 000 students. At the end of the 2020 academic year, about 26% of students utilised the *EBA platform* for more than an hour per week.[14] A year later, in March 2021, it had increased to 66%.[15]

Cultivating the digital competence of education stakeholders

The ministry is increasingly interested in improving teachers' digital skills, although it is not a legal requirement in their pre-service or in-service training, nor is it to use digital technology in class. The previous strategy, Education *strategy 2023,* aimed to recruit teacher trainers who develop learning and teaching materials, as well as face-to-face in-service training programs for teachers in algorithmic thinking, and content videos and workshops for digital skills needed in digital education. The current policy priority is on improving teachers' digital competences, so several online and onsite courses are planned for various target groups: school administrators, trainers, and teachers.

In 2022, the ministry introduced the *Teacher Information Network* (ÖBA*)* to support the professional development of educators. The platform proposed about 158 digital training programmes. About 900 000 teachers had completed at least one programme as of August 2022, in addition to various workshops, webinars and face-to-face training sessions. To support teachers' digital competences, 40 online courses have been developed and published on ÖBA, reaching out more than 369 000 teachers as of October 2023. Through the ÖBA platform, the government provides local and central guidance by introducing different digital tools to teachers to enhance their digital skills. For example, ÖBA provides training sessions on using *Pardus*, a *Linux* version developed in Türkiye to help teachers and students become proficient with open-source software. Furthermore, there are courses for teachers on designing their own educational resources online: courses on web design using *HTML* and *CSS* allow teachers to create their own

educational websites and web-based resources, and courses on 3D Modelling with *Blender*, a software for 3D modelling, gives teachers opportunity to develop creative learning materials for their students.[16]

To support teachers' digital competences, a needs analysis has been conducted at the national level to collect evidence and identify teachers' needs, so as to organise teacher training. The needs analysis includes 33 760 participants across the country and identifies teachers' needs in using technology for professional development, for teaching, assessment, and for empowering learners.

In addition to the publicly provided teacher training resources, the *Teacher's Academy Foundation* (ÖRAV), a non-governmental organisation, provides professional training to teachers. ÖRAV offers an online platform, *E-Kampus*, where teachers can access various courses for their professional development since 2015. *E-Kampus* currently offers some teacher courses that relate to digital education, such as the *Interactive Course Design in Online Education* and *STEM Practices in Nature Education Training Programme*.[17]

Governance of data and digital technologies in education

The primary legislation governing data protection in Türkiye is the *Law on Protection of Personal Data No. 6698* ("*Kişisel Verilerin Korunması Kanunu*" or KVKK, referred to as the Data Protection Law), published in 2016. Similar to the European Union *General Data Protection Regulation* (EU GDPR), the KVKK also requires privacy notices and consent forms from parents/guardians of minors when collecting data to ensure data privacy. However, unlike the GDPR that specifically indicates an age range of which parental consent is necessary, the KVKK does not specify minimum age requirements.[18]

Although the Turkish Data Protection Law does not specifically cover children, the Personal Data Protection Authority (TDPA*),* a governmental agency founded in 2017 responsible for enforcing the *KVKK,* has issued guidance on this subject in 2020. It highlighted the protection of children's personal data, emphasising the need for security due to children's increasing online activity. The KVKK advises parents on ways to protect their children online and urges commercial developers to adhere to strict data protection standards when dealing with children's data, emphasising the need for parental consent in specific circumstances when processing minors' personal data, as well as raising awareness on the importance of understanding privacy notifications and the potential risks of online platforms.

Supporting innovation and research and development (R&D) in digital education

Türkiye has a central register system with rules that ensure equitable access to and use of data for various diverse education stakeholders. In general, the direct access to the central register, powered by MEBBIS, is typically restricted to authorised personnel within the ministry and its related government institutions, mainly used for administrative and bureaucratic procedures. Whether researchers can access data in MEBBIS depends on the nature of the data, the purpose of the research, and the permissions granted, under a strict screening process. Researchers should have a legitimate academic or policy-driven reason to access certain datasets. They might be able to obtain permission through formal channels, possibly requiring approval from the ministry or related governmental bodies and compliance with Turkish data protection laws.

In terms of research, some public universities have their own R-D centre that focuses on developing digital tools. Furthermore, Türkiye has a specific funding programme directly supporting academic research on digital education and education data use. The Scientific and Technological Research Council of Türkiye (TÜBİTAK) has several programmes aimed at promoting science and technology in the country. The 4005 Call for Innovative Educational Practices, which is part of the TÜBİTAK's Science and Society Innovative Education Practices Support Programme, primarily focuses on supporting innovative educational activities. Under this programme, TÜBİTAK provides financial support to projects that aim to develop and implement

innovative educational practices with the aim of increasing the interest and curiosity in science and technology in society and of school-aged students, introducing innovative, sustainable, and replicable educational practices, and supporting professional development of science and mathematics teachers.[19]

In the next five years, the ministry aims to prioritise the development of intelligent tutoring systems (ITS) as well as the strengthening of its digital education platform (*EBA)* and of its learning management system (*e-Okul)*. Precisely, with the expansion of the *EBA* functionalities and the continuous support for the *Safe Schooling and Distance Education Project* (*SSDE*), the ministry foresees the development of further versions and features for *EBA* and expects an increased use in schools and at home. Moreover, the ministry will continue providing interactive whiteboards and Internet access to public schools.

