Starting Strong

Empowering Young Children in the Digital Age

Editorial

The early years of a child's life are a period of rich brain development. It is when they rapidly develop cognitive, social and emotional skills that are fundamental to their later achievements as adults. In an evolving world of smartphones, computers and other digital technologies, it is therefore vital for positive early experiences with digital tech.

Early childhood education and care, which focuses on infancy to primary school entry, has immense potential to shape young children's development and well-being. While the impact of technology on young children is inconclusive, it is important they are protected from harmful effects and equipped with knowledge to thrive in digitally enhanced societies. Unfortunately, up until now early education policies have struggled to find a balance between the risks and opportunities of digitalisation. This only adds to the challenges of the sector.

The new OECD report *Empowering Young Children in the Digital Age* sets out five key challenges facing creches, nurseries, kindergartens and preschools, and options for dealing with the risks that children face. As some countries aim to hold tech companies accountable for inappropriate practices and poorly protecting minors online, the report makes clear that it is crucial for young children to learn about the dangers and benefits of digital technology in early education and care settings. In many of these establishments, this will require a step change in the way they approach learning and care, and how they use technology to organise themselves.

The report outlines how young children are increasingly interacting with digital technologies, and how digital tools can be used to enrich learning activities. For example, interactive features can help young kids build up their expressive skills in the use of audio, graphics, photos, text and video. The use of digital content in learning environments can also expose children to quality content they do not necessarily receive at home.

By getting an early understanding of digital technology, children can also be exposed to new ideas and concepts. This empowers children and can potentially lead to the development of skills that help them in later life, as well as sensitise them to pursue careers in tech fields such as artificial intelligence (AI), programming and engineering. This does not necessarily involve direct exposure to computers. There are numerous 'unplugged' approaches that can be used, for example a child can learn how to code through puzzles or by creating a game. Careful use of new technologies can, in effect, support children by establishing engaging and effective learning practices.

That said, the risks must not be ignored. The report raises a range of issues including the impact of extended screen time on young children, the potential for children to have fewer in-person interactions, and the exposure to inappropriate content or misuse of personal data. The OECD is already active in this area, with recommendations on how children should be protected in digital environments.

Regarding screen time, it is well known the importance of preventing children from spending long hours unsupervised watching screens. Passive and excessive use of digital technology can be harmful to a young child's development, particularly if not balanced by stimulating in-person interactions, including back-and-forth conversations, play and exercise. Slow-paced, educational and age-appropriate activities should be

encouraged. The focus should be on quality engagement with digital technologies, under the guidance of an adult and integrated in a broader set of learning experiences.

It is imperative for teachers, carers and parents to understand the benefits of using technology in an active and educational way. At the same time, they must also ensure that time-constraints are routinely enforced. Young children need to learn early on to disconnect from screens and reconnect with the offline world. We should also be wary of uses of technology that disrupt interactions between adults and children, which are crucial for cognitive, social and emotional development at this age.

All of these issues may prompt some to suggest that 'turning off all screens' is the solution. But the realities of the modern world make a blanket ban on technology impractical and ineffective in most instances, as children need to be prepared to face the challenges raised by digitalisation.

The potential for technology to reinforce inequalities is another concern. Globally, a digital skills divide is growing, with girls and disadvantaged children being left behind. The report highlights that disadvantaged children and girls are currently less likely to pursue careers in technology-intensive fields compared to most boys. This risks some being effectively shut out from opportunities in an increasingly fast-changing and technology-rich world.

In order to tackle these issues, the focus should be on effective education strategies that mitigate the risks of digital technology by preparing all young children to engage with it in safe and creative ways. A central part of this requires the training of professionals to understand the impact of technology on children and how digital tools can be used to further educational goals. Technology can also contribute to the professionalisation of the workforce through the development of tools to assess and improve the quality of care, share best practices and engage with families. It is important to monitor these developments and make sure they result in positive outcomes.

There is a lot to consider and not much agreement among, or even within, countries on how best to develop quality early childhood education and care. But this report makes it clear that harnessing technology to improve its quality will help children have a stronger start in life. It will also enable them to gradually become masters, not subjects, to technology.

A considered and balanced approach to these matters can open new channels to early education, creativity and social interaction, while guarding children from new types of risks, including cyberbullying and privacy threats.

While this may be a low priority area for many policymakers, governments should heed the advice in the report: by empowering young children in the digital age, it will help lay the foundations for social-emotional development, improved learning and educational success for years to come.

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Acknowledgements

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The development of this report was guided by Andreas Schleicher and Yuri Belfali and led by Carlos González-Sancho and Stéphanie Jamet. Stéphanie Jamet wrote Chapters 1 and 4, Carlos González-Sancho wrote Chapters 2 and 8, Christa Rawkins wrote Chapter 3, Elizabeth Shuey wrote Chapter 5 and made various contributions to the project, Clara Barata wrote Chapter 6 and Nora Brüning wrote Chapter 7. Country notes were prepared by Heewoon Bae and Christa Rawkins with inputs from Kentaro Sugiura, who also contributed to the report. Christa Rawkins co-ordinated the development of the compendium of case studies. Duncan Crawford provided communication and messaging support. Jennifer Allain edited the report. Cassandra Davis, Stephen Flynn, Kevin Gillespie, Eleonore Morena, Cassandra Morley, Della Shin and Olivia Tighe provided support for production and communication. Graphical design support was provided by *Lushomo*. The collection of data through the *Early Childhood Education and Care in a Digital World* policy survey and statistical analyses and outputs were performed by Nora Brüning, Vanessa Denis, Lynn-Malou Lutz and Judit Pál. Lynn-Malou Lutz also contributed to the report. The authors would like to thank OECD colleagues Gabor Fulop, Francesca Gottschalk, Jordan Hill, Rowena Phair, Giannina Rech, Lisa Robinson and Daniel Salinas for their contributions.

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Reader's guide

The OECD *Starting Strong* series provides an international comparative perspective on early childhood education and care (ECEC) systems to support countries and jurisdictions in reviewing and designing their policies in this space. As part of the OECD's long-term strategy to develop ECEC, the reviews discuss the strengths and opportunities of different approaches and provide policy orientations that help promote high-quality and equitable ECEC services. The *Starting Strong* reviews are developed in close collaboration with the OECD's Early Childhood Education and Care Network, a unique knowledge-sharing platform for national, regional and local policy makers working on ECEC policies.

This volume of the series, *Empowering Young Children in the Digital Age*, is the culmination of the *Early Childhood Education and Care in a Digital World* project, which was carried out between 2021 and 2023 to investigate ways in which ECEC systems can respond to digitalisation, harnessing opportunities to promote high-quality and equitable ECEC while minimising the associated risks. The project sought to identify the skills that help children thrive as they live and learn in the digital age; examine strategies to prepare the ECEC workforce and the sector at large to exploit the affordances of digital technologies to support quality in ECEC; and explore the role of ECEC in helping to protect children in digital environments and ensuring equitable outcomes of digitalisation.

Building on the multi-dimensional framework for quality in ECEC developed by previous *Starting Strong* publications, a primary goal of this policy review is to discuss strategies and actions covering the following policy levers, which countries can draw on to promote quality and equity in ECEC:

1. quality standards, governance and funding
2. curriculum and pedagogy
3. workforce development
4. family and community engagement
5. monitoring and data.

In addition, the review considers equity and inclusion as a transversal theme.

More information about the *Starting Strong* series and other activities of the OECD's Early Childhood Education and Care Network is available at: www.oecd.org/edu/earlychildhood.

Methodology, data and structure of the report

Multiple activities were carried out under the *Early Childhood Education and Care in a Digital World* project to generate the underlying data for the analysis presented in this publication. These included the administration of two policy surveys, the collection of case studies and extended exchanges with the countries that decided to engage in the policy review in greater depth.

The data from these sources were supplemented by other activities. To frame policy analysis on recent research and policy developments, extensive desk-based research was undertaken on the implications of digitalisation trends for young children and ECEC systems, building also on insights from related OECD projects, including the horizontal OECD Going Digital initiative and the Directorate for Education and Skills' 21st Century Children and Future of Education and Skills 2030 projects. In addition, three targeted literature reviews were commissioned to academic experts on topics for which a synthesis of the emerging knowledge base was deemed relevant for the project. After consultation with members of the OECD's Early Childhood Education and Care Network, it was decided to focus these reviews on computational thinking in early childhood education, digital competences for ECEC professionals and opportunities to use digital technologies to support children with special needs in ECEC settings. The literature reviews are available at: www.oecd.org/edu/earlychildhood.

In parallel, new statistical analyses were carried out of relevant OECD databases, including the Starting Strong Teaching and Learning International Survey (TALIS Starting Strong), the Teaching and Learning International Survey (TALIS), and the International Early Learning and Child Well-being Study (IELS).

This report includes eight substantive chapters bringing together analyses of these data sources. Chapter 1 summarises the policy directions stemming from the report's findings and outlines a roadmap of policies to address key digitalisation challenges for ECEC. Chapter 2 provides an overview of transformations of the digital era, discussing their implications for young children and ECEC systems. The remaining chapters are organised around the various policy levers and areas covered in the analytical framework. Chapter 3 considers the protection of young children in digital environments. Chapter 4 discusses ECEC curriculum frameworks and pedagogies in light of the digital transformation. Chapter 5 explores how countries are preparing and supporting ECEC professionals to meet the demands of digitalisation. Chapter 6 discusses how digital technologies could be mobilised to strengthen family and community engagement in ECEC. Chapter 7 focuses on equity and inclusion by analysing digital divides among young children and among ECEC centres. Finally, Chapter 8 discusses the opportunities and demands that digitalisation brings for quality monitoring in ECEC.

The ECEC in a Digital World policy survey

Between February and April 2022, the OECD Secretariat administered a policy survey to members of the OECD's Early Childhood Education and Care Network. Thirty-seven responses were received from 26 countries, including responses for subnational jurisdictions from 3 countries (Australia, Canada and Germany). This resulted in a rich comparative database of digitalisation policies targeting early childhood and ECEC as of 2022.

Guided by the project's data collection framework, the survey included questions organised around the policy levers listed above as well as around the transversal theme of equity and inclusion. In addition, a section was dedicated to identifying policy challenges concerning digitalisation, young children and ECEC.

Most sections of the survey asked participants to provide information on system-level policy developments. However, given the complex architecture of ECEC systems, countries and jurisdictions were asked to provide information on curriculum and pedagogy in relation to specific curriculum frameworks as well as information on engagement with families and communities in relation to specific types of ECEC settings. Countries and jurisdictions could provide multiple sets of responses to questions about different curriculum frameworks and types of ECEC settings.

Annex A provides more detailed information about the data collection and treatment through the survey.

Case studies

Members of the OECD's Early Childhood Education and Care Network were invited to present recent and ongoing policy initiatives related to digitalisation and early childhood at meetings of the Network and dedicated project webinars throughout 2021 and 2022. Further, to increase the number of policy examples and enhance the consistency and comparability of the information collected across countries and jurisdictions, a template was distributed for the submission of case studies. The template outlined the shared elements and questions that case studies were expected to address. A total of 20 case studies were submitted from 16 different countries. More information on the compendium of case studies is available in Annex C.

Study on responses to the COVID-19 pandemic in early levels of education

In 2021, following the initiative of the G20 Education Working Group under Saudi Arabia's presidency, the OECD was commissioned to carry out a study on the use of digital technologies to maintain continuity of education for young children during the COVID-19 pandemic. A policy survey was administered to OECD, G20 and invited countries on system-level policy developments regarding the use of digital technologies in pre-primary education (International Standard Classification of Education [ISCED] Level 02) and in the first years of primary education (ISCED Level 1, typically for children aged 7-8). The survey collected responses from 34 countries and jurisdictions between February and April 2021. Its results have been used to inform this policy review. The study is available at: https://doi.org/10.1787/fe8d68ad-en.

Country notes

Complementary country notes summarise findings and policy pointers relating to responses to digitalisation in ECEC for the six countries that engaged in the policy review in greater depth: Canada, Finland, Japan, Korea, Norway and Sweden. These country notes follow the structure of the main report and highlight relevant policy developments and opportunities for peer learning. The notes, prepared by the OECD Secretariat, are available at: https://doi.org/10.1787/50967622-en.

Scope

Country coverage

ECEC systems are often decentralised, with authority for different types of settings or particular aspects of ECEC provision being the responsibility of different levels of government. In federal countries, the mix of responsibilities between national governments and subnational jurisdictions (e.g. provinces, states, territories) can make understanding ECEC systems even more complex from the perspective of international comparisons.

Given the goal of providing internationally comparative data, the Starting Strong VII policy review focused on collecting data at the national level from all countries. However, in federal systems where substantive variation in policies exists across subnational jurisdictions, data were also collected at the subnational level. Indicators and analyses relating to subnational jurisdictions are noted in the report.

Settings, curricula and age groups

Consistent with previous OECD work on ECEC, the data collection for the Starting Strong VII policy review applied to settings belonging to countries' regulated ECEC systems, regardless of type, funding sources, opening hours or programme content. These settings include childcare, *crèches*, kindergartens, nursery schools or preschools, integrated centre-based ECEC, and home-based care.

Building on the reporting procedures implemented in the Starting Strong VI publication, this policy review presents information on ECEC settings and curriculum frameworks as applying to three standardised age groups to facilitate analysis and comparisons of different settings and curricula across age groups within and across countries and jurisdictions. When completing the *ECEC in a Digital World* policy survey, countries and jurisdictions were asked to select specific curriculum frameworks and types of ECEC settings as belonging to one of the following age groups: 1) age 0-2; 2) age 3-5/primary school entry; 3) age 0-5/primary school entry.

This strategy was implemented to facilitate the use of the information, enable meaningful comparisons across age groups within and across countries, and ensure consistency with previous Starting Strong reviews and the development of ECEC indicators in other OECD databases.

Staff roles and development

The professionals working in ECEC systems have many different roles and titles, including pre-primary school teachers, pedagogues, care workers, educators and counsellors. To address the workforce development and related policy levers, the Starting Strong VII policy review considered these different staff roles and the different types of ECEC settings in which they work.

To collect data that are meaningful across countries and address the different roles of staff across settings, the *ECEC in a Digital World* policy survey asked countries to report on workforce development policies based on the structure of their ECEC systems and applying to three categories of staff: teachers, assistants and leaders. Although these staff categories are not exhaustive, they capture the majority of staff within ECEC centres across countries.

Figures and tables

Labels and symbols

Certain labels and symbols are used to denote non-available or non-reported information:

- **"Not applicable"**: indicates the corresponding process or aspect does not exist, is not regulated or is not required in that ECEC system, as reported by the system's ECEC authorities.
- **"m"**: indicates missing information or unchecked response option. In tables displaying results from TALIS Starting Strong 2018, this typically implies there are fewer than 10 centres/leaders and/or 30 staff with valid data, which means there are too few or no observations to provide reliable estimates, or to ensure the anonymity of respondents.

Interpretation of data

When showing the distribution of a response across countries and jurisdictions in comparative figures and tables, both in the present publication and in the country notes, results from the policy survey generally correspond to system-wide policy developments and can be interpreted as representing country-wide or jurisdiction-wide challenges, policies or programmes.

For a smaller set of figures and tables, in particular those corresponding to the policy levers of curriculum and pedagogy and of engagement with families and communities, results refer to specific types of ECEC settings and curriculum frameworks within countries and jurisdictions, as noted above. As a result, care should be taken in interpreting these figures and tables and, in particular, in drawing conclusions for the level of countries and jurisdictions. A category shown for a country or jurisdiction in a figure may, for instance, only apply to one of several settings or curricula within a country and not all of the settings or

curricula. At the same time, countries and jurisdictions may appear in different categories within the same age group in the same figure, representing different settings in that country.

Readers should also be careful in interpreting information from the case studies, since the policy initiatives of programmes covered in the case studies can have varying scope and refer to different levels of governance of the ECEC system and to different age groups, as explained in Annex C.

ISO codes

ISO codes are used to identify countries and jurisdictions in some figures and tables, to improve their readability.

Country or jurisdiction	ISO code
Australia	AUS
Australia (South Australia)	AUS-SA
Australia (Tasmania)	AUS-TAS
Australia (Victoria)	AUS-VIC
Belgium, Flemish Community (pre-primary education)	BEL-FL PP
Belgium, Flemish Community (childcare settings for under 3's)	BEL-FL U3
Brazil	BRA
Canada, All provinces and territories (centre-based sector)	CAN CB
Canada, All provinces and territories (school-based sector)	CAN SB
Canada (Alberta)	CAN-AB
Canada (British Columbia)	CAN-BC
Canada (Manitoba)	CAN-MB
Canada (New Brunswick)	CAN-NB
Canada (Quebec)	CAN-QC
Costa Rica	CRI
Czech Republic	CZE
Denmark	DNK
Estonia	EST
Finland	FIN
France	FRA
Germany	DEU
Germany (Bavaria)	DEU-BY
Hungary	HUN
Iceland	ISL
Ireland	IRL
Israel	ISR
Italy	ITA
Japan	JPN
Korea	KOR
Lithuania	LTU
Luxembourg	LUX
Morocco	MAR
Norway	NOR
Portugal	PRT
Slovak Republic	SVK
Slovenia	SVN
South Africa	ZAF
Spain	ESP
Sweden	SWE
Switzerland	CHE
United Arab Emirates *(Dubai)*	ARE-DU

Executive summary

Opportunities and risks of digitalisation for early childhood education and care

The rapid development of digitalisation provides opportunities for early childhood education and care (ECEC) including new learning materials and environments, new ways for staff development and collaboration, and strengthened links between institutions and parents. At the same time, digitalisation has created challenges to young children's lives. From concerns about screen time to the misuse of children's data, ECEC faces many dilemmas and difficult issues. This report sets out the opportunities and risks of digital technology for young children and identifies five key challenges and potential responses for the sector. At its heart, the report makes clear that ECEC should use digital technologies to improve the quality of services and prepare young children to understand the dangers and benefits of these technologies. It outlines a roadmap to help policymakers take a consistent approach to digitalisation in ECEC and support young children to thrive in the digital age. The report summarises findings from a two-year policy review that collected data from 30 countries and jurisdictions in 2022.

Better protecting young children in digital environments is an imperative

The use of the internet, tablets and smartphones, social media and messaging apps have profoundly changed the lives of children around the world. As a result, many governments have concerns about the impact of digital technologies on the development of young people. This is reflected in policy agendas for early childhood that largely focus on the risks to young children and how to deal with the challenges. Physical, social and emotional harms related to technology, threats to privacy, and the growth of digital divides are among the main worries, according to a survey carried out for this report.

At the moment, most countries and jurisdictions focus on promoting safe and responsible use of technologies in ECEC settings, rather than adopting restrictive approaches such as blanket bans on digital devices. However, there are often conflicting or incomplete guidelines and regulations for helping young children to learn how to protect themselves against digital risks, as well as to use digital technology in safe and creative ways. This means professionals may adopt different approaches – of varying quality – depending on their own ability and initiative. What guidance is available is usually targeted at parents, not ECEC professionals. And less than half of those surveyed currently evaluate the use of digital technologies in ECEC settings as part of their quality monitoring frameworks.

There is growing recognition across countries of the need to engage digital service providers to ensure children's digital safety. However, countries have more frequently introduced privacy regulations than requested providers to adopt 'safety-by-design' approaches to promote age-appropriate content and activities. Many countries also lack oversight bodies with specific responsibilities on digital safety for children.

Digital divides among children can be tackled from an early age

Closing the digital skills divide is a key reason for introducing children to digital literacy at an early age. Girls and disadvantaged children are often less likely to pursue careers in technology-intensive fields compared to boys and more advantaged children. Closing that gap is a policy priority for many countries, survey data show. For example, by helping to spark young girls' interest in technology-intensive fields or by informing parents about age-appropriate digital practices for young children.

However, almost half of those surveyed do not have specific goals for early digital literacy development in ECEC curriculum frameworks. And many report large differences in the quality and types of digital resources available at ECEC settings. This means many countries are missing out on an opportunity to level the playing field and help all children reap the benefits of digitalisation.

While young children's exposure to digital technologies typically starts in home environments, ECEC can play an important role in helping all children begin to learn about risks, gain an appreciation for how computers work, and how technology can support play, creativity and self-expression. This can also be done without direct exposure to screens, for example though the use of robotic kits and unplugged materials such as puzzles and cards. However, this approach is not broadly supported by governments.

ECEC professionals and quality assurance are key to a policy roadmap

The ECEC workforce is essential to advancing policy responses to digitalisation. All ECEC staff need foundational training to understand how to use digital technologies in an effective way. Staff with specific responsibilities can be trained to develop enhanced and specialised skills. Most countries and jurisdictions surveyed provide some funding or training support for ECEC staff to develop their digital competencies, but few require this as part of initial preparation programmes for ECEC teachers. Opportunities for professional development through online platforms are also available in many countries, but only a minority support digital tools for mentoring or coaching.

Digital technology can also facilitate communication with families and their engagement in ECEC activities. While this is increasingly happening, there is limited evidence that the overall quality of interactions has improved thanks to technology. The available training on how to establish meaningful communication with parents through digital technology is also generally lacking. Improving these forms of engagement with families can be particularly important for ECEC centres serving disadvantaged children.

Robust data can also inform and strengthen policy design and monitoring in the ECEC sector. A large majority of those surveyed have in place data systems that maintain individual-level information about their ECEC sector. However, the breath of coverage of these systems varies. Data sharing becomes even more important when responsibilities for different services or age groups are split across multiple actors.

Going forward, digitalisation will continue to have an impact on education and learning, and the way young children interact, play and engage with wider society. Countries should have clear goals for ECEC to respond to digitalisation, so that it offers a first opportunity to help all young children be safe and flourish in the digital world. These goals should recognise the complexities of the sector, involve all relevant stakeholders, be informed by the best available evidence, and be implemented in a flexible manner.

Opportunities and risks of digitalisation for early childhood education and care

Key messages from a policy review that collected data from 30 countries and jurisdictions in 2022

Young children must be better protected in digital environments

Potential negative impacts of technology on young children include:

Physical and socio-emotional harms

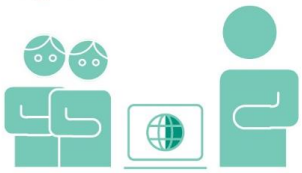
Threats to privacy

Most countries and jurisdictions promote **safe and responsible use of technologies in ECEC**, rather than restrictive approaches, such as blanket bans

Conflicting and incomplete guidelines mean professionals may adopt approaches of variable quality

Digital divides need to be tackled from an early age

Introducing children to digital literacy in early education settings is key to **closing gaps in digital skills**



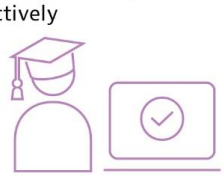
But, almost 50% of countries and jurisdictions lack specific goals for early digital literacy in curriculum frameworks

Early digital literacy skills can be introduced with minimal exposure to screens, using, for example, robotic kits and puzzles

But few governments support this

Early childhood professionals and quality assurance are key to a policy roadmap

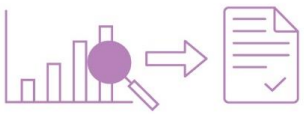
All staff need foundational training to use digital technologies safely and effectively



Staff with specific responsibilities can be supported to develop **enhanced** or **specialised** digital skills

Digital tools can facilitate engagement with families, especially in disadvantaged communities, but few countries and jurisdictions provide training for staff in this area

Robust data can support policy design and monitoring



However, the current breadth of coverage of data systems varies across countries and jurisdictions

1 Making early childhood education and care responsive to digitalisation: A policy roadmap

This chapter presents a policy roadmap for making early childhood education and care (ECEC) responsive to digitalisation. It discusses the main challenges brought about by digitalisation for ECEC and then provides a roadmap of policies to address these key challenges, building on the policy directions stemming from the report's findings. It also identifies examples of countries that are relatively active in some of these policy areas to inform policy reflection in other countries.

Introduction

Digitalisation is transforming education and social and economic life, with far-reaching implications for today's children. Studies across countries show young children interacting with digital technologies with increasing frequency and precocity, and the range of their digital activities broadening with age. The evidence base on the effects that these digital experiences have on children's development and well-being is still incipient and inconclusive, but the stakes are high. The accelerating pace of digitalisation urges policy makers, educators and families to identify effective ways to protect children while equipping them to thrive in the digital age. Early childhood education and care (ECEC), with its immense potential to shape children's early development, learning and well-being, can play a significant role in addressing the opportunities and risks of digitalisation for young children.

Furthermore, digitalisation brings new ways of working, communicating and networking and amplifies the power of data, all of which are relevant for the ECEC sector, as for other levels of education and other sectors of activity more generally. Digitalisation brings many challenges but also solutions for modernising work processes, expanding opportunities for workforce training and developing quality assurance processes.

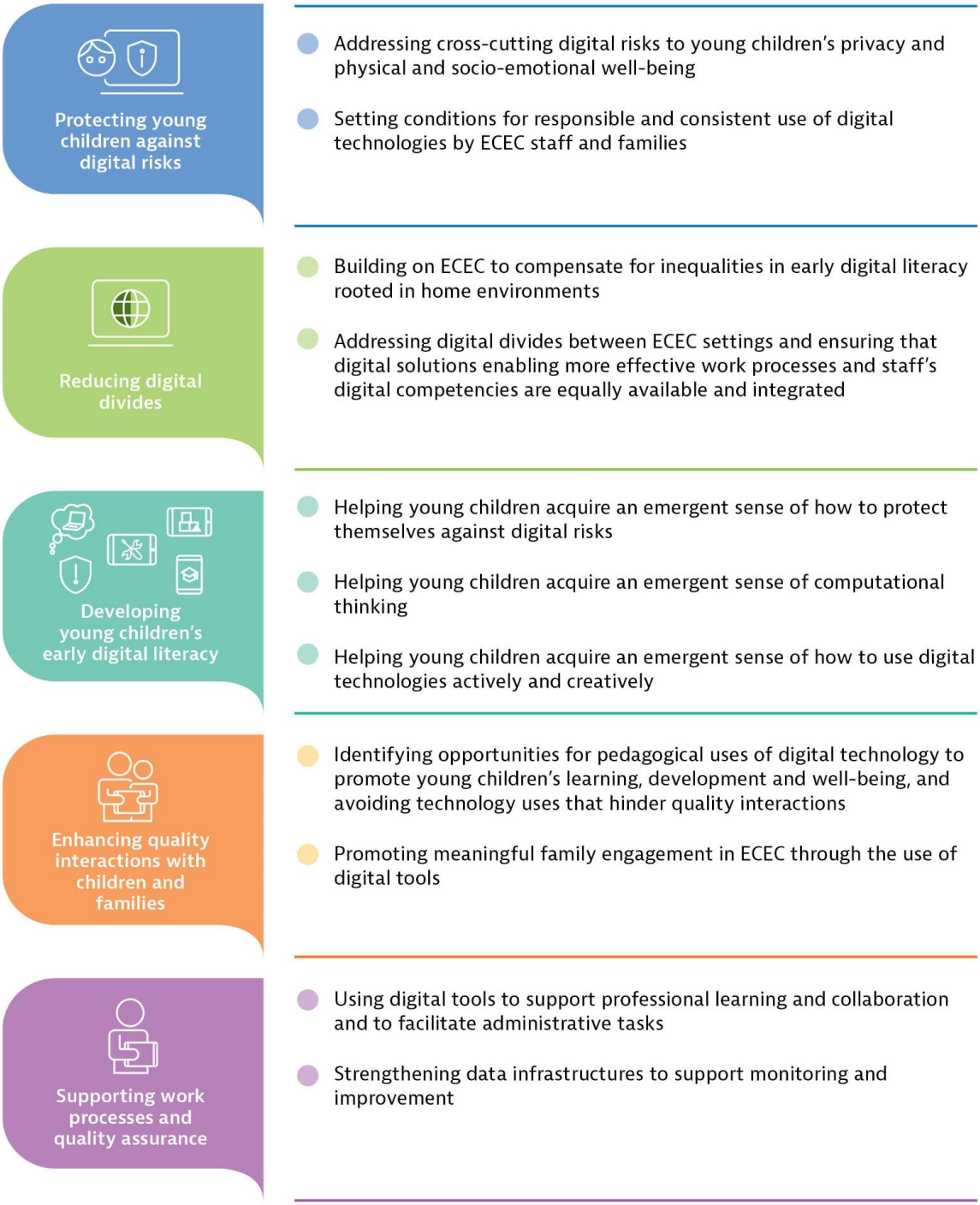
This report provides a 360-degree view of the challenges and opportunities brought about by digitalisation for ECEC and of the possible policy responses. This chapter summarises the policy directions stemming from the report's findings and provides a roadmap of policies to address the key challenges. It also identifies examples of countries that are active in some of these policy areas to inform policy reflection in other countries. However, the report recognises that given the lack of evidence, the rapidness of changes in this space and the varied contexts of ECEC systems across countries, ECEC policies can respond to digitalisation at different paces and in different directions.

Key digitalisation challenges for early childhood education and care

Digitalisation engenders complex and multi-faceted challenges for ECEC, which can be summarised in five key areas (Figure 1.1). Countries value these challenges differently depending on their policy priorities, views on the role and objectives of ECEC, and the context and history of their ECEC policies.

The first challenge is to protect young children against digital risks, addressing their limited awareness of risks and protective behaviours in digital environments. This is a serious concern indicated by the 26 countries and jurisdictions that responded to the *ECEC in a Digital World* policy survey (2022) (see Chapter 2). A second challenge is to mitigate digital divides: divides between children, compensating for unequal access to quality resources and unequal experience with positive digital mediation in home environments; and divides between ECEC settings, enabling more effective work processes in all settings. These are key reasons to make ECEC responsive to digitalisation. The third challenge concerns laying the foundations for young children to develop their digital literacy, attending to its multiple dimensions and without detriment to other curricular goals. The fourth challenge relates to enhancing the quality of the interactions children experience in ECEC settings and between the ECEC workforce and children's families to promote their cognitive and socio-emotional development in the digital age. The fifth challenge is to mobilise digital tools and data to improve opportunities for professional learning and collaboration among ECEC staff, as well as for quality monitoring and service co-ordination. This might be a less controversial challenge than some of the others, but it is important given the characteristics of ECEC settings and staff.

Figure 1.1. Five key challenges for early childhood education and care in the digital age



These five challenges highlight the close intertwinement between digital opportunities and risks and the need for policy solutions that strike a careful balance between the two. Risks are inherent to an increasing reliance on digital tools, from young children's extended screen time to growing digital divides and diverting the focus from the in-person interactions that constitute the core of high-quality ECEC. However, preparing all young children to engage in safe and creative uses of digital technology can be an effective strategy for reducing most of these risks. Supporting staff to integrate digital tools into their work selectively and meaningfully can open the door to quality improvements. Making ECEC responsive to digitalisation involves managing rather than trying to eliminate these risks and exploring rather than ignoring these opportunities.

Addressing these five challenges also involves paying attention to age differences among young children. The age gradient in early development requires age-specific and evolving responses, with little exposure to digital tools for children between birth and age 3 and a growing emphasis on children's experience with digital tools as a foundation for digital literacy as children get older.

Fifteen policy pointers to make early childhood education and care responsive to digitalisation

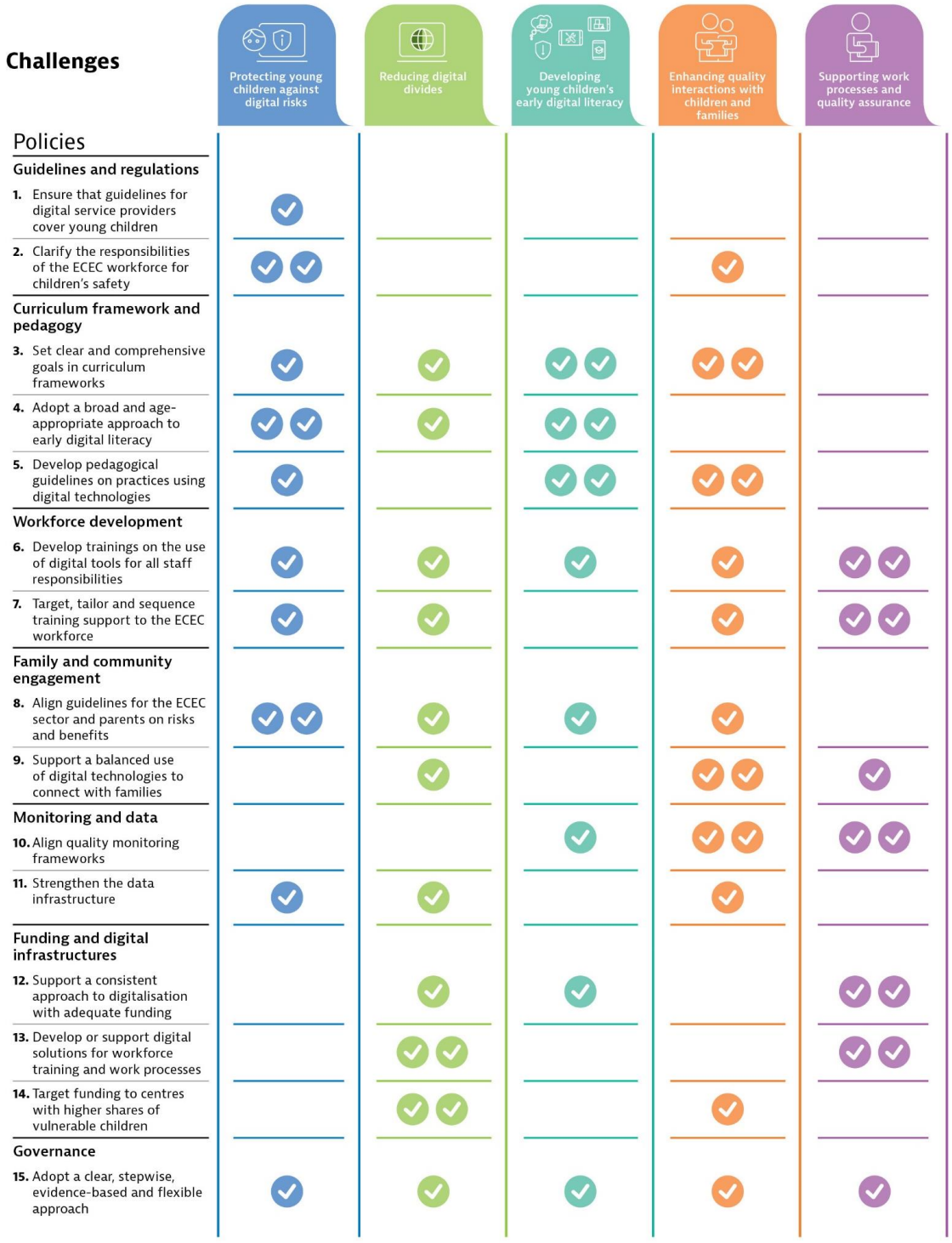
Research consistently underscores the importance of ensuring ECEC is of high quality to support children's development and well-being and to realise the numerous benefits of investing in this period of the life course (OECD, 2021[1]). The new challenges and opportunities brought about by digitalisation call for reviewing the main policy areas to promote quality ECEC. Drawing on the policy levers of the Starting Strong framework, this report identifies 15 policy pointers to meet the 5 key challenges in making ECEC responsive to digitalisation (see Figure 1.2 and Box 1.1).

Countries put different weights on these challenges (see Chapter 2) and there can be rationales for focusing on a limited number of challenges, at least in the short run. The roadmap can help inform these choices by identifying policy pointers to address each of these challenges. However, the roadmap also shows that even when focusing on a particular challenge, a broad policy approach that combines actions across multiple policy levers is recommended. Another way to look at the roadmap is to consider all policy levers simultaneously and identify directions to update these policies in light of digitalisation. This would lead to a comprehensive strategy for making ECEC responsive to digitalisation. However, care is needed when revisiting one policy lever alone, as this can lead to inconsistencies in the approach, such as setting ambitious goals in curriculum frameworks without adequately preparing the ECEC workforce.