Notes

[1] Report on the role of PSA in Türkiye: ED594202.pdf

[2] Türkiye Digital Factsheet: A515573AAB05AD73C12582B1004E5B94_Digital factsheet_Turkey.pdf (europa.eu)

[3] UNESCO Report on Türkiye Education Vision: turkey_education_vision_2023.pdf (unesco.org)

[4] https://doi.org/10.1787/28bb8223-en

[5] Eurydice Report : National reforms in school education (europa.eu)

[6] National reforms in school education (europa.eu)

[7] Introduction: (europa.eu)

[8] MoNE publish: TURKEY MADE DIGITAL WORLD LIST WITH ITS DISTANCE EDUCATION STATISTICS (meb.gov.tr)

[9] EJ1308084.pdf (ed.gov)

[10] Khan Academy Turkish Team: Türk takımı / The Turkish Team – Khan Academy Help Center

[11] The Geographical Digital Divide: Urban-Rural, Regional and Gender Inequalities of Digital Transformation in Turkey (istanbul.edu.tr)

[12] A515573AAB05AD73C12582B1004E5B94_Digital factsheet_Turkey.pdf (europa.eu)

[13] Eğitim Sen. (2021). Eğitim-Sen Uzaktan Eğitime Yakından Bakıyor. Ankara: Türkiye.

[14] ERG. (2021). Eğitim İzleme Raporu 2021: Öğrenciler ve Eğitime Erişim. Istanbul: ERG

[15] Documentation of Education Response in Türkiye during the COVID-19 Pandemic.pdf (unicef.org)

[16] In detail, there are examples of local and central guidance provided for teachers and schools to encourage the use of digital tools beyond OBA, but provided through OBA courses:

1. Digital Games: Courses on using digital games in education can help teachers leverage gamification and interactive learning methods.

2. AI Applications: This translates to "Artificial Intelligence Applications Course." Such courses are designed to help educators incorporate artificial intelligence concepts and applications into their teaching methods.

3. Pardus: Pardus is a Linux distribution developed in Turkey. Training sessions on using Pardus on desktops could help teachers and students become proficient with this operating system and open-source software.

4. Web Design with HTML and CSS: Courses on web design using HTML and CSS can empower teachers to create their own educational websites and web-based resources.

5. Educational Videos: Training on the use of educational videos in teaching is valuable for educators looking to enhance their digital teaching materials.

6. mBlock: mBlock is a graphical programming tool for creating interactive animations and games. Courses like this can help teachers integrate coding and AI concepts into their curriculum.

7. Raspberry Pi: Raspberry Pi is a versatile microcomputer. Training in Raspberry Pi applications can enable educators to use this technology for various educational projects.

8. 3D Modelling with Blender: Blender is a 3D modeling software. Courses like this can be valuable for teachers who want to create 3D educational resources.

These are examples of various training sessions and courses provided to teachers and schools to encourage the use of digital tools in education beyond the OBA. Such guidance can enhance the quality of teaching and provide students with more engaging and effective learning experiences.

[17] ORAV Website: Online Training Courses | ÖRAV (orav.org.tr)

[18] Turkey: Provisions for the protection of children's data | Insights | DataGuidance

[19] 4005 Project: 4005 - Yenilikçi Eğitim Uygulamaları Destekleme Programı | TÜRKİYE BİLİMSEL VE TEKNOLOJİK ARAŞTIRMA KURUMU (tubitak.gov.tr)

29 United States

This note provides an overview of the United States' digital education ecosystem, including the digital tools for system and institutional management and digital resources for teaching and learning that are publicly provided to schools and educational stakeholders. The note outlines how public responsibilities for the governance of digital education are divided and examines how the United States supports the equitable and effective access to and use of digital technology and data in education. This includes through practices and policies on procurement, interoperability, data privacy and regulation, and digital competencies. Finally, the note discusses how the United States engages in any initiatives, including with the EdTech sector, to drive innovation and research and development towards an effective digital ecosystem.

Key features

- In the United States, the provision, regulation, and governance of the digital infrastructure in education is primarily a state and school district responsibility. The federal government does not directly develop or operate digital tools for system management, nor does it directly provide digital teaching and learning resources, but it supports states and school districts in the development of their digital ecosystems through various funding programmes.
- The Federal Department of Education, supported by a range of federal agencies, supports the digital transformation of the education system. It devises and revises a national strategy for digital education and tries to mitigate potential digital divides through several equity-targeted mechanisms.
- The federal government also supports innovation and research and exploratory development in digital education, by monitoring the uptake of digital technology in schools, funding (or directly conducting) research on their use, and ensuring that researchers have access to relevant education data.
- The United States has a sectoral approach to data and privacy protection. There is no general data protection regulation, but sector-specific regulation, including for the education sector, as well as regulation concerning children data. States have the autonomy to set up their own data governance policies above and beyond federal regulations.

General policy context

Division of responsibility

Education is primarily a state and local responsibility in the United States. The federal department of education (and other federal agencies) funds about 8% of the expenditures in primary and secondary education. The establishment of schools (and tertiary education institutions), the development of curricula, the requirements for enrolment and graduation, the material conditions of teaching and learning are the responsibility of US states and their subnational governments as well as other public and private organisations. The reality of education in the United States is thus very diverse, with different mixes of public and private education, different educational requirements and legislations across states. Most of the time, states give local education districts a significant level of autonomy: in 2017, the US Census Bureau counted about 13 500 school systems in the United States. About 12 800 school districts operate as legal entities that do not necessarily overlap with municipalities while the remainder are operated by municipalities, counties, townships or states.[1] US states and school districts are typically responsible for the school infrastructure as well as the regulation and provision of digital tools and resources to schools, teachers and learners.

This devolved governance of most aspects of education policy to many separate systems highlights the potential (and actual) diversity of the digital infrastructure and governance within the United States. This note focuses on the responsibilities of the federal level and highlights the trends and commonalities in US education. This diversity does not imply that the federal Department of Education and US states' departments of education have no influence in supporting and leading the digital transformation in education. There are also many non-governmental organisations and foundations that have a harmonising role in the United States, as the "common core" or the Next Generation Science standards that were adopted by many US states showcase.

The US Department of Education's mission is "to promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access". Regarding equal access, the department of education has a specific role for students with special needs. In addition to its role of

awareness raising, idea generation and lesson sharing to influence the educational enterprise, the department operates a certain number of grant programmes for individuals but also to support and incentivise states in developing policies in certain directions. In the case of digitalisation, the department of education offers a series of earmarked (by law) and discretionary grant funding programmes that can be used to support states', US territories' or just school investments in digital tools and learning resources. The Office of Educational Technology provides a vision and guidance on how funds could be used towards expanding access to and effective use of digital learning technologies.[2] The Institute of Education Sciences (IES) of the department of education also funds research on education technology or initiatives such as the National Center of Education Statistics' (NCES) Statewide Longitudinal Data Systems (SLDS) programme to support US states and territories to develop their digital infrastructure.[3]

Digital education strategy

As of 2023, the department of education was working on the *2024 US National Education Technology Plan* (NETP), the flagship educational technology policy document for the United States. Education technology plans have been published since 1996. The plan as of 2023 was designed in 2015 and updated in 2017.[4] It is structured around five pillars: learning (through technology); teaching (with technology); leadership (culture for innovation and change); assessment (measuring for learning); infrastructure (enabling access and effective use). The 2017 plan's update calls upon all stakeholders involved in US education to ensure equity of access to transformational learning experiences enabled by technology. When published, the 2024 NETP may have a different structure.

In terms of policy, the COVID-19 pandemic has led to an emphasis on the physical or hardware digital infrastructure. In 2023, the Office of Education Technology released guidance and future directions for federal funding and support of the educational technology landscape.[5] Through this COVID relief fund and other investments made over the last two years, the federal government has provided funding for broadband connection, Wi-Fi, Intranet servers and digital devices in schools, as well as for digital devices for children directly, especially for children with special needs. Funding included subsidies from the Federal Communications Commission and Universal Service Administrative Company's *E-Rate Universal Service Program for Schools and Libraries*. Through the *E-Rate* programme, eligible schools and libraries received discounts on telecommunications, telecommunications services, and Internet access, as well as Intranet connections, Intranet broadband services and basic maintenance of Intranet connections.[6] Furthermore, the 2021 US Secretary of Education's Supplemental Priorities lists "Providing students and educators with access to reliable high-speed broadband and devices" as a priority.[7] As such, the department of education has a broad emphasis on developing the US digital hardware infrastructure, while prioritisation of specific digital hardware resources occurs at the state and local levels, typically covering the provision of laptops or tablets for student use in institutions (and at home in some states or school districts) as well as Internet access.

To ensure a coherent use of digital technologies across different policy areas, the federal government has set up inter agency working groups on artificial intelligence and machine learning, cybersecurity, data privacy, etc. Such working groups are typically coordinated by the Office of Science and Technology Policy, placed under the Executive Office of the US President. The department of education has also appointed champions on these specific topics to promote a coherent use of digital tools throughout education systems.

The public digital education infrastructure

The federal government does not directly provide many components of the public digital ecosystem in education.[8] As with other matters in education, states have significantly more responsibility in the provision (and regulation) of digital infrastructure in schools. Schools and teachers can then choose to acquire

additional elements to their digital ecosystem, either directly from the private sector or from other education stakeholders that release solutions and resources for free. This section reviews two aspects of the public digital infrastructure in the United States: digital solutions for system and school management, and digital learning resources for teaching and learning.

Digital ecosystem for system and school management

Student information and learning management systems

The federal government does not operate a student information system at the national level, but it supports all states to develop and use such tools through its Statewide Longitudinal Data Systems (SLDSs) grant programme and provide a growing range of services and resources to this effect.[9] This programme has helped propel the design, development, implementation, and expansion of longitudinal student information systems, which are used in all US states.