Box 1.1. Methodology of the policy roadmap

This policy roadmap draws on a variety of sources to identify policy challenges, pointers and examples. The five key challenges for ECEC in the digital age are derived from an analysis of the associations between specific challenges regarding digitalisation, young children and ECEC presented in Chapter 2 of this report. The 15 policy pointers synthesise strategies, across multiple policy levers, from the specific policy directions discussed in the concluding sections of Chapters 3-8. Countries and jurisdictions implementing relevant policy developments, as well as examples of specific programmes or initiatives, at multiple levels, are identified based on information provided through the *ECEC in a Digital World* policy survey and the project case studies. More detailed information on the methodology is provided in Annex A.

Figure 1.2. A policy roadmap to respond to key digitalisation challenges in early childhood education and care



Notes: This figure presents a summary of the policy pointers identified in the report. A discussion of the policy pointers can be found at the end of each chapter of the report. These are short versions of each policy pointer. For more details on each policy pointer, see Table 1.1. Two check marks indicate a direct strong link between the policy pointer and the challenge. One check mark indicates an indirect, weaker link.

Guidelines and regulations should set the preconditions for any use of digital technologies in ECEC settings

Guidelines and regulations for digital service providers need to include dispositions relating specifically to young children, apply to any type of digital technology or service amenable to use in ECEC settings, and set some responsibilities on digital service providers for protecting young children's safety and well-being in digital environments (**Policy Pointer 1**). The responsibilities of the ECEC workforce for protecting children against digital risks need to be clarified and spelt out, depending on their role, children's age and type of ECEC setting (**Policy Pointer 2**). These are preconditions for digital technologies to be used in ECEC settings, including for collecting or processing their personal data, and for ECEC professionals to have clear standards about digital safety in their work.

Policies around curriculum frameworks and workforce development are at the core of the response of ECEC to digitalisation

Curriculum frameworks can set clear goals for ECEC in light of the digital transformation. These goals can be comprehensive and reflect the broad impact of digitalisation on children's development, learning and well-being rather than focusing only on the use of digital technologies (**Policy Pointer 3**). The holistic approach of ECEC that aims to support comprehensive cognitive, social and emotional developments is well-aligned with a 21st century curriculum. In addition, curriculum frameworks and other documents, such as digital education strategies, can set clear goals for children's early digital literacy development and adopt a broad view on digital literacy (Chapter 4), including on how technology works (computational thinking); developing risk awareness and safe behaviours in the use of technology; and learning to use technology in support of play, creativity and self-expression (**Policy Pointer 4**).

ECEC professionals hold most of the responsibilities for providing a mix of care and education that aligns with the evolving goals set by curriculum frameworks. Developing pedagogical guidelines for digital practices with children and choosing digital materials aligned with curriculum goals can help them implement these frameworks (**Policy Pointer 5**). ECEC professionals also have large responsibilities for documenting children's development, learning and well-being; engaging with families; ensuring compliance with standards; and engaging in continuous professional development. Digitalisation has implications for all these processes. Providing training opportunities for ECEC staff on the use of digital technologies for the breadth of their responsibilities, both in initial preparation programmes and continuous professional development, is a key policy action (**Policy Pointer 6**). The timing and content of the training for the ECEC workforce to develop digital competencies must be carefully considered. This training needs to come prior to or in parallel with the introduction of policies that aim to adapt ECEC to digitalisation. Not all staff need to develop the same set of digital competencies. All staff should acquire foundational knowledge on how digital technologies can be safely and meaningfully integrated into ECEC settings, but some staff could develop enhanced and specialised digital competencies to meet greater responsibilities in some aspects of their work (e.g. initiating creative work with children in a digital space or using data to improve monitoring or management) (**Policy Pointer 7**).

Digitalisation is an additional reason for ECEC to engage with parents but is also a tool

Family and community engagement are becoming even more important as digital technologies become a fixture of children's home environments, bringing new risks but also new opportunities for play, learning and socialisation. Guidance for parents that generally focuses on risks can be complemented by information about the opportunities and educational uses of digital technologies and therefore be better aligned with objectives for the ECEC sector (**Policy Pointer 8**). This can reduce the potential dissonance between digital attitudes and practices in ECEC and in home environments. Additionally, digital

technologies offer opportunities to facilitate more frequent and wider communication with parents, communities and other institutions in charge of education and young children (**Policy Pointer 9**).

Improved monitoring and data use and adequate funding and investment in infrastructures can support responses to digitalisation in ECEC

As ECEC policies are modified or adapted in response to digitalisation, monitoring frameworks should reflect these changes. For instance, the implementation of changes to the curriculum framework and pedagogical approaches on process quality and on learning, development and well-being should be monitored. The quality of ECEC workforce training on digital competencies also needs to be monitored (**Policy Pointer 10**). At the same time, digitalisation brings new tools for monitoring the equity and quality of ECEC. The data infrastructure can be strengthened through improved data collection and data sharing, enabling a wider range and more actionable uses of ECEC data (**Policy Pointer 11**). This also implies paying greater attention to data security and privacy protection in ECEC.

A consistent approach to ECEC and digitalisation requires adequate funding to support workforce training in particular (**Policy Pointer 12**). Governments can ensure that all ECEC settings have access to the needed solutions (e.g. digital infrastructures and materials, material for unplugged approaches) for work processes and uses with children (**Policy Pointer 13**).

Promoting equal opportunities and inclusion in ECEC are key reasons for making ECEC responsive to digitalisation

For many children, digital divides are already emerging in early childhood, driven by differences in the level of digital resources and digital skills in their family environments. ECEC can play a role in redressing these inequalities by providing opportunities to build early digital literacy for all children. Furthermore, the potential for digital technologies to improve a range of work practices is particularly important for centres with a high proportion of disadvantaged children or a lack of financial and human resources. Finally, digitalisation can also help promote more inclusive and responsive practices for learning and development. For these reasons, funding for digital infrastructure and related workforce training can be targeted to centres with larger shares of children from disadvantaged backgrounds, and on how to better reach out to and increase the engagement of their families in ECEC (**Policy Pointer 14**).

The policy response needs to take children's age into account

There are multiple facets to the question of making ECEC responsive to digitalisation. Some call for age-specific policy responses while others hold for young children generally.

An important argument is around making ECEC more anchored in today's childhood and ready to prepare children for the future. The ability to learn, capacity to solve problems with complex sets of information and creative thinking are viewed as crucial skills in a rapidly changing environment. ECEC can adapt to these changes. While practices with children to support these developmental areas depend on the children's age, the goal holds for the entire education sector, including for very young children.

Another facet is that children should become digitally literate. This report adopts the notion of "early digital literacy", which is about laying the foundations of digital literacy, and can be seen as including several dimensions (see Chapter 4): getting a sense of how to protect oneself against digital risks; how to use digital technologies for play, self-expression and learning; and how a computer works (computational thinking). Likewise, while practices to support these developmental areas depend on the children's age, the goal holds for all children.

Using digital technologies with children to support the development of early digital literacy or other areas of development calls for an approach differentiated by age. Approaches that can support early digital literacy without exposure to screens, such as robotic kits and "unplugged approaches", are well-suited for ECEC children, especially the youngest ones. When digital technologies are used with children in ECEC settings, research points to usages that make children active and interact with others, and not in place of other activities. These situations might be more difficult to realise in ECEC settings with the youngest children. Responses to the *ECEC in a Digital World* policy survey (2022) indicate that governments tend to invest in materials that can lead to passive uses if not well integrated into an age-appropriate pedagogical approach.

Uncertainties call for a balanced but consistent and timely approach

Many risks come to mind when planning to make ECEC responsive to digitalisation: young children's passive and excessive exposure to screens, displacement of meaningful in-person interactions with children, ineffective communication with families through digital channels, or privacy violations in the processing of children's or staff's personal data. Not only is robust scientific evidence lacking on many aspects, but the speedy pace of developments also turns many questions into moving targets. Uncertainties relating to the impact of digital technologies on children and ECEC and to the effectiveness of potential policy responses are therefore bound to persist. Nonetheless, attempts to fully isolate ECEC from digitalisation appear futile and countries' responses to the *ECEC in a Digital World* policy survey indicate that preserving ECEC as a space where children have no contact with digital technology is not a priority.

This report explores the various policy levers for ECEC to prepare children for a digital world and build on digitalisation for better ECEC quality. The policy response needs to be proportionate to the capacity of the sector to adapt. In many countries, the ECEC sector has a number of fragilities relating to the lack of resources, the heterogeneity of the workforce and the inherent difficulties of providing high-quality experiences for young children. There is no single direction and countries can have different objectives. However, it is important that the goals of ECEC responses to digitalisation are clear and articulated around an approach that involves all relevant stakeholders, is informed by the best available evidence, and can be implemented gradually and flexibly (**Policy Pointer 15**). The timing of the adaptation is important. Infrastructure in a broad sense – including digital solutions, funding and workforce training – have to be in place to accompany change in curriculum frameworks and pedagogical approaches. Monitoring needs to follow.

Learning from countries on the multiple strategies

This report does not take a stance on how far countries should go in their response to digitalisation. Each country is transforming its ECEC policies to account for digitalisation at its own pace. The landscape can also change quickly, as experienced during the COVID-19 pandemic, which has led to an expansion in the use of digital technologies to maintain children's learning as centres were closed, to engage with parents and to support ECEC workforce training.

The roadmap identifies examples of countries that are active on some policy pointers and may provide peer-learning experiences to other countries (Table 1.1). The report and its compendium of case studies provide multiple examples of policy initiatives that are also indicated in Table 1.1.

Table 1.1. Policy pointers for making early childhood education and care responsive to digitalisation and country examples

Policy pointers	Examples of countries active on this pointer	Specific initiatives
Guidelines and regulations		
1. Ensure that guidelines for digital service providers pertinently cover young children	Australia, Germany, Norway, United Kingdom	Box 3.1: Germany, Japan, Sweden; Box 3.2: United Kingdom, United States
2. Clarify the responsibilities of the ECEC workforce for children's safety in digital environments depending on their role, children's age and type of ECEC setting	Australia, Germany, Luxembourg, Norway	Box 3.5: Canada, Netherlands, Norway, United Kingdom Case Studies: Australia, Norway
Curriculum framework and pedagogy		
3. Set clear and comprehensive goals in curriculum frameworks for ECEC in light of digitalisation	Finland, Germany, Israel, Luxembourg, Norway, Spain	Box 4.1: Portugal
4. Adopt a broad and age-appropriate approach to early digital literacy in curriculum frameworks	Belgium (3-5), Canada (Manitoba), Finland, Germany, Norway, Spain	Box 4.1: Canada (Manitoba), Finland Case Study: Israel
5. Develop pedagogical guidelines on practices using digital technologies and choices of digital material	Finland, Japan, Norway, Portugal, South Africa	Box 4.2: Finland, Japan, Norway, Portugal, South Africa Case Studies: Germany (2), Estonia, Lithuania, Norway
Workforce development		
6. Develop trainings (initial and continuous) on the use of digital tools for the breadth of the ECEC workforce's responsibilities	Denmark, Spain, Luxembourg, Norway, Sweden	Box 5.2: Germany, Slovenia Case Studies: Germany (Bavaria), Spain
7. Target, tailor and sequence training support to the ECEC workforce depending on their responsibilities, needs and diffusion of digitalisation	Denmark, Germany, Spain, Iceland, Japan	Box 5.4: Germany, Slovenia Box 5.6: Canada, Germany, United States Case Studies: Germany (Bavaria), Israel, Lithuania, Luxembourg
Family and community engagement		
8. Align guidelines for the ECEC sector and parents on managing risks and realising the benefits of digital environments for children	Germany, Luxembourg, Norway, Slovak Republic, Spain	Case Study: Luxembourg
9. Support a balanced use of digital technologies to better connect ECEC settings with families, schools, communities and social institutions	Czech Republic	Chapter 6: New Zealand, United States
Monitoring and data		
10. Align quality monitoring frameworks with policies in response to digitalisation (e.g. curriculum framework implementation and quality of training programmes)	Czech Republic, Israel, Slovak Republic	Case Study: Luxembourg Box 3.4: Denmark, France, United States
11. Strengthen the data infrastructure (collection, sharing and use; data security and privacy protection) of the ECEC sector	Korea, Finland, Israel, Luxembourg, Norway, Slovenia	Chapter 8: Finland, Norway
Funding and digital infrastructures		
12. Support a consistent approach to ECEC and digitalisation with adequate funding	Czech Republic, Finland, Germany,	Case Study: Czech Republic
13. Develop or support digital solutions for workforce training and work processes	Australia (Victoria), Italy, Norway, Sweden	Case studies: Costa Rica, Estonia, Slovenia Chapter 5: Canada; Box 5.3: Australia, Canada (Manitoba), Costa Rica, Korea, Italy, Spain Box 5.5: Iceland, Norway, Slovenia, Sweden
14. Target funding on digital infrastructure and tools and related workforce training to centres with larger shares of vulnerable children	Israel, Italy, Korea	Box 7.2: Australia, Canada, Germany, Spain, United States
Governance		
15. Articulate clear objectives for ECEC and digitalisation and involve all relevant stakeholders with an incremental, evidence-based and flexible approach		

Notes: Countries and jurisdictions "active" for these policy pointers are selected following an approach that combines answers to the *ECEC in a Digital World* policy survey (2022) and analysis presented in the chapters of this report. "Specific initiatives" point to case studies of the compendium and parts of the report. Initiatives can be at any level, not necessarily at the country level.
Canada (Manitoba): kindergarten sector only.

Examples of countries active in a specific policy lever

Some countries are particularly active in at least one of the five policy levers (Table 1.2). This information can be helpful to countries that have identified areas of policies for which they plan to do more to make ECEC responsive to digitalisation.

Answers to the *ECEC in a Digital World* policy survey (2022) and analysis carried out for this report show that several countries are implementing policies and initiatives to prepare the workforce for changing demands brought about by the digital transformation. The ECEC workforce can create momentum for adopting modernised work processes and preparing children for the digital age. Furthermore, several countries invest in workforce training and infrastructures relating to digitalisation. However, funding needs to be sufficient and part of it should target centres with the least favourable conditions. Ensuring that the monitoring framework is adjusted to include goals of ECEC relating to digitalisation and workforce development on digital technologies remains a priority in many countries.

Table 1.2. Which countries are active in a particular policy lever?

Guidelines and regulations	Curriculum framework and pedagogy	Workforce development	Family and community engagement	Monitoring and data	Funding and digital infrastructures
Australia	Canada (Manitoba)	Australia (Victoria)	Czech Republic	Finland	Canada
Germany	Germany	Denmark	Luxembourg	Norway	Germany
Norway	Finland	Iceland	Slovak Republic		Israel
United Kingdom	Norway	Japan			Korea
	Spain	Norway			Sweden
		Spain			
		Sweden			

Note: Countries and jurisdictions "active" for these policy levers are "active" for multiple policy pointers of the policy lever according to answers to the *ECEC in a Digital World* policy survey (2022) and analysis presented in this report. Canada (Manitoba): kindergarten sector only.

Examples of countries combining multiple policies to address a particular challenge

Some countries have implemented a mix of policies related to the same challenge. These countries offer opportunities for learning how to address a particular challenge through a consistent set of policies.

Protecting children against digital risks is a challenge for which some countries appear to advance with a consistent set of policies. This is also the challenge ranked the highest by countries participating in the *ECEC in a Digital World* policy survey (2022). For other challenges, not many countries can be identified as putting forward a comprehensive policy response.

Table 1.3. Which countries have a set of policies to address a particular challenge?

Protecting young children against digital risks	Reducing digital divides	Developing young children's early digital literacy	Enhancing quality interactions with children and families	Supporting work processes and quality assurance
Australia	Germany	Finland	Australia	Denmark
Canada (Manitoba)	Luxembourg	Luxembourg	Germany (Bavaria)	Norway
Luxembourg		Spain	Israel	
Norway		Sweden	Japan	
Portugal				

Notes: Countries and jurisdictions shown are "active" on policy pointers that address the same challenge (see Table 1.1) according to answers to the *ECEC in a Digital World* policy survey (2022) and analysis presented in this report. Canada (Manitoba): kindergarten sector only.

Going forward

Even more than higher levels of education, ECEC systems around the world respond to the challenges brought about by digitalisation with thin evidence on its impact on young children, and in the context of rapidly evolving technological developments and broader questions on how to design ECEC policies that benefit all children equally. This report presents a snapshot of countries and jurisdictions' policy responses as of 2022 and a synthesis of research to propose possible policy directions. Further research and analysis will be needed to strengthen the evidence base and provide additional policy insights. Among the priorities for follow-up work could be investigating in greater detail implications for different age groups of young children, capitalising on the data generated by the monitoring of current policy initiatives, paying close

attention to the voices of the ECEC workforce as new policies are introduced, and better understanding connections between the dynamics of digitalisation in ECEC settings and in home environments.

Reference

OECD (2021), *Starting Strong VI: Supporting Meaningful Interactions in Early Childhood Education and Care*, Starting Strong, OECD Publishing, Paris, https://doi.org/10.1787/f47a06ae-en. [1]

2 Digitalisation and early childhood education and care: Trends and challenges

This chapter provides an overview of digitalisation trends with implications for young children and early childhood education and care (ECEC). It reviews economic and social changes shaping the skills bundle for the digital age, as well as trends in young children's engagement with digital technologies and associated risks and opportunities. The chapter describes policy challenges for supporting young children and ECEC systems through the digital transformation as identified by the countries and jurisdictions participating in the OECD project ECEC in a Digital World.

Key findings

Digitalisation brings forth deep and accelerated transformations to the economy, civic life and the world of education. Among their implications for young children, these changes broaden the bundle of skills needed to thrive in a technology-rich world. Strong cognitive and socio-emotional skills, as well as strong digital literacy, are key components of this bundle. High-level thinking and interpersonal skills complement the enhanced capabilities of new technologies.

In home environments, young children (aged 0-6) are interacting with digital technologies at increasingly younger ages, for a wide range of activities, and often with or under the supervision of their parents. The evidence base on the effects of digital technologies on children's early development and well-being is inconclusive, but research suggests that it is the quality of digital experiences rather than the amount of time they spend using digital tools that has the strongest influence on children's outcomes. Research also points to the importance of adapting digital media exposure and activities to young children's developmental stages, as the balance of risks and opportunities varies with age.

Early childhood can be a window of opportunity for introducing children and families to safe, creative and educational uses of digital technology, as it is a time when young children gradually gain autonomy in using digital tools but remain more accepting of adult guidance and supervision. ECEC settings can play an important role in supporting parents in their digital mediation practices and in levelling the playing field for developing early digital literacy for all children.

Responses to the *ECEC in a Digital World* policy survey (2022) suggest that risk-focused challenges dominate policy agendas for responding to the impact of digitalisation on young children. Protecting young children's privacy and preventing potential harms from the use of digital technologies are the challenges most commonly listed as being of major importance by countries and jurisdictions. However, many also attribute high relevance to seizing opportunities from digitalisation, including preparing young children for the future of education or promoting their agency and empowerment in digital environments. Concerns about digital divides are perceived as having a strong bearing on young children's opportunities to benefit from digitalisation.

ECEC continues to operate with large uncertainties about effective policies to respond to digitalisation, but increasing attention is being paid to the use of digital technologies in support of process quality. The limited available evidence suggests low preparedness for using digital technologies with children among ECEC teachers relative to a growing inclusion of digitalisation-related contents in training programmes for primary school teachers. However, the COVID-19 pandemic was a catalyst for rethinking policies regarding the use of digital technologies with children in ECEC.

When surveyed about responses to digitalisation in ECEC specifically, most countries and jurisdictions listed promoting safe and responsible uses of digital technologies by both ECEC staff and young children as the most important challenges, while preserving ECEC as a digital-free space was the lowest ranked priority. This suggests a commitment on the part of ECEC systems to help young children and ECEC staff to live with and manage the risks associated with digital technologies without foregoing their opportunities. Other policy challenges considered of major importance relate to the effective use of digital technologies in professional learning and collaboration, communication with families, or monitoring practices. Some countries and jurisdictions emphasise responses to digitalisation in work with children whereas others prioritise integrating digital technologies into processes that do not involve direct interactions with children.

Introduction

Digitalisation is a transformational force reshaping how people learn, work, communicate and participate in society, with the pace of these changes accelerating due to the development and combinatory enhancements of digital technologies (OECD, 2019[1]; 2019[2]; 2019[3]). Digitalisation affects young children in multiple ways, operating through a variety of channels and time frames. It has distal implications for today's children by shaping the society and the labour markets they will encounter in adulthood, and the school and higher education systems they will navigate in the coming years. Its impact is, however, more immediate and visible through the direct interactions that children have with digital tools, starting in their home environments. Supporting young children through the changes that digitalisation brings to the environments where they grow and learn involves a range of policy challenges as well as placing children, rather than technology, at the centre of the discussion.

This chapter provides an overview of some of the major transformations of the digital era, discussing their implications for young children. The first part of the chapter describes changes in the economy, society and education that are expected to modify the set of competences that will equip people to thrive in the future. It then reviews trends in young children's engagement with digital tools at home and the risks and opportunities associated with these experiences. The second part of the chapter describes challenges for the ECEC sector across multiple policy areas in adapting to the digital age. The chapter draws on responses to the *ECEC in a Digital World* policy survey (2022) to identify the priorities of participating countries and jurisdictions in making their ECEC systems responsive to digitalisation.

Digitalisation trends affecting young children

This section reviews global and long-term digitalisation trends affecting young children, drawing primarily on prior OECD work, including a selection of indicators from the *Going Digital Toolkit* (GDT) and work from the 21st Century Children project (Burns and Gottschalk, 2019[4]; 2020[5]). The second part of the chapter looks more specifically at digitalisation in ECEC.

Digital infrastructure

Infrastructure development underpins the use of digital technologies across sectors and contexts. Recent decades have witnessed a massive increase in the number of connected people and devices and in the volume of data flowing across online networks. In OECD countries, mobile broadband connectivity grew from 31 to 124 subscriptions per 100 inhabitants between 2009 and 2021 (GDT Indicator 11) (Figure 2.1). It is estimated that three Internet-connected devices were in service per person worldwide in 2022 (OECD, 2019[1]). Most of these connected devices are powered by fast processors and equipped with substantial storage capacity, technologies that have become more and more affordable over time. For instance, the cost of a megabyte of computer memory shrank from about USD 46 in 1990 to less than USD 0.01 in 2016 (Our World in Data, 2022[6]). The strong demand for connectivity has been met by a concurrent increase in network capacity, which nearly quadrupled between 2016 and 2021 across OECD countries, jumping from 2.4 GB to 8.4 GB of monthly data usage per mobile broadband subscription (GDT Indicator 15). These improvements in digital infrastructure enable individuals and organisations to engage with increasingly diverse online services and content. Further, and notwithstanding disparities in quality, the use of digital technologies is spreading across most segments of society. For instance, on average across European Union (EU) countries, 89% of adults living in households in the lowest income quartile were Internet users in 2021, so were 96% of adults in Korea and 84% of adults in the United States (GDT Indicator 51).

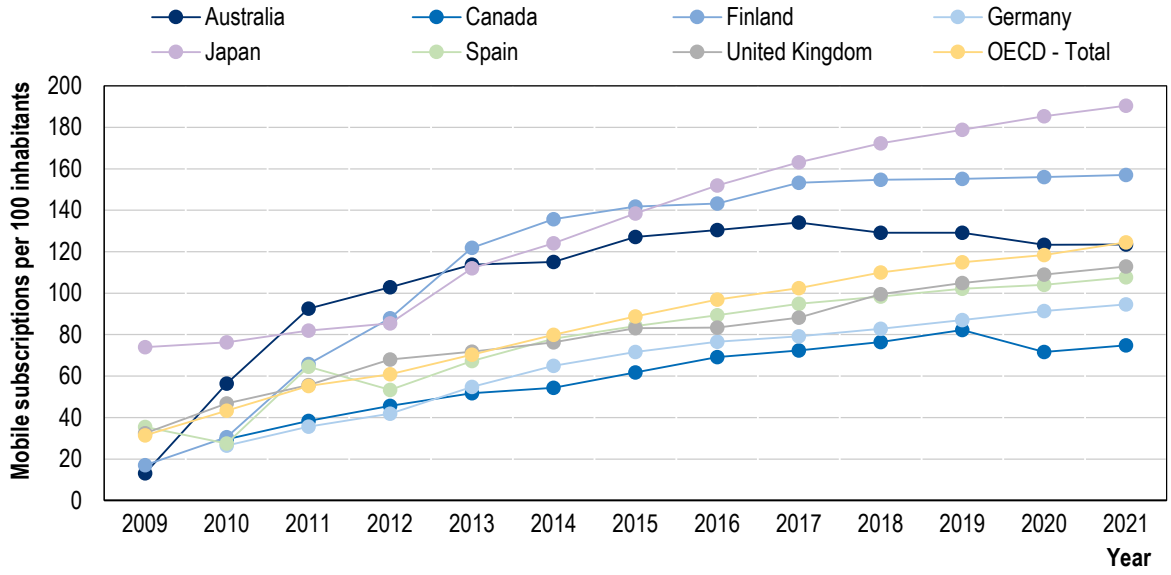
The economy in the digital age

Digitalisation is driving major changes in modern economies, spurring innovation and productivity gains but also bringing important disruptions to the world of work. Between 2001 and 2018, the contribution of digital-intensive sectors to economic growth averaged around 20% of the annual growth in real value added across OECD countries (GDT Indicator 8). And in most OECD countries, from 2005 to 2018, labour productivity was between 1.2 and 2.5 times higher in information industries than in non-agriculture business sector activities (GDT Indicator 1).

The digital transformation is visible in the labour market, where it creates new employment opportunities while shaking up many existing jobs. Between 2006 and 2016, highly digital-intensive sectors contributed significantly to job creation, accounting for 42% of newly created jobs, on average, across OECD countries. An analysis of job postings published online over the last decade in ten countries shows a strong increase in the demand for digital skills, with occupations such as software developers, programmers and engineers, and data scientists having experienced the highest rates of growth (OECD, 2022[7]). Digital skills are highly valued in this changing labour market and enjoy wage premia in many industries, particularly in growing occupations linked to new technologies, a pattern that holds for numeracy or management and communication skills, too (OECD, 2019[2]).

Figure 2.1. Uptake of broadband technology

Mobile broadband subscriptions per 100 inhabitants, 2009-21



Source: OECD (n.d.), Going Digital Toolkit, http://goingdigital.oecd.org, (accessed on 10 December 2022).

StatLink https://stat.link/ts6xi4

Meanwhile, much attention is being paid to the disruptions that advanced robotics and artificial intelligence technologies will bring to employment in the near future. On average across the countries that participated in the OECD Survey of Adult Skills, the percentage of jobs that face a high likelihood of automation over the next 10-20 years is estimated at 14%, with an additional 32% of jobs that could face significant changes due to the automation of a sub-set of the tasks required to carry them out (Nedelkoska and Quintini, 2018[8]). An expert assessment of computer capabilities suggests that current computers are already close

to reproducing the proficiency of the literacy skills that 62% of workers in OECD countries use on a daily basis (Elliott, 2017[9]). Overall, digital technologies may increasingly replace workers in easy-to-automate routine tasks while affording capabilities that complement rather than reproduce the creativity, problem solving and thinking skills that human workers exercise in more complex, non-routine tasks. Concerns over the extent of machine substitution for human labour may lead to overlooking the strong complementarities between technology and the skills in which humans maintain a comparative advantage, and which have the potential to increase productivity, earnings and the demand for labour (Autor, 2015[10]; Acemoglu and Restrepo, 2019[11]). In the digital age, employment opportunities tend to improve in occupations characterised by non-routine tasks and requiring high-level cognitive, interpersonal and digital skills (OECD, 2019[2]). Inversely, employment conditions tend to deteriorate in occupations that are intensive in low-skilled routine tasks.

Civic engagement and information flows in the digital age

Digitalisation is similarly reshaping many public services and conditions for civic participation, creating opportunities for citizens and governments to interact with greater ease, openness and transparency, but also introducing new tensions and dilemmas. Public administrations in many countries have digitised a large number of processes in public services, from tax collection to applications for public benefit programmes, and gradually shifted from simply facilitating e-government services to also trying to promote civic engagement. For instance, governments in most OECD countries conduct public consultations over the Internet, using digital channels to actively seek feedback from the general public and advisory groups (OECD, 2018[12]).

The uptake of digital government services indicates an increasing reliance on digital tools from the side of citizens as well. For instance, between 2010 and 2020, the share of individuals using the Internet to interact with public authorities increased from 40% to 57% on average in the EU, whereas it grew from 55% to 79% in Canada, and from 1% to 28% in Mexico (GDT Indicator 23). Citizens are also gradually embracing other digitally mediated forms of civic and political engagement. In 2017, 11% of adults across EU countries posted opinions on civic or political issues online, a share that grew to 16% among 16-24 year-olds. In countries like Iceland or Switzerland, close to one in four adults shared civic or political views online (OECD, 2019[3]).

In other spheres of social life, an increasing number of activities are also taking place online, as digital tools are revolutionising how society generates and consumes information. For instance, on average across OECD countries, the share of Internet users going online to obtain information about goods and services jumped from 40% in 2005 to 75% in 2020 (OECD, 2022[13]), and 57% of women and 47% of men reported having used the Internet to access health information in 2018 (OECD, 2019[3]). Unprecedented levels of digital connectivity are redefining the channels through which knowledge is produced and disseminated. Whereas traditional sources like encyclopaedias or the mass media of the 20th century were controlled by an elite few, the content of today's social media and online sites like Wikipedia is largely generated by networked interactions of millions of people across the world. Wikis, for which the number of pages grew from about 10 000 to over 250 million in just 20 years, are one example of the resources on which people increasingly rely to take decisions in the digital age (OECD, 2022[13]).

While digital tools can enable greater efficiencies in public services and more decentralised flows of information, these developments are not without risks. As digital content gets reproduced and amplified at an unprecedented speed, online mis/disinformation has emerged as a major challenge for modern democracies in the Internet age (Humprecht, Esser and Van Aelst, 2020[14]). Against this backdrop, media literacy education can play a key role in empowering children to discern false and misleading content and identify genuine and useful information (Hill, 2022[15]).

Education systems in the digital age

Digitalisation is also one of the major forces behind ongoing transformations in the world of education. On the one hand, education systems are redesigning their curriculum frameworks to respond to the challenges of a digitalised and globalised world. On the other hand, digital technologies are gradually permeating teaching and learning processes. These changes can shape the experiences of today's young children as they advance in their schooling, including their time in ECEC.

In recent years, countries across the world have been making a significant shift towards a 21st century curriculum, aiming to prepare learners not only for changing labour market needs but, more generally, to navigate complexity and uncertainty and be able to shape their own perspectives, ensure their individual well-being, and contribute to collective prosperity and sustainability. This is reflected in an increasing emphasis on cross-curricular content, competency-based curricula, personalised and flexible curricula, and digital curricula. As put forward by the OECD Learning Compass 2030, what is commonly articulated across these types of curricula are future visions of learner profiles that emphasise both cognitive (e.g. critical thinking, creativity) and socio-emotional skills (e.g. self-awareness, curiosity) as well as agency, co-agency and transformative competencies such as taking responsibility or reconciling tensions (OECD, 2020[16]). Individuals' ability to adapt and thrive in a fast-evolving world rests on education systems enabling them to acquire strong foundational knowledge and skills and providing opportunities for lifelong learning. This is supported by high-quality ECEC that enables all young children to develop the skills and learning habits that help them thrive throughout their lives. Skills identified as particularly important to benefit from lifelong learning include "learning to learn" or "self-directed learning" (OECD, 2021[17]). Another key component of the skills bundle required to meaningfully participate in the digital age, and increasingly recognised in future-oriented curriculum frameworks, is digital literacy, understood as a combination of the knowledge, skills and attitudes that enable a confident, critical and responsible engagement with digital technologies (Nascimbeni and Vosloo, 2019[18]). "Early digital literacy" refers to adapting this concept to early childhood (see Chapter 4).

Besides changes to high-level curriculum and learning goals, education systems are also exploring effective ways to integrate digital technology at all levels, building on the potential of applying digital technologies to teaching and learning processes (National Academies of Science Engineering and Medicine, 2018[19]; Escueta et al., 2020[20]). Digital tools are becoming increasingly present in educational settings, particularly in schools and universities, and growing demands are being placed on teachers to integrate these tools into their practice.

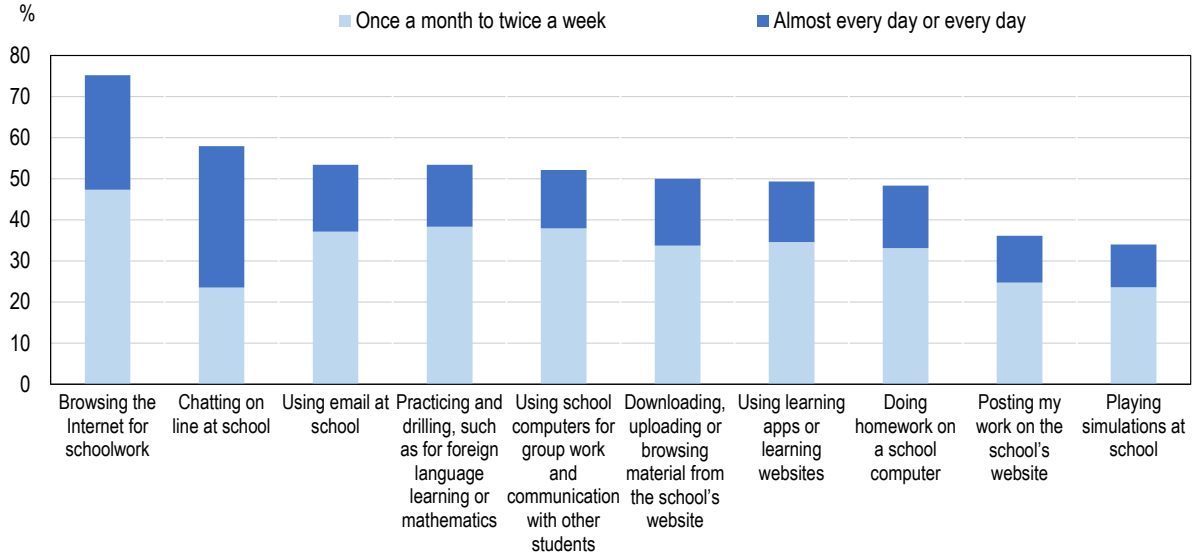
Results from the Programme for International Student Assessment (PISA) show that, in 2018, 15-year-old students spent around 8 hours per week on the Internet at school, on average, across OECD countries, while in countries such as Australia, Denmark, New Zealand, Sweden or the United States, students reported using the Internet at school for 12 hours or more per week. Moreover, on average across OECD countries, between 2012 and 2018, the amount of time 15-year-old students spent using the Internet at school increased from 13% to 23% of their total online time (OECD, 2021[21]). This suggests that while the bulk of 15-year-olds' online time happens outside of school, an increasing amount of their school activities make use of digital technologies. For instance, on average across OECD countries, 75% of students reported browsing the Internet for schoolwork at least once a month, including 28% who reported doing so almost every day or every day, and close to 50% reported using school computers for group work and communication with other students, or using learning apps or websites at least once a month, including in both cases around 15% of students engaging in these activities daily or nearly (Figure 2.2).

Adopting school-level practices for using digital devices is also becoming widespread in many OECD countries. For instance, a specific programme to prepare students for responsible Internet behaviour is reported by more than nine in ten school principals in Norway and the United Kingdom (compared to the OECD average of 60%), and regular discussions with teaching staff about the use of digital devices for

pedagogical purposes are reported by principals in more than eight in ten schools in Denmark, Latvia, Lithuania, New Zealand and Sweden (compared to the OECD average of 63%) (OECD, 2021[21]).

Figure 2.2. Frequency of activities on digital devices in secondary schools

Percentage of 15-year-old students reporting using digital devices for the following activities at school at least once a month, OECD average, 2018



Notes: Based on student self-reports.
Items are ranked in descending order of the percentage of students who reported using digital devices for each activity at least once a month.
Source: OECD (2019[22]), *PISA 2018 Database*, Table B.6.14, https://www.oecd.org/pisa/data (accessed on 10 December 2022).