According to the Data Quality Campaign survey, as of 2023 all student information systems contained a unique and longitudinal identifier. All states also include standardised assessment scores, though not always broken down by all federal required groups of students (e.g. 13 states did not share data broken down by gender).[10] In many states, student information systems provide real-time information and display both analytics (with limited access) and public dashboards. While collected and available at the state level, the federal department of education collects some of these data in aggregate format (attendance, test state scores, etc.) through its National Center for Education Statistics (NCES).[11] The provision of those data is required by law, as per the *Elementary and Secondary Education Act*. Many small school districts share their student information with their state authorities (as required by state law) before it is then passed on to the federal government.

In Colorado for instance, a first grant application for the SLDS programme was awarded in 2007, for an amount of USD 4 million. It fuelled the development of Colorado's Longitudinal Education Data Action Plan (LEAP) that built upon the foundation of their initial statewide student record system, initiated in 2002.[12] A first major initiative of this action plan aimed to expand the data warehouse with longitudinal projections and detailed student-level analysis, graduation and drop-out data, migrant and homeless data, teacher statistics, and special education statuses. A second pilar targeted the automation of data submission files, between local education agencies and the state, and between the state and the federal government. Finally, the third effort was to expand the local data analysis and reporting tools with wider access to data and professional development opportunities. In 2010, a new USD 17 million grant was awarded to Colorado to improve what had become *SchoolView*, the states' student information system, with better data collection features, cross-agency interoperability, and functionalities that ensure stakeholders could access understandable, timely and reliable information. Finally, in 2020, another USD 2 million grant aimed at further expanding the functionalities of *SchoolView*, with connection to the federal department of labour and employment and between agencies, expansion into adult education, and reporting tools for schools and districts.

While a few states do so, it is usually local districts that provide their schools with a learning management system (LMS). They can be publicly owned, notably in large school districts (such as New York City), but most of them are licensed from commercial providers. In smaller districts, schools will typically use the same learning management system, while in larger districts there may be more variability because of different needs, which may lead some schools to use the district-provided learning management system while others use others, for instance, *Google Classroom or Canvass*. Typically, learning management systems display analytics dashboards. A smaller proportion are interoperable with state system-level tools and other institution-level digital tools and provide learning and other content repository. Most do not offer communication tools, a functionality that is typically dealt with separately. At the level of the school district,

there are data elements that all learning management systems should track but others that vary across education jurisdictions.

Admission and guidance

In primary and secondary education, the management of student admission is devolved to schools (or school districts). No student admission management systems are provided by US states, let alone the federal government. This does not prevent those processes to be conducted online in most cases, except in the smaller districts. Admissions are mainly based on students' place of residence and in some cases family preferences. In the case of students with disability, the largest determining factor is also the place of residence but if the indicated school cannot meet the students' needs, then they may be "outplaced" – following a human- rather than a technology-based decision. Charter schools, which are publicly funded but operate independently, may not have residence requirements on admission. Those schools typically use lotteries facilitated by technology, and applications are processed electronically. Magnet schools and competitive application schools under the public umbrella typically use the same process.

Similarly, no student or teacher career/study guidance platforms are provided and maintained by the federal government. Career and study guidance, whether online or not, would also typically be handled at the level of the school district, if any.

Assessments

In the United States, one important education responsibility that remains at the federal level is the organisation of the *National Assessment of Educational Progress* (NAEP), overseen and administered by the National Center for Education Statistics. NAEP longitudinally assesses a representative sample of students at grades 4, 8 and 12 in a number of key subjects. The assessment is conducted online and a few subjects feature scenario-based questions. Results in reading and mathematics are representative at the national, state and district levels, while results in other subjects are only representative at the national, and sometimes state levels, and only for certain cohorts of students.

All US states administer their own yearly state-level assessments, initially as a school accountability measure mandated by the *No Child Left Behind Act* in 2001, that then evolved in further legislation but remained a mandated state practice.[13] Every year (except during the COVID-19 pandemic), US states assess all students in English and mathematics, usually for every single student in grades 3 to 8. These yearly assessments provide each state, district and school with very granular information about students' performance in those two subjects, which could in principle be used to inform teaching and learning in addition to its initial accountability purpose. While they usually remain traditional in format (non-adaptive, multiple-choice questions), the assessments are computer-based.

The federal department of education encourages the implementation of innovative assessment implementation by encouraging state education agencies (SEAs) to pursue the Innovative Assessment Demonstration Authority (IADA) and improve statewide assessments. Since 2018, Louisiana, New Hampshire, North Carolina, and Georgia have applied for the IADA programme, which has provided them with the authority to establish and operate an innovative assessment system in their public schools.[14]

Other types of digital management systems

While not provided by the federal government, school districts and schools typically use a range of other digital tools to manage education. For example, according to government officials and other professionals working on digitalisation with states and districts, most US schools use knowledge and content management systems (to access digital learning resources, when not available in learning management systems) as well as administrative function systems to assist with staffing, pay, schedule, budget, and finance for instance.

Most schools use customer relationship management systems to communicate with parents and students – a functionality that is typically not featured in learning management systems. Communication systems allow to send text messages or email, to automatically translate content and provide simplified dashboards for parents, etc. Rather than being publicly procured or provided by US states of districts, those digital tools tend to be freemium products chosen by teachers.

Finally, most school districts provide their schools with some sort of early warning system. The majority have a basic model for flagging students at risk of dropping out, usually based on absenteeism. Fewer districts (but an increasing number of them) use more sophisticated early warning systems with predictive models, usually based on AI models, which build on interim assessments and other data elements to signal where extra support would be needed.

Digital ecosystem for teaching and learning

In the United States, the federal government's responsibility in the provision of digital resources for teaching and learning is often – though not always – limited to a support role, except for students with special needs.[15] Since 1965, it is forbidden by law for the federal government to set curriculum requirements or standards. States and districts are responsible and provide different types of digital teaching and learning resources aligned with their curriculum to their schools. They typically procure commercial resources, which schools, teachers and students can use and complete with external resources of their choice.

Open-access resources

While many Open Education Resources (OER) are accessible to people, students, teachers and schools, the federal government plays a limited role in their provision. Learning content curated by public TV and radio broadcasters and their corresponding social media channels are examples.[16] Substantial public investments in public libraries and museums, which curate part of their educational content online, can also be noted.[17] Additionally, online textbooks are openly licensed and funded by federal government programmes.[18]

The OER ecosystem for teaching and learning is supported by a variety of non-government actors, notably non-governmental organisations and philanthropy. For example, the OER Commons platform, which brings together thousands of OERs, is administered by the Institute for the Study of Knowledge Management in Education (ISKME), mainly funded by philanthropic foundations and donations (e.g. the William and Flora Hewlett Foundation).[19] Private US universities also contribute, as the Massachusetts Institute of Technology's (MIT) *Open Courseware* exemplifies.[20] The most famous platforms of massive open online courses (MOOC) (e.g. *Coursera* and *edX*) are commercial initiatives initiated in private US universities, offering a mix of fee-paying but also free-of-charge courses and self-paced learning resources[21].

Closed-access resources

The role of the federal government in the provision of teaching and learning resources to teachers and students enrolled in the education system is limited to learning and support tools for students with special needs. This applies to digital tools as well. As mandated by the Individual with Disabilities Education Act (IDEA), the federal government subsidises the provision of digital learning tools and assistive technologies for students with disabilities, as well as online platforms for special education teachers.[22] The Office of Special education Programs (OSEP) administers state and local grants for this purpose. As per the Assisted Technology Act, each state must have at least one centre providing knowledge, support and materials on assisted technology (e.g. screen reader, text to speech software).[23] The department of

education funds all those centres, which allow parents and teachers to test specific assistive technologies and assess whether they are functional before schools purchase them.

Apart from the federal support to ensure a degree of accessibility, the department of education does not directly provide or subsidise digital tools and resources for teaching and learning.[24] Instead, states and school districts may fund digital teaching and learning resources for their schools. Most recent statistics indicate that in the majority of public schools, teachers and learning have access to static and interactive digital learning resources of all sorts, as well as digital assessment resources and online platform for teacher development.[25] A survey conducted by the NCES in the 2019-20 school year indicates that 45% of public schools reported having a computer for each student, among which one-third were individually assigned. About half of public schools reported using interactive textbooks or self-contained instructional packages (Gray and Lewis, 2021[1]). Since the COVID-19 crisis, intelligent tutoring systems are also more and more prevalent in primary education.[26] Intelligent tutoring systems are used in classroom teaching – sometimes in the class, sometimes for homework – including by students with special needs.

Some central taxonomies

There exists no national or predominant standard taxonomy for digital teaching and learning resources. As some states voluntarily follow the same curriculum framework for some subjects, notably the *Common Core State Standards* (for mathematics and English language arts) and the *Next Generation Science* Standards (for science), these provide a common taxonomy for digital learning resources to be tagged. As of 2023, 41 out of 50 states have adopted the *Common Core State Standards*,[27] while 20 out of 50 states have adopted the *Next Generation Science Standards*.[28]

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

Providing some kind of public digital education infrastructure does not necessarily imply that stakeholders will use it. Different rules and policies can therefore ensure access to digital technologies in education, as well as support and govern their use.

Ensuring access and supporting use

Equity of access

At the federal level, the funding of digital infrastructure for education is directly tied to schools' socio-economic characteristics, covering public and government-dependent schools – although in principle, independent private schools also have access to earmarked federal funding for students with special needs. For instance, the E-Rate programme mentioned above uses reimbursement percentages which are based on percentage of children receiving free- and reduced-price school meals. Based on this, eligible schools and libraries may receive discounts that range from 20 to 90 percent of the initial prices. Rural schools and libraries also receive a higher discount.[29]

In addition, the *Bipartisan Infrastructure Law* (BIL) addresses digital equity through a USD 65 billion investment, which aims to provide learners, families, and caregivers with the connectivity they need to engage in technology-enabled learning opportunities. As part of the BIL, the *Digital Equity Act* calls on states to develop digital equity plans that identify barriers to digital inclusion and set measurable objectives to address them.[30]

Finally, schools that receive federal funding should provide inclusive access to students with special need so that they enjoy the same benefits as all students.[31]