StatLink https://stat.link/lz08tm

These results, from data collected in 2018, are likely to underestimate current levels of integration of digital tools in school education given the acceleration and intensification of the use of digital technologies in the delivery of education spurred by the COVID-19 pandemic (OECD, 2021[23]), which was also experienced in early levels of education (OECD, 2021[24]). Going forward, more advanced technologies and more intensive use of data will likely be introduced in a growing number of teaching and learning processes and the management of educational organisations. While currently far from being mainstreamed, technologies such as intelligent tutoring systems, learning analytics, social robots or game-based standardised assessments may, in the years to come, become a regular feature of the schooling experiences of today's young children (OECD, 2021[25]).

Young children and digital technology in home environments

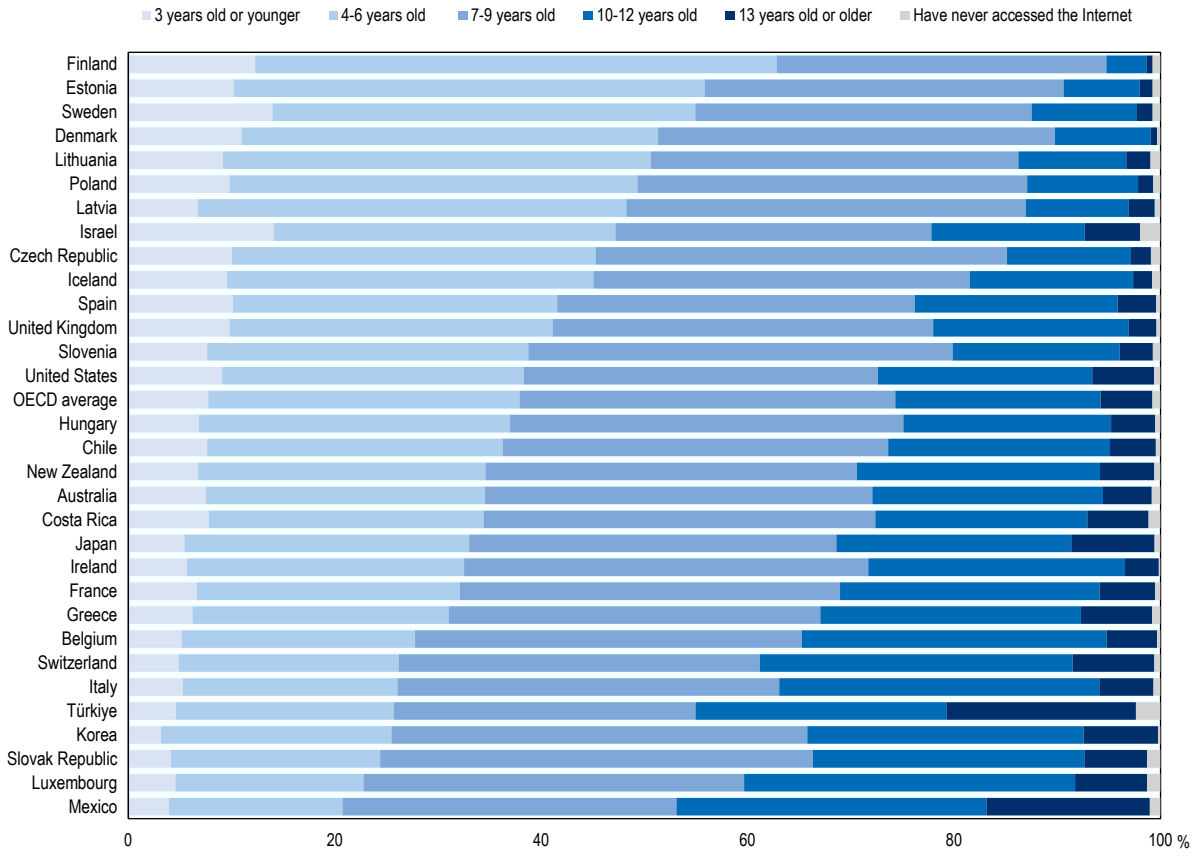
This section reviews some key patterns regarding the use of digital technologies by and with young children in their home environments. An effort is made to highlight features and implications of specific relevance to children aged 0-6, as different from the dominant focus of research on older children and adolescents (Hooft Graafland, 2018[26]). Overall, the evidence clearly suggests that, across OECD countries, young children are using digital technologies in home environments with increasing frequency and intensity, for many different activities, and often with or under the supervision of their parents. The evidence contradicts simplistic framings of their relationships with digital technology, such as the discourse of the "digital native". This has a limited empirical basis and fails to account for the diverse experiences of young children with

digital media, the need to educate and support them to engage with technology in safe and meaningful ways, and the social inequalities that undermine many children's capacity to benefit from technology (OECD/Rebecca Eynon, 2020[27]; Hietajärvi, 2021[28]).

Evidence across OECD countries suggests that children's exposure to digital technology often starts before age 3, and that by ages 3 and 4, significant proportions of children are using digital devices and going online daily. Data from PISA indicate that, on average across OECD countries, around 4 in 10 15-year-olds in 2018 had used a digital device for the first time when they were age 6 or younger, and that close to three-quarters of them had interacted with digital devices by age 9 (Figure 2.3). These results suggest that, in the mid-2000s, the modal age for first using digital devices was 7-9 years old in most OECD countries.

Figure 2.3. Age of first use of digital devices in the mid-2000s

Percentage of 15-year-old students reporting the age when they first used a digital device, 2018



Notes: Based on student self-reports.
Countries are ranked in descending order of the percentage of students who reported that they first used a digital device at age 6 or younger.
Source: OECD (2019[22]), *PISA 2018 Database,* https://www.oecd.org/pisa/data (accessed on 10 December 2022).

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However, more recent evidence from the International Early Learning Study reveals that, in 2018, on average across the three participating countries (England, Estonia and the United States), 83% of the 5-year-olds sampled for the study were using a digital device at least once a week, with 42% of them using such a device every day, and only 7% of them having never or hardly ever used a device (OECD, 2020[29]).

Other parental surveys provide further indication that, over the last decade, the initiation to the use of digital devices and online activities has been occurring before age 6 for large shares of children. For instance, in Australia, 81% of parents with pre-schoolers reported in 2018 that their children were using the Internet, and the vast majority already by age 4 (eSafety Commissioner, 2018[30]). In France, a 2013 survey of parents of infants aged 5-40 months found that around 90% of children had been in contact with touch screens by age 2, and that around 50% of them were using this technology daily or several times a week (Cristia and Seidl, 2015[31]). Evidence from Japan indicates that around 70% of children attending kindergarten (0-6 years old) were using the Internet in 2021, a 15-percentage point increase from 2019 (Cabinet Office, Government of Japan, 2022[32]). In the United States, 81% of parents of children aged 3-4 and 57% of parents of children aged 0-2 surveyed in 2020 said their child watches videos online, with half of the children aged 4 or younger reported doing so daily (Pew Research Center, 2020[33]).

The time that young children spend interacting with digital technology is central to debates about the potential implications of these activities. A systematic review of the literature on the correlates of mobile screen media use among children under age 9 suggests that time on screen-based devices has increased in recent years and ranges between one and two hours a day for a large proportion of children, albeit much variation exists depending on their age and context (Paudel et al., 2017[34]). In Canada, 29% of children under age 5 were reported to spend one to two hours on a digital device on weekdays but more time on weekends (Brisson-Boivin, 2018[35]). In Korea, daily usage time of smartphones by children aged 2-5 was estimated at around 1 hour on weekdays and 1.5 hours on weekends in 2017, an increase of about 30% in media use time from 2015 (Lee et al., 2019[36]). A comparison of two recent cohorts in the United States found that the time children aged 2-5 spent engaged with technology increased by 32% between 1997 and 2014, when it accounted for close to 25 hours per week (Goode et al., 2019[37]). More recently, cross-country studies have documented increases in screen time during COVID-19 lockdowns both for toddlers (Bergmann et al., 2022[38]) and children aged 3-7 (Ribner et al., 2021[39]).

Young children use digital technology for multiple purposes, the most prevalent being for entertainment (Ofcom, 2022[40]; Cabinet Office, Government of Japan, 2022[32]). Watching cartoons and animations or listening to music on video-sharing platforms (e.g. YouTube) are the most common entertainment activities, along with creative and building games (e.g. Minecraft, Roblox) for gaming. Communication with family members is also important, generally in the company of parents and through shared rather than personal accounts or devices. Young children are much less likely than older children to be present on social media platforms, although a significant number have their own profiles, often in breach of age restrictions, or an indirect footprint when their parents post photos, videos or other information on these platforms ("sharenting") (Brisson-Boivin, 2018[35]; Ofcom, 2022[40]; Pew Research Center, 2020[33]). Young children's activities with digital technologies are varied, and often integrated with other, offline forms of entertainment, play and socialisation. These digital activities involve opportunities for creative self-expression, learning, play, and social and family bonding, but also a range of risks.

Young children tend to have very limited awareness of the risks they may encounter in digital environments. They often lack a clear understanding of the variety of content available online, of what constitutes problematic behaviour, of potential motivations for being contacted online and of the Internet as a commercial landscape, as well as of threats to privacy or of potential implications for their physical and emotional well-being (Chaudron, Di Gioia and Gemo, 2018[41]; Stoilova, Nandagiri and Livingstone, 2019[42]). They also have a limited capacity to prevent and react to those risks by themselves. The most salient concern for parents of young children is excessive screen time and its potential effects on sleep and cognitive capacities such as attention, but concerns about content and contact risks are also frequent (Brisson-Boivin, 2018[35]; Pew Research Center, 2020[33]). Parents of young children tend to perceive fewer benefits from their digital engagement than parents of older children, but the assessment is generally positive with regards to play and communication activities, and most negative with regards to participation in social media (Ofcom, 2022[40]).

Parents mediate children's engagement with digital technologies with a range of control, monitoring and support practices, which can be classified on a continuum from restrictive to enabling mediation. The prevalence of different mediation strategies varies depending on the level of education, socio-economic status and digital literacy of the parents themselves: enabling mediation is positively associated with more highly educated and digitally literate parents from advantaged socio-economic backgrounds (Livingstone et al., 2017[43]). Having some rules and supervision from parents about their online activity is the norm for most children aged 6 and under. Common parental rules include limits on screen time and types of oversight, such as asking what the child has been doing online, followed by direct supervision of their devices. Further, joint use of technology with adults, such as co-viewing audio-visual content and co-play, is common for young children. Co-viewing appears as a particularly relevant practice for scaffolding and helping children understand digital content (Gottschalk, 2019[44]).

Parents turn to many sources when seeking advice on how to handle and safeguard their young children's interactions with digital technologies. These include, primarily, other parents and online resources, but much less often schools or ECEC settings (eSafety Commissioner, 2018[30]; Cabinet Office, Government of Japan, 2022[32]; Ofcom, 2022[40]). The range of digital practices in home environments can expand when a meaningful integration of digital technologies in schoolwork leads to enlarging and diversifying the digital activities and tools that young children and parents are aware of. Such integration may take place through homework, which applies less often to the routines of young children, but also through the discovery of educational apps and resources and the modelling of practices with technology (Chaudron, Di Gioia and Gemo, 2018[41]). Further, children place more trust in the content they access on apps and sites used for school and homework than in the content of social media or news platforms (Ofcom, 2022[40]).

Digital divides among young children

Social inequalities are associated with digital divides, understood as disparities in opportunities to benefit from digital technologies as well as in resources to prevent and manage digital risks. Perspectives on such disparities have shifted from an early focus on access towards skills and usage and, more recently, to offline outcomes. Research emphasises that these dimensions are interrelated and can be addressed simultaneously (van Deursen and van Dijk, 2015[45]; Helsper and Smirnova, 2019[46]).

A first-level digital divide exists with regard to access to digital tools and connectivity. Results from PISA 2018 show that, by the mid-2000s, first experiences using digital devices and connecting to the Internet for children aged 6 and under were less common for children from families in the bottom quarter of the socio-economic distribution than for peers in the most advantaged families in about two-thirds of OECD countries (see Chapter 7). Access to digital technology is now almost universal for children in many OECD countries, although access to high-quality devices and broadband, and to enough devices in the household, is still a challenge for many disadvantaged children (Clarke and Thévenon, 2022[47]).

A second divide relates to inequalities in digital skills. This is a growing concern since early digital attitudes and practices can be an important determinant of technology uses and exposure to digital risks later in life. For instance, the International Computer and Information Literacy Study 2018 found that, across 12 countries, socio-economic status was a consistent positive predictor of 8th grade students' digital competences, including both their computer and information literacy and their computational thinking skills. The study also found that students from non-immigrant families scored higher on both types of competences than students from immigrant families (Fraillon et al., 2020[48]). In the same vein, PISA 2018 results indicate that opportunities to learn digital skills at school vary systematically by socio-economic background, and that students from more advantaged backgrounds had a stronger knowledge of reading strategies for assessing the credibility of digital sources than students from disadvantaged backgrounds in all participating countries and economies (Suarez-Alvarez, 2021[49]). These findings reflect differences in the extent to which children are able to use digital technology safely and productively in a variety of contexts.

Home environments remain the main sphere of influence for developing digital literacy, and much variation exists in families' capacity to promote young children's digital competences. Parents with low levels of digital literacy, often from low socio-economic backgrounds, tend to lack the necessary skills to extend their parenting efforts successfully into the digital world, whereas more digitally knowledgeable parents, generally from higher socio-economic status, are better able to help their children build their own digital skills. Parents with less confidence in their ability to manage digital risks and who hold more negative perceptions about digital technologies are more prone to adopt restrictive measures as a way to minimise potential harms, but may also be very permissive when having very low digital skills and risk awareness. As a result, their interactions with children tend to be characterised by low levels of active mediation. By contrast, digitally skilled parents tend to embrace more diversified perceptions and attitudes towards digital media, and to adopt a more enabling approach characterised by more co-use, monitoring and scaffolding, thus encouraging their children to explore and learn while also explaining why certain practices can be risky or inappropriate (Paus-Hasebrink et al., 2013[50]; Brito et al., 2017[51]; Livingstone et al., 2017[43]; Chaudron, Di Gioia and Gemo, 2018[41]). Parents' own digital literacy therefore conditions the opportunities and risks their children experience with digital tools.

Social gaps in digital literacy are therefore likely to persist if the responsibility for building digital skills lies solely with families. Education systems have an important compensatory role to play in levelling the playing field, and many policy initiatives to tackle the first- and second-level digital divides among children have been introduced in OECD countries in recent years (Burns and Gottschalk, 2019[4]). However, most of these target primary and secondary schools, as well as higher education. This report explores how these policies can be designed and implemented for ECEC.

Digital risks for young children

Increasing engagement with digital technologies has attracted a great deal of attention to their impact on children's development and well-being. Much of this is driven by the concern that time spent on digital devices may displace important analogue developmental activities, including physical exercise, sleep, play, reading or in-person interactions (Neuman, 1988[52]).

The OECD Typology of Risks (see Chapter 3) recognises health and well-being risks as a cross-cutting category of risks that children face in digital environments while also noting the limited availability of evidence to support many of the concerns voiced in public discourse (OECD, 2021[53]). The impact of technology use on children's physical, cognitive and socio-emotional development is indeed the focus of a burgeoning yet recent field of research, in which important knowledge gaps persist. Research tends to find small associations between technology use and both developmental (e.g. cognitive abilities, executive functions) and health and well-being outcomes (e.g. obesity, sleep, stress), and is largely inconclusive about the causal effect of technology and the real-life implications for children, due mainly to the correlational nature and limited quality of study designs (Gottschalk, 2019[44]; Kardefelt-Winther, 2019[54]; Bediou, Rich and Bavelier, 2020[55]). Nonetheless, some consistent findings emerge from the literature (for a review, see Gottschalk (2019[44])). These include, among others, the disruptive effects of blue light on melatonin production and sleep (e.g. Figueiro and Overington (2016[56])); the fact that both no and heavy digital screen time can have small negative impacts on socio-emotional well-being, compared to small positive effects for moderate use of technology (e.g. Przybylski and Weinstein (2017[57])); and substantial variation in impact depending on the type of digital activity (active vs. passive engagement), on the type of content (age-appropriateness; entertainment vs. educational focus), and on the degree and style of adult mediation (e.g. Flecha et al. (2020[58])). An important caveat is the paucity of research on children aged 6 and under, which raises questions on the generalisability of findings largely based on the technology usage patterns and well-being outcomes of children in late childhood and adolescence.

Excess exposure to screens has come to epitomise threats to young children's development and well-being and spurred much discussion among parents, educators and health specialists. Screen time, measured as the duration of intentional exposure to screen-based media, is the object of many guidelines and recommendations issued by professional medical associations and governments in OECD countries, often with a quantitative and limitation-focused approach but also, in some cases, with a growing emphasis on the co-use of developmentally appropriate media between parents and children (for a review, see Burns and Gottschalk (2019[4])). Nonetheless, screen time is increasingly seen as a simplistic construct that fails to capture the heterogeneity of the content, contexts and interactivity of screen-based experiences, and thus growingly contested as a basis for advancing research and providing advice for policy and practice (Bediou, Rich and Bavelier, 2020[55]; Hietajärvi, 2021[59]). Many of the current shortcomings of the screen time literature are rooted in measurement and conceptual difficulties, including reporting biases and varying modalities of engagement with digital media (Kaye et al., 2020[60]). Going forward, new assessments of media usage that improve on conventional measures and conceptualisations of technology use can be especially relevant for research on young children, given the importance of contextual factors such as the parental mediation of media use (Barr et al., 2020[61]; Radesky et al., 2020[62]). Presently, though, the lack of clear and consistent evidence-based recommendations on young children's screen time and the use of digital technology creates dilemmas for policy and practice (Straker et al., 2018[63]).

The tensions in reconciling opportunities to prepare children for a technology-rich world and protect them against potential harms are particularly acute in the case of children under age 3, as infants and toddlers have highly specific developmental needs. The first three years of a child's life are characterised by rapid brain development, reliance on relationships with adults and extreme responsiveness to environmental variation (National Scientific Council on the Developing Child, 2004[64]). Children under age 3 learn aptly from real-life interactions with other people and objects but struggle to transfer knowledge from digital media (Moser et al., 2015[65]). Research finds that early screen exposure can have a negative effect on the development of cognitive abilities, but this appears largely mediated by contextual factors such as whether viewing is supervised or the age-appropriateness of the content (Guellai et al., 2022[66]). Screen time guidelines often provide specific recommendations for children under age 3, including strong limitations from birth through 18 months, but the stance of some organisations is, however, evolving. For instance, the updated guidelines from the American Academy of Pediatrics recommend limiting screen use to one hour a day for toddlers, but emphasise the co-use of developmentally appropriate media, also for infants and toddlers (APP, 2016[67]). In the United Kingdom, a guide published by the Royal College of Paediatrics and Child Health in 2019 avoids recommending age-based limits for screen use, underlining instead that families determine screen time in relation to whether it may displace health-related behaviours or social activities (RCPCH, 2019[68]).

With these caveats in mind, the literature offers some insights into the impact digital technology use can have on young children specifically. A recent meta-analysis shows that sleep is the outcome for which findings are more consistent (Mallawaarachchi et al., 2022[69]). Evidence suggests that the negative association of screen time with sleep consistency and sleep duration is particularly pronounced for children under age 6, albeit effect sizes remain modest: for instance, one study estimated that each hour of digital screen time would be associated with eight fewer minutes of sleep per night for this age group, and that time spent with digital devices accounts for less than 2% of the variability in sleep duration (Przybylski, 2019[70]). Besides screen time, the literature points to the importance of the timing of device use, and specifically to avoid screens as part of bedtime routines. By contrast, research is less conclusive regarding the impact of digital technology use on other health and well-being outcomes, although some studies find modest negative associations between the amount of time that young children spend with digital devices and their self-regulation and externalising behaviours (Mallawaarachchi et al., 2022[69]). Research on children under age 3 provides a further indication that the conditions for healthy technology use involve not only time limits, but also media experiences that respond to children's individual characteristics, include content that engages children in meaningful and active ways, and allow interactions with responsive adults

(Barr, McClure and Parlakian, 2018[71]). Overall, the evidence suggests that it is the quality rather than the quantity of digital media use that has the strongest influence on children's developmental and well-being outcomes.

Privacy is another category of risk with the potential to have wide-ranging implications on children's lives (OECD, 2021[53]). Risks to children's privacy are at the forefront of current concerns regarding children's activities in the digital environment (Council of Europe, 2021[72]). Such activities are the focus of commercial interests and can result in multiple types of data collection and processing. Research indicates that children tend to be aware of data supplied knowingly ("given data") in interpersonal contexts, for instance because they provide the data themselves or are aware that their family and friends do so. However, their understanding of how they may be contributing to the generation of other types of data (e.g. "data traces" left by online activity, or "inferred" data derived from other data) and of the value that such data can have for other parties is often limited and depends on contextual opportunities to learn about privacy issues. The small number of studies that include children under age 8 further suggests that young children have low awareness of the risks of sharing information online (Stoilova, Nandagiri and Livingstone, 2019[42]). Research documents also multiple threats to privacy in apps and services targeted at young children, including the collection and sharing of personal identifiers or advertising (Jibb et al., 2022[73]). Parenting practices using digital technologies, from the use of tracking devices to sharing information on children through social media, also play a role in the increasing datafication of childhood and associated privacy risks (Siibak, 2019[74]). Therefore, protecting young children's data and privacy online requires concerted efforts, from advice and rule setting by responsible adults to implementing safety measures in technology design and digital service provision (see Chapter 3). Additionally, with a growing reliance on digital technology for delivering education, accelerated by the COVID-19 pandemic, concerns regarding the security of the data managed by education authorities and providers are also mounting (OECD, 2022[75]).

Policy challenges regarding digitalisation and young children

The challenges brought about by digitalisation are multifaceted and bear on various interconnected policy areas. This section draws on responses to the *ECEC in the Digital World* policy survey (2022) to describe the main policy challenges identified by participating countries and jurisdictions in relation to digitalisation and young children generally. It looks at the prominence of different challenges as well as at the extent to which specific challenges combine into clusters. This analysis contributes to identifying the priorities and motivations of governments and ECEC systems in responding to digitalisation as of 2022, when the data were collected.

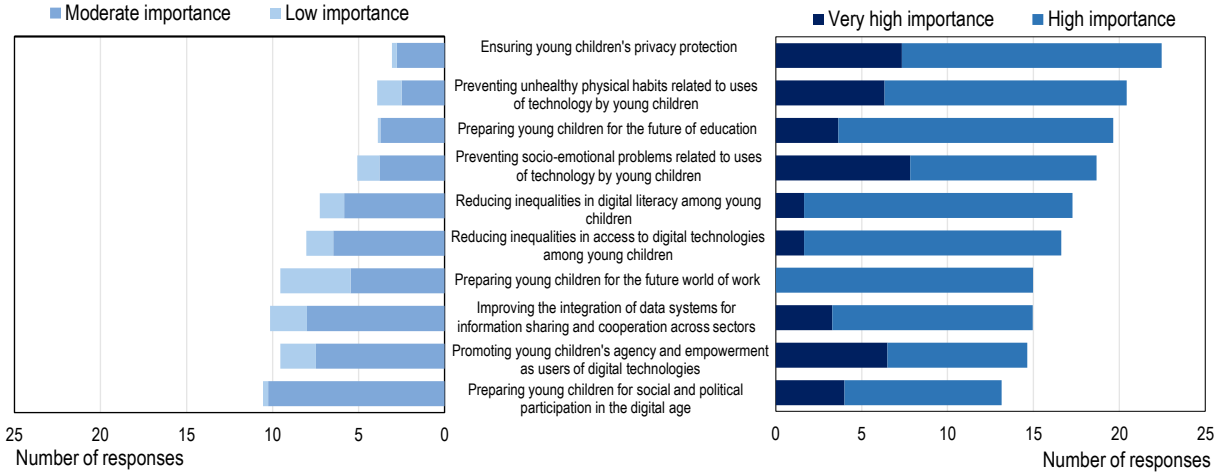
Responses to the survey indicate that risk-focused challenges dominate policy agendas for responding to the impact of digitalisation on young children (Figure 2.4). The challenges that countries and jurisdictions most commonly listed as being of "very high" or "high" importance in their national or regional contexts relate to protecting young children's privacy and preventing both physical and socio-emotional harms. This suggests that major concerns exist regarding the potential negative consequences of the use of digital tools by young children, likely related to the difficulty of controlling the collection and uses of their personal data, as well as to the view that heavy engagement with screens and digital activities may have harmful effects on children's well-being. Many countries and jurisdictions rated at least two of these challenges as being of "very high importance": for instance, Australia, the Czech Republic, the Slovak Republic and the United Arab Emirates (Dubai) did so regarding the prevention of both physical and socio-emotional harms; Hungary and Spain included privacy protection in that category as well.

Inequalities in access to digital technology and in the development of digital literacy are two other challenges listed as being of "very high" or "high" importance by many countries and jurisdictions. Digitalisation is thus broadly perceived as a trend that can exacerbate inequalities among young children unless policy compensates for the unequal capacity of families and individuals to engage in safe and meaningful uses of digital tools. Generally, survey respondents rated the two types of digital divides with

the same level of importance. For instance, Germany rated both challenges as having “very high” importance, and 14 countries and jurisdictions rated both as having “high” importance.

Figure 2.4. Policy challenges regarding digitalisation and young children

Number of countries and jurisdictions identifying different policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category “very high importance” was limited to three out of ten response items maximum.
Items are sorted in descending order of the share of countries selecting the response categories “very high importance” or “high importance”.
Source: OECD (2022[76]), *ECEC in a Digital World* policy survey, Table B.1.

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Countries and jurisdictions are also aware that important policy challenges relate to their ability to seize opportunities from digitalisation. Responses to the survey indicate that early childhood is seen as an important period to prepare for the changes that education is undergoing. Opportunities to prepare young children for the future world of work and for citizenship in the digital age were also mentioned as important challenges by many countries, but relatively less than other options. In particular, preparing for work is the only challenge that no country or jurisdiction listed as being of “very high” importance and the most often ranked as being of “low” importance. This prioritisation of challenges reflects the view that the key goals for young children relate to setting foundations for later experiences in the education system and society more generally, rather than to preparedness for the labour market. Further, promoting young children’s agency and empowerment with digital technologies, which can be seen as a transversal enabler for opportunities in other areas, is a challenge listed as being of “very high” importance by many respondents. Notably, Finland, Japan, Norway and Sweden listed two opportunity-focused challenges among their top three priorities.

A more specific opportunity identified as important by several respondents is the use of digital tools to better integrate data across the different services that support young children and families, which holds the potential to improve the co-ordination of policy action across multiple sectors. This challenge was noted as having “very high” importance by Japan; the Slovak Republic; South Africa; and the Canadian provinces of Manitoba (kindergarten sector only) and Quebec.

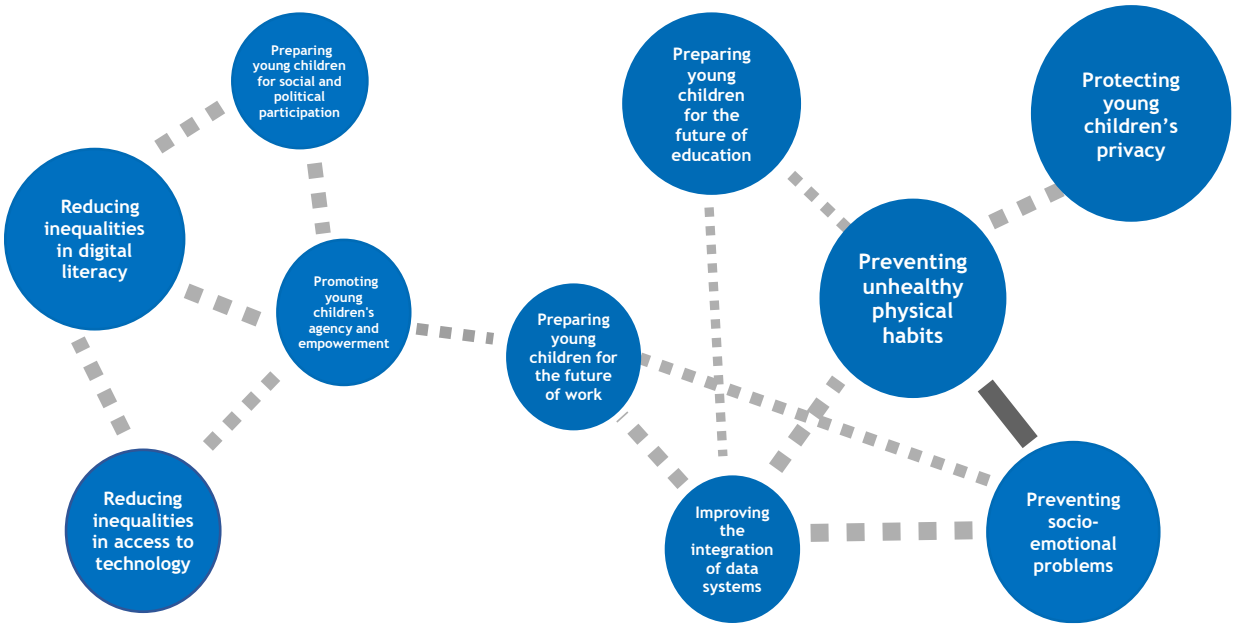
Further insights about these policy challenges can be derived from the associations between their ratings of importance as attributed by countries and jurisdictions. Two clusters of challenges emerge from this analysis (Figure 2.5). The first cluster, on the right-hand side of the figure, includes protecting children’s privacy and preventing harms to their physical and socio-emotional well-being, with strong correlations

reflecting the interconnected nature of digital risks (OECD, 2021[53]). Within the same group, the positive association with the level of importance assigned to integrating data systems across services supporting young children and families suggests an opportunity to address these risks.

The second cluster, on the left-hand side of the figure, groups risk-focused challenges about digital divides and opportunity-focused challenges about children's empowerment as users of digital technology and as citizens in the digital age. This may reflect the view that levelling inequalities in access to technology and digital literacy represents a pre-condition for seizing these opportunities. Interestingly, correlations between challenges across the two clusters are weak, suggesting that concerns about digital divides are seen as having a stronger bearing on uneven opportunities to benefit from digitalisation than on differential exposure to digital risks.

Figure 2.5. Clustering of policy challenges regarding digitalisation and young children

Correlations between average ratings of importance across all countries and jurisdictions, 2022



Notes: The size of circles reflects the number of times a challenge was selected as being of "very high" or "high" importance; larger circles denote greater importance. The width of the connectors reflects the correlations between the ratings of importance attributed to each pair of challenges across countries and jurisdictions; wider connectors denote stronger correlations (only correlations >.33 with partial (adjusted) correlation >.20 are shown).
Source: OECD (2022[76]), *ECEC in a Digital World* policy survey, Table B.1.

StatLink https://stat.link/80934z

Making early childhood education and care responsive to digitalisation

Children's experiences in their early years, including those in ECEC, are critical for building strong and equitable foundations for individual and societal outcomes. However, at a time when digital technologies transform the ways in which billions participate in the economy, society and cultural life, ECEC continues to operate with large uncertainties about the best policies for exploiting the opportunities and managing the risks brought about by digitalisation. Designing policies that empower and protect children in digital environments is an important element to putting people first in the digital transformation.

There is growing recognition of the potential of high-quality ECEC to give a strong start to all young children by providing equitable opportunities and experiences that support their learning, development and well-being. Quality in ECEC is a multidimensional concept, but at its core is "process quality": the range of interactions that children experience through ECEC settings with other children, with staff and teachers, with space and materials, and with their families and the wider community (OECD, 2018[77]; 2021[78]).

Identifying and implementing opportunities for using digital technologies in support of process quality emerges as a priority to make ECEC systems responsive to digitalisation and improve their capacity to prepare children for an increasingly technology-rich world. However, technology cannot replace the real-life interactions with ECEC teachers and carers that young children need for their learning and well-being. Beyond the possibilities for digital technologies to support process quality, their potential to enhance work processes (e.g. professional learning, data development) can enhance ECEC quality more broadly. This report discusses how digital technologies can enhance, rather than interfere with, the processes that are important for supporting young children's development and the work of ECEC professionals.

A pressing but disputed priority

Reflecting on open debates about the role digital technologies should play in young children's learning and development, it is only recently that responses to digitalisation have attracted research and policy attention in ECEC. Across different Starting Strong policy reviews, digital skills were included as a content area in less than 10% of the ECEC curriculum frameworks covered in 2011 (OECD, 2011[79]), 42% of the frameworks covered in 2015 (OECD, 2017[80]) and 61% of the frameworks (for all ages) covered in 2019 (OECD, 2021[78]). Despite this increasing recognition over time, digital skills remained the second-least common area of ECEC learning frameworks among the 16 areas considered in 2019.

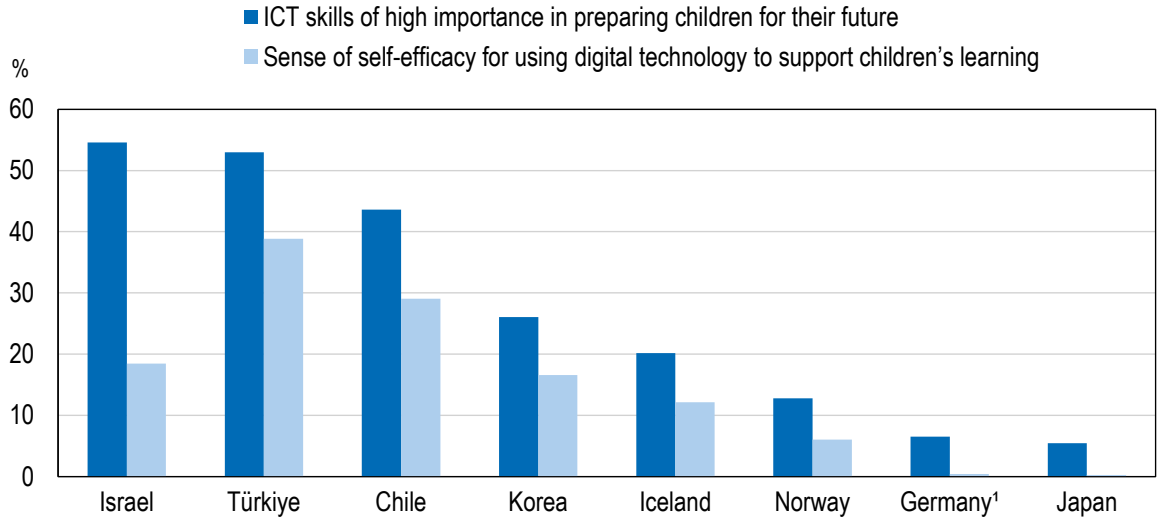
Comparative indicators about digitalisation in early levels of education are scarce, but TALIS Starting Strong and TALIS at the ISCED 1 level offer a glimpse into aspects such as the attitudes of ECEC professionals and primary education teachers or the extent to which digital technologies are part of their training opportunities and regular practice. At the ECEC level, digital skills rank low among the abilities and skills that ECEC professionals see as important for children to develop for their life in the future as part of their experience in ECEC (OECD, 2019[81]). Similarly, the use of digital technology to support young children's learning is the area where ECEC staff report the lowest levels of self-efficacy among different aspects of their work with children (OECD, 2020[82]). Both the percentage of ECEC teachers who think that digital skills are of "high importance" in preparing children for the future and teachers' levels of self-efficacy for using technology vary widely across countries (Figure 2.6). Nonetheless, in countries where more teachers perceive digital skills as being highly important for children, their confidence in using technology for pedagogical purposes tends also to be higher, and vice versa. Although the data cannot support any causal claims or directionality in this association, the results may suggest that the inclusion of digital skills and digital technologies in the ECEC curriculum and workforce preparation programmes can influence the attitudes of ECEC professionals. Research finds that pro-technology attitudes in the cultural sphere and national ECEC policies are macro-level factors shaping these professional attitudes (Mertala, 2019[83]), which in turn are important for a successful integration of technology in staff practices (Blackwell, Lauricella and Wartella, 2014[84]).