Data collected by the OECD TALIS study across the 2017/2018 school year illustrate the pre pandemic access to digital hardware infrastructure across schools in the United States.[32] Before the COVID 19 outbreak, 19% of lower secondary principals reported that their schools' capacity to provide quality instruction was hindered by shortage or inadequacy of digital technology for instruction (compared to 25% on average across the OECD countries), and 17% of them noted that it was hindered by insufficient Internet access (while 19% was the average across the OECD countries). The COVID-19 pandemic exposed the disparities in accessing devices and good Internet connectivity: according to data collected by the US Census Bureau in 2018, 99% of households earning USD 150 000 a year had access to a personal computer, compared to 77% of households making less than USD 25 000. Broadband subscription rates differed by 30 percentage points across income groups. Homes with older householders, those with lower levels of education, or living in rural areas had lower levels of computer ownership and broadband access. Additionally, the survey showed that smartphone use has exceeded that of desktop and laptop use, with Black and Hispanic households more likely to be "smartphone only" homes, which has an impact on the types of tasks one can accomplish on the Internet.[33] Further data collected in 2020 during the pandemic note that around 20% of households reported as very or somewhat likely that their child will not be able to complete schoolwork because they do not have access to a computer at home or to reliable Internet connection.[34] A 2023 survey finds that 28% of state leaders identify "home access connectivity" as an "unmet technology need" in their state, far beyond other unmet needs (SETDA, 2023).

Supporting the use of digital solutions

At the federal level, the United States uses direct and indirect incentives to support the access to, and use of, digital tools and resources at the state, school, and classroom levels – and thus support equity in use opportunities.

First, the federal government offers grants and other types of financial incentives to encourage the use of digital tools and resources, as illustrated by the SDLS grant programme that pushes states to develop their student information systems.

Second, the federal government can support the uptake of digital tools and resources in education. A share of the federal funding that public and government-dependent schools receive (about 7% of their funding) is earmarked, and may for instance cover the cost one-to-one programmes that impose the delivery of one digital device per student. This is for instance the case with a part of the fundings awarded through the *Student Support and Academic Enrichment Programme* (SSAE).[35]

States and school districts have full autonomy in their procurement choices and how much digital tools and resources they decide to provide, which can in principle lead to very differing access to technology across schools. However, they have to provide equitable access for students with disabilities, as required by the *Individuals with Disabilities Education Act* (IDEA); they also have to meet the security and privacy obligations of the *Family Educational Rights and Privacy Act* (FERPA), the *Children's Internet Protection Act* (CIPA), and the *Children's Online Privacy Protection Rule* (COPPA).[36]

In addition to legal criteria, the Office of Educational Technology offers guidance on procurement of educational technologies, which was revised in 2023.[37] In particular, it has developed a toolkit to help local education authorities prioritise evidence-based decisions on the adoption and use of educational technology in schools. [38]

Cultivating the digital literacy of education stakeholders

Engaging all education actors in the digital transformation of the US education systems demands to develop digital literacy, and in particular teachers' and students' digital competencies. As the pre-service and in-service training requirements of teachers (as well as curriculum requirements) are exclusively set by states and school districts, there is some variation across states. Some states (such as California and

New York) mutually recognise the credentialling of their teachers. The federal government provides guidelines, about the digital competencies that teachers must acquire before and during their teaching service though, for example in the digital strategy and guidance documents mentioned above. At the state level, some curriculum requirements encourage specific uses of digital technology in class, while others incentivise education districts to integrate the development of student digital skills as a learning outcome of the curriculum.

All 50 US states are members of the NASDTEC organisation which aims to establish interstate agreements on teachers' training requirements, credentials, and professional development.[39]

Governance of data and digital technology in education

The United States has taken a sectoral approach to data protection. There is no general data protection regulation, but sector-specific regulation. Education is one of the sectors with a data protection law. For example, the *Family Educational Rights and Privacy Act* (FERPA), the *Children's Internet Protection Act* (CIPA), and the *Children's Online Privacy Protection Rule* (COPPA) regulate different aspects of data protection and privacy. Because they concern children, the two latter laws also concern education.36 States have the autonomy to set up their own general or specific laws or rules about data protection and privacy above and beyond the federal ones. For instance, California has a cross-cutting data protection Act. Commonly used digital tools (for example *Google Classrooms*) benefit from a FERPA exemption, according to which software providers can process student data on behalf of schools, even though those data cannot be transferred to any third party without explicit consent from the school district. In case of consent, any data must be de-identified and not be re-identifiable.

Teachers and school staff's data protection falls under the federal employment law and their employment contracts.

The federal government implements usual statistical rules about the access and use of the education administrative data it collects for public of private research and development. Federal policies have focused on increasing publicly availability of educational databases for research. This includes data available through the department of education, the Institute for Education Science, and the National Science Foundation, in addition to other federal agencies. Federal regulations include funder requirements for making data open access as well as guidelines for making data accessible.[40] Most states have similar regulation for access to their administrative data, although the levels of access and implementation rules vary from state to state.

Apart from the federal rules about data protection and privacy, no federal rule governs the access to digital tools and resources in education. The federal government provides guidelines, and states and schools districts enact their own regulation. For instance, during the COVID-19 pandemic, the state assessments were often taken remotely with digital proctoring, which forced states and school districts to publish related rules.

As of 2023, there are no federal rules about automated decision-making in education – and probably few states, if any, use such practice either. No state uses automated decisions that have high stakes for students. Individual states – such as California, a state with more data privacy legislation than others – can offer rules and guidance to inform access, use, and automation of digital technologies.[41] In 2023, Federal guidance by the White House and the department of education were issued on the use of automated decisions related to AI, and a bill of rights on AI was being prepared. [42] As of 2023, the blueprint for this bill focused on promoting safe and effective systems, tackling algorithmic discrimination protections, and ensuring data privacy. It also called on improving notice and explanation whenever an automated system was being used and on the impact it may have on certain outcomes; as well as on the "human alternatives" and the ability to opt out.

Likewise, interoperability in education is not federally regulated, but federal guidance exists. For example, the Common Education Data Standards (CEDS) encourages semantic interoperability by identifying the most commonly used education data elements to support the effective exchange of data within and across states (and for federal reporting). The initiative is led by the National for Center for Education Statistics with the assistance of a CEDS Stakeholder Group that includes representatives from states, districts, institutions of higher education, state higher education agencies, early childhood organisations, federal programme offices, interoperability standards organisations, and key education associations and non-profit organisations.[43] Additionally, the Office of Educational Technology highlights the importance of interoperability in its *National EdTech Plan*, the *Developer's Guide*, and the *Infrastructure Guide*.[44] Finally, at the state and local level, multiple non-governmental organisations supporting state departments of education and school districts provide guidance on interoperability across systems.[45] For the most part, however, efforts towards interoperability are driven by voluntary efforts. Similarly, there is no federal rule on data portability in education.

Support for innovation and research and development (R D) in digital education

Developing a national education technology ecosystem requires a vibrant education technology sector as well as robust research and evaluation of technology and its use in school. Providing incentives to support research and exploratory development (R-D), funding education technology start-ups, and funding academic research are typical innovation tools used by governments.

Through its annual Survey of Federal Funds for Research and Development, the National Centre for Science and Engineering Statistics provides a mapping of the federal agencies that conduct R D programmes through federal funding, several of which concern education.[46] In the last five years, federal fundings have notably supported academic research on the use of digital technologies to improve learning outcomes and student engagement, including students will special needs, to predict school dropout, to support teaching and school management functions, and to improve assessment and credentialing.[47]

The federal government also conducts monitoring and evaluation on the national digital infrastructure. One notable example is the *EdTech Equity* initiative undertaken by the NCES in 2019.[48] The initiative aims at bridging the relative gap that exists in the collection of data on certain issues at the intersection between EdTech access and equity – such as access to technology outside of school, how technology is integrated into learning, and students' technology related knowledge and skills. It has notably involved a study on the "use of educational technology for instruction in Public schools and the production of a dashboard on equity in education. Many organisations provide further information within the country. For example, at the state level, the *State Educational Technology Directors Association* (SETDA) produces a yearly "State EdTech Trends" report, the *Consortium for School Networking* (CoSN) provides further insights into the use of EdTech tools in primary and secondary education, and the *Centre for Assistive Technology Act Data Assistance* (CATADA) documents the provision of assistive technology to students with special needs.[49]

At the federal level, according to government officials the emphasis has been placed on attaching evidence requirements for tools and resources procured with some federal funds within states, districts, and schools. Priority should indeed be given to *Every Student Succeeds Act*'s definition of "evidence-based", which defines evidence according to a continuum between "promising" and "proven" by a randomised control trial.

The department of education's Institute of Education Science (IES) funds state education agencies, educational research universities and organisations, as well as R D, regional, and technical assistance laboratories and centres, as opposed to discrete EdTech companies, to develop digital learning resources and educational software that can be used across all levels of education.[50]

Federal regulations include funder requirements for making data open access as well as guidelines for making data accessible.40 While this is not about data about digital education, which are scarce, this certainly improves educational research. The federal government provides documentation for the public administrative datasets it manages, albeit a tiny part of the US education administrative datasets, and communicates clear public R D priorities through its research programmes. Federal research programme (notably IES and NSF for science-related education programmes) are prestigious and well-funded, but they represent a minority of the funding for research in the United States, which is supported by philanthropic foundations, limited responsibility organisations and, de facto, universities.

In addition to conducting its own R D on digital tools and resources, educational authorities in the United States have established relationships with other education stakeholders, including non-profit organisations and companies from the private sector, to support digital innovation in education. Such partnerships generally take place at the state level, although the US department of education's Office of Educational Technology regularly engages with EdTech organisations, companies, and developers through ongoing collaboration, consultation sessions, and work related to specific projects.[51] The Office of Educational Technology is the primary department of education's office for outreach to the EdTech developer community. However, as pointed out above there is no funding or monetary incentives allotted by federal agencies to specific EdTech companies. The National Science Foundation also support various institutions to conduct research on specific learning technologies. For instance, the AI Institute for Engaged Learning conduct research on AI-driven narrative-centred learning environments, learning analytics and natural language processing. Digital Promise is another example of a global, non-profit organisation that aims to advance equitable education systems through research and development on technology. Such organisations cultivate local or national communities of practices as they regularly hold forums or consultations with education stakeholders and practitioners.