More expectations exist for incorporating digital technologies into teaching and learning practices at the primary level of education. TALIS data show, for instance, that the use of information and communications technology (ICT) for teaching was a content area included in the initial education or training programmes of more than two-thirds of the primary teachers surveyed in 2018 in countries like England (United Kingdom), Japan, Korea or the Republic of Türkiye; for about half of the primary teachers in the Flemish Community of Belgium, France or Spain; or for about four in ten teachers in Denmark and Sweden (OECD, 2019[85]). Moreover, in all these systems, a significantly larger share of novice (i.e. with five or fewer years of experience) than of more experienced primary education teachers reported that this content

area was part of their initial preparation or training (OECD, 2021[86]), which reflects an increasing recognition of digitalisation in workforce preparation programmes at the primary level of education across countries.

Figure 2.6. Perceived importance of digital skills for children and sense of self-efficacy for using technology among early childhood education and care teachers

Percentage of ECEC teachers who believe that ICT skills are of "high importance" in preparing children for the future, and who report that they feel they can use digital technology to support children's learning in their work, 2018



Notes: 1. Estimates for sub-groups and estimated differences between sub-groups need to be interpreted with care.
Results refer to ECEC staff in teaching roles ("teachers"), except for Iceland where they refer to all staff. ECEC teachers are those with the most responsibility for a group of children.
Countries are sorted in descending order of the percentage of teachers perceiving ICT skills as being of "high importance" in preparing children for their future.
Source: OECD (2019[87]), *TALIS Starting Strong 2018 Database*, https://www.oecd.org/education/school/oecdtalisstartingstrongdata.htm (accessed on 10 December 2022).

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The COVID-19 pandemic push

Education systems were deeply affected by the COVID-19 pandemic. The transformations that digitalisation is bringing to the world of education were accelerated during the pandemic, and the systems that were less prepared for the digital transition fell significantly behind. This shows that inequalities in digital infrastructure and digital competences can hinder the inclusivity of education systems (Schleicher, 2022[88]).

Approaches to the continuity of ECEC during the COVID-19 pandemic varied notably across countries and jurisdictions. The crisis highlighted the role of ECEC staff in supporting children as well as the importance of ECEC services for parental employment, but also underscored long-term challenges such as workforce shortages and limited support to staff for implementing curriculum frameworks (OECD, 2021[78]). Nonetheless, the ECEC sector responded to steep demands to ensure continuity of service during school and centre closures and put into practice many innovative strategies to support children and families, many of which involved using digital technologies. In 2020, countries reacted as fast as they could, but the

pandemic brought to the forefront the need to engage in a deeper exploration of the benefits and risks associated with the use of digital technologies in the education of young children to inform future policy developments.

Drawing on a policy survey completed by 34 countries and jurisdictions, a G20/OECD study investigated how digital technologies were used to maintain education continuity for young children in 2020, the challenges that arose and the changes that the pandemic may bring to ECEC policies around digitalisation in the near future (OECD, 2021[24]). Some major findings of this study include:

- Prior to the pandemic, in ECEC, digital technologies were more extensively used as communication tools than as pedagogical tools for activities with children.
- Most participating countries expected pre-primary teachers to use digital technologies in their work with children only to a "moderate" or "small" extent. Similarly, most countries reported that children had just "moderate" or "small" levels of exposure to digital technologies in their pre-primary centres prior to 2020.
- In the majority of participating countries, schools/centres and/or other actors at the local level held the main responsibilities regarding the choice of technology tools and the approaches for their integration activities with young children, generally within frameworks established by governments.
- The pandemic accelerated the adoption of measures to protect young children from potential harms from digital technology. These measures included recommendations for teachers and parents about young children's screen time, advice to families about adult-supervised use of technology, and information on approaches to protect children's privacy and well-being in digital environments.
- The main challenges encountered by countries and jurisdictions in using technology for maintaining continuity of ECEC in 2020 related to the capacity of families to support distance education activities, equipment and connectivity problems, and a shortage of digital tools and content specifically designed for young children. These affected mostly children from socio-economically disadvantaged backgrounds and children with special education needs.
- The pandemic acted as a catalyst for rethinking policies regarding the use of digital technologies in early education. A third of the countries and jurisdictions reported "substantial" changes in their approach to integrating digital tools into pre-primary education. The most commonly listed strategy as a high priority going forward was to improve professional training on digital competencies.

Policy challenges regarding digitalisation and early childhood education and care

The *ECEC in the Digital World* policy survey (2022) asked countries and jurisdictions to rate the relative importance of a series of policy challenges more specifically related to how ECEC can respond to digitalisation. This information sheds light on priorities for policy action in the ECEC sector.

Promoting safe and responsible uses of digital technologies by both ECEC staff and young children are the two challenges the most commonly rated as being of "very high" or "high" importance (Figure 2.7). This can be seen as mirroring the emphasis on risk-focused challenges for young children more generally. Interestingly, however, the challenge to which countries and jurisdictions attributed the lowest level of importance, by a large margin, is that of preserving ECEC as a digital-free space. Results thus suggest that countries' and jurisdictions' strategies for preventing potential harms hinge mainly on preparing ECEC staff and young children to engage in safe uses of digital technologies rather than on keeping these tools outside of ECEC settings. This may reflect the perception that digital technologies have become a fixture of contemporary childhood, and hence a commitment on the part of ECEC systems to mitigate adverse impacts by helping young children to live with and manage the associated risks without foregoing the opportunities. In the same vein, other policy challenges perceived to be of major importance are preparing the ECEC workforce to use digital technologies effectively in a variety of other work processes (e.g. professional learning and collaboration, administrative tasks), as well as helping children to engage

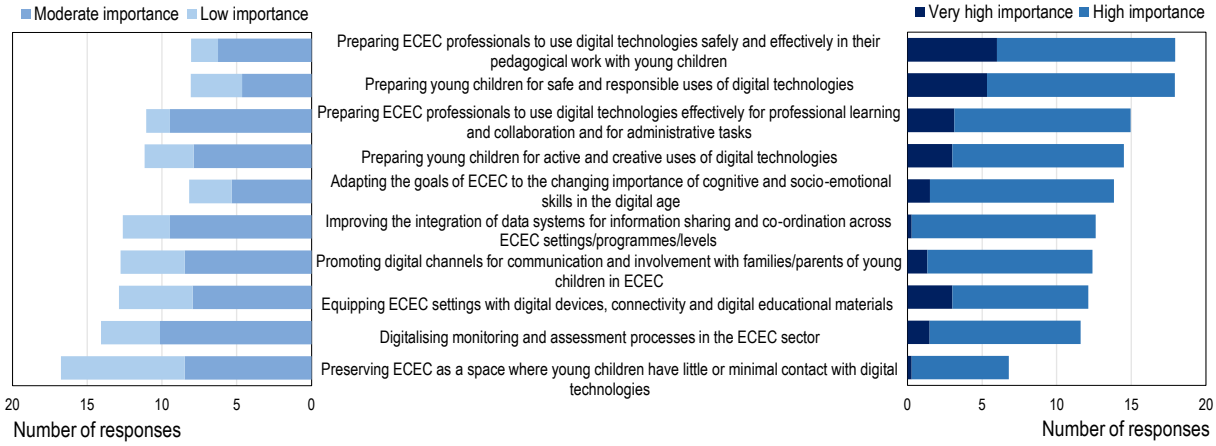
in active and creative uses of digital tools. Adapting ECEC learning and development frameworks to reflect the skills bundle demanded by the digital age was also listed as being of "very high" or "high" importance by a large number of countries and jurisdictions.

A different set of challenges with more varying ratings of importance pertain to improving digital infrastructure, better integrating data within the ECEC sector, and digitalising monitoring and assessment processes. These challenges may appear less pressing to countries and jurisdictions having already made progress in these areas, or because they hinge to a greater extent on infrastructure provision rather than on practical implementation (as compared, for instance, with the integration of digital tools in pedagogical work). As for the promotion of digital channels for communication and engagement with families, its intermediate rating suggests that fewer difficulties are perceived for integrating digital tools into these practices, especially after the experience of the COVID-19 pandemic.

Overall, the promotion of digital literacy, in its multiple dimensions and for both ECEC professionals and young children, underlies the challenges that most countries and jurisdictions considered the most important, which relate primarily to developing safe and meaningful uses of digital technologies in interactions with children. By contrast, digitalising other areas or work processes, including data management, monitoring and evaluation, and communication with families, is perceived as a relatively less difficult challenge.

Figure 2.7. Policy challenges regarding digitalisation and early childhood education and care

Number of countries and jurisdictions identifying different policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category "very high importance" was limited to three out of ten response items maximum.
Items are sorted in descending order of the share of countries selecting response the categories "very high importance" or "high importance".
Source: OECD (2022[76]), *ECEC in a Digital World* policy survey, Table B.2.

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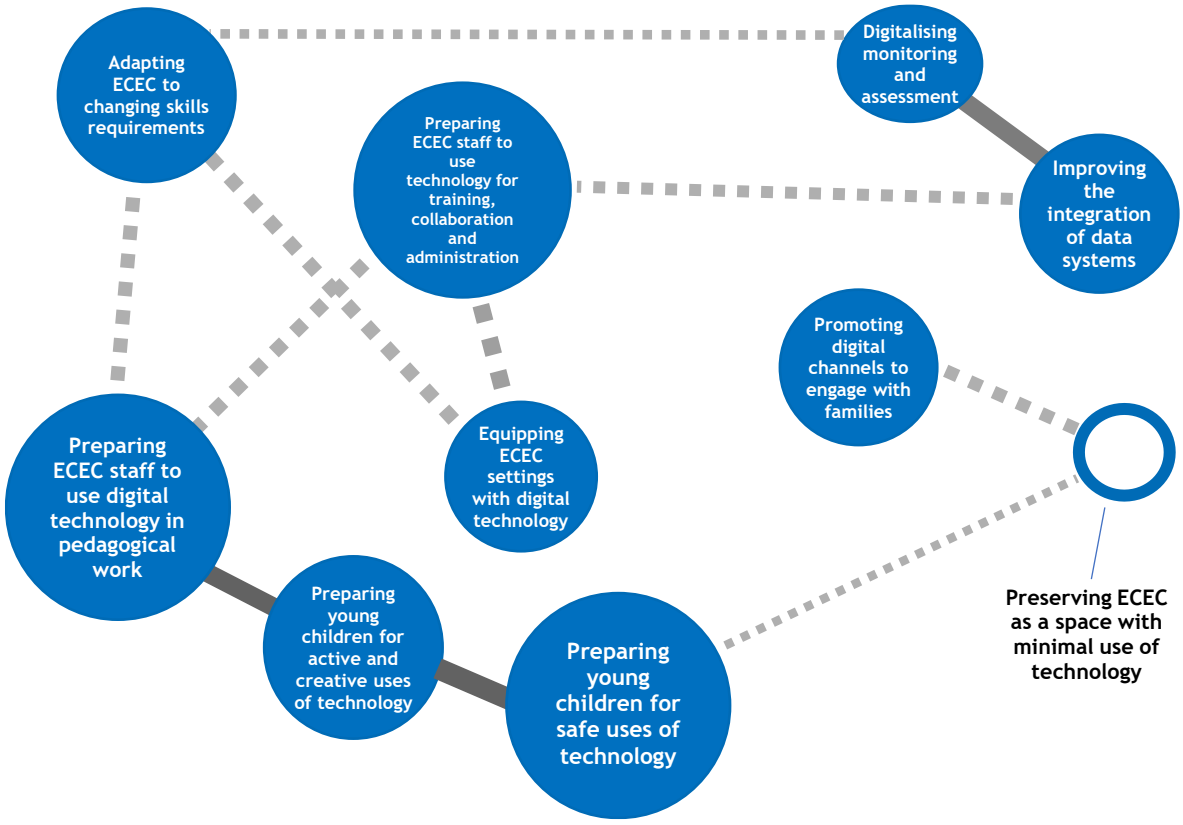
The analysis of correlations between ratings of importance suggests that policy challenges regarding digitalisation and ECEC also form two broad clusters (Figure 2.8). The first group, on the left-hand side of the figure, corresponds to goals around integrating digital tools into many of the interaction processes that support process quality in ECEC settings. These include most notably pedagogical activities with children, but also other aspects of work such as professional learning and collaboration between ECEC staff. A shared feature of these challenges, which are strongly inter-correlated in countries' ratings, is their reliance on the development of digital literacy, for both ECEC professionals and young children, and concerning competencies for both managing risks and for going beyond operational and passive uses of digital tools.

The Czech Republic, Japan, Norway and the German state of Bavaria are among the countries and jurisdictions that attributed consistently high levels of importance to the challenges in this cluster.

The second cluster, on the right-hand side of the figure, is made up of challenges about processes that involve data use, such as monitoring and assessment or the integration of data systems, but also includes communication with families on digital channels. These goals emphasise using digital technologies in processes other than direct interactions with children. Unsurprisingly, when listed as important, the limitation of children's exposure to digital tools in ECEC settings clusters with these other goals. Some countries and jurisdictions having assigned high levels of importance to the challenges in this cluster include Australia, Spain, the United Arab Emirates (Dubai), and the Canadian provinces of Manitoba (kindergarten sector only) and New Brunswick.

Figure 2.8. Clustering of policy challenges regarding digitalisation and early childhood education and care

Correlations between average ratings of importance across all countries and jurisdictions, 2022



Notes: The size of circles reflects the number of times a challenge was selected as being of "very high" or "high" importance; larger circles denote greater importance. The width of the connectors reflects the correlations between the ratings of importance attributed to each pair of challenges across countries and jurisdictions; wider connectors denote stronger correlations (only correlations >.33 with partial (adjusted) correlation >.20 are shown).
Source: OECD (2022[76]), *ECEC in a Digital World* policy survey, Table B.2.

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Policy areas to support high-quality and equitable early childhood education and care in the digital age

This report builds on the analytical framework of the OECD Starting Strong policy reviews, which identifies five policy levers instrumental for building high-quality and equitable ECEC systems (OECD, 2011[79]; 2021[78]). These levers are: 1) quality standards, governance and funding; 2) curriculum and pedagogy; 3) workforce development; 4) monitoring and data; and 5) family and community engagement. In addition, the framework considers equity and inclusion as a transversal theme. These policy levers can be revisited in light of the digital transformation and the complex nature of quality in ECEC, which requires multifaceted policy solutions. The analytical focus on responses to digitalisation in each of these policy areas is described below, mirroring the structure of the report.

Standards for protecting children in digital environments

Governance, standards and funding are core components of structural quality, enabling conditions for process quality, and thus considered the foundation for all other policies to support child development, learning and well-being in ECEC settings. All these components vary greatly from one country to another and are rooted in their historical and cultural contexts. This report addresses strategies in this policy area through the lens of the adoption, in ECEC systems, of standards for protecting young children in digital environments. This approach is motivated by recent policy developments at the national and international levels, including the OECD Recommendation of the Council on Children in the Digital Environment adopted in 2021 (OECD, 2021[89]). The Recommendation aims to help governments implement coherent policies to address the new and evolving risks that children can encounter in digital environments while continuing to support children in realising the opportunities of digitalisation. Chapter 3 builds on the themes of the Recommendation by discussing standards for digital service providers as well as guidance for ECEC professionals, parents and families for safe uses of digital technology with young children. In doing so, it explores the role ECEC can play in preventing potential harms to children resulting from digital risks. Some of the considerations in this policy area relate to clarifying the responsibilities of ECEC staff in protecting children, providing evidence-based guidance and focused professional development opportunities, improving co-ordination among different sets of actors, and ensuring that risk-focused guidance is complemented by information about opportunities and educational purposes of technologies.

ECEC curriculum and pedagogy for a digital world

By defining broad learning and development goals as well as supporting content and types of activities, curriculum frameworks are crucial to make ECEC responsive to the changes in children's lives brought about by the digital transformation. This includes helping children develop a broad set of skills and identifying effective pedagogies for using digital technologies in interactions with young children. Approaches to making curriculum frameworks and pedagogical guidance responsive to the digital transformation are discussed in Chapter 4. Supporting a future-oriented or 21st century curriculum framework involves adapting curriculum frameworks to the changing nature of childhood, changing skills requirements of the digital age, as well as incorporating the objective of developing early digital literacy. Pedagogical approaches can also be adapted to exploit the affordances (e.g. interactivity, multimodality) of the different types of digital tools that can be used with children in ECEC settings. Considerations in this policy area include addressing the fragmentation of curriculum frameworks or their absence for the youngest children, providing support and training opportunities to prepare ECEC staff to implement curriculum innovations, or improving the monitoring of the activities in which technologies may be used with children in ECEC settings.

ECEC workforce development for the digital age

ECEC professionals are the major driver of the quality of an ECEC system. Workforce development encompasses initial education and training and continuous professional development, and the governance, duration, quality and content of these programmes have important implications for the staff's capacity to develop high-quality interactions with children and parents in ECEC settings (OECD, 2021[78]). Digitalisation places a set of new demands and opportunities on ECEC professionals, from promoting safe, developmentally appropriate and effective uses of digital technology with children to incorporating digital tools for improving a range of other work processes (e.g. professional development and collaboration, communicating with parents and families, or administrative tasks). Chapter 5 explores strategies for ECEC systems to provide the support that staff need to meet these demands, looking at digital competence frameworks and their integration in pre-service and in-service training. Specific considerations in this area include providing clear guidelines or standards on digital competencies in training programmes, differentiating requirements for staff with varying roles and responsibilities, providing ECEC staff and settings with sufficient resources and time to engage with digital tools, ensuring the quality of training, and exploiting opportunities for combining formal and informal professional learning about digital competences.

Family and community engagement in ECEC in a digital world

Engaging with parents is increasingly seen as an important policy lever to enhance ECEC's contribution to child development and learning. Parental engagement in ECEC is critical in improving staff's knowledge about the children they work with and for ensuring alignment with learning and development opportunities in home environments. Chapter 6 explores conditions and barriers for using digital technologies to strengthen family engagement in ECEC, including for facilitating a higher frequency and quality of interactions between ECEC staff and family members and reaching out to a greater diversity of groups of society. Some of the considerations in this area relate to researching and documenting ways in which digital channels enhance rather than replace meaningful communication and engagement with parents and to support their adoption across the sector, including by incorporating this dimension into workforce development programmes.

Equitable and inclusive digitalisation in ECEC

Equity and inclusion are a transversal theme across policy areas and a critical aspect complementing the quality of ECEC systems. Equity and inclusion goals relate to ensuring that children from all backgrounds have access to high-quality ECEC rather than to simply achieving low variability in quality. In the digital age, promoting equity and inclusion means that all children have similar opportunities to benefit from digitalisation and similar resources to prevent undesirable outcomes. Chapter 7 looks at digital divides among young children and ECEC centres, focusing specifically on children from socio-economically disadvantaged backgrounds, children with special education needs and children with a different first language. Drawing on several OECD databases in addition to the research literature, the chapter presents evidence on differences in access to and use of digital technologies in home environments as well as in ECEC settings, and discusses opportunities to harness digital technologies in pedagogical and other professional practices to make ECEC more equitable and inclusive. Important considerations in this policy area relate to reducing differences in the quality of digital infrastructure across ECEC centres, promoting safe and educational digital mediation strategies among parents with lower levels of digital skills, and promoting inclusive digital practices regarding pedagogy and engagement with families.

ECEC data and monitoring in the digital age

Data and monitoring can encourage quality in ECEC by establishing facts, trends and evidence about whether children have equitable access to high-quality ECEC. They can be used to enhance accountability and support improvements in policy design and implementation. Chapter 8 addresses strategies in this

policy area from the perspective of ECEC data systems and the adaptation of quality monitoring frameworks. Digital technologies enhance the capacity to efficiently store, link and use the wealth of data collected in the ECEC sector for a range of purposes. At the same time, digitalisation brings new demands for quality monitoring, as digital technologies are increasingly integrated into ECEC settings. Considerations for activating this policy lever include creating a strong data infrastructure for the ECEC sector and aligning quality monitoring with the changes in other policy areas.

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3 Protecting young children in digital environments

This chapter considers policy efforts to protect young children in digital environments, with a specific focus on the role of early childhood education and care (ECEC). Building on the OECD Recommendation of the Council on Children in the Digital Environment (2021), it explores the ways in which three groups of key actors can be supported to fulfil their respective roles. First, the chapter considers policy measures to engage digital service providers in efforts to keep young children safe in the digital world. Next, it examines the role of parents and families, and how governments can best support and advise them about safeguarding young children against digital risks. Finally, the chapter investigates the complex and expanding role ECEC professionals play in supporting young children in navigating digital opportunities and risks and outlines policy actions underway to do so.

Key findings

The use of digital technologies by young children, under the right conditions, can benefit their learning, development and well-being. However, with these opportunities come expanded risks, some of which young children may be more vulnerable to because of their age and circumstances, such as their specific digital habits or the different ways adults mediate their digital interactions.

Results from the *ECEC in a Digital World* policy survey (2022) indicate that many countries and jurisdictions see risk-focused policy challenges relating to digitalisation and young children (0-6 year-olds) as highly important. While the same is true of risk-focused policy challenges relating specifically to digitalisation and ECEC, governments are generally not prioritising restrictive approaches for the sector.

There is growing recognition of the essential role of digital service providers (DSPs) in providing a safe and beneficial digital environment for children, including 0-6 year-olds. However, concrete policy actions in this area have only recently started emerging. Efforts to protect privacy dominate, particularly through legislation. In contrast, safety-by-design approaches are less common and more likely to be non-mandatory. Moreover, despite a high need for strategic leadership and accountability in this area, there are not always relevant oversight bodies in place.

In general, guidelines and recommendations published or endorsed by governments to support parents and ECEC professionals more commonly cover risks to young children's socio-emotional well-being or the amount of screen time than other topics, such as protecting young children's privacy.

Support and guidance targeting parents of young children cover many topics related to digital safety and come from a variety of sources. Much of the guidance for parents endorsed by governments focuses on risks and restrictive approaches, while public discourse also tends to be biased towards the negative impacts of digital technologies. This sometimes ignores the fact that not all risks translate into harms for all children and could potentially exacerbate parental anxieties around digital parenting.

Support and guidance targeting ECEC professionals specifically are less common and less comprehensive than those for parents. This likely reflects the fact that technology is already embedded in young children's home lives while it is still an emerging feature of ECEC environments. Nevertheless, conflicting or incomplete guidance means professionals may adopt different approaches – of varying quality – depending on their own ability and initiative.

Among the specific guidance aimed at ECEC professionals that does exist, there is evidence of messaging that promotes a balance of digital risks and opportunities. However, the misalignment of messaging between the risk-focused supports for parents and the more balanced supports for ECEC professionals has the potential to inhibit constructive collaboration between the two groups of key actors.

Introduction

Technological developments, accelerated by the COVID-19 pandemic, have increased both the intensity and breadth with which young children engage with the digital world. From watching videos on YouTube to playing educational games on mobile applications (apps) and interacting with voice-recognition Barbies, technology is firmly implanted in the day-to-day realities of even the youngest children. These technologies offer many opportunities for alternative and sometimes enhanced forms of learning, communication and play, but also come with higher exposure to an ever-expanding suite of risks. This is important, as both children's digital experiences and their vulnerability to risks are dependent on the age and circumstances of these first experiences.

High-level international frameworks exist to help guide governments' efforts to safeguard children in digital environments. In 2012, the OECD Council adopted the Recommendation of the Council on the Protection of Children Online. Following technological, legal and policy advances, a revised version, the Recommendation of the Council on Children in the Digital Environment (OECD Recommendation), was adopted in 2021. The United Nations Committee on the Rights of the Child's General Comment No. 25 (2021) on children's rights in relation to the digital environment and the Council of Europe's Guidelines to Respect, Protect and Fulfil the Rights of the Child in the Digital Environment (2018) are other notable examples. All of these adopt a children's-rights perspective, guiding countries to develop coherent policies that support governments, parents, DSPs and education professionals to better protect 0-18 year-olds from digital risks while enabling them to benefit from digital opportunities.

While other chapters in this report look into the opportunities digital technologies present to the ECEC sector, this chapter considers governments' policy efforts to protect and empower young children in the digital environment. First, it explores young children's engagement with the digital world and the potential risks they encounter. Second, it considers actions taken to better regulate the activities of DSPs whose services and products are used by young children. Next, it examines efforts to support and advise parents and ECEC professionals about how to safeguard young children against digital risks. The chapter concludes with policy pointers to strengthen governments' efforts to protect young children in the digital age.

Young children in digital environments: Risk, opportunity and challenge

As younger children's engagement with the digital world covers more areas of their lives, encompasses a wider range of technologies and increases in intensity, their exposure to risks and potential harms also grows. Young children may be more vulnerable to certain risks simply due to their age and circumstances, including their specific digital habits and the different ways in which DSPs, parents and educators mediate their digital interactions. While not all risks translate into harms for all children, effectively managing the digital risk landscape is an important and pressing policy challenge for today's governments.

Digital risks and opportunities for young children

The omnipresence of technology in 21st century society means that the digital environment is now an established feature of young children's lives. Recent studies from a range of OECD countries indicate that substantial shares of 0-6 year-olds regularly use digital technologies. For example, in Japan, data from 2018 reveal that while 6% of children under age 1 use the Internet, the share quickly rises to 47% of 2 year-olds and 66% of 6 year-olds (Cabinet Office of Japan, 2019[1]). In the same year in Canada, 30% of 0-4 year-olds spent 1-2 hours per weekday on a digital device and 33% used digital technology in the hour before bed every or most nights (Brisson-Boivin, 2018[2]). In the United States, parental reports in 2020 showed that 57% of 0-2 year-olds watched YouTube videos online, as did 81% of 3-4 year-olds (Pew Research Center, 2020[3]) (see Chapter 2 for further explorations of these trends).

These figures are likely to have increased: a qualitative study of digital habits in 21 European countries concluded that very young children (0-8 year-olds) have shown the fastest growth in Internet use (Chaudron, Di Gioia and Gemo, 2018[4]). Furthermore, the COVID-19 pandemic increased young children's use of digital technologies in the home, particularly for entertainment, and is likely to have accelerated uptake in both ECEC and home settings for learning and development (OECD, 2021[5]; Bergmann et al., 2022[6]; Ribner et al., 2021[7]).

There is evidence that young children's use of digital technologies, under the right conditions, benefits their learning, development and well-being. Research undertaken with children across the 0-6 age range indicates that young children's interactions with talking smart toys and voice assistants can support their ability to search for information, early language development and imaginative play (OECD, 2021[8]; Marsh et al., 2018[9]; Charisi et al., 2022[10]). The use of touchscreen technology has been associated with the development of young children's fine motor skills, creativity and a range of positive learning outcomes (Bedford et al., 2016[11]; Xie et al., 2018[12]; Herodotou, 2018[13]). Interactions with social robots may promote social behaviours and problem solving (Charisi et al., 2022[10]). Later chapters consider ways to harness these digital technologies and others to provide high-quality and more equitable and inclusive ECEC (see Chapters 4-8).

But with these opportunities come expanded risks. The OECD's Typology of Risks (2011, updated in 2021) identifies four categories of digital risks for children: content, conduct, contact and consumer. Cutting across these categories are three cross-cutting risks: privacy, advanced technology, and health and well-being (OECD, 2021[14]). The OECD's 21st Century Children project observes that personality factors (e.g. low self-esteem), social factors (e.g. lack of parental support) and digital factors (e.g. weak digital skills) make some children particularly vulnerable to online risks (Burns and Gottschalk, 2019[15]).

While previous OECD work considers digital risks for 0-18 year-olds, the project ECEC in a Digital World focuses on how risks manifest and can be managed specifically for 0-6 year-olds. This is important, as both children's digital experiences and their vulnerability to harms are age dependent. There is variation even within the 0-6 year-old group: research suggests that for children under 2 in particular, the benefits of digital media may be limited and more dependent on adult interaction during digital media use, while negative physical effects impacting sleep and weight patterns have been identified (Hill et al., 2016[16]). Parental attitudes mirror the increased concern for younger children, even though these concerns are not always evidence-based (see below): in the United Kingdom and the United States, survey data indicate that parents of young children more commonly believe that the risks of technology outweigh the benefits (Ofcom, 2022[17]; Pew Research Center, 2020[3]). At the same time, research on older children (8-11 year-olds) suggests that the younger the child, the more prone they are to both overestimate their ability to stay safe online and to lack concrete skills to identify and navigate specific risks (Macaulay et al., 2020[18]).

With the exception of negative implications for children's sleep, research on the impact of digital technology use on children's developmental and well-being outcomes across ages is generally inconclusive (see Chapter 2 and Gottschalk (2019[19])). Nevertheless, the 0-6 year-old cohort may be particularly vulnerable to certain risks based on their digital habits. The most popular digital activity for 0-6 year-olds is generally watching videos or television online (Chaudron, Di Gioia and Gemo, 2018[4]; Ofcom, 2022[17]; eSafety Commissioner, 2018[20]; Cabinet Office of Japan, 2019[1]). Other uses such as finding information, listening to music, communicating with family or friends, and playing games are also common. While some of these activities may take place on child-specific services (e.g. YouTube Kids, Wiki for Kids), many occur on platforms not designed for children. This increases potential exposure to age-inappropriate content. The growing prevalence of automatic play functions and algorithmic recommender systems may exacerbate this.

In addition, an important share of young children is interacting with technologies designed for older users. For example, in the United Kingdom, more than one-fifth of parents of 3-4 year-olds said they would allow their child to have a profile on social media before they reached the minimum age (i.e. generally 13 years old, depending on the platform) (Ofcom, 2022[17]). Furthermore, the growth in popularity of voice assistants, wearables, home surveillance technologies and Internet of Things devices in the home means that young children are exposed to increasingly sophisticated forms of adult-centric technology from birth. Young children are particularly likely to attribute anthropomorphic characteristics and agency to such technologies, which makes them more vulnerable to associated risks such as data disclosure, over-trust and over-reliance (Charisi et al., 2022[10]).

Young children most commonly use mobile devices (e.g. tablets or smartphones), but smart televisions, game consoles, and desktop or laptop computers are also popular. First use generally takes place via a parent's or sibling's device, which may not have the controls or child-friendly device settings expected on a young child's device. Nevertheless, in some countries, many children have access to their own device from an early age, particularly tablets, smartphones and increasingly – although still only for a minority – smart toys (Brisson-Boivin, 2018[2]; Ofcom, 2022[17]; eSafety Commissioner, 2018[20]). Furthermore, children quickly become more independent digital users: in the United States, 5-8 year-olds mostly use digital tools independently and qualitative research from across Europe concludes that young children learn how to interact with digital devices individually and autonomously (Pew Research Center, 2020[3]; Chaudron, Di Gioia and Gemo, 2018[4]). Access to personal devices and increased autonomy increase the likelihood of unsupervised online activities.

Table 3.1 offers some examples of how digital risks can manifest for young children. The examples are not exhaustive; nevertheless, they help illustrate that there is a complex digital risk landscape beyond commonly cited threats such as cyberbullying for young children as for children of other ages. For example, while children of any age risk being exposed to age-inappropriate content through their use of digital technologies, 0-6 year-olds are perhaps particularly vulnerable to this risk due to their lower awareness of what is and is not age-appropriate and to the wider scope of content that is inappropriate for this age group. At the same time, conduct risks (i.e. activities in the digital environment whereby children create risks for other children) may be less common among this age group as they are less present on social media or other tools via which users communicate independently with their peers.

Table 3.1 includes two types of risk, "technoference" or "phubbing" and sharenting, that are not included in the OECD's Typology of Risks but are increasingly common phenomena for which there is growing evidence of negative implications and to which young children may be particularly at risk. For example, research is beginning to reveal the negative impact of technology-related disruptions to parenting behaviours, which may affect young children, particularly given the importance that frequent and highly sensitive parental interactions have for their early development. When it comes to interactions between parents and young children, "technoference" (i.e. everyday disruptions in interpersonal interactions due to the use of digital devices) can lead to low-quality interactions marked by less positive affect, weaker engagement in play and educational activities, and more conflict (Konrad et al., 2021[21]; Kildare and Middlemiss, 2017[22]). In addition, the term "sharenting" refers to a growing trend among parents to share information and photos of their children on social media. Research indicates that a significant number of parents engage in this practice without considering privacy and safety issues and other risks to children's present and future emotional well-being and identity formation (Siibak, 2019[23]). Further research into digital risk manifestations for young children is required, including into risks for children of specific ages within the 0-6 age group, to explore these hypotheses further.

Table 3.1. Examples of digital risk manifestations for young children

Digital risks	Examples of digital risk manifestations for young children
Filter bubbles	Recommender systems within online platforms propose content based on previous consumption. As such, they risk narrowing young children's opportunities to discover different information and new perspectives (Charisi et al., 2022[10]).
Harmful/age-inappropriate content	In one study of user logs on mobile devices, 3-5 year-olds commonly accessed general audience apps such as Cookie Jam and Candy Crush as well as age-restricted apps such as gambling apps (Radesky et al., 2020[24]). A YouTube trend has been identified which sees videos that look to be child-friendly spliced with violent and other age-inappropriate content (e.g. a Peppa Pig video spliced with images of self-harm) (Zon and Lipsey, 2020[25]).
Hacking	In 2018, toymaker VTech reached a settlement with the US Federal Trade Commission following legal action for failing to protect its smart toys from hackers (Zon and Lipsey, 2020[25]).
Mistreatment of personal data	A study of the smart toys "Cayla" and "i-Que" found numerous security risks, including data tracking for third parties (Myrstad, 2016[26]).
Hidden purchasing	A nationally representative survey of parents of 0-5 year-olds using digital apps in the United Kingdom found that 10% of the children made accidental in-app purchases (Marsh et al., 2018[9]).
Aggressive advertising	Ninety-five per cent of a sample of popular apps for 1-5 year-olds were found to contain at least one type of advertising, many of which were classed as "manipulative" (Meyer et al., 2019[27]).
Technoference/phubbing	In the United States, 68% of parents reported sometimes feeling distracted by their phone when spending time with their children. This share was 75% among young parents, who were more often the parents of younger children (Pew Research Center, 2020[3]).
Sharenting	Increasingly, parents share a large volume of private information about young children, often without consent. This raises potential risks such as identity theft and unauthorised resharing and may inhibit personal identity formation (Zon and Lipsey, 2020[25]).

Challenges related to managing digital risks for young children

Protecting young children from digital risks is a key priority for governments. In the *ECEC in a Digital World* policy survey (2022), risk-focused policy challenges were consistently identified by a large share of governments as being of "very high" or "high" importance (see Figure 3.1). For example, with regards to digitalisation and young children in general, 88% of countries and jurisdictions participating in the survey attributed "high" or "very high" importance to ensuring young children's privacy and 84% to preventing unhealthy physical habits related to uses of technology, such as negative impacts on sleep, exercise and nutrition. Preventing socio-emotional problems related to young children's use of technology – including, for instance, social isolation, stress, anxiety or harassment – was identified as being of "very high" importance by nearly one-third of participating countries and jurisdictions.

With regards to digitalisation and the ECEC sector specifically, both preparing ECEC professionals to use digital technologies safely and effectively in their pedagogical work and preparing young children for safe and responsible uses of digital technologies were identified as being of "very high" or "high" importance by two-thirds (68%) of participants (see Figure 3.1). Notably, and in contrast, preserving ECEC as a space where young children have little or minimal contact with digital technologies was attributed the same level of importance by just over one-quarter (28%) of participants. This indicates that despite governments being highly concerned about the risks related to digitalisation and the ECEC sector, they are not pursuing restrictive approaches. Rather, by focusing on promoting safe and responsible use through the sector, many governments are positioning ECEC as an important element in supporting young children to confidently navigate risks in digital environments.

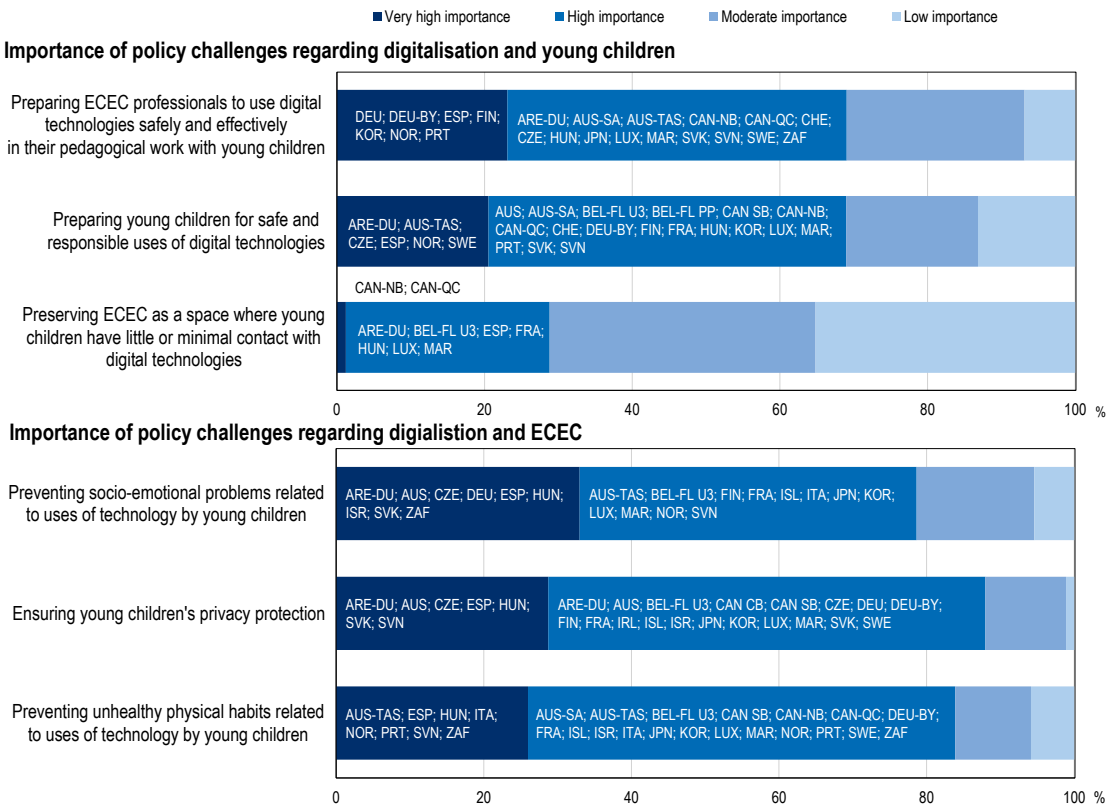
Specific legislation or regulation already exists to protect children from many offline risks (e.g. child labour, sexual abuse, aggressive advertising, etc.). Where relevant, this has generally been expanded to cover related risks in the digital environment. However, there is a mounting sense of urgency and complexity when it comes to broader protections for children across the full range of present and future digital risks. This is partly due to the speed of technological and related social developments. At the same time, public

discourse also tends to be biased towards the negative impacts of digital technologies, often over-simplifying research findings and ignoring the fact that not all risks translate into harms for all children (Brito, Dias and Oliveira, 2018[28]; Green, Wilkins and Wyld, 2019[29]).

This bias has allowed a series of myths to emerge, including that young children and technology should not mix and that technology dominates young children's lives (Plowman and McPake, 2013[30]). Compounded by intensive parenting trends, this has produced a collective anxiety that further disconnects the available evidence on risks from public perceptions and related policy approaches (OECD, 2020[31]; Radesky and Hiniker, 2022[32]). For example, parents often report being more concerned by the amount of time their child spends in front of a screen than by what they are doing on the screen (Livingstone et al., 2018[33]). In reality, the evidence base for the dangers of extended exposure, even for young children, is increasingly brought into question (see Chapter 2). Meanwhile, as Table 3.1 illustrates, potential risks extend far beyond the intensity of exposure. Furthermore, beyond quantity, the quality (i.e. context and content) of young children's engagement plays a crucial role in their exposure to both risks and benefits (Livingstone et al., 2015[34]).

Figure 3.1. Policy challenges related to digital risks

Percentage of countries and jurisdictions identifying the following policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). BEL-FL U3: ECEC for children under age 3 in Belgium (Flanders). CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada.
Source: OECD (2022[35]), *ECEC in a Digital World* policy survey, Tables B.1 and B.2.

StatLink https://stat.link/kb10mw

Just as 0-6 year-olds interact with digital technologies differently than older children, thus encountering a particular digital risk landscape, the ways in which adults mediate young children's digital engagement also differ. Effectively managing risks, even for young children, is not a question of simply eliminating them: a zero-risk digital environment is both unattainable and undesirable. Digital opportunities and risks are intrinsically related, so that maximising opportunities to build digital skills can increase exposure to digital risks, while attempts to minimise risk exposure can limit children's opportunities (Smahel et al., 2020[36]; Livingstone, Mascheroni and Staksrud, 2015[37]). For young children specifically, trial-and-error approaches – which naturally entail taking risks – are key to developing foundational competencies, including early digital literacy (see Chapter 4). Nevertheless, research indicates that the younger the child, the more adults favour restrictive approaches (Chaudron, Di Gioia and Gemo, 2018[4]). This has the potential to create a vicious cycle, as young children are deprived of opportunities to develop key skills that help them safely navigate the risks they will inevitably encounter on an increasingly regular basis as they age.

Given the specific nature of young children's experiences of the digital environment, supporting them to safely navigate the digital world requires a targeted approach. However, studies have shown that, compared to other age groups within the 0-18 range, young children's digital experiences have been neglected in research and policy efforts (OECD, 2020[31]; Burns and Gottschalk, 2019[15]). Similarly, secondary and tertiary levels of education have dominated national digital education strategies, to the neglect of ECEC settings and staff (van der Vlies, 2020[38]). As digital technologies become increasingly embedded in children's lives, governments have an opportunity to review and redouble efforts to protect young children specifically, including through ECEC policies. This entails policy action aimed at the sector itself, but also at DSPs and parents and families, taking advantage of the interconnections between the three sets of actors to enhance efforts across all areas of young children's engagement with digital technologies. The rest of this chapter explores what governments are currently doing to safeguard young children in digital environments and where further work could be done.

Digital service providers and young children's safety in digital environments

DSPs are any natural or legal person that provides products and services, electronically and at a distance (OECD, 2021[39]). They may target young children directly (e.g. smart toy companies, educational app designers) or a wider general audience but count young children among their users (e.g. video streaming platforms, cloud services). The OECD Recommendation recognises the essential role DSPs play in providing children with a safe and beneficial digital environment (OECD, 2021[39]). The OECD Guidelines for digital service providers set out guidance in four key areas: 1) child safety by design; 2) information provisions and transparency; 3) privacy, data protection and commercial use; and 4) governance and accountability (OECD, 2021[40]). This section considers policy efforts governments are taking across these areas for young children specifically.

The role of digital service providers in protecting young children in digital environments

Approaches to combatting digital risks have traditionally placed responsibility on users themselves, emphasising self-regulation and education as key protective strategies. However, the high speed of change of digital technologies and digital practices means that new risks are constantly emerging. At the same time, commercial forces and adult-centricity in the conception of digital technologies lead to safety and privacy often being overlooked at the design stage (Edwards, 2021[41]). This places a heavy burden on individual users, asking them to be resilient to a system that is increasingly difficult to comprehend and often has an inherent disregard for their security (5Rights Foundation, 2019[42]).

An individualistic approach to risk management seems particularly inappropriate for young users. Young children are unlikely to comprehend the simplest notions around digital technology, including what it means to be online, or the difference between advertising and content (Chaudron, Di Gioia and Gemo, 2018[4]; Hartung, 2020[43]). By default, many safety or privacy decisions fall on parents or ECEC professionals. But these actors often lack the resources to fulfil a role which demands increasing amounts of knowledge, skills and time (OECD, 2020[31]; Burns and Gottschalk, 2019[15]).

Engaging DSPs can therefore make important contributions to young children's safety in digital environments. First, it leverages sectoral expertise in the face of increasingly complex digital risks. While parents may favour protective or restrictive approaches, DSPs have a greater capacity to manage risk in a proactive manner, anticipating and addressing potential harms *ex ante* while also optimising opportunities. Regulatory and policy actions that place more responsibility on DSPs can also help mitigate inequalities: the differing levels of skills and resources with which each child, their parents or educators are equipped to take decisions around safety and privacy can lead to unequal levels of protection (Livingstone et al., 2018[44]).

Finally, as ECEC professionals look to engage further with digital technologies, policy action to establish DSPs' responsibilities for young children's safety can provide greater clarity for the sector. Holding DSPs to account for developing high-quality, safe and secure digital content and services for young children reduces the burden placed on ECEC staff responsible for selecting and monitoring the suitability and safety of the technologies that may be used in ECEC settings. Furthermore, such action can establish the conditions by which DSPs engage with the expansion of digital technology into the ECEC sector responsibly.

Safety-by-design and transparent, age-appropriate information

The objectives and success indicators by which digital services and products are designed (i.e. to maximise reach, activity and time spent online) often contravene the need to keep children safe. Designers themselves recognise that this results in a fundamental conflict of interest between DSPs and their young users (5Rights Foundation, 2021[45]). Furthermore, practices and regulations to protect children from risks in the digital environment are often less developed than those for the physical environment (Livingstone, Byrne and Carr, 2016[46]). In the case of commercial risks, for example, this is affecting the youngest digital users: a review of apps aimed at 0-5 year-olds found that 95% contained at least one advertisement, including aggressive and covert approaches such as video adverts interrupting play or adverts disguised as games (Meyer et al., 2019[27]). Meanwhile, children, parents and educators often feel frustrated about the complexity of both the interfaces and language used to inform them of their rights and security (Farthing et al., 2021[47]; OECD, 2020[31]).

To address these challenges, the OECD Guidelines for Digital Service Providers call upon providers to adopt a precautionary approach when designing and delivering services targeted at or potentially used by children. This includes considering children's safety in the design, development, deployment and operation of products and services. In addition, the guidelines call on DSPs to provide transparent information. This means presenting information (e.g. terms of service, policies, community standards, etc.) to children and their parents that is concise; intelligible; easily accessible; and formulated in clear, plain and age-appropriate language (OECD, 2021[40]).

Governments can encourage DSPs to adopt approaches promoting safety-by-design and transparent, age-appropriate information through various framework conditions. This includes formal tools such as legislation and mandatory codes of conduct and less formal approaches such as recommendations, best practices, or industry standards and guidelines (Hooft Graafland, 2018[48]). In the *ECEC in a Digital World* policy survey (2022), 15 of the 37 participating countries and jurisdictions indicated that they had standards related to safety-by-design in place for DSPs whose services or content could be used by young children (Table 3.2). Of these, 9 had formally regulated standards while 11 had guidelines or recommendations. An

important minority (5) reported having both formal and less formal efforts in place. Notably, 11 participating countries and jurisdictions reported having no such standards in place, which suggests that many governments have further work to do to shift some of the responsibility for young children's online safety to industry.

Nevertheless, legislative efforts to enhance children's online safety at the national level appear to be gaining momentum across the OECD. Although no examples have been identified for this report that focus on digital safety specifically for young children, some countries have introduced legislation to protect children in general, including Germany and Japan, with provisions that take account of children's age (see Box 3.1). Among other requirements, France's Parental Control Law (2022) requires DSPs to educate users and parents about the specific risks around early exposure to screens for the youngest children (Government of France, 2022[49]). Still under debate, the United Kingdom's Online Safety Bill calls for all DSPs to establish risk management practices for children that are differentiated by age (Government of United Kingdom, 2022[50]). The United States' proposed Kids Online Safety Act also calls for age-appropriate control measures and information provision, and requires DSPs to engage in transparent reporting and market research disaggregated by age (e.g. 0-5 year-olds) (Senate of United States, 2022[51]).

Table 3.2. Efforts to protect young children in digital environments targeted at digital service providers

Countries and jurisdictions reporting having introduced the following in relation to the role of digital service providers in ensuring a safe digital environment for young children, 2022

	Standards for providers of digital services and content that may be used by young children	Standards for the processing of young children's data	Oversight bodies with specific responsibilities for monitoring the protection of young children in the digital environment
Australia			
Australia (*South Australia*)	m	m	m
Australia (*Tasmania*)			
Australia (*Victoria*)	m	m	m
Belgium (Flanders PP)			
Belgium (Flanders U3)			
Canada CB			
Canada SB			
Canada (*Alberta*)			
Canada (*British Columbia*)			
Canada (*Manitoba*)			
Canada (*New Brunswick*)			
Canada (*Quebec*)			
Czech Republic			
Denmark			
Finland			
France			
Germany			
Germany (*Bavaria*)			
Hungary			
Iceland			
Ireland			

	Standards for providers of digital services and content that may be used by young children	Standards for the processing of young children's data	Oversight bodies with specific responsibilities for monitoring the protection of young children in the digital environment
Israel			
Italy			
Japan			
Korea			
Luxembourg			
Morocco			
Norway			
Portugal			
Slovak Republic			
Slovenia			
South Africa			
Spain			
Sweden			
Switzerland			
United Arab Emirates *(Dubai)*			
Formally regulated mechanisms	**9**	**14**	**12**
Guidelines or recommendations	**11**	**8**	**5**
Not in place	**10**	**4**	**8**

Notes: Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
Formally regulated or established – a legal instrument or statutory body
Guidelines or recommendations – codes of conduct without a legal obligation
Not in place
Not applicable or Not known
m: Missing
Source: OECD (2022[35]), *ECEC in a Digital World* policy survey, Table B.4.

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Legislative efforts in Australia and the United Kingdom are supported by mandatory codes of conduct that include age-specific provisions. Australia's guidance for these codes notes that younger children are at greater risk from the social, emotional, psychological and physical impacts caused by exposure to harmful content and behaviour online (eSafety Commissioner, 2021[52]). The United Kingdom's Age-Appropriate Design Code (2020) goes further, differentiating risks, protections and the responsibilities of DSPs according to age (see Box 3.2).

Other countries have published recommendations or guidelines for DSPs. These often address more specific digital risks, such as advertising or consumer rights, and come from a variety of actors, including government bodies (e.g. media authorities, consumer agencies, ministerial departments), professional associations and civil society. Some of these, such as a guide for stakeholders in Sweden (Box 3.1), include relevant provisions for young children. Guidance in Spain highlights the development and use of search engines and apps specifically designed for children as being particularly effective in protecting the youngest users (Spanish Data Protection Authority, 2020[53]). A policy statement from the American Academy of Pediatrics in the United States recommends that DSPs work with developmental psychologists and educators to design quality interfaces for children ages 0-6, as well as to eliminate advertising and unhealthy messages on apps for this age group (Hill et al., 2016[16]).

Box 3.1. Framework conditions for digital service providers that encourage safety-by-design

In 2008, **Japan** introduced the Act for an Enhanced Environment for Youth's Safe and Secure Internet Use to, among other key objectives, reduce the chances of young people (ages 0-18) viewing harmful content online. Accompanying policy efforts have included promoting the development and design of safety features, obliging digital service providers (DSPs) to provide filtering services for young users, developing and disseminating related standards, and establishing a public-private partnership framework. In 2018, Japan updated the act in part to reflect the growing use of digital technologies by younger children. The accompanying action plan focused on promoting the use of filtering services and software for digital users from the earliest age.

Germany's amendment to the Youth Protection Act (2021) aims to implement the requirements of the United Nations' General Comment on the Rights of Children in the Digital Environment through federal law. One key measure is the introduction of a legal obligation for DSPs to appoint a qualified youth protection officer. The youth protection officer has responsibility for supporting design processes from a child-safety perspective, identifying potential risks to children, promoting the use of age labels or other technical solutions to limit children's access to potentially harmful content, and championing the protection of minors in all internal decision making. The amendment also introduced a Safety-by-Design Standard for DSPs which, among other requirements, obliges DSPs to take precautions relative to both the level of risk of their service or product and the child's age.

In **Sweden**, the Swedish Authority for Privacy Protection, the Ombudsman for Children in Sweden and the Swedish Media Council collaborated to publish guidance for DSPs on children's rights in digital environments. Regarding young children specifically, the guidance notes that they may lack the tools required to handle certain media content or to understand the consequences of publishing images or sharing personal data. It also emphasises the need to adapt information to ensure it reaches the child, regardless of age. Thus, even in cases where the parent is required to give consent, the guidance recommends addressing children too. To facilitate this, the guidance recommends involving young children of the target age in the development of the text.

Sources: Germany: German Association for Voluntary Self-Regulation of Digital Media Service Providers (2022[54]); Japan: Government of Japan (2020[55]); Sweden: Swedish Authority for Privacy Protection, Ombudsman for Children in Sweden and Swedish Media Council (2021[56]).

Young children's privacy and data protection

In today's digital world, DSPs collect and share a wealth of data on children, even before they are born. Young children may knowingly or unknowingly offer their personal information and data directly to DSPs, or that information may be inferred from their activities online or from disclosures by others. These data are valuable: young children represent three large consumer markets in one (direct spending, future spending, indirect spending through parents) (OECD, 2020[31]). In addition, high potential for innovations in the health and education sectors through developments in artificial intelligence and big data make young children increasingly attractive targets for datafication (European Commission, 2022[57]).

However, the ability of children to identify, evaluate and consent to such data practices is highly questionable. Research indicates that young children are particularly trusting of privacy-invasive technologies and struggle to comprehend commonplace commercial activities such as selling data to a third party or combining multiple data points to profile a user (Information Commissioner's Office, 2019[58]). Parents and other adults often lack awareness of the extensive sharing of personal data that results from using digital services (European Commission, 2022[57]). This reduced comprehension minimises young

children's agency and undermines their right to privacy, while parental control or consent mechanisms often give only the illusion of protecting them (van der Hof and Lievens, 2017[59]). Moreover, the expansion of digital technology use in ECEC settings means entrusting personal data to ECEC staff or educational technology companies with little scope to refuse or challenge privacy arrangements (Schleicher, 2022[60]). The risk is real: in 2020, an analysis of nearly 500 educational technology apps found that many were collecting device identifiers, some were taking location data and nearly two-thirds of those submitted to further testing shared user data with third parties (Cannataci, 2021[61]).

The OECD guidelines call on DSPs to adopt four key actions with respect to privacy protection: 1) provide information on how personal data are collected, processed and used in concise, accessible and age-appropriate language and formats; 2) limit the collection of personal data and its subsequent use or disclosure to third parties; 3) not use children's data in ways that evidence indicates are detrimental to their well-being; 4) not allow the profiling of children or use of automated decision making unless there is a compelling reason to do so and appropriate protections in place (OECD, 2021[40]).

Results from the *ECEC in a Digital World* policy survey (2022) suggest that countries have been more active in implementing efforts targeted at DSPs to protect children's privacy in comparison to efforts to embed safety-by-design approaches (see Table 3.2). The majority (21) of participating countries and jurisdictions reported having standards in place for processing young children's data. These were most often formally regulated, as reported by 14 participants. A smaller share (7) relied only on more informal approaches, such as guidelines or recommendations. Only Portugal reported having both approaches.

In recent years, legislative reform in this area has largely been driven by the General Data Protection Regulation (GDPR) of the European Union (EU), which came into force in 2018. The GDPR recognises children as requiring specific protections, including providing age-appropriate information, applying the right to be forgotten and prohibiting profiling, with some exceptions (European Parliament, 2016[62]). The GDPR also requires DSPs to seek consent for data-processing activities concerning children younger than 16 years old, with countries able to adapt this age according to domestic norms. The GDPR applies to any DSP that targets or collects data on users in the EU, regardless of the location of the DSP itself. As such, it has helped harmonise privacy laws across EU member states as well as encouraging other countries (e.g. Brazil, Japan, Korea, New Zealand, South Africa) to adopt similar measures. Some countries have introduced further provisions within their privacy laws for children (Woodward, 2021[63]). These include, for example, seeking consent for data processing from both parents and minors themselves (France) or requiring DSPs to conduct data protection impact assessments when processing minors' personal data for marketing purposes (Finland, Ireland and Italy) (Gabel and Hickman, 2019[64]; Government of France, 2018[65]).

Laws for young children's privacy specifically are not common, but some countries, including the United Kingdom (Box 3.2), have introduced regulations, recommendations or guidelines. Guidance published in Canada and Iceland encourages DSPs to design services that are appropriate for the youngest possible users by default, including by avoiding collecting personal information entirely (Office of the Privacy Commissioner of Canada, 2015[66]; Ombudsman for Children, n.d.[67]). France's National Commission for Information Technology and Civil Liberties (CNIL) recommends that DSPs fully involve children of all ages in the design process; the Data and Design Project supports such collaboration, seeing young children work with digital designers to develop child-friendly interfaces (CNIL, 2021[68]). Ireland offers concrete guidance on how to ensure child-oriented transparency, even for young children, including using non-textual messages wherever possible, such as cartoons, videos, images, icons or gamification (Data Protection Commission, 2021[69]).

Box 3.2. Regulation and legislation to protect young children's data

The **United Kingdom**'s Age-Appropriate Design Code (2020), or "Children's Code", is a statutory code of practice for digital service providers (DSPs) whose products or services are used by children. The code establishes design- and privacy-related benchmarks for the appropriate protection of children's personal data, in line with the EU's General Data Protection Regulation and the United Kingdom's Data Protection Act (2018). The Information Commissioner's Office, the United Kingdom's data protection authority, applies the code when considering possible breaches of these laws; such breaches may result in assessment notices, warnings, reprimands or fines. The code sets out 15 risk-based standards of age-appropriate design ranging from general guidance, such as putting the best interests of the child first and applying standards in an age-appropriate manner, to measures relating to specific tools, such as parental controls, geolocalisation, profiling and nudge techniques. When it comes to the youngest users, there are several noteworthy aspects of the code:

- *Precautionary approaches to user age* – the code applies to any DSP providing services or products *likely* to be accessed by children, entailing that DSPs apply the standards to all users when they cannot establish user age with confidence, thus providing protections for younger children by default. This recognises that age limits and verification tools are often inadequate.
- *Consideration of age ranges* – to support DSPs to put the varied needs of children at different ages and stages of development at the heart of design, the code provides specific advice according to the capacity, skills and behaviours a child is likely to exhibit within certain age ranges. For very young children (0-5 year-olds), specific advice is offered in 4 of the 15 standards (transparency, parental controls, nudging and online tools). An annex sets out further key considerations based on relevant, up-to-date academic research for that age group.
- *Respecting the rights of the youngest* – the code aims to complement rather than replace parental supervision and guidance. Nevertheless, it seeks to recognise even the youngest children's agency and uphold their right to privacy. For example, the code encourages DSPs to rely more on parental involvement in managing privacy settings for 0-5 year-olds, but it also advises providing the children with information, in less detail and using visual or audio formats. In addition, young children should be advised, through clear and obvious signs, when parental controls are being used to monitor or track their behaviour and should be informed of their right to privacy in an age-appropriate way.

Similar efforts are now emerging in other jurisdictions. In the **United States (California)**, the California Age-Appropriate Design Code Act (2022) follows many of the above-mentioned principles. It also establishes a California Children's Data Protection Taskforce to evaluate best practices and provide support to businesses, with an emphasis on small and medium-sized businesses. The **European Commission** has committed to developing an EU code of conduct on age-appropriate design.

With regards to privacy in educational settings specifically, the state of **Maryland**, in the **United States**, recently updated legislation on student data privacy. The provisions cover children from pre-kindergarten (3-4 year-olds) and apply to both school- and home-based instruction, as well as administrative activities and communication between children, staff and parents. The law increases student data protection over personal data and tightens definitions for covered information and targeted advertising.

Sources: European Commission: European Commission (2022[57]); United Kingdom: Information Commissioner's Office (2020[70]); United States (California): 5Rights Foundation (2022[71]); United States (Maryland): Maryland General Assembly (2022[72]).

There are few identified examples of specific guidance for DSPs operating in the education sector, including ECEC, despite the growing role of both data management systems to support monitoring and evaluation processes (see Chapter 8) and pedagogical uses of digital tools and devices (see Chapter 4). The Council of Europe published Guidelines on Children's Data Protection in an Education Setting. These have recommendations for governments, education professionals and DSPs and emphasise the need for age-appropriate approaches (Council of Europe, 2021[73]). In the United States, most states have legislation that deals specifically with protecting student data in educational settings; recent reforms in Maryland have implications for young children (see Box 3.2).

Governance and accountability approaches

As governments introduce new efforts to enhance children's safety and privacy in digital environments, demand for effective oversight and enforcement increases. Governments can establish clear roles and lines of responsibility for implementing, monitoring and adapting such efforts. This may be carried out by administrative, judicial, quasi-judicial and/or parliamentary oversight bodies, or a combination. For example, in addition to data privacy authorities, consumer protection agencies, sectoral regulators, anti-discrimination bodies and human rights institutions could all contribute to oversight (United Nations High Commissioner for Human Rights, 2021[74]).

However, the diverse web of actors involved in meeting the needs of children in the digital environment can lead to a lack of strategic leadership, bringing the risk of policy fragmentation, duplication of efforts and inconsistencies in monitoring and evaluation (Burns and Gottschalk, 2019[15]; OECD, 2020[31]). Moreover, the fast pace of technological change contrasted with the slower, lengthier research processes required to understand the impact of that change can create much uncertainty. Without strategic leadership, parents and ECEC professionals are left to navigate this uncertainty alone, risking confusion and stress. In recognition of this challenge, the OECD Recommendation calls upon governments to establish dedicated oversight bodies with *inter alia* responsibility for multistakeholder engagement, policy implementation and ensuring complementarity.

In the *ECEC in a Digital World* policy survey (2022), 15 of the participating countries and jurisdictions indicated having oversight bodies in place with specific responsibilities for monitoring the protection of young children in the digital environment (see Table 3.2). Among these, the majority (12) are statutory bodies with specific powers to implement legislation or regulation and their role and responsibilities have been formally defined. However, nine countries or jurisdictions reported having no specific oversight body in place, despite all but three of these respondents having reported that they have established standards for aspects of design and/or privacy. Some countries, such as Australia and Hungary, have established new oversight structures; others like Germany and Norway have expanded the remit of and/or encouraged collaboration between existing oversight bodies (Box 3.3).

Box 3.3. Oversight and strategic leadership of children's digital safety

Australia's eSafety Commissioner is the independent regulator for online safety. Established in 2015 as the Children's eSafety Commissioner, the commissioner's responsibilities were extended in 2017 to cover all users of digital technologies. The commissioner has hard powers to ensure regulatory compliance and its actions have a specific focus on several groups of vulnerable users, including young children. The commissioner holds industry to account for upholding Australia's Basic Online Safety Expectations. This involves providing guidance on the expectations and reasonable practical steps to meeting them, as well as compliance actions. The commissioner's powers include requiring digital service providers (DSPs) to report on how they are meeting the expectations, issuing a formal warning or infringement notice, and seeking court-ordered injunctions or civil penalties. Regarding children's

safety, specific actions include handling complaints and reports of cyberbullying and investigating or overseeing the removal of harmful content. The commissioner also leads activities to support parents and early childhood education and care staff in their efforts to enhance young children's digital safety.

In **Hungary,** the Child Protection Internet Roundtable was established in 2014 as a consultative review committee within the National Media and Communications Authority, which brings together representatives of 20 different organisations with a vested interest in or responsibility for children's online safety. The roundtable issues non-binding recommendations and statements to promote compliance by DSPs and raise awareness among children and their parents. It also reviews and supports the implementation of the Digital Child Protection Strategy (2016).

Germany recently reformed the Federal Testing Centre for Media Harmful to Young People, considerably increasing its powers in line with new provisions in the Youth Protection Act (see Box 3.1). The newly named Federal Centre for the Protection of Children and Young People in the Media (BzKJ) is responsible for ensuring that DSPs respect their obligations under the act; promoting shared responsibility among government, industry and civil society; and establishing networking structures to enable stakeholders to collaborate.

In **Norway**, the Children's Ombudsman, the Norwegian Data Protection Authority, the Norwegian Media Authority and the Norwegian Consumer Agency have all produced content such as guidance, research and recommendations to encourage DSPs to enhance children's online safety. The Norwegian government has appointed the Norwegian Media Authority as the national co-ordinator of this work.

Source: Australia: eSafety Commissioner (2021[75]); Germany: Federal Centre for Child and Youth Media Protection (2021[76]); Hungary: National Media and Communications Authority (n.d.[77]); Norway: Norwegian Media Authority (n.d.[78]).

Parents and families protecting young children in digital environments

Parents, carers and guardians are central figures in young children's lives and have traditionally been at the centre of efforts to enhance children's safety in the digital environment. The OECD Recommendation recognises that while parents have a fundamental role in protecting their children in the digital environment, they need support in this role. In particular, they need to be supported to have awareness and understanding of the rights of children in digital environments and as data subjects. In addition, it states that parents require support to fulfil their role to ensure that children can become responsible participants in the digital environment and recognises that the continually increasing complexities of digital technologies may increase the necessity for such support (OECD, 2021[39]). This section explores different ways in which governments are supporting parents to keep young children safer in digital environments.

Parents' role in protecting young children in the digital world

Today's young children largely engage with the digital world in the home (Carvalho, Francisco and Relvas, 2015[79]). For these digital users, parents can do much more than simply facilitate or restrict access to digital tools; they are a key source of support and inspiration for children's digital experiences, establishing rules and boundaries but also fostering agency and empowerment for their later digital lives (Chaudron, Di Gioia and Gemo, 2018[4]; Green, Wilkins and Wyld, 2019[29]). Studies indicate that children whose parents implement Internet safety measures, model healthy digital behaviours and keep up to date with their children's digital habits are less likely to be victims or perpetrators of negative online conduct than children whose parents adopt a restrictive approach or model unhealthy interactions with technology. They are also more likely to be digitally resilient (i.e. able to react appropriately and adjust positively in the face of risks, potentially minimising associated harms) (Livingstone et al., 2017[80]).

From a parent's perspective, this responsibility, twinned with the increase in young children's interactions with the digital world, is often a source of internal conflict and stress. In the United States, a survey of parents of 0-6 year-olds found that 86% reported being satisfied with how their young children use technology, identifying benefits to child development and literacy. At the same time, 72% had concerns, specifically around too much screen time, inappropriate content and physical health (Erikson Institute, 2016[81]). Similarly, an investigation into parental perceptions about smart toys found that parents strongly supported the educational and entertainment potential but equally feared possible threats to privacy (Brito, Dias and Oliveira, 2018[28]).

Supporting parents to effectively navigate this tension is critical for curbing parental anxieties and amplifying digital benefits for young children while minimising harms. This requires equipping parents with the skills, knowledge and attitudes to combine the best available evidence with their own tacit knowledge, to arrive at the most appropriate course of action for the individual child. For example, accurate knowledge that helps parents to distinguish between evidence-based and perceived risks can support them to take more informed decisions (Green, Wilkins and Wyld, 2019[29]). Such information can also usefully include guidance regarding safe and responsible uses of technology, including a broader set of healthy habits around sleep and exercise. However, at present, research indicates that parents receive conflicting information from media, social, medical and educational sources, exacerbating their internal conflict regarding digital parenting (Dardanou et al., 2020[82]).

Parents could also benefit from being informed about the pros and cons of different digital parenting styles. Qualitative research among parents of young children across multiple European countries indicates that parents are often unclear or inconsistent about how and why parental mediation matters in digital parenting, or which strategies are effective (Livingstone et al., 2015[34]). Certainly, there is no one-size-fits-all model: digital parenting is a dynamic process, shaped by individual contexts and constraints (Smahelova et al., 2017[83]; Livingstone et al., 2015[34]). Nevertheless, research can guide parents towards certain beneficial approaches. For example, among young children in offline environments, authoritarian and permissive parenting styles with their emphasis on control, intrusiveness and detachment have been shown to correlate to negative behaviours and lower development of executive functions, while positive approaches that emphasise scaffolding, cognitive stimulation and supported autonomy seem particularly beneficial (Hosokawa and Katsura, 2018[84]; Valcan, Davis and Pino-Pasternak, 2018[85]; Ulferts, 2020[86]). Although more research is required as to how these effects manifest in digital contexts for young children, among older children, digital parenting strategies that combine responsiveness, warmth and clear rules, as well as a recognition of children's rights in the digital environment are considered useful in balancing digital risks and opportunities (Duerager and Livingstone, 2012[87]; Milovidov, 2020[88]).

Parents also need to be supported to understand the risks their own digital behaviours carry for their children. Not only does children's screen time appear to increase with parents' screen time, but in both online and offline contexts, studies have shown that when left unsupervised or in the presence of a distracted parent, children, particularly young ones, will engage in risky behaviours to re-engage a parent (Sanders et al., 2016[89]; Kildare and Middlemiss, 2017[22]). In addition, distracted parents have been shown to be less attentive to the potentially unsafe situations or actions their children may encounter and to engage in less verbal and non-verbal communication. This may both negatively impact the child and lead to less positive parenting experiences (Kildare and Middlemiss, 2017[22]). At the same time, parents' digital skills play an important role: restrictive strategies tend to be adopted by parents with less confidence in their own digital skills (Burns and Gottschalk, 2019[15]), while a higher sense of digital self-efficacy among parents of younger children has been shown to correlate negatively with screen time (Sanders et al., 2016[89]).

Finally, as policy efforts regarding young children's safety in digital environments increasingly extend to spheres outside the home and the family, making parents aware of those developments will be necessary to enhance impact and support alignment and coherence. For instance, the effect of safety-by-design approaches, transparent information about children's security and privacy, and parental controls or consent

mechanisms will partly depend on the extent that parents actively engage with them. In addition, in many countries, there is a dissonance between the messaging of or towards education and industry actors, which tend to promote the use of digital technology by young children, and that of public health actors targeting parents, which often emphasises risk management and counsels screen time reduction (Straker et al., 2018[90]). When it comes to ECEC provision, this has contributed to hostility from parents about the use of digital technologies in ECEC settings in several countries (Straker et al., 2018[90]; Zimmer, Scheibe and Henkel, 2019[91]).

Support and guidance for parents and families with young children

While public education and awareness-raising efforts are by no means a silver bullet, they are important policy tools that help to empower parents to support their children (OECD, 2020[31]; Livingstone et al., 2018[33]). This has been a favoured approach for many years but, in relation to young children at least, the COVID-19 pandemic likely accelerated the adoption of such measures. For example, the experience of distance education in 2020 led many countries to disseminate advice to parents and families about adult-supervised use of technology for young children (OECD, 2021[5]).

Responses to the *ECEC in a Digital World* policy survey (2022) illustrate the breadth of topics covered in guidelines and recommendations targeting parents or a general audience about young children's engagement with digital environments as of 2022 (see Table 3.3). The majority of participating countries or jurisdictions (28 out of 37) have some guidance in place for parents, issued or endorsed by the government. For a large share of these, this guidance appears to be quite comprehensive: 23 countries and jurisdictions reported addressing 4 or more of the 6 topics asked about in the policy survey. This may reflect the fact that parents have typically been seen as having primary responsibility for protecting children from digital risks. The issuing of these guidelines or recommendations could also be in response to the demand for support from parents who feel increasingly confused about how to manage digital risks and opportunities for their children.

Recommendations related to screen time were the most common type of guideline issued, with 28 of 37 participating countries and jurisdictions reporting having them in place. Much of the country-specific guidance follows the recommendations of the World Health Organization (WHO): zero screen exposure for children under age 1, preferably zero exposure for 1-2 year-olds and less than one hour per day, supervised, for 2-5 year-olds (WHO, 2019[92]). Responses to the policy survey and further research indicate that there are some variations in national interpretations, however: Germany recommends zero exposure for 0-3 year-olds; Australia and the United States recommend zero exposure up to 18 months. While many countries follow the recommendation of a maximum of one hour per day for children over 2 years old, Luxembourg suggests 10-15 minutes maximum.

Such guidance can usefully provide consistent, tangible and evidence-based recommendations. Nevertheless, as described in Chapter 2 and at the start of this chapter, the traditional concept of screen time increasingly fails to capture the diversity of children's interactions with digital technologies. For example, the WHO recommendations are in specific reference to sedentary screen time but may often be interpreted as referring to time spent on any engagement with digital technologies. Furthermore, for most families, the reality is that young children are often exposed to screens earlier and at a higher intensity than recommendations propose and research undertaken during the COVID-19 pandemic highlights that when young children are exposed to premature, increased or unsupervised screen time, it is not necessarily a result of parents' ignorance or scepticism of the guidance but wider contextual factors, such as parental availability (Hartshorne et al., 2020[93]).