In its future activities, the US Secretary of Education's *Supplemental Priorities* put a broad emphasis on the effective use of technology in education, as well as on the development of online education platforms and resources. More granular prioritisation towards specific digital resources occurs at the state and local levels. Online education platforms and digital resource, but also classroom analytics, learning management systems, and student information system are widespread states' priorities.

In terms of research and development, the department of education established in February 2023 and began a process of promoting quick-turnaround high-reward scalable solutions by building federal education research and development infrastructure. This infrastructure will be based on the ARPA model. That R D model began with the Defense Advanced Research Projects Agency (DARPA), which is a federal agency that has helped guide technological innovation and breakthrough in technologies to the service of defence and national security for more than sixty years now.[52] The aim of this ARPA-style initiative in education would be to emulate ARPA-E (energy) and ARPA-H (health), and work within an innovation ecosystem that includes academic, corporate and governmental partners to nurture an environment conducive to an innovation culture in education.[53] Such an infrastructure would ultimately support state educational agencies and local educational agencies in their use of evidence-based educational practices – including those related to digital infrastructure in schools.

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State EdTech Trends - Leadership, Technology, Innovation, Learning | SETDA https://www.setda.org/priorities/state-trends/

State of EdTech Leadership | CoSN https://www.cosn.org/edtech-topics/state-of-edtech-leadership/

CATADA | CATADA Charts https://catada.info/at/?report=summary

[50] Examples of educational software or resources whose development was funded by federal funds: https://oese.ed.gov/offices/office-of-discretionary-grants-support-services/innovation-early-learning/education-innovation-and-research-eir/awards/; https://ies.ed.gov/sbir/success_stories.asp; https://www.xprize.org/challenge/digitallearning; https://ies.ed.gov/sbir/EdGamesExpo.asp

[51] For more information, please visit: Home - Office of Educational Technology https://tech.ed.gov/ and For Developers - Office of Educational Technology https://tech.ed.gov/developers/

[52] For more information: ‘DARPA for Education’ Is a Good Start. Now, Congress Must Do More – The 74 (the74million.org) https://www.the74million.org/article/darpa-for-education-is-a-good-start-now-congress-must-do-more/#:~:text=But%20the%20seed%20of%20a%20bold%20new%20approach,Research%20Projects%20Agency%20%E2%80%94%20DARPA%20%E2%80%94%20for%20education

[53] Potential ARPA programme in education: https://www.federalregister.gov/documents/2023/10/12/2023-22482/request-for-information-on-potential-new-program-from-seedlings-to-scale-s2s

Annex A. The Questionnaires

Part of the information presented in this volume and in the *OECD Digital Education Outlook 2023* comes from a systematic survey of OECD countries and Brazil regarding their digital education infrastructure and their governance of digital education as of December 2023.

The OECD designed two distinct policy questionnaires that inquired about countries and jurisdictions':

- **Digital education infrastructure**: what digital tools and resources are publicly provided, at what levels of education and through what means; which are commonly accessible to schools, teachers, and students regardless of public provision; where the public/private responsibility boundaries lie for providing digital tools and resources and for supporting their use; and what countries consider as their priorities for further development. Two types of digital infrastructure are distinguished: the infrastructure for system and school management and the infrastructure for teaching and learning. This questionnaire can be accessed here.
- **Governance of digital education**: how do countries and jurisdictions govern, regulate, encourage the access to, and use of, digital technology and smart data in education; how do they integrate teachers and students in their digital ecosystem; what are their procurement policies and practices; how do they ensure school procurements comply with policy objectives on equitability, effectiveness, security, data protection, interoperability; how do they collaborate with the EdTech sector and other education stakeholders to ensure that innovation, research and development are incentivised and useful for teachers and students; how do they encourage research on and through digital education. This questionnaire can be accessed here.

The two questionnaires were designed to work with respondents representing different levels of their countries' governments. Each country was expected to provide a response at the central/national level. In addition, a couple of responses at the sub-national level supplemented the national answer where relevant.

All information collected from central and subnational levels of government were supplemented by a series of bilateral interviews with all relevant jurisdictions to review and validate their responses, understand the context, and ensure comparability across countries and jurisdictions. This work was complemented with desk research and several rounds of consultations with countries and jurisdictions that provided iterative feedback.

Country Digital Education Ecosystems and Governance

A COMPANION TO DIGITAL EDUCATION OUTLOOK 2023

This report, linked with the Digital Education Outlook 2023, provides an overview of 29 countries' (or jurisdictions') digital education ecosystem and governance. Each chapter covers the devolution of responsibilities within countries; how it affects digital education; what digital tools for management and teaching and learning are made publicly available to schools, teachers and students; how they are provided or procured; how countries ensure the security, privacy, equity and effectiveness of this digital ecosystem while keeping incentives for private education technology (EdTech) companies. The information and analysis are based on a survey on digital education infrastructure and governance, interviews with national and regional government officials as well as desk-based research.

Providing for the first time a holistic view of 29 countries' and jurisdictions' digital education ecosystem and governance, this report will be of interest to policy makers, academics and education stakeholders interested in the digital transformation of education at home and internationally.

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