Table 3.3. Guidelines and recommendations to protect young children in digital environments targeted at parents and families, and early childhood education and care professionals

Countries and jurisdictions reporting having introduced the following to support families and ECEC professionals in ensuring a safe digital environment for young children, by topic and target audience, 2022

	Parents/families or the general public							ECEC professionals specifically						
	Total number of topics	Risks to physical health	Risks to socio-emotional well-being	Protection of privacy	Amount of screen time	Educational uses of technology at home	Balancing participation with protection	Total number of topics	Risks to physical health	Risks to socio-emotional well-being	Protection of privacy	Amount of screen time	Educational uses of technology at home	Balancing participation with protection
Total no. of countries/jurisdictions		25	26	21	28	24	17		9	12	10	11	11	11
Australia	6	■	■	■	■	■	■	5		■	■	■	■	■
Australia *(South Australia)*	0							0						
Australia *(Tasmania)*	0							0						
Australia *(Victoria)*	0							0						
Belgium (Flanders PP)	6	■	■	■	■	■	■	0						
Belgium (Flanders U3)	5	■	■	■	■	■		0						
Canada CB	5	■	■	■	■	■		0						
Canada SB	5	■	■	■	■	■		0						
Canada *(Alberta)*	0							0						
Canada *(British Columbia)*	4	■	■		■	■		2	■				■	
Canada *(Manitoba)*	6	■	■	■	■	■	■	5		■	■	■	■	■
Canada *(New Brunswick)*	6	■	■	■	■	■	■	0						
Canada *(Quebec)*	5	■	■	■	■	■		0						
Czech Republic	4	■	■		■	■		4	■	■		■	■	
Denmark	5	■	■	■	■		■	0						
Finland	3	■	■		■			3	■	■	■			
France	3	■	■		■			2	■			■		
Germany	6	■	■	■	■	■	■	6	■	■	■	■	■	■
Germany *(Bavaria)*	2				■	■		4	■	■	■			■
Hungary	6	■	■	■	■	■	■	0						
Iceland	5		■	■	■	■	■	2		■			■	
Ireland	3	■	■		■			0						
Israel	6	■	■	■	■	■	■	0						
Italy	0							3				■	■	■
Japan	6	■	■	■	■	■	■	0						
Korea	4	■	■		■	■		0						
Luxembourg	6	■	■	■	■	■	■	6	■	■	■	■	■	■
Morocco	0							0						

	Parents/families or the general public							ECEC professionals specifically						
	Total number of topics	Risks to physical health	Risks to socio-emotional well-being	Protection of privacy	Amount of screen time	Educational uses of technology at home	Balancing participation with protection	Total number of topics	Risks to physical health	Risks to socio-emotional well-being	Protection of privacy	Amount of screen time	Educational uses of technology at home	Balancing participation with protection
Norway	4	■		■	■		■	3		■	■			■
Portugal	5		■	■	■	■	■	5		■	■	■	■	■
Slovak Republic	6	■	■	■	■	■	■	6	■	■	■	■	■	■
Slovenia	5	■	■	■	■	■		1						■
South Africa	2					■	■	1				■		
Spain	6	■	■	■	■	■	■	6	■	■	■	■	■	■
Sweden	0							0						
Switzerland	6	■	■	■	■	■	■	0						
United Arab Emirates *(Dubai)*	0							0						

Notes: Responses refer to guidelines or recommendations as issued by either a government agency (e.g. a ministry), a public entity with government support (e.g. research institute, non-governmental organisation) or other institution with a far-reaching role, as long as the guidelines or recommendations are endorsed by government.

Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).

■ Yes

□ Not in place, Not known or Not applicable

Source: OECD (2022[35]), *ECEC in a Digital World* policy survey, Table B.5.

StatLink https://stat.link/13oh8y

At the same time, the evidence base on which screen-time recommendations are formed is constantly evolving as new digital technologies and habits emerge and researchers attempt to overcome some of the weaknesses of previous studies, including narrow or unreliable measures of young children's screen time (Barr et al., 2020[94]). The WHO recommendations were developed following a research review undertaken in 2017, which found a predominantly unfavourable, or null, association between sedentary screen time and cognitive or motor development, psychosocial health and being overweight but rated the overall quality of evidence available for these relationships at the time as very low (WHO, 2019[95]). With all this in mind, for screen time guidelines to be useful to parents, and not cause more stress, they should be reviewed regularly and paired with wider advice on digital parenting and risk management. This could usefully include information that supports parents to enable children to benefit from technology by encouraging them to seek out educational and prosocial content and discuss healthy digital habits (Hill et al., 2016[16]).

A majority of participating countries and jurisdictions (25) reported having issued guidance for parents of young children on the risks of digital engagement to physical health, such as the impact on eyes, sleep and posture. The same number (25) reported guidance on limiting risks to socio-emotional well-being, such as exposure to inappropriate content and social isolation. Meanwhile, 24 countries and jurisdictions reported issuing guidance on educational uses of technology in the home. This is particularly important for parents of young children, as research indicates that they often lack awareness of the educational potential

of their digital parenting role (Mascheroni, Ponte and Jorge, 2018[96]). It also provides an area of opportunity for aligning with young children's digital interactions in ECEC settings.

In contrast, less than half of participating countries and jurisdictions (17) reported having guidance in place to support parents in balancing young children's right to participate in the digital environment with protecting them from harm. This indicates the risk-focused nature of much of the guidance available to parents. It may be that the absence of clear evidence regarding the impact of digital technology use on young children encourages governments to adopt a cautious approach that emphasises potential risks. However, as described earlier in this chapter, focusing on digital risks to the detriment of digital opportunities can limit children's scope for developing critical digital skills and increase parental anxiety.

Finally, 21 countries and jurisdictions reported having issued guidance related to children's privacy. Given that legislative and regulatory efforts in this area have multiplied in recent years, as described above, it is notable that this topic remains one of the less-covered topics included in the policy survey. However, much of the guidance or regulation aimed at DSPs to help protect young children calls for interventions that involve parents (e.g. providing transparent and clear information about data processing, requiring parental consent, implementing parental controls), meaning efforts to engage them in issues related to privacy are important.

As responses to the survey and further research indicate, the online safety space is well-populated. Most countries have dedicated websites for children's online safety; many have multiple. Efforts may come from government bodies (e.g. ministries, media authorities, data protection agencies) or civil society. At the same time, a lot of information exists that is not endorsed by governments. Furthermore, as research and technology advance, resources quickly become outdated. For parents of young children in particular, guidance may not always be tailored to their needs, as much of the knowledge base concerns older children and teenagers. Together, this can lead to duplication, overlap and a lack of clear, authoritative messaging (Green, Wilkins and Wyld, 2019[29]).

Nevertheless, some countries have developed a range of evidence-based guidance tailored to the needs of parents of young children specifically. Australia's Early Years Program developed by the eSafety Commissioner and Denmark's First Digital Steps initiative (see Box 3.4) are good examples. The Early Years Program targets parents and carers of children under 5 and includes guidance on the risks young children are exposed to, as well as practical tips for navigating those risks, such as modelling healthy digital habits, setting rules and selecting quality content (see Case Study AUS_1 – Annex C). Responses to the *ECEC in a Digital World* policy survey (2022) and further research also indicate that some government-endorsed websites include specific resource collections for parents of young children. For example, in the Flemish Community of Belgium, the Flemish Knowledge Centre for Digital and Media Literacy has established an online catalogue of resources to support parents with digital parenting. Items are disaggregated by age, including categories for 0-3 year-olds and 4-6 year-olds (Medianest, n.d.[97]).

In addition to informational resources, interventions exist to enhance parents' practical toolkit for digital parenting. This is particularly important for parents who are less confident in their own digital skills (de Haan, Nikken and Wennekers, 2018[98]). Such practical tools are generally aimed at all parents, but may be customisable to suit parents of young children specifically. For example, online tools developed in Australia, France and the United States (Box 3.4) can be used by parents to establish a family technology agreement with their children. Other jurisdictions, such as Denmark and the Flemish Community of Belgium, offer opportunities for parents to enhance their own digital safety and digital parenting skills through learning opportunities. France has recently committed to further developing this type of support (Box 3.4).

Box 3.4. Digital safety guidance and support tools for parents

In **Denmark**, the First Digital Steps (2022) by the Danish Media Council for Children and Young People is the first national initiative on digital education for young children. Actions aim to support parents, professionals and municipalities to enhance young children's critical understanding, confidence and creativity in the digital world. For parents, support includes a guide covering role modelling, physical and socio-emotional well-being, digital content and age ratings, and data collection. A range of further advice and video guides for safety-focused activities with digital media (e.g. digital treasure hunts, image editing) has also been developed. Outputs are based on academic research; qualitative interviews and quantitative research with parents; and workshops with ECEC staff, health nurses and some municipal authorities.

France's Action Plan for Reasonable Use of Screens by Children and Young People (2022) aims to promote information, education and support for children, parents and professionals. For parents, the plan commits to three key actions. First, improve the official national website for parents looking to support their children's digital resilience, adding awareness-raising content, guidance on the use of filtering and parental control tools, and resources to support parent/child dialogue. Second, develop a network of digital parenting support services across the country through relevant parenting associations. Third, establish an annual barometer to better understand children's use of digital technologies. The action plan is the result of a partnership approach between several ministries and other public bodies.

In the **United States**, parents can use the American Academy of Pediatrics' Family Media Plan tool as practical support for digital parenting. Alongside agreeing on and setting target time limits, each member of the family can select priorities for their media use (e.g. media balance, kindness and empathy, selecting good content). The online tool then supports them in achieving these goals through further tailored tools, ideas and advice.

Sources: Denmark: Media Council for Children and Young People, Denmark (2022[99]); France: French Ministry of Health (2022[100]); United States: American Academy of Pediatrics (2022[101]).

Early childhood education and care professionals keeping young children safe in the digital world

As digital technologies become further embedded in a wide range of professional activities in ECEC settings, ECEC professionals take on a greater role in helping to protect young children's safety and privacy in digital environments. The OECD Recommendation recognises that the digital environment is a fundamental part of children's daily lives, including in formal and informal education contexts. As such, it calls on all actors to support educators in identifying opportunities and benefits of the digital environment for children, and evaluating and mitigating possible risks. It also emphasises the importance of helping educators to ensure children become responsible participants in the digital environment (OECD, 2021[39]). This section explores how governments are developing and implementing efforts to support the ECEC sector in this regard.

The role of early childhood education and care professionals in supporting young children's safety in digital environments

In many countries, digital technologies are rapidly becoming a key feature of young children's learning and development in ECEC settings. In the G20/OECD Survey on Distance Education for Young Children in 2020, nearly two-thirds of countries reported that children were routinely exposed to digital technologies to a "great" or "moderate" extent in pre-primary settings prior to the COVID-19 pandemic, and three-quarters reported the same at the primary level of education (OECD, 2021[5]). This undoubtedly accelerated during the pandemic: over half of participating countries and jurisdictions reported placing "major" or "moderate" importance on digital material with direct exposure of children to screens to maintain education continuity in pre-primary education. At the primary level, the share rose to over three-quarters (OECD, 2021[5]). Digital technologies are also increasingly embedded in working practices and systems in the ECEC sector, including professional development (see Chapter 5), engagement with families (see Chapter 6), and monitoring and evaluation (see Chapter 8).

As engagement with digital technologies in ECEC settings increases, a dual role for staff emerges. First, ECEC professionals must teach young children about safe and responsible uses of technology as part of wider efforts to introduce early digital literacy (see Chapter 4). This is critical in empowering children to protect themselves against risks, seize opportunities as they age and become increasingly independent digital users. As noted above, governments recognise that this is an important role for ECEC professionals, identifying the promotion of safe and responsible use of digital technologies as a policy challenge of much importance for the sector.

There is scope for ECEC professionals to have a particularly positive impact on young children's capacity to develop healthy digital habits and resilience to digital risks. Research indicates that young children tend to be more aware of the risks associated with using digital technologies if schools integrate programmes to develop digital literacy and technologies into the curriculum. At the same time, educators' positive views towards technology have a positive impact on young children's digital skills (Chaudron, Di Gioia and Gemo, 2018[4]). Furthermore, parents of young children commonly identify educators as trusted sources of information regarding the digital world, suggesting that they may have a positive impact on approaches to digital parenting (Erikson Institute, 2016[81]). In many OECD countries, the status of ECEC settings as publicly funded institutions that reach the majority of children increases their potential to positively impact digital interactions in home environments, including compensating for asymmetries in the resources available to parents and carers (Livingstone et al., 2015[34]).

Nevertheless, qualitative research across several European countries has indicated that parents have received very little guidance from ECEC settings or schools and have felt uninformed about their children's digital activities within these settings (Livingstone et al., 2015[34]). At the same time, more recent research undertaken in Australia reveals that ECEC staff experience tension in this role, having to manage and respond to a wide range of parental concerns and expectations about their child's potential engagement with the digital environment in ECEC settings while restrictive mediation practices often employed in the home negatively influence and impact young children's digital interactions in ECEC settings (Schriever, 2020[102]).

Alongside helping young children to stay safe in digital environments and supporting parents to do the same, ECEC staff also have a responsibility to ensure a safe and responsible use of digital technologies in their own professional activities. This means, for example, that any digital technologies used with children for learning and development purposes within ECEC settings need to favour safe and high-quality, age-appropriate content. In addition, digital technologies employed for wider worker processes such as professional development or collaboration; monitoring and evaluation; or administration, communication and management tasks should be respectful of children's privacy and follow data protection practices. This is important, as actions by individual users are more likely to endanger data protection than the technical systems themselves (Jardine, 2015[103]).

Although responsibility for children's digital safety extends to staff across all levels of ECEC governance, the highly decentralised arrangements favoured by many ECEC systems across OECD countries mean that ECEC professionals can have a particularly important role. In the *ECEC in a Digital World* policy survey (2022), 19 out of 37 participating countries and jurisdictions reported that, when it comes to decisions about digital infrastructure (e.g. devices, connectivity), at least some of the decision-making responsibility lies with individual ECEC settings, whether that be through staff, leaders, governing boards or owners. Even more participants reported the same for decisions about digital educational materials (22 out of 37) and approaches to using digital technologies to engage with parents and families (26 out of 37). As digital technologies become increasingly prevalent in ECEC settings, professionals across the system could benefit from authoritative, evidence-based guidance regarding the selection and safe use of digital devices and content to reduce the decision-making burden.

As a result, all staff working in ECEC settings require relevant foundational competencies, including an understanding of digital risks and how to protect children in relation to digital technologies. At the same time, certain staff members will require enhanced and/or specialised competencies, such as understanding and sharing best practices for data storage and use, or staying abreast of evolving recommendations and requirements around the use of digital tools with young children (see Chapter 5).

Support and guidance for early childhood education and care professionals

Governments can employ a range of approaches to support ECEC professionals in fulfilling their dual role of keeping young children safe in digital environments. Integrating related knowledge and skills into curriculum frameworks can help ensure that ECEC staff develop an emerging sense of digital safety competence in young children (see Chapter 4). In addition, providing relevant, high-quality professional development opportunities can support staff to implement these curricula components, and also increase their own capacity to use digital technologies responsibly in their professional activities (see Chapter 5).

Alongside these curriculum and professional development approaches, disseminating reliable and up-to-date information and advice regarding digital risks, opportunities and how to help young children manage them is also crucial. This can take a variety of forms, including more formal approaches such as official statements, sectoral strategies or statutory expectations and recommendations, and less formal efforts such as awareness raising, guidance, research reports, and online catalogues of tools and resources.

Responses to the *ECEC in a Digital World* policy survey (2022) suggest that, as of 2022, these approaches are still emerging in ECEC systems. First, more than half of the participating countries and jurisdictions (20 out of 37) did not report having guidelines or recommendations in place for ECEC staff for any of the topics listed in the survey. This indicates that, while digital technologies are increasingly being used in the ECEC sector, and while governments place considerable importance on policy challenges related to the risks this poses, efforts to support staff to address such risks in their interactions with young children are lagging relative to actions at other levels. This may have negative implications for the sector and young children: without sufficient guidance in place, professionals may adopt different approaches – of varying quality – depending on their own ability and initiative.

Second, very few countries or jurisdictions reported comprehensive topical coverage in these recommendations: only 4 ECEC systems reported having guidelines in place for each topic included in the survey compared to 12 for guidance targeting parents. This may be due to a lack of clarity among governments regarding the types of information and guidance ECEC professionals need or the scope of their role in supporting young children's digital safety. This is further indicated by the heterogeneity in different governments' chosen combinations of topics for the sector.

With one exception, guidance for each of the digital safety topics asked about in the survey was reported as being in place for ECEC professionals by a similar number of respondents. Guidance regarding the risks of digital engagement to young children's socio-emotional well-being and regarding the educational uses of digital technologies in the home was issued by 12 countries and jurisdictions each. It is noteworthy that nearly as many countries and jurisdictions choose to address educational opportunities as those that address key risks, suggesting a recognition of ECEC staff's important role in supporting balanced approaches to digital parenting.

In contrast to guidance for parents, when it comes to ECEC staff, governments appear to place similar importance on balancing young children's protection in digital environments with their participation. In the policy survey, 11 participants confirmed having published or endorsed guidance of this nature. This aligns with responses regarding policy challenges for the ECEC sector which, as stated above, indicate that governments are seeking to promote safe and responsible use of digital technologies by young children through the promotion of such practices in ECEC, as opposed to ruling out interactions with digital technology for this age group.

Guidance for ECEC professionals regarding young children's screen time exposure was reported to be in place by 11 of the participating countries and jurisdictions. These provide overall screen time recommendations covering exposure in the home and in educational settings. However, beyond the challenges of such recommendations already outlined in this chapter, screen time recommendations calling for strong limits on young children's digital activity may contradict or inhibit the implementation of digital education strategies or curriculum frameworks that promote the embedding of technology in young children's educational settings.

Information for ECEC professionals regarding the protection of young children's privacy was also reported to be in place by ten participating countries and jurisdictions. In Germany (Bavaria), for example, as part of efforts to support the implementation of the Digitalisation Strategy, ECEC staff can access guidelines on security settings for tablets in ECEC settings. In addition, the State Institute of Early Childhood Research has developed a rolling list of suitable digital apps that can support ECEC staff with administrative, communication and documentation needs. The assessment of the apps takes into account data protection and privacy laws and regulations. The institute also prepares statements on relevant research findings in areas such as data security (see Case Study DEU_Bav – Annex C).

As is the case for parents, however, it appears that although many countries and jurisdictions have made efforts to enhance data protection and data security for young children in recent years through regulations and legislation, fewer have developed specific actions to support staff in understanding the implications for practices in ECEC settings. Nevertheless, ECEC professionals are having to engage proactively with matters relating to children's data protection and security. In Japan, for example, an integrated ECEC centre for children ages 0-5 has been embedding digital technologies in their work with children as a way of complementing and enhancing their direct experiences of learning and development. In so doing, they have established kindergarten-specific security settings when accessing external sites or introducing new applications. They also regulate the advertisements displayed on apps available on children's tablets (see Case Study JPN_3 – Annex C).

Finally, the topic of risks to young children's physical health was covered by only nine countries or jurisdictions participating in the survey. Given that this was among the most common topics for guidance targeting parents, physical health may be seen as being more within the remit of parental responsibility and home life. However, it may also be indicative of the tendency for guidance for parents to focus on risks, particularly those related to extended exposure, while that for ECEC staff appears more oriented towards balancing risks and opportunities.

In general, results from the *ECEC in a Digital World* policy survey (2022) illustrate that issuing guidance or recommendations for parents of young children is much more common across jurisdictions and more comprehensive in its coverage of key topics than the guidance issued for ECEC staff specifically. This

likely reflects the fact that technology is already embedded in young children's home lives while it is still an emerging feature of children's ECEC environments. However, it may also reflect that issuing guidance for a general audience is more straightforward than tailoring guidance to people in specific contexts and roles. Indeed, in some cases, educators and other professionals are directed towards this general or parental guidance to support their work with young children.

Responses to the survey and further research reveal that some countries do publish guidance for ECEC staff as part of a holistic approach combining formal and informal efforts to embed aspects of online safety and digital resilience throughout the ECEC sector. Norway and the United Kingdom provide such examples (see Box 3.5). In comparison, other countries have produced one-off formal efforts responding to specific needs. For example, during the COVID-19 pandemic, the Czech Republic and Italy published recommendations for distance education which included references to digital safety and well-being, particularly in relation to screen time, and had some specific provisions for younger learners. Several countries, including Iceland, New Zealand and Spain, have published guidance for educators relating to data protection in educational settings. However, these are generally not disaggregated by education level.

Most countries have dedicated websites for children's online safety, many of which – although not all – contain sections targeted towards educators. Of those that do target educators, only some, including Australia, Austria and Canada (see Box 3.5), have subsections specifically for ECEC staff. Generally, resources for these staff include information fact sheets, handbooks, lesson ideas and resources, as well as links to other useful resources. Some countries have also developed teaching units to support young children's skills in digital risk navigation. In the Czech Republic, for example, the National Pedagogical Institute launched the TIO project to provide educators in pre-primary and primary schools with material to introduce children to the topics of communication, ethics and safety in the digital world through a robot, TIO, and the stories of its digital experiences (see Case Study CZE – Annex C).

There are also some examples of professional development opportunities and tools related to digital safety. In Australia, ECEC professionals can access a series of three accredited online training modules, with a further module specifically for ECEC leaders, to support understanding of safe online practices and the latest related research (see Case Study AUS – Annex C). In Austria, tools are available for staff and the children in their care to self-assess their knowledge and skills in matters related to digital safety and security, while in the Netherlands, ECEC staff can access support tools for engaging parents in young children's online safety (Box 3.5).

Box 3.5. Supporting early childhood education and care professionals beyond guidelines for digital safety: Country examples

Norway's Right Online – National Strategy for Safe Digital Upbringing (2021) offers a comprehensive policy for children's online safety (ages 0-18). The strategy presents relevant, up-to-date research and points to opportunities for children and young people's Internet use as well as to the risks and challenges. It calls for kindergartens to embed digital safety, including critical digital judgement, in learning and development work with children and for kindergarten staff to be trained accordingly. Aligning with this, Norway's Framework Plan for Kindergarten includes a specific section on digital practice that requires settings to exercise their own digital judgement and contribute to the development of children's digital judgement. To support staff in putting this into action, Norway has developed three online competence packages for kindergarten staff, related to digital judgement, digital practice and data protection. These aim to support ECEC staff to both act as role models in demonstrating digital judgement and to help children develop early ethical understandings of digital media and privacy (see Case Study NOR – Annex C). Finally, staff can also access targeted guidance and recommendations on preventing children from accessing harmful content and supporting them when they do.

The **United Kingdom (England)** has embedded online safety within its statutory guidance for schools (from age 3) on keeping children safe in education, its inspection framework for schools, and its statutory framework and inspection handbook for the early years (ages 0-5). These formal efforts are complemented by a guide to safeguarding children and protecting professionals in early years settings, and a curated list of related practical resources for ECEC staff.

In **Canada**, the Media Smarts website supports children, youth and the adults in their lives to develop the critical thinking skills required to engage with media as active and informed digital citizens. The website is run by a not-for-profit organisation and supported by the federal government. Among the website's collections is a targeted section for kindergarten teachers with lesson plans, worksheets, interactive activities, and information and guidance. Educators can also access a Digital Media Literacy Framework, disaggregated by education level from kindergarten upwards. The framework provides a road map for teaching nine key topics, four of which address online safety (i.e. ethics and empathy, privacy and security, media health, and consumer awareness). Media Smarts recruits volunteer teacher champions to pilot and help develop the material it publishes and to participate in a peer learning network.

The **Netherlands** Youth Institute, supported by the *Mediawijzer* network, launched the Toolbox for Parental Mediation in 2015 to build capacity among various professionals to better support families in developing digital parenting strategies. The toolbox includes a comprehensive set of age-specific fact- and tip-sheets about children and media for education professionals, as well as colleagues in healthcare and parent support. The information is based on academic research, addresses risks and opportunities, and discusses measures for children with specific needs. It also offers practical suggestions for holding discussions with parents, including those with a non-Dutch cultural background or limited functional literacy.

Sources: Canada: Canada's Centre for Digital and Media Literacy (n.d.[104]); Netherlands: de Haan, Nikken and Wennekers (2018[98]); Norway: Norwegian Ministry of Children and Families (2021[105]); Norwegian Directorate of Education (2017[106]); United Kingdom (England): Department for Education, England (2022[107]; 2021[108]).

Policy pointers

The analysis in this chapter indicates that policy efforts to support ECEC professionals to help protect young children in digital environments are less developed than those for parents. At the same time, there is a clear will among governments to position ECEC as an important element in supporting young children to safely and confidently navigate risks in digital environments and maximise digital opportunities with a view to developing the early digital literacy key to later success, safety and security. With this in mind, and as digital technologies are becoming more prevalent in ECEC, this section outlines some possible policy approaches to enhancing the role of the ECEC sector in the management of digital risks for young children.

Policy pointer 1: Clarify, formalise and extend support for the early childhood education and care sector

- Clarifying the role of ECEC professionals when it comes to young children's safety in digital environments can help operationalise the expectations placed on staff, taking into account the duality of their responsibilities (i.e. developing children's digital resilience and ensuring that their own interactions with digital technologies keep children safe). The clarifications could be usefully differentiated by professional role (e.g. ECEC owners, leaders, educators and support staff), by setting type (e.g. home-based or centre-based, public or private) and by children's age and be developed in collaboration with the sector to ensure they are reflective of working realities.

- Integrating the newly clarified responsibilities into relevant frameworks such as competency frameworks for training programmes, curriculum frameworks, or inspection and evaluation frameworks and statutory guidance could help further formalise these roles and foster constructive accountability approaches.
- Publishing government-endorsed and evidence-based guidance or recommendations across a range of relevant topics could better support ECEC staff to fulfil newly defined roles about digital safety. Moreover, integrating related supports into the formal training offer could help promote engagement. Over the longer term, developing more targeted and localised support measures such as digital protection specialists based in settings, networks or local authorities could provide more responsive support and guidance for staff in settings.

Policy pointer 2: Consider efforts targeting digital service providers and parents that can facilitate the work of the early childhood education and care sector

- Developing guidance, recommendations and standards for DSPs that pertinently cover young children but that also clarify how existing framework conditions apply to digital technologies and services used for educational purposes could help direct some of the responsibility for young children's safety to actors involved in the design and provision of digital solutions and facilitate procurement decisions for the sector. This may include, for example, guidance relating to privacy and data protection, or standards regarding safety and quality criteria for educational services or products.
- Ensuring that risk-focused guidance for parents is complemented by information about digital opportunities for young children would better align with guidance and objectives for the ECEC sector in many countries. This could usefully include greater nuancing around screen time recommendations considering the opportunities and risks of different types of digital engagement. Alongside this, efforts to communicate to parents the role of ECEC in supporting young children's safe and responsible use of digital technologies could help reduce the potential for dissonance between digital experiences in home and ECEC environments.

Policy pointer 3: Foster collaboration and coherence across the three groups of actors

- Encouraging dialogue and co-creation processes among ECEC staff, DSPs and parents could help these actors to share valuable sectoral knowledge and expertise and enhance their co-ordination and practices around young children's digital safety. For example, fostering collaboration between ECEC staff and DSPs would support DSPs to better understand the vulnerability of young children to specific risks, and therefore, to better design protective measures, including tailoring them by age. Greater collaboration could be achieved through formal actions such as using industry codes of conduct or standards to require DSPs to engage with other stakeholders in design processes or risk assessments and introducing co-operation with families on digital safety to ECEC frameworks or standards or through more informal actions, such as a one-off hackathon or similar co-creation events.
- Ensuring that strategic leadership efforts are in place, whether through a national policy, action plan or dedicated body, could help provide more joined-up thinking across the three groups of actors; minimise the duplication or overlapping of efforts; and support framework conditions, guidance and supports to stay abreast of technological change.

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4 Early childhood education curriculum and pedagogy in the digital age

This chapter discusses rationales for and ways to adapt curriculum frameworks and pedagogical approaches in light of the digital transformation. Curriculum frameworks can capture emerging trends that shape childhood and early childhood education and care (ECEC) and thereby constitute a core policy lever for making ECEC responsive to digitalisation. The chapter presents the notion of early digital literacy and discusses its integration into ECEC curriculum frameworks across countries. It discusses pedagogical approaches that can support a future-oriented curriculum framework and foster early digital literacy development, including through approaches that do not require screen exposure. Finally, the chapter reviews various digital tools that can be used with young children in ECEC settings and the principles for ensuring age-appropriate uses.

Key findings

Rationales to revise curriculum frameworks in light of the digital transformation include recognising changes in children's play, supporting 21st century skills from an early age, and setting common goals for all ECEC settings and staff.

Results from the *ECEC in a Digital World* policy survey (2022) indicate that, as of 2022, ECEC curriculum frameworks in a large majority of countries and jurisdictions recognise digitalisation but put the focus on the use of digital technologies and less so on seeing digitalisation as a trend shaping children's development, learning and well-being.

Digital literacy includes several dimensions that can be developed from an early age: getting a sense of how to protect oneself against digital risks; how to use digital technologies for play, self-expression and learning; and how a computer works (computational thinking). According to the *ECEC in a Digital World* policy survey (2022), curriculum frameworks recognise early digital literacy as an area for young children's learning and development in a majority of countries and jurisdictions. However, for most dimensions of early digital literacy, around half (or less) of those surveyed have specific development goals in their ECEC curriculum frameworks. Notions of computational thinking are rarely included in curriculum frameworks of countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022).

Pedagogical approaches used in ECEC generally aim to support whole-child cognitive, social and emotional development, which is well aligned with a 21st century curriculum. Rationales to revise pedagogical approaches in light of the digital transformation include using digital technologies to promote early digital literacy and to support innovative pedagogies for all areas of children's development.

Research points to several principles for using digital technologies with young children, such as ensuring that children are actively engaged and work together and that activities with digital technologies do not replace or limit other play and learning opportunities. Responses to the *ECEC in a Digital World* policy survey (2022) suggest that curriculum frameworks generally point towards pedagogical practices that are aligned with these principles.

Not all the digital tools that can be used with children offer the same potential to support children's learning, development and play. ECEC authorities of countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022) support the provision of multiple types of digital resources for ECEC settings, but there is a limited focus on materials offering greater opportunities to engage young children in more interactive, collaborative and playful activities, such as robotics kits.

Only a minority of countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022) indicate that their ECEC curriculum frameworks discourage the use of digital technologies with children. However, tensions exist for ECEC policy and practice as international and national guidelines tend to recommend no or minimal screen time for young children, especially before age 3.

Early digital literacy can be developed without direct exposure to screen-based digital tools through so-called unplugged approaches, which are particularly well-suited for the youngest children. Unplugged materials are not broadly supported by governments.

Introduction

A core dimension of making ECEC responsive to digitalisation is ensuring that it promotes children's development, learning and well-being, taking into account that digitalisation changes children's everyday life, their home and global environments, and their future. By defining goals, learning and development content, and types of activities for ECEC, curriculum frameworks are crucial to make ECEC responsive to changes in children's lives brought about by the digital transformation. Curriculum frameworks can be regulated, changed and adapted to evolving goals and quality standards, thereby constituting a core lever for policies. Furthermore, curriculum frameworks aim to constitute overarching agreements among various institutions and stakeholders at the national or subnational level, and to articulate a broad vision within the context of ECEC and education systems. As the topic of digitalisation and young children is often highly debated in many countries, curriculum frameworks can steer a common vision that goes beyond what is done in ECEC settings.

Pedagogy refers to the practices and methods employed by staff to support children's development, learning and well-being. How curricula are implemented through pedagogy has direct effects on children's experiences in ECEC (OECD, 2018[1]; Shuey et al., 2019[2]). Concerning digital technologies in particular, how they are used, for what purpose and in which environment greatly condition the impact that these technologies might have on children's development, learning and well-being. Pedagogical approaches to using digital technologies with children and, more generally, to prepare children for the future, are at the core of the mechanisms to make ECEC responsive to digitalisation. Pedagogical approaches are more difficult to impact through policies, but curriculum frameworks generally specify the pedagogical approaches to be used in ECEC settings. Furthermore, policies can influence these curriculum implementation and pedagogical practices through initial education and continuous professional development of the ECEC workforce (see Chapter 5).

This chapter starts by discussing the rationales for adapting ECEC curriculum frameworks in light of the digital transformation. It presents the notion of early digital literacy and discusses how this is integrated into curriculum frameworks. It continues with a discussion on the need to adapt pedagogical approaches to the challenges brought about by digitalisation. The chapter further discusses the various types of digital tools that can be used with children in ECEC settings. It ends with a selection of policy pointers.

Digitalisation and 21st century curriculum frameworks for early childhood education and care

Curriculum frameworks are major tools for steering the main directions of education systems. They set principles, goals, guidelines, values and approaches to children's development, learning and well-being in a country or jurisdiction. For ECEC, they generally cover knowledge, competencies and skills areas, the characteristics of children's interactions with staff and other children, and the experiences and resources that children are offered within the ECEC setting and sometimes in the home-learning environment. Curriculum frameworks can be revised and adapted to incorporate the main trends shaping ECEC and education systems, including digitalisation.

Rationales and goals for revising ECEC curriculum frameworks in light of the digital transformation

There are several reasons and directions to incorporate digitalisation into ECEC curriculum frameworks. A common feature of most ECEC curriculum frameworks is to place children at the centre and build on children's perspectives as a driving principle of ECEC. This strong focus on children's global development and well-being, in addition to learning, is a specificity of ECEC and is mostly justified by the child's age.

From this point of view, curriculum frameworks can reflect the prevalence of digital technologies in children's lives and, more specifically, in their play and discovery of the world, which is the first reason to review curriculum frameworks in light of digitalisation. Most OECD countries have ECEC curriculum frameworks that are centred around children's interests and recognise play as central to children's development, learning and well-being (OECD, 2021[3]). Over the last decades, young children have started to engage with a range of technologies through their play activities (Marsh et al., 2016[4]). An important change to children's play universe is the relationship between online and offline spaces. Children now move across physical and virtual domains when playing and integrate material and immaterial practices. Curriculum frameworks can recognise the extension of the universe of play brought about by digitalisation and how digitalisation changes children's everyday experiences. The focus can be on building new opportunities while mitigating risks.

The digital transformation changes the world of work and societies and, therefore, the skills mix people need to thrive in a digital world (OECD, 2019[5]). Some skills gain in importance while others become less important (see Chapter 2). The ability to learn, the capacity to solve problems with complex sets of information and creative thinking are viewed as crucial skills in a rapidly changing environment. The digital transformation also creates new jobs in digitalisation-intensive sectors. Curriculum frameworks for higher levels of education are being adapted to incorporate computational thinking, coding or other digital skills. A second rationale for revising ECEC curriculum frameworks is to promote the development of these skills at an early age to ensure continuity with primary education, but also because there might be advantages to starting at an early age. However, curriculum frameworks for the early years are not always articulated around specific skills areas but more broadly around children's development and well-being (OECD, 2021[3]). Preparing for primary education is also not an explicit goal of ECEC in several countries. However, digitalisation can be integrated into curriculum frameworks as a general trend shaping children's future or, more specifically, as a reason to promote children's development and skills in some areas.

Ensuring equal opportunities is the main argument for making ECEC responsive to digitalisation (see Chapter 6). Digitalisation has exacerbated inequalities between geographical areas and between individuals according to their socio-economic background. For instance, high-skilled occupations are generally less exposed to the risk of automation and children from low socio-economic backgrounds are less likely to enter these occupations. Research also shows the importance of the family context for developing digital literacy (see Chapter 6). Finally, the gender gap in access to science, technology, engineering and mathematics (STEM) and high-tech occupations can be mitigated by acting against gender stereotypes at an early age. ECEC can help create equal opportunities for all children to benefit from the digital transformation. By setting shared goals and approaches for all ECEC settings and staff, curriculum frameworks can help ensure that children equally benefit from opportunities and are protected against risks related to digitalisation, which is the third main reason to review curriculum frameworks. A specificity of ECEC is the heterogeneity of ECEC settings and the diversity of ECEC staff's education, background and experience. Curriculum frameworks play an important role in setting common goals for all settings and staff.

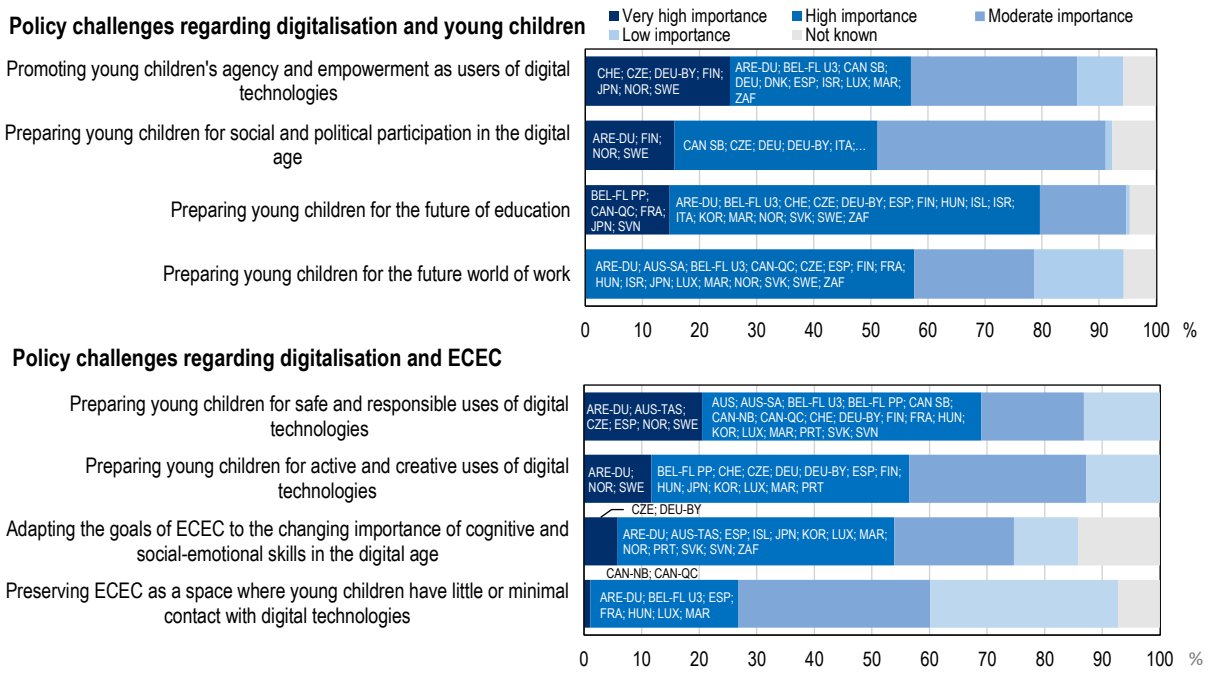
While curriculum frameworks play a crucial role in setting common and age-appropriate goals and approaches to make ECEC responsive to digitalisation, this policy lever should not be activated in isolation. Other policies, such as general guidelines for protecting children, ECEC workforce development, governance, funding and monitoring (discussed in other chapters of this report), are also important and need to be considered together with curriculum framework policies. Furthermore, evidence on approaches and tools that can support changes made to curriculum frameworks to integrate digitalisation and their impact on children is still lacking. Further research is needed in these areas.

Challenges related to curriculum frameworks for ECEC in a digital world

The *ECEC in a Digital World* policy survey (2022) asked countries about the important policy challenges regarding digitalisation and young children generally and digitalisation and ECEC specifically. While risk-focused challenges dominate policy agendas around digitalisation for young children in countries and jurisdictions having responded to *ECEC in a Digital World* policy survey (2022) (see Chapter 2), respondents also pointed to challenges that are rationales to adapt curriculum frameworks. For instance, preparing young children for the future of education in light of the changes brought about by digitalisation is considered to be a key challenge of almost all countries participating in the survey (Figure 4.1) and ranks third among the ten challenges presented to countries in the *ECEC in a Digital World* policy survey (2022) (see Chapter 2, Figure 2.4). Preparing young children for the future world of work and for social and political participation in the digital age or promoting young children's agency and empowerment as users of digital technologies are considered to be of relatively less importance, but are still perceived to be important challenges for a majority of countries and jurisdictions. This might come from the fact that in some countries, the goals of ECEC are mainly framed around children's well-being and less with the view to preparing children for their future social and economic roles.

Figure 4.1. Policy challenges related to 21st century curriculum

Percentage of countries and jurisdictions identifying the following policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. Some countries and jurisdictions responded for multiple curriculum frameworks and therefore appear more than once with the same country and jurisdiction code. See Annex A. The response category "very high importance" was limited to three out of ten response items maximum.
BEL-FL PP: pre-primary education in Belgium (Flanders). BEL-FL U3: ECEC for children under age 3 in Belgium (Flanders). CAN SB: school-based sector in Canada.
Items are sorted in descending order by the share of countries selecting response categories "very high importance".
Source: OECD (2022[6]), *ECEC in a Digital World* policy survey, Tables B.1 and B.2.

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Along with these challenges related to digitalisation and young children, when asked about the specific challenges for ECEC, two-thirds of participating countries and jurisdictions indicated that preparing young children for safe and responsible uses of digital technologies was of "very high" or "high" importance. Preparing young children for active and creative use of digital technologies is also considered a priority for ECEC by a slight majority of participants. These two challenges rank high compared to other challenges listed in the *ECEC in a Digital World* policy survey (2022) (see Chapter 2, Figure 2.7). These results suggest that countries see the importance of developing multiple dimensions of digital literacy to empower and protect children as users of digital technology. Beyond the use of digital technologies, one approach consists of adapting the goals of ECEC to the changing importance of cognitive and social-emotional skills in the digital age. This more general challenge is considered of "very high" or "high" importance by a majority of countries and jurisdictions. Just over one-quarter (27%) of countries and jurisdictions [Belgium (Flanders for children under 3), Canada (New Brunswick and Quebec), France, Hungary, Luxembourg, Morocco, Spain and the United Arab Emirates] aim to preserve ECEC as a space where young children have little or minimal contact with digital technologies. Overall, answers from countries and jurisdictions point towards challenges that require curriculum framework policies alongside others discussed in this report.

Approaches to digitalisation in curriculum frameworks and other guidelines

ECEC curriculum frameworks vary substantially across countries in their general approach and level of detail. This reflects differences across countries in the goals assigned to ECEC and how curriculum frameworks are used and framed to support these goals. Countries where ECEC is seen as a way to foster children's development, learning and well-being tend to have curriculum frameworks that are framed around these whole-of-child goals and the general environment in which children develop (e.g. Ireland, Japan, Sweden). Some countries see ECEC as advancing children's learning and development in a number of areas that might be explicitly linked to primary education (e.g. Portugal, South Africa). Curriculum frameworks in these countries tend to be more specific. Because of these fundamental differences in how curriculum frameworks are framed, the way they incorporate digitalisation also differs substantially. Curriculum frameworks that are drafted in general terms may not mention digitalisation specifically, but they can still set expectations for ECEC to respond to digitalisation as one of the trends shaping children's lives. More specific curriculum frameworks are more likely to explicitly mention digitalisation and include skills development goals in this area.

Recognising these differences in approaches, the *ECEC in a Digital World* policy survey (2022) asked participating countries to indicate how digitalisation is recognised in their ECEC curriculum framework or other relevant documentation to account for the fact that other documents might complement the curriculum framework (see Figure 4.2). In a large majority of countries and jurisdictions, the framework sees digital technologies as "one among many other tools" to be used with children in ECEC settings (with more than 90% of countries and jurisdictions responding this is the case to a "great" or "moderate" extent). The focus is, therefore, on the possibility of integrating digital technologies into interactions with children as part of broader approaches to foster their development, and alongside other pedagogical tools.

Beyond the use of digital technologies, curriculum frameworks can recognise that digitalisation shapes children's development and learning more generally. For instance, in pre-primary education curriculum frameworks (3-5/primary entry), digitalisation is seen as a trend "shaping how young children learn and develop in our time" in almost all participating countries and jurisdictions and as a trend "shaping young children's socio-emotional development" in a majority of them. This is, to some extent, the case but less so in curriculum frameworks covering children 0-5/primary school entry.

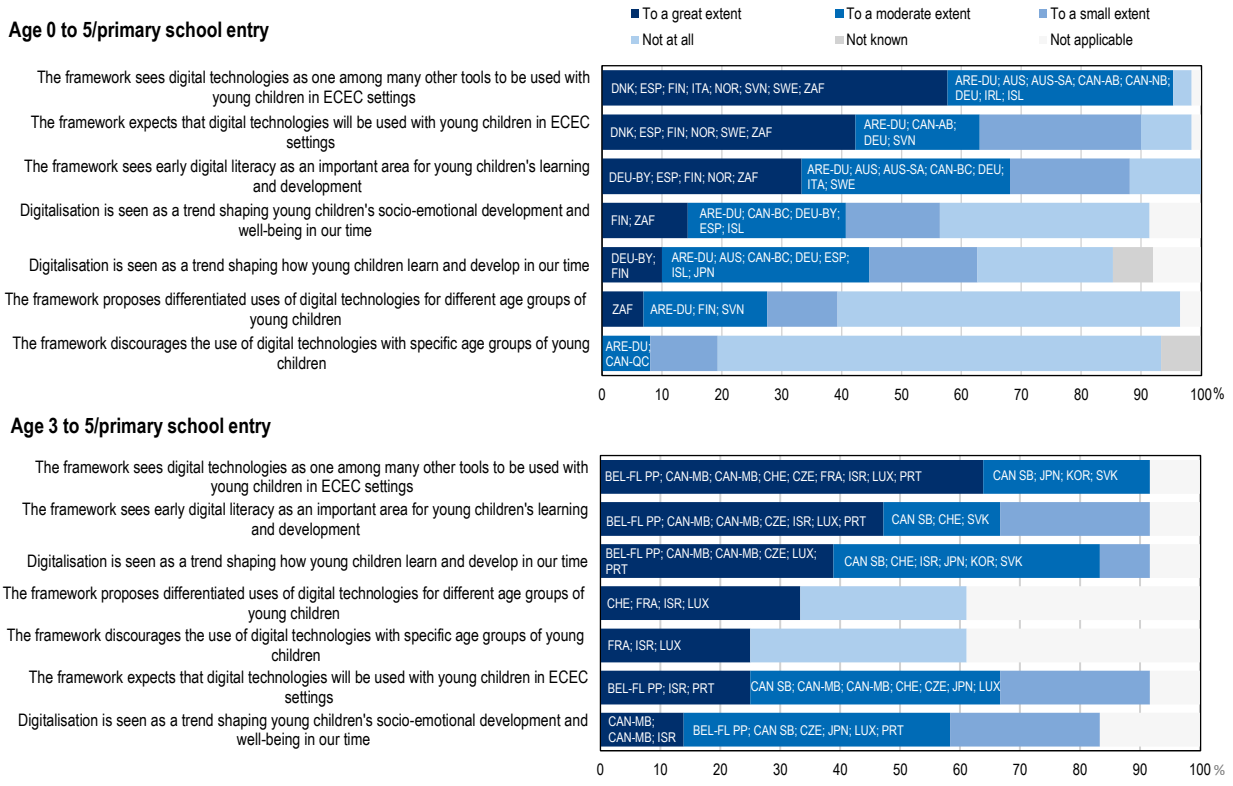
Responses to the *ECEC in a Digital World* policy survey (2022) suggest that some countries and jurisdictions integrate digitalisation into their curriculum frameworks as a trend shaping children's learning, development and well-being but also expect digital technologies to be used with children in ECEC settings.

This is the case “to a great extent” for Belgium (Flanders, 3-5/primary school entry), Denmark, Finland, Israel (3-5/primary school entry), Norway, Portugal (3-5/primary school entry), South Africa, Spain and Sweden. This chapter, therefore, gives more information on these countries and jurisdictions while also mentioning others.

Overall, ECEC curriculum frameworks are more specific about digitalisation when they target pre-primary education children as reflected by the fact that a higher percentage of countries have answered to a “greater extent” questions on the recognition of digitalisation in curriculum frameworks for pre-primary education than for curriculum frameworks covering a broader age range. Curriculum frameworks covering a broader age range might favour a whole-child approach to the goals of ECEC and approaches with children and might therefore be less specific than pre-primary curriculum frameworks about digitalisation. Furthermore, curriculum frameworks propose differentiated uses of digital technologies with specific age groups of young children to a greater extent for pre-primary education curriculum frameworks than for those covering the full age range. This might be because countries adopt a more cautious approach for the youngest children.

Figure 4.2. Perspectives on digitalisation in early childhood education and care curriculum frameworks

Percentage of countries and jurisdictions reporting the following, by age coverage of the curriculum framework and other relevant documents, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. Some countries and jurisdictions responded for multiple curriculum frameworks and therefore appear more than once with the same country and jurisdiction code. See Annex A. BEL-FL PP: pre-primary education in Belgium (Flanders). CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).

Items are sorted in descending order by the share of countries selecting response categories “very high importance”.

Source: OECD (2022[6]), *ECEC in a Digital World* policy survey, Tables B.6 and B.8.

StatLink https://stat.link/4vwqa3

To address the lack of specificity about digitalisation in their ECEC curriculum frameworks, some countries and jurisdictions have developed digitalisation strategies for education or other types of documents (e.g. directives, statements) that are relevant for ECEC in the context of the digital transformation and that complement the curriculum framework. These strategies put ECEC into a broader perspective, including other levels of education and possibly the role of families.

Among survey participants, such additional documents exist in Australia, Belgium (Flanders, pre-primary), Canada, the Czech Republic, Denmark, Germany (Bavaria), Finland, Ireland, Israel, Luxembourg (for more information see Case Study LUX – Annex C), Japan, Slovenia, South Africa, Switzerland, Sweden and the United Arab Emirates. Korea has also developed a series of initiatives to complement the ECEC curriculum framework that includes little explicit reference to digitalisation (Case Study KOR – Annex C). These documents generally cover the whole education system and are more specific about digitalisation than curriculum frameworks. They are, for instance, specific on the types of digital skills to be developed and on the methods to be used with children. While they typically do not give indications for ECEC in particular or explicit recommendations for practices with young children, some countries and jurisdictions have developed a digitalisation strategy specifically for ECEC (Case Study DEU_Bav – Annex C). Furthermore, staff may not be aware of these documents that go beyond education institutions and may tend to mainly focus on the curriculum framework. In most OECD countries, curriculum frameworks include or are accompanied by implementation guides (OECD, 2021[3]). To ensure a consistent approach to digitalisation, it is important to update these guidelines so that they state clear directions on how ECEC settings and staff can respond to digitalisation in their approaches with children.

Early digital literacy and its integration into early childhood education and care curriculum frameworks

Definitions

The early development of skills that are needed in a digital world can be a focus area of curriculum frameworks. Beyond the general view that the skills mix to thrive in a digital world has changed, for instance because skills that are used for tasks that can now be automated will be less needed, some new skills and knowledge are important to benefit from the opportunities brought by digitalisation and protect against its risks. These skills are grouped under the umbrella of digital literacy and are increasingly seen as important developmental and well-being areas that can be integrated into curriculum frameworks.

Digital literacy includes the ability to use digital devices or software, to be capable of consuming and producing digital content, and to meaningfully participate in a digital world (Nascimbeni and Vosloo, 2019[7]). The definition has evolved towards a more comprehensive understanding of what it should mean to be digitally literate today and has moved away from the concept of “digital skills”, which relates more narrowly to the use of digital devices. Digital literacy encompasses notions of being able to use digital technologies but also understanding the risks and benefits of digital technologies and being able to protect oneself and realise the potential of digital technologies. Digital literacy is understood as a combination of knowledge, skills and attitudes involving the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work and participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property-related questions, and problem solving and critical thinking (European Council, 2018[8]).

For children, the OECD Recommendation on Children in the Digital Environment advocates to promote digital literacy as “an essential tool for meeting the needs of children in the digital environment”. The recommendation does not propose a formal definition and has a clear focus on risk minimisation, but it also recognises that digital literacy encompasses other aspects, such as an understanding of how the

digital environment operates and how actions in the "online world" can have consequences in the "offline world". These directions are similar to those followed by other international organisations, governments and researchers that recommend a holistic approach to digital literacy for children. An important element emerging from the research is the call for an active role for children as content creators and engaged actors. The notion of empowerment also seems particularly relevant for children, as it goes with protection and helping children to benefit from opportunities while mitigating risks. Overall, several dimensions are important: understanding the role of digital technologies and the types of technologies that can be used for different purposes, the skills to use these technologies, the ability to translate uses into outcomes and derive benefits, and the ability to prevent potential harms from participating in the digital environment.

Experts in computer science have developed the concept of computational thinking and while multiple definitions exist, it can be considered as one aspect of digital literacy. The notion of computational thinking encompasses a broad set of analytic and problem-solving skills, dispositions, habits, and approaches most often used in computer science, but that can serve in multiple other contexts (Barr, Harrison and Conery, 2011[9]; Barr and Stephenson, 2011[10]; Lee et al., 2011[11]). One commonly used definition is that computational thinking describes the thought processes involved in formulating problems and in constructing and/or decomposing the sequential steps of a solution in a form that can be executed by a computer, a human or a combination of both (Wing, 2011[12]; Aho, 2011[13]; Kim and Lee, 2016[14]). Computational thinking represents a type of analytical thinking that shares similarities with mathematical thinking (e.g. problem solving), engineering thinking (designing and evaluating processes) and scientific thinking (systematic analysis) (Bers, Strawhacker and Sullivan, 2022[15]). The concept of computational thinking does not focus on a particular technology, but on the ideas and the science behind the technology of the digital revolution. Computational thinking can be developed both through direct engagement with digital tools and through approaches that do not entail their use, known as "unplugged approaches".

This report adopts the notion of "early digital literacy" to situate the concept of digital literacy in the context of early childhood. Early digital literacy is about laying the foundations of digital literacy and children's approaches to and knowledge of digital technologies as it develops throughout the years when they first engage with these technologies but are typically not yet ready to make an informed use of them fully autonomously. Children may appear to acquire an understanding of digital technologies at a very early age as they can operate some devices, but this does not necessarily involve the development of other dimensions of digital literacy. The characterisation of young children as "digital natives" has been shown to be a myth and the development of early digital literacy requires efforts in the same way as the development of early literacy and numeracy does (Burns and Gottschalk, 2020[16]).

Early digital literacy encompasses all the dimensions of digital literacy, as they can find expression in the developmental stages of young children (Figure 4.3). At an early age, children can learn about some risks of digital technologies, such as excessive use, inappropriate content and privacy issues, and how to protect themselves against these risks, which are key aspects of digital literacy. These include, among others, a basic understanding that the Internet can be a commercial space and that data can be shared and used by others. For instance, in their interactions with smart toys, children might not realise that when telling toy robots personal information, the toy can record their conversations. Children can be trusting of these devices and influenced by them (Williams et al., 2019[17]). Children can also learn to benefit from the opportunities of digital technologies by being exposed to content that steers their curiosity and becoming actively engaged in creative activities. They can also be introduced to some notions of computational thinking, such as solving problems by breaking them down into sequential steps and getting an understanding of how a computer works (Bers, Strawhacker and Sullivan, 2022[15]). For children, acquiring both digital literacy, in general, and computational thinking, in particular, consists of becoming empowered users of digital technologies. Developing early digital literacy can therefore be a long-term investment that prepares for working and living with any technology in the future. Concerning computational thinking more specifically, rationales to start at an early age also include preparing for primary education and addressing socio-economic and gender inequalities in the development of these skills. Digital literacy, in general, and

computational thinking, more specifically, can be developed both with and without direct exposure to digital devices, as discussed later in this chapter, or a combination of both approaches.

Figure 4.3. Key dimensions of early digital literacy

Dimensions of early digital literacy integrated into curriculum frameworks

Curriculum frameworks can promote a shared vision by all ECEC staff and leaders on developing early digital literacy. In countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022) (OECD, 2022[6]), early digital literacy is seen as an important area for young children's learning and development (to a great or moderate extent) in 68% of the countries and jurisdictions with ECEC curriculum frameworks and guidelines for ages 0-5/primary school entry and in 66% of the countries and jurisdictions with curriculum frameworks and guidelines for ages 3-5/primary school entry (see Figure 4.2).

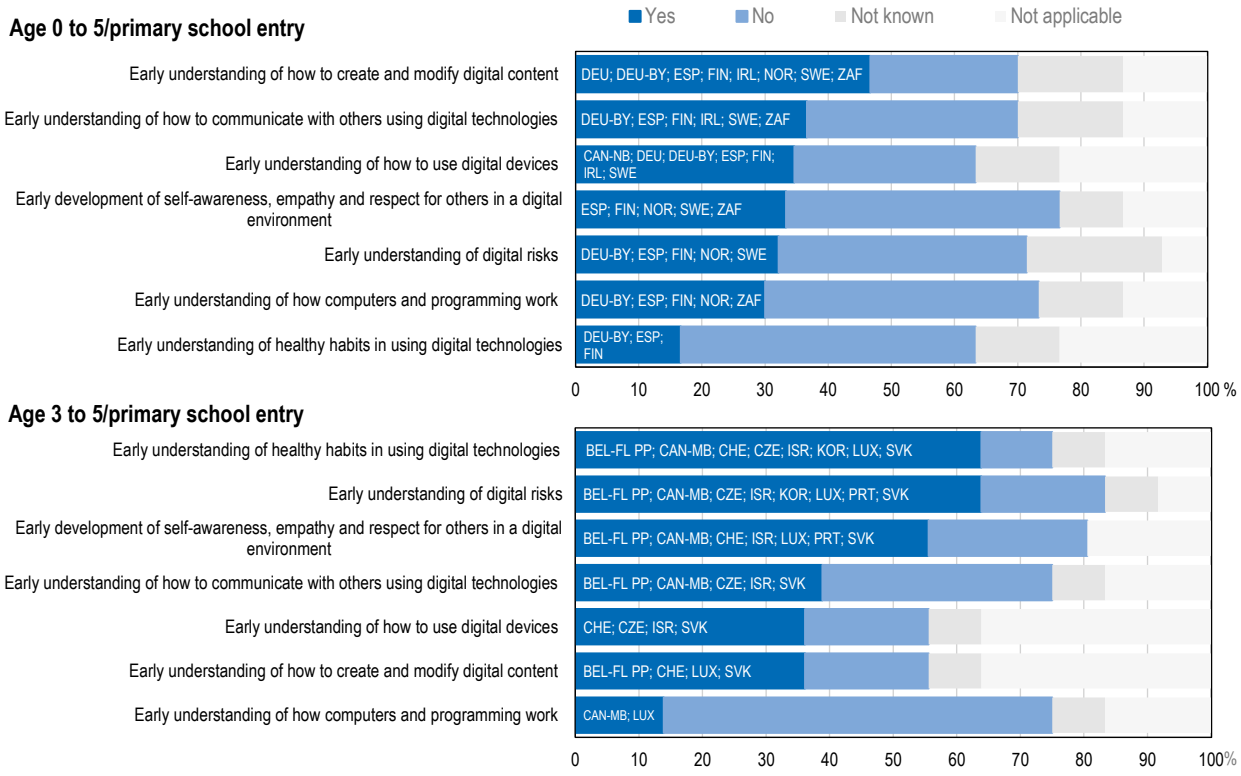
However, when asked about the components of early digital literacy specified in curriculum frameworks, only between 14% and 64% of the surveyed countries and jurisdictions have specific goals for early digital literacy development, depending on the dimension of early digital literacy and the age coverage of the curriculum framework. Among the specific dimensions of early digital literacy, an early understanding of how to create and modify digital content is the dimension that is incorporated in curriculum frameworks and guidelines for ages 0-5/primary school entry by the highest percentage of countries (Figure 4.4). Getting an early understanding of how to communicate with others using digital technologies is also at the top. The focus, therefore, seems to be placed on the opportunities these tools bring. An early understanding of healthy habits in the use of technology (e.g. sleep, posture) is the least commonly incorporated dimension for this age group. Norway, Spain and Sweden have many dimensions of early digital literacy incorporated into their curriculum frameworks. Some countries include only one or two. In Germany, the focus is on using digital devices and creating content. In curriculum frameworks for ages 3-5/primary school entry, a higher percentage of countries have curriculum frameworks that incorporate specific dimensions of early digital literacy. Dimensions around understanding risks and healthy habits are commonly included and rank at the top. Early development of self-awareness, empathy

and respect for others in a digital environment is also a relatively common focus area for those curriculum frameworks that target early digital literacy, for both age groups.

Computational thinking (early understanding of how computers and programming work) is incorporated into the curriculum frameworks of only a limited number of countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022): Canada (Manitoba, kindergarten sector), Finland, Germany (Bavaria), Luxembourg, Norway, South Africa and Spain. This dimension of early digital literacy is, therefore, still relatively rare in ECEC curriculum frameworks.

Figure 4.4. Components of early digital literacy specified in curriculum frameworks and other relevant documents

Percentage of countries and jurisdictions reporting the following, by age coverage of the curriculum framework, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. Some countries and jurisdictions responded for multiple curriculum frameworks and therefore appear more than once with the same country and jurisdiction code. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order by the share of countries selecting response categories "very high importance".
Source: OECD (2022[6]), *ECEC in a Digital World* policy survey, Tables B.6 and B.8.

StatLink https://stat.link/ct1pyi

In countries where early digital literacy is incorporated into ECEC curriculum frameworks, the focus appears to be placed on the dimensions that are considered to be more important for children by experts, governments and international organisations, such as raising awareness of the risks or involving an active role of children (creating content, using technologies for communicating). However, there are broad-ranging differences in how early digital literacy is included in curriculum frameworks, even among countries that have generally indicated in their responses that digitalisation is integrated into their

curriculum frameworks. Some countries and jurisdictions make explicit reference to digital literacy in the curriculum framework, while in others, the focus is broad and references are implicit (Box 4.1).

Box 4.1. Early digital literacy in early childhood education and care curriculum frameworks

Countries have different strategies for incorporating early digital literacy into their curriculum frameworks. References to early digital literacy can be quite specific or general.

In **Canada (Manitoba, kindergarten sector)**, the curriculum framework "A Time for Learning, A Time for Joy" includes a section on "Landscape of Literacy with Information and Communication Technology". It defines digital literacy as "thinking critically and creatively, about information and about communication, as citizens of the global community, while using information and communications technology (ICT) responsibly and ethically". The starting point is that children nurture the seeds of digital literacy within pre-primary settings. The focus is placed on inquiring with ICT (plan and question, gather and make sense, produce to show understanding, communicate, and reflect). The framework sees the integration of digital literacy in ECEC as an opportunity to foster both social-emotional and cognitive development. It states that technology should be available to children on a "just in time, just enough" basis, focusing on interactive whiteboards and touch-screen tablets, digital cameras, and programmable robots.

In **Finland**, ICT competencies and media literacy are recognised as important skills for the future and are included in the National Core Curriculum for ECEC as a transversal competence. However, several studies have indicated that the integration of these skills into teaching and ECEC activities varied among ECEC centres and municipalities. Therefore, in 2020, the Ministry of Education and Culture launched a pilot programme focusing on developing new literacies. The National Agency for Education co-ordinates the programme together with the National Audiovisual Institute. The aim is to strengthen the following skills for children: ICT skills such as responsible and safe use of ICT, creative work with ICT and interacting with others; media literacy such as interpreting information from the media and operating in media environments; and programming skills such as computational thinking and programming environments. The programme was developed in close co-operation with experts and ECEC professionals.

In **Japan**, the curriculum framework for pre-primary schools is expressed in broad terms but also includes more specific goals for children. It emphasises the importance of pre-primary education for lifelong learning. In 2017, the curriculum framework was revised to state that children should become creators of sustainable societies. Each setting should set up a curriculum framework in line with the national one with specific aims. In addition, since 2017, the curriculum framework should clarify the daily life that is appropriate for children and the type of skills children should develop. It also states that activities need to be selected and developed by setting concrete aims and content, and that children should gain the experience they need through proactive interaction with the environment. Emphasising the importance of direct experiences in early childhood, it recommends when using equipment such as audio-visual teaching materials and computers, to supplement the experience to make it one that is otherwise difficult to obtain in life at the ECEC centre, and consider how it relates to children's experiences (Case Study JAP_3 – Annex C).

The **Portuguese** curriculum framework is organised by learning areas and includes one on the digital world and the use of digital technologies. It recognises that children interact with complex instruments and techniques and have access, through the media and digital technologies, to knowledge about more distant realities. The objective is to lay the foundations for structuring scientific thought, build a research attitude, centred on the ability to observe, the desire to experiment, the curiosity to discover from a critical perspective and knowledge sharing. The area is embodied in the knowledge of the world domain

together with sciences methodologies and approaches. Learning areas to be promoted are understanding the functions of digital technologies, using various digital supports carefully and safely, and developing a critical attitude towards digital technologies. It states that understanding technologies implies that the child is not only a consumer (consulting, watching films, etc.), but also a producer (photographing, recording, etc.), thus expanding the child's knowledge and perspectives on his/her reality.

In **Sweden**, the curriculum framework defines broad objectives for ECEC, such as encouraging children to express their thoughts and ideas and creating the conditions for this to happen. The starting point should be the interests of children, as well as the knowledge and experiences that children have already acquired. Digital technologies can be part of these experiences. The focus is on a holistic approach to children's development and includes several broad areas of development and learning. The curriculum framework specifically states that "each child should develop an interest in stories, pictures and texts in different media, both digital and other, and their ability to use, interpret, question and discuss them" and that ECEC staff should "challenge children's curiosity and understanding of language and communication, and also of mathematics, science and technology" and "create conditions for children to develop their ability to communicate, document and convey occurrences, experiences, ideas and thoughts using different forms of expression, both with and without digital tools".

In **South Africa**, the curriculum framework is strongly oriented towards the development of 21st century skills. It states, among other outcomes, that young children should learn to use science and technology effectively and critically, showing responsibility towards the environment and the health of others. It also states that early education should lay strong foundations for lifelong learning, which in a broad sense can be seen as preparing children for a changing world, including for changes brought about by digitalisation.

Source: Country input for OECD (2022[6]) and countries' curriculum frameworks.

Early digital literacy and computational thinking in relation to other developmental areas

Generally, research suggests making connections between domains of education and development where activity across domains is mutually supportive of learning in each domain (National Academies of Sciences, Engineering, and Medicine, 2022[18]). There can be value in partial integration, full integration or interdisciplinary approaches, but research suggests eschewing superficial connections between domains or add-on approaches without any meaningful integration. More integration is not necessarily better. Research comparing various types of integrated curricula does not always support full integration.

Digital literacy is linked specifically with computational thinking, on the one hand, and with other areas of learning, on the other (Bers, Strawhacker and Sullivan, 2022[15]). Advocates of promoting computational thinking from an early age argue that it fosters development in many areas: problem solving and mathematical thinking; cognitive development more broadly such as number sense, language skills and visual memory; and social-emotional development such as collaboration skills, social interactions and pro-social behaviour, for instance through working with other children on a project.

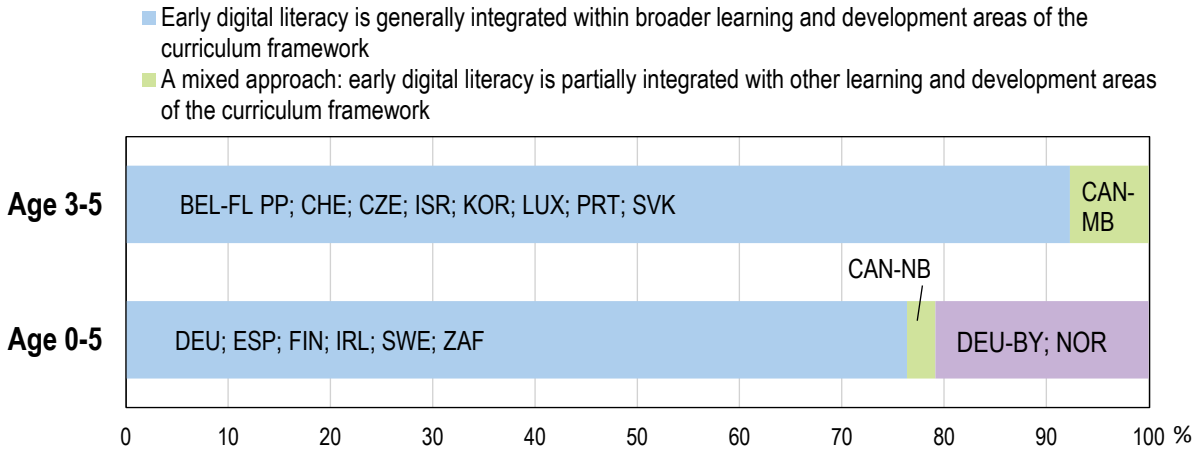
Given that computational thinking might support learning across domains and that several learning areas can provide a meaningful context for engaging in computational thinking, there are arguments for integrating computational thinking with other learning and development areas. In particular, some research argues that computational thinking is well suited to be part of science, technology, engineering, arts, mathematics (STEAM) education that proposes an integrated approach to those areas (Bers, Strawhacker and Sullivan, 2022[15]). Within an early childhood context, a STEAM education means finding ways for children to explore these subjects in an integrated and playful manner through hands-on projects, books, discussions and experiments. New technological tools such as robotics kits and programming languages

designed for young children provide ways for children to engage in STEAM education. However, it is important to note that this body of research is in its infancy and some claims are yet lacking systematic verification in empirical studies. Furthermore, experiences of integrating computational thinking into pre-primary education at a large scale (e.g. at a country or subnational level) are rare or very recent, which makes it difficult to assess their outcomes conclusively.

Most countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022) indicated that early digital literacy is integrated within broader learning and development areas of curriculum frameworks, with the exception of Germany (Bavaria) and Norway, where early digital literacy is considered as a learning and development area in its own right (Figure 4.5). These results are similar to those obtained from a broader survey covering several levels of education which shows that, across countries, digital skills tend to be integrated into existing subject areas (Burns and Gottschalk, 2020[16]). For instance, in South Australia, the "STEM in the Early Years" project aims to increase the knowledge, skills and dispositions of children and educators in STEM learning and teaching within a play-based curriculum (Case Study South AUS – Annex C). The skills identified by the project, curiosity and critical and creative thinking, are both important to navigate a digital world. Digital devices are used as an additional mode of representation of science issues aiming to expand communication and children's level of engagement.

Figure 4.5. Early digital literacy in relation to other areas of the curriculum framework

Percentage of countries and jurisdictions reporting the following, by age coverage of the curriculum framework, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). CAN-MB: kindergarten sector only in Canada (Manitoba).
Source: OECD (2022[6]), *ECEC in a Digital World* policy survey, Tables B.7 and B.9.

StatLink https://stat.link/ylasp8

Pedagogical approaches in a digital world

While curriculum frameworks are important to set common guidelines for all ECEC staff on the goals of ECEC and on specific learning and development content, pedagogy is at the core of the interactions with staff that matter the most for children's development, learning and well-being (OECD, 2021[3]). There are multiple understandings of pedagogy and the relationships between curriculum and pedagogy are complex. In a narrow sense, pedagogy refers to the practices and methods employed by staff to support children's development, learning and well-being. With this definition, pedagogy can be considered as a subsidiary to curriculum and a variety of pedagogical practices may be employed within a given curriculum

framework. In a broader sense, pedagogy can denote the theoretical foundation of a curricular approach, setting principles and values for specific methods of teaching or interacting with children. Taken in this sense, pedagogy can be considered to both inspire and support curriculum (OECD, 2021[3]).

The increasing focus of curriculum frameworks on preparing children for a changing world and supporting, from an early age, the development of 21st century skills such as collaboration, persistence, creativity and curiosity, as well as becoming lifelong learners, requires a correspondingly strong focus on pedagogies conducive to the development of these skills (Paniagua and Istance, 2018[19]). Likewise, the development of digital literacy that encompasses various domains and skills calls for pedagogical approaches deliberately designed to foster these competencies. Overall, preparing young children for a digital world requires pedagogical approaches that help to both attain the new specific goals set by curriculum frameworks (pedagogy as a subsidiary to curriculum) but also more generally to support future-oriented ECEC.

Rationales for adapting pedagogical approaches

A first rationale for adapting pedagogical approaches is to support a 21st century curriculum. The digital transformation changes the skills mix required to work and live, with skills required to perform routine tasks becoming less in demand while skills to perform non-routine tasks are more in demand (OECD, 2019[5]). These include advanced cognitive skills but also many social-emotional skills such as co-operation, creativity and the ability to learn. Aligned pedagogical approaches are a critical enabler of the development of these skills.

In many countries, ECEC, in fact, already puts the focus on comprehensive cognitive, social and emotional development. Staff are expected to use multiple pedagogical approaches that are play-based, children-centred and developmentally appropriate, and view learning as an active exchange between the child and the environment (constructivist/interactive approach) (OECD, 2021[3]). These approaches are well suited to support a 21st century curriculum. The recognition of the importance of the quality of the interactions children experience (or process quality) for their learning, development and well-being should be accompanied by policies (e.g. ECEC staff education and training; monitoring tools) that encourage pedagogical approaches supporting broad development rather than narrow didactic teaching. On these aspects, ECEC may therefore need to adapt to a lesser extent than other levels of education. However, ensuring that all staff are prepared to design such learning and development environments for all children is still challenging in many countries. These questions have been discussed in depth in previous Starting Strong publications (OECD, 2021[3]; 2019[20]) and are therefore not further addressed in this report.

A different but related rationale is that digital technologies might enable implementing innovative pedagogies that offer opportunities for more interactivity, feedback, self-regulation, collaboration and exposure to open-ended challenges.

A third rationale comes from the fact that the digital transformation also means that more tasks at work and in everyday life will be performed with digital technologies, creating a need for all children to develop digital literacy. Using digital technologies and integrating digital technologies in practices with young children is generally seen as the most direct way to develop early digital literacy. However, other pedagogical approaches are also possible and both early digital literacy, in general, and computational thinking, more specifically, can also be developed without or with very limited exposure to digital tools, through so-called “unplugged approaches”.

The following sections discuss pedagogical uses of digital technologies and approaches to foster digital literacy. When digital technologies are used with children in ECEC settings, this needs to be done to protect children against the harms that may result from heavy screen exposure and privacy breaches. Having clear guidelines and regulatory frameworks that protect children against multiple digital risks (e.g. exposure to inappropriate content, collection and misuse of personal data) is a condition for any use of digital technologies with children in ECEC settings (see Chapter 3).

Pedagogical uses of digital technologies: Meaning and guiding principles

ECEC staff build on their professional knowledge and experiences about how young children play, learn and develop to provide children with meaningful learning and development opportunities. When doing so, ECEC staff take pedagogical decisions. ECEC staff take decisions on using or not digital technologies in certain situations and when they use digital technologies on how and for what reason to use them (Early Childhood Australia, 2018[21]). All these decisions and practices can be broadly called the pedagogical uses of digital technologies.

Different pedagogical traditions exist in ECEC in OECD countries and there is generally no consensus on a pedagogy that should prevail, as various factors affect how pedagogical practices influence process quality in practice, such as cultural factors. Furthermore, most curriculum frameworks in participating countries and jurisdictions encourage the use of multiple pedagogical approaches (OECD, 2021[3]). In their use of digital technologies with children, it is expected that staff follow the pedagogical approaches that they generally use for other activities or with other materials.

However, experts have highlighted some guiding principles that are particularly important for the use of digital technologies with children. Guidelines in some countries underscore that digital technologies can be used to complement staff's practices with children but not to replace other activities and even less so interactions with adults or children. In the United States, recommendations indicate that digital technologies can be used as a means for a goal and not for their own sake (NAEYC and Fred Rogers Center for Early Learning, 2012[22]). Highlighting that interactions between children and adults are essential to children's development, this position argues that digital technologies can be used to support learning and children's access to new content but should not replace creative play, real-life exploration, physical activity, outdoor experiences, conversation or social interactions. Passive use of technology should be avoided.

Using digital technologies with children requires establishing clear routines. Children like to play with digital tools and like with other games, playing with digital games/toys can help them concentrate and focus on a task while providing satisfaction. However, children can also become unduly attracted to using digital technologies, partly because designers of digital material aim to create highly engaging experiences for users (Early Childhood Australia, 2018[21]). It is, therefore, important for ECEC staff to establish routines and structures to move from an activity with digital technologies to an activity without. While protecting children in the short run, this approach would also empower children to use digital technologies safely.

While research papers and guidelines highlight the importance of several conditions to ensure good outcomes, curriculum frameworks in ECEC are often quite general on the use of digital technologies or do not mention it explicitly. There are, however, some examples of countries where curriculum frameworks are explicit on how to use digital technologies with children (Box 4.2). When curriculum frameworks are not specific about it or when they are modified to become more future-oriented, it is particularly important to ensure that staff are well trained for the use of digital technologies with children and have a good understanding of its potential role in children's development and learning in the digital age (see Chapter 5 and Case Studies: EST, ESP, LTU, NOR, SVN_2 – Annex C).

Box 4.2. Guidelines on using digital technologies with children in early childhood education and care settings

In **Finland**, ICT devices, digital toys and other equipment can be used with children in a way that is defined by ECEC providers and agreed upon with parents. The focus is on the role of ICT in daily life and the use of various devices to promote safe behaviour. Children should have an active role when using digital technologies and get an understanding that technology is a product of human activity. The pilot programme launched in 2020 by the Ministry of Education and Culture on new literacies development provides examples of good pedagogical activities in the three areas of skills development (see Box 4.1). For ICT skills, it mentions play activities that encourage children's production of content on their own. For media literacy, it recommends that children, with ECEC staff, look at how the media is visible and influences their everyday life, such as in play but also producing content, for instance, through digital storytelling and sound recording. For programming skills, it recommends that children gain experiences with technology by playing together and that they practise logical thinking skills, such as categorisation and comparison. Between 2020 and 2022, the programme was piloted by around 40 ECEC providers as well as in basic education (starting with primary education). The institutions in charge of the programme have developed an online library with pedagogical resources and provide training to ECEC staff and teachers.

In **Japan**, the guidelines indicate that digital technologies can be used with children but with a clear instruction plan. They can be used to provide children with experiences that would be difficult to gain through other material. For instance, teachers help children search for information with a tablet on animals, mushrooms, etc. that is difficult for children to obtain in kindergarten activities.

The **Norwegian** curriculum framework sets broad and holistic goals for ECEC and children and includes a section on digital practices in kindergarten. It states that digital practices shall encourage children to play, be creative and learn. The use of digital tools must support the children's learning processes, create a rich and varied learning environment for all children, and help children develop an early ethical understanding of digital media. Staff shall be actively involved with the children when using digital tools. Digital tools must be used with care and not become a dominant practice. The curriculum framework states that staff shall enable children to play, learn and create using digital forms of expression and that staff should do this together with the children.

The **Portuguese** curriculum framework indicates that access to the computer in pre-primary settings enables learning not only in the field of knowledge of the world, but also in artistic languages, written language, mathematics, etc. It recognises that digital technologies are integrated into children's play universe, including through pretend play. Observing these situations should enable staff to understand the role of technologies in children's lives and to start from what they know to broaden their knowledge and support ways of using it. Following these directions, the curriculum gives examples of situations in which staff can promote these learning areas. For instance, ECEC staff should encourage children to observe, talk about and understand the usefulness of different technological resources present in their surroundings. They should talk with children about their favourite TV shows and "heroes"; encouraging debate between different opinions; and about what is real, imaginary or manipulated. They should encourage children to talk about care and norms in using technological resources, aiming to adopt safe behaviours. The curriculum framework also provides suggestions for reflection, such as whether staff know about technological resources that may be accessible in the community surrounding the ECEC centre, use them and alert families about their existence and potential. It also invites staff to reflect on whether children use technologies in a diversified way in the classroom and to think about the most frequent functions children are using.

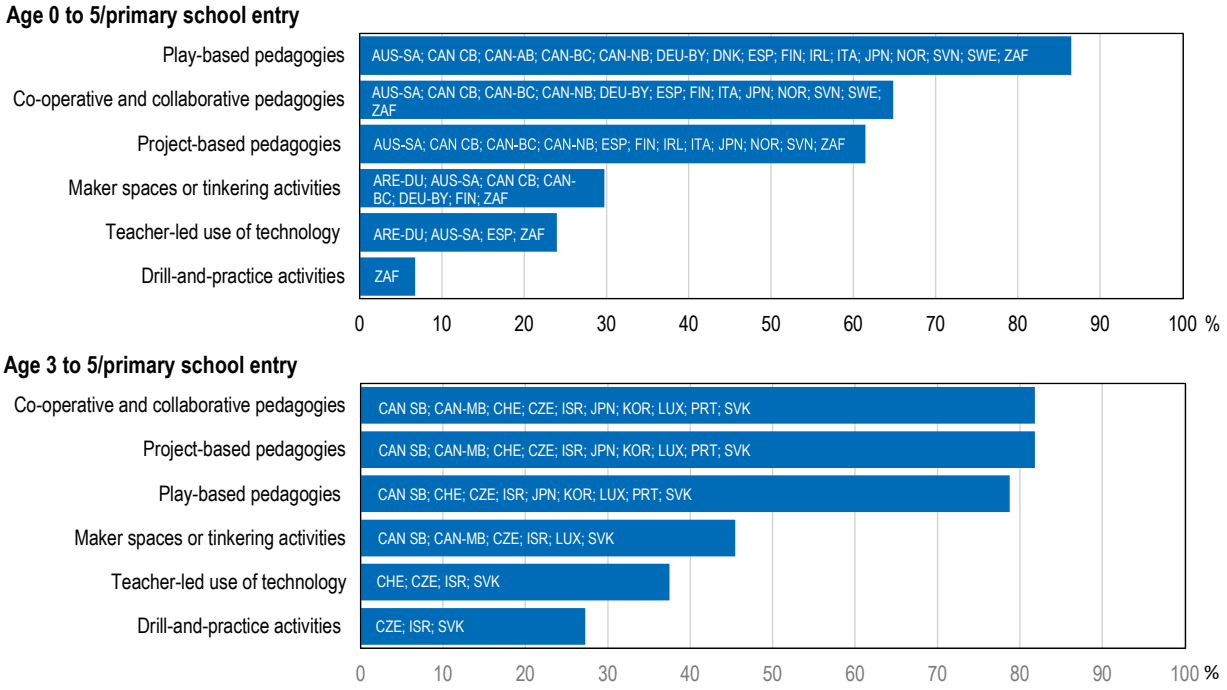
In **South Africa**, a specific goal is that children explore design, make items and use technology. Guidelines are differentiated by age. For babies, it is about showing interest in resources that may include technology and in how things work. Examples for adults are talking to children about what they see, hear and touch, explaining what is happening. For toddlers, it is about investigating how things work, showing interest in turning on and operating electronic items. Adults are invited to talk about the electronic items and how they can be used safely, where available let children operate the items under adult guidance, for example computers and other electronic devices such as cell phones. Older children can experiment with different tools and techniques, know how to operate simple equipment. Adults can encourage children to build their own creations, introduce them to different tools and techniques, and encourage them to operate equipment such as electronic toys and computers.

Source: Country input for OECD (2022[6]) and countries' curriculum frameworks.

The *ECEC in a Digital World* policy survey (2022) asked countries and jurisdictions whether curriculum frameworks and other relevant documents specify a range of pedagogical approaches to integrate digital technologies in relation to interactions with young children within ECEC settings (Figure 4.6). The results are discussed further below.

Figure 4.6. Pedagogical approaches for using digital technologies in interactions with young children in early childhood education and care settings specified in curriculum frameworks and other relevant documents

Percentage of countries and jurisdictions reporting the following, by age coverage of the curriculum framework, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. Some countries and jurisdictions responded for multiple curriculum frameworks and therefore appear more than once with the same country and jurisdiction code. See Annex A. CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba). *Items are sorted in descending order.*

Source OECD (2022[6]), *ECEC in a Digital World* policy survey, Tables B.7 and B.9.

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Play-based pedagogies involving digital technologies

Answers to the *ECEC in a Digital World* policy survey (2022) indicate that play-based pedagogies are a commonly proposed approach in curriculum frameworks and other relevant documentation, as they are considered by around 86% of the participating countries and jurisdictions in frameworks for children ages 0-5/primary school entry and by 79% in frameworks for children ages 3-5/primary school entry (Figure 4.6).

In general, research emphasises that pedagogical approaches with young children should promote learning through play (OECD, 2021[3]). For digital technologies, there are specific reasons to adopt play-based pedagogies. The starting point is that children integrate digital tools into their play, for instance by using digital games or pretending they are using digital technologies. Some researchers have proposed a pedagogical approach in which there is no distinction between digital and traditional play, called "converged" or "connected" play. Here children move fluidly across and between different modes and, for instance, use a technology and/or are inspired by popular culture characters to participate in traditional play activities (Edwards, 2016[23]). The main argument in favour of this type of approach is that it builds on children's own interests, expertise and knowledge in technologies, and on the digital media and popular culture they have access to in their home environments. These researchers also argue that converged play enables children to develop positive dispositions for learning and can relate to knowledge and learning areas that are generally included in national ECEC curriculum frameworks. It is, however, difficult to assess how effective these pedagogical approaches can be on a large scale.

Some researchers have also argued that computer science and developing computational thinking are well suited for ECEC (starting around age 3) as it offers an environment where young children can play and learn at the same time (Bers, Strawhacker and Sullivan, 2022[15]). In a play-based learning environment, young children can engage in basic coding or early programming and have the possibility to develop problem-solving and computational thinking skills as well as mathematical reasoning and spatial awareness when supported by well-designed and developmentally appropriate digital technologies (Murcia, Campbell and Aranda, 2018[24]).

Children's digital play practices tend to be more advanced than teachers' adaptation of curriculum and pedagogical approaches to incorporate digital technologies, digital media and popular culture into their practices with children (Edwards, 2016[23]; Wood et al., 2019[25]). ECEC staff may not always connect digital activities well with curriculum frameworks despite the importance of children's digital play and of play being at the core of many ECEC curriculum frameworks. Furthermore, ongoing debates and lack of certainty on the appropriateness of digital technologies tend to discourage staff from using digital technologies with children as part of play activities. Lack of clarity of guidelines for ECEC on the use of digital technologies with children (see Chapter 3) and legislated curriculum frameworks that value traditional modes of learning and play and academic learning outcomes also act against the introduction of digital play. By training staff on how to integrate digital play into their practices and more concretely reflecting these approaches in curriculum frameworks, ECEC authorities could help staff be better equipped to support a 21st century curriculum. Some countries have curriculum frameworks that explicitly specify the use of digital technologies in relation to play (Box 4.3) or have developed initiatives to recognise digital play (Case Study KOR – Annex C).

Box 4.3. Digital play in early childhood education and care curriculum frameworks

The **Norwegian** curriculum framework, which generally assigns a core role to play, states that digital practices in ECEC settings shall encourage children to play, be creative and learn. The use of digital tools must support children's learning processes and help create a rich and varied learning environment for all children. Staff are expected to be actively involved with the children when using digital tools,

which should be used with care and not become a dominant practice. It gives a number of broad directions for staff, such as: enabling the children to explore, play, learn and create using digital forms of expression; evaluating the relevance and suitability and participating in the children's media usage; exploring the creative and inventive use of digital tools together with the children.

In **Portugal**, the curriculum framework also recognises the prevalence of digital play. It states that digital technologies are present in children's play, for instance when the child pretends to talk on the phone. It explains that these situations enable ECEC staff to understand the role of technologies in the child's life and to start from what children know to broaden their knowledge and support ways of using it.

Source: Country input for OECD (2022[6]) and countries' curriculum frameworks.

Co-operative, collaborative and project-based pedagogies

In addition to play, curriculum frameworks in ECEC generally include the "constructivist/interactive" and "social pedagogy" approaches that view learning and social development as constructed through interactions with others and underline the importance of learning in groups (OECD, 2021[3]). Digital technologies provide many options for play activities and interactions with others.

In the *ECEC in a Digital World* policy survey (2022), a large majority of countries and jurisdictions (82% for pre-primary education curriculum frameworks and 67% for 0-5/primary school entry curriculum frameworks) indicated that the curriculum framework specifies co-operative and collaborative pedagogies for using digital technologies with young children.

Project-based learning, which shares some features of co-operative and collaborative pedagogies, has been increasingly used in higher levels of education and has now entered early education (Claussen, 2017[26]). This pedagogical approach builds on the learning-by-doing concept and consists of getting children to gain knowledge and skills by "working" for a period of time on a question, problem or challenge. With this approach, children learn in a specific context, are active in the learning process and interact with others to achieve a common goal (Krajcik and Blumenfeld, 2006[27]). While not necessarily involving digital tools, this approach fits well with the use of technology tools that can support learning. For instance, children or students make use of technology tools to support their investigations and communicate with others (Case Study JAP_2 – Annex C).

In a majority of countries and jurisdictions having participated in the *ECEC in a Digital World* policy survey (2022), project-based learning and co-operative and collaborative technologies are specified in curriculum frameworks for using digital technologies with young children (see Figure 4.6). These approaches are somewhat more prevalent in curriculum frameworks for pre-primary age children than for those that cover the full ECEC age range, as they can be more difficult to implement with younger children or groups of children of different ages.

The active role of children and the co-operative feature involved in these approaches are particularly important for using digital technologies with young children. These approaches are, for instance, aligned with what is recommended in the Statement on Young Children and Digital Technologies by Early Childhood Australia (2018[21]), which aims to guide ECEC professionals in their role and optimal use of digital technologies with, by and for young children in ECEC. Building on research, the document provides concrete examples of these practices and explains their goals. The statement recognises that digital technologies can be used to support interactions between ECEC staff and children, as children often enjoy looking at digital photographs and videos of themselves, family members and peers. These images and videos can be used to promote opportunities for language development. Children also enjoy using digital technologies with others and sharing what they have learnt. Using digital technologies with children can create opportunities for social and emotional development by encouraging children to take the lead, share

experiences and listen to others. ECEC staff can engage with children to create content and document learning.

Teacher-driven versus child-driven activities

One dimension that has been receiving increasing attention in pedagogical approaches is the importance of seeing children as contributors to their knowledge rather than consumers and putting individualised learning, children's choices and self-direction at their core. Rather than focusing on transmitting some specific knowledge, teachers can use open-ended questions and present challenging activities to children that lead to various learning opportunities. In particular, these approaches have been recommended by researchers in computational science, who consider that open-ended coding and programming environments offer children the most playful learning opportunities. More generally, given that digital technologies provide open education sources, when digital technologies are used with children, the approach can consist of adopting approaches in which children are given an active role in learning.

To some extent, pedagogies that favour child-driven activities contrast with top-down approaches to teaching and learning and with classic methods favouring mainly teacher-initiated activities, including repetition. There are, however, some cultural variations in regard to the perceived value of more didactic approaches, such as whole-group teaching versus more constructivist and personalised methodologies, such as child-initiated play. For instance, a study on the use of ICT in seven ECEC centres in Hong Kong (China) by teachers who completed a course on this matter showed that teachers used ICT mainly in the context of a teacher-directed approach (Hu and Yelland, 2017[28]). The experience led to few child-directed activities and very few child-initiated activities. The authors conclude that school factors, the curriculum framework, the type of digital tools and teachers' approaches to interactions with children played an important role in how teachers incorporated ICTs into their practices with children. When the context is supportive, a more integrated and balanced approach could also be possible. When using digital technologies with young children, teacher-led use of technology can be helpful to initiate activities or ensure all children participate and then complement this approach with other ones that give a stronger role to children.

Along these lines, a minority of countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022) (24% for 0-5/primary school entry curriculum frameworks and 38% for pre-primary curriculum frameworks) have indicated that teacher-led use of technology was specified in the curriculum framework. Related to this, approaches that build on repetitive learning processes, such as "drill-and-practice" approaches, are mostly not included in curriculum frameworks. Co-operative, collaborative and project-based learning approaches that are included in curriculum frameworks of a higher percentage of countries are well suited to include this open-ended component. Approaches that include "maker spaces or tinkering activities" that focus on helping children to solve a problem through open-ended questions and give children time to design and build their products have the open dimension but are specified in the curriculum frameworks of a minority of countries and jurisdictions and more so for pre-primary curriculum frameworks. While these approaches might be well suited to ECEC children in general, implementing them for the use of digital technologies might be complicated with young children, which could explain the relatively low percentage of countries and jurisdictions specifying this approach in their curriculum frameworks.

Unplugged approaches

An age-appropriate use of digital technologies is needed for young children. The World Health Organization (WHO) recommends that children under five spend less time sitting watching screens and more time in active play. Furthermore, WHO recommends no screen time for children one-year-old or under, and sedentary screen time such as watching TV or videos and playing computer games limited to an hour per day for children ages 2-5 (WHO, 2019[29]). In line with these recommendations or to align with national ones, some countries might choose to discourage the use of digital technologies in ECEC settings. There might also be the view that ECEC should not add to children's exposure at home and parents might fear that sedentary screen time replaces play activities. However, in countries and jurisdictions responding to the *ECEC in a Digital World* policy survey (2022), the use of digital technologies with children is strongly discouraged only in a limited number of countries for specific age groups (France, Israel and Luxembourg in pre-primary curriculum frameworks) (see Figure 4.2).

An important reason to develop digital literacy at an early age is to mitigate inequalities in the use of digital technologies between children depending on their socio-economic background (see Chapter 7). It is, therefore, important that even if the use of digital technologies with children is discouraged or if digital technologies are not available in ECEC settings, all children have equal opportunities to develop early digital literacy. These skills can be developed without exposure to digital technologies and some experts even argue that the so-called "unplugged approach" is the most appropriate one for young children.

Unplugged approaches have been developed mainly for computational thinking. These approaches involve engaging children in the principles of computational thinking through activities without actual computers, for example, using hands-on activities such as drawing, role-play and interacting with physical objects (Murcia, Campbell and Aranda, 2018[24]). In particular, the Computer Science Unplugged movement considers that before engaging children in learning how to programme, it is important for them to learn basic concepts, including how to decompose problems into smaller, more manageable parts and how to design precise steps to solve those problems and represent solutions in code, all of which can be explored without a computer (Bers, Strawhacker and Sullivan, 2022[15]).

Unplugged approaches to computer sciences are play-based and introduce children to ways of thinking about computer science without relying on learning computer programming. For example, an unplugged computer science activity in pre-primary education might involve creating bead necklaces in binary numeric code with beads that represent 1s and 0s, using a grid and symbols to put classic fairy tales in a logical order, or making a peanut butter sandwich following a set of instructions or algorithm (Bers, Strawhacker and Sullivan, 2022[15]). This concrete example shows that computational thinking can be developed without direct engagement with digital tools, but also underlines that ECEC staff need to be intentional in their interactions with children to develop these skills. If unplugged approaches are prioritised for some age groups, ECEC settings or countries, they need to be integrated into curriculum frameworks and ECEC staff need to be trained to engage in them. In Germany, the Little Scientists' House, a non-profit early childhood education initiative in the STEM area, launched a programme in 2017 to develop computational thinking for children ages 3-10 starting in ECEC centres. The programme includes material and training for staff using unplugged approaches (Case Study DEU_2 – Annex C). In Spain, the School of Computational Thinking and Artificial Intelligence is a project developed by the Ministry of Education and Vocational Training in collaboration with the regional educational administrations for the whole education system (ages 3-20) (Case Study ESP – Annex C). The objective is to offer open educational resources and teacher training to support teachers in embedding computational thinking and coding in their daily teaching. For pre-primary education, the focus is on activities without a computer.

Like for other approaches to computational thinking, evidence on the impact of unplugged approaches is lacking on a large-scale basis. However, some researchers question the effectiveness of attempts to teach and learn computational thinking concepts in the absence of practical coding experiences, given the importance of a learning-by-doing and iterative approach in this domain (Bers, Strawhacker and Sullivan, 2022[15]).

Beyond computational thinking, other aspects of digital literacy can be developed without exposing children to digital technologies. There does not seem to be much research into this topic so far. However, especially for the youngest children, there is potential for these approaches beyond computational thinking. Through pretend play, children can, for instance, learn to develop routines about the use of digital devices such as smartphones and get a first understanding of some of the risks.

Types of digital technologies and their possible uses

In addition to the goals stated by curriculum frameworks and the pedagogical approaches followed to develop children's early digital literacy, the type of digital resources (specific devices and content) that ECEC staff and children may engage with in ECEC settings also matters. Different types of technologies do not offer the same potential for children's learning, development and well-being. The possible impacts of these tools on children's learning, development and well-being are, therefore, likely to depend on how they are used as well as on the characteristics of the technology.

Policies can support the development of digital infrastructure and digital educational materials in ECEC settings that are safe and appropriate for the children's age and relevant for their learning, development and well-being, including for the development of early digital literacy. For instance, in Germany during the COVID-19 pandemic, the government supported the use of software to support literacy development when children were at home with their parents. A committee made up of psychologists and early childhood and pedagogical professionals tested and reviewed the suitability of various digital materials for children's literacy development (Case Study DEU_1). Furthermore, when investment is made in the provision of digital materials, it is important to develop guidelines for ECEC staff to inform their practices using these materials (Case Studies BRA_1 and CZE).

The *ECEC in a Digital World* policy survey (2022) asked countries whether ECEC authorities at the national, regional or local level provide or support the provision of digital infrastructure and educational materials to ECEC settings (Figure 4.7). The results are discussed below.

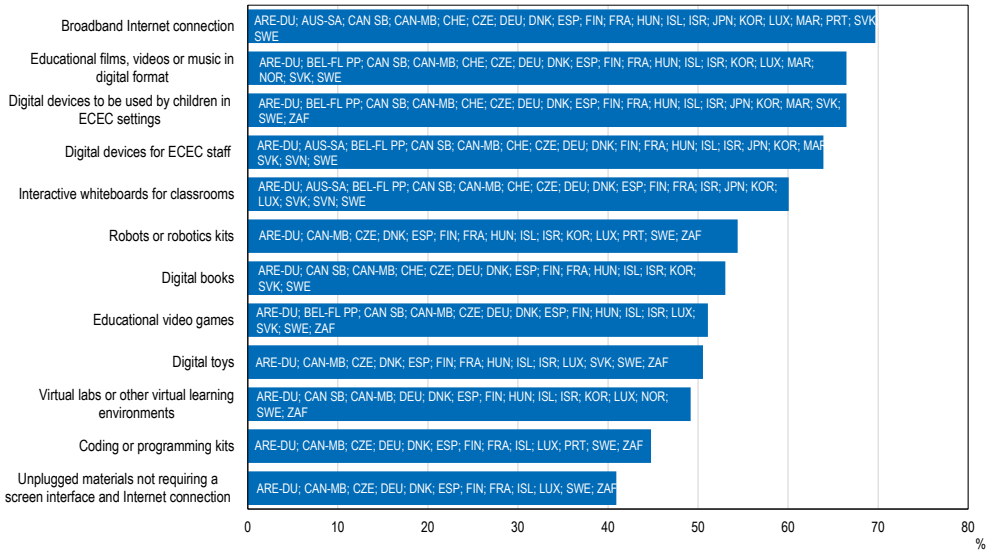
Broadband connectivity

Broadband connectivity is a pre-condition to any use of digital technologies with children and for integrating digital technologies into ECEC more generally, such as for ECEC staff work without children (e.g. workforce development practices) (see Chapter 5); connection with other institutions and services; and for the development of data, for instance for quality assurance mechanisms (see Chapter 6). Inequalities in broadband connectivity can create inequalities among children both for developing early digital literacy and benefiting from modern ECEC services (see Chapter 7).

The COVID-19 pandemic has highlighted gaps in Internet connectivity for ECEC centres (OECD, 2021[30]). However, a large majority of countries and jurisdictions having participated in the *ECEC in a Digital World* policy survey (2022) indicated that, as of 2022, they support broadband Internet connection either at the national or federal, regional or local level (Figure 4.7).

Figure 4.7. Digital infrastructure and educational materials in early childhood education and care settings

Percentage of countries and jurisdictions providing or supporting the provision of digital infrastructure and educational materials to ECEC settings, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order.
Source: OECD (2022[6]), *ECEC in a Digital World* policy survey, Table B.10.

StatLink https://stat.link/fimrxb

Screens, touchscreens and tablets

While often used in home environments, digital devices involving screen exposure (e.g. tablets) are generally the main reason for reluctance for integrating digital devices into ECEC settings. However, research increasingly highlights that it is the qualitative aspects of screen time (e.g. for what activities, with what content, in what context) that matter for children more than the amount of exposure (see Chapter 2). Combined with pedagogical approaches that lead to an active role of children in co-operation with others and with a specific goal, these digital devices can help develop both digital literacy and other cognitive and socio-emotional skills.

Research indicates that the active role of children is crucial, as is the goal of using the digital device. For example, researchers have observed young children becoming socially isolated when they are focused on a screen, while when playing with tangible coding technologies (e.g. robots designed for young children) they collaborate and communicate with others as they code the actions of the "robot" (Murcia, Campbell and Aranda, 2018[24]). Furthermore, research suggests that children's best learning experiences come when they are engaged not simply in interacting with materials, but in designing, creating and inventing with them (Sullivan, Kazakoff and Umashi Bers, 2013[31]).

A majority of countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022) indicate that the government supports the provision of digital devices to be used by children, such as tablets and notebooks, as well as educational films and videos (see Figure 4.7). On the positive side, investment from the government in these digital devices can help mitigate inequalities between children (see Chapter 7). However, these digital tools run the risk of too much screen exposure and passive use. It

is therefore important to accompany this investment by promoting pedagogical approaches that lead to an active role of children, open-ended learning and co-operation practices. For instance, in Israel, an initiative aims to combine physical space (in the ECEC centre) and traditional material (e.g. furniture, building blocks) with digital materials (e.g. smartphones, cameras) to create "physital spaces" that provide opportunities for play and learning to support physical development and the acquisition of digital skills (Case Study ISR – Annex C).

Children-specific and advanced digital tools

Some digital tools are specifically designed for young children and generally have some educational goals. Digital books have become highly popular and are supported by governments in around half of the countries and jurisdictions having responded to the *ECEC in Digital World* policy survey (2022) (see Figure 4.7). A meta-analysis of 39 studies looking at the story comprehension and vocabulary learning of children ages 1-8 showed that when digital books only differ from paper ones by their digitalisation, comprehension was lower with digital books (Furenes, Kucirkova and Bus, 2021[32]). However, with story-congruent enhancements, digital books outperformed paper books. An embedded dictionary had no or a negative effect on children's story comprehension but positively affected children's vocabulary learning. Adults' mediation when reading print books was more effective than the enhancements in digital books read by children independently. These findings point to the importance of choosing the right products if digital books are introduced in ECEC settings as well as ensuring that digital books do not replace reading paper books with ECEC staff.

Positive effects on learning outcomes are also being documented for high-quality resources such as educational apps or online educational programmes for children. A meta-analysis synthesised findings from 36 intervention studies evaluating the effectiveness of high-quality (interactive, based on learning science principles and focused on specific learning goals) educational apps for preschool to primary school children (Kim et al., 2021[33]). Results show positive effects in both numeracy and literacy skills. One study evaluated the effects of an online version of Reading Camp, a well-structured early literacy training programme for 5-year-olds and also found a positive effect on reading acquisition (Weiss et al., 2022[34]). These examples speak to the potential benefits of early learning of digital educational resources with a design guided by developmental science and evidence-based practice.

In addition to digital books and apps, responses to the *ECEC in a Digital World* policy survey (2022) indicate that in around half of the participating countries and jurisdictions, governments support other education digital tools such as educational video games and robots or robotics kits and more advanced technologies, such as virtual labs or other virtual learning environments. A smaller percentage of countries and jurisdictions support coding and programming kits.

Concerning the characteristics of these digital education tools, researchers in computer sciences have made recommendations on digital tools that aim to promote computational thinking. There are differences between these tools, with some using programming languages that are quite repetitive while others stimulate children's creativity (Sullivan, Kazakoff and Umashi Bers, 2013[31]). Researchers in this area recommend that for young children, programming languages are simple and offer open-ended opportunities for the child to create and explore. Programming languages that are restricted and, for instance, follow a series of sequential levels instead of letting the child drive the experience would require more adult direction and involve children's creativity to a lesser extent. Overall, researchers in the field of computational thinking highlight a number of features of digital tools appropriate for young children, such as: offering visual (i.e. picture, symbol or icon-based) languages as opposed to text-based languages; a syntax that offers multiple levels of complexity and that supports multiple combinations and solutions, as opposed to supporting just one correct outcome; the possibility to create something easily right away; and programming scripts that run as a sequence of text (e.g. from left to right in the Western world rather than top to bottom as in many adult programming environments).

There are differences between these digital tools that make them adapted to children of different ages. Robotic kits often target the youngest children and do not necessarily involve screen exposure. Programmable robotics kits allow young children to explore the foundations of computer science in a hands-on way. Social robots have been used in small-scale experiences, but can be adjusted to the children's age. For instance, the language of a social robot can be adjusted to the children's age and the robot can act as a slightly more advanced peer in a storytelling game between children and the robot (Kory-Westlund and Breazeal, 2019[35]). Digital games and puzzle-style software applications aim to support young children's learning of computer science concepts without the need to experiment with a programming language and can therefore be appropriate for young children, although they involve screen exposure. They also propose a limited set of experiences. Researchers in computational science consider that open-ended coding and programming environments offer the most playful learning opportunities. They can be tangible (e.g. KIBO), screen-based (Scratch Junior) or a combination of the two, but evidence suggests that tangible tools may be more effective as a first introduction to programming in the early years.

Finally, for the youngest children, digital toys that are technology-augmented toys with lights, sound, motion and programmed interactions have also developed. Governments support the provision of these toys in half of the countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022). There are debates on the pros and cons of these toys versus more traditional ones. The main argument for integrating these tools into ECEC settings is to expand the universe of play and better recognise digital play as a possible pedagogical approach, as discussed earlier in this chapter (Stephen and Plowman, 2014[36]). Digital toys for children are often presented as having some educational properties for commercial reasons, but they are generally very simple and are unlikely to provide more learning opportunities than other toys. However, an open debate exists on whether these toys may enhance or inhibit development while they, in fact, do not have the potential to do so. There is much less focus on how digital toys and other resources for young children are integrated into play activities and can bring play value rather than educational value. An argument against digital toys and other devices is that play with digital technologies may be less likely to extend children's physical capacities than traditional play activities, but evidence also suggests that young children continue to enjoy traditional toys and motor activities after being initiated to digital play, and that they can transition easily between digital and non-digital play (Arnott, Palaiologou and Gray, 2019[37]).

Policy pointers

Policy pointer 1: Ensure that curriculum frameworks set clear and comprehensive goals for ECEC in light of children's increasing exposure to digital technologies

- ECEC curriculum frameworks can have different levels of ambition and granularity for responding to digitalisation, but it is important that the directions build on research evidence and are clearly set and explained. Curriculum frameworks also need to create a shared understanding of the goals and concepts that are accessible to all stakeholders (e.g. staff, parents, education providers).
- The goals set by curriculum frameworks can be comprehensive (e.g. addressing the digital divide at an early age, protecting children against digital risks) and reflect the broad impact of digitalisation on children's development, learning and well-being rather than focusing only on the use of digital technologies with or by children.

- Given that digital literacy can be developed at an early age, curriculum frameworks and other documents can set clear goals for children's early digital literacy development. Given the age of children in ECEC settings, the goals should be to lay the foundations for digital literacy development at a later age and should not involve any goals that are inappropriate for the early years. However, curriculum frameworks can adopt a broad rather than a narrow view of digital literacy. Beyond using digital technologies per se, the focus can also be put on getting a first understanding of how technology works, developing safe behaviours in the use of technology, learning to create content and exploring self-expression with digital technologies.
- Beyond digital literacy, ECEC curriculum frameworks that place a great importance on child play can better recognise that digital technologies have changed the universe of play. This may provide opportunities to connect with children's own interests and build on their shared knowledge.

Policy pointer 2: Develop pedagogical guidelines on practices and choice of material aligned with the goals of the curriculum framework

- Curriculum frameworks need to include or be accompanied by guidelines for ECEC staff on how to support and implement parts of the curriculum framework relating to digitalisation. The implications of digitalisation for young children are complex and multifaceted and it cannot be taken for granted that ECEC staff will know how to support a 21st century curriculum framework without clear guidelines. At the same time, designing these guidelines is, in itself, a challenge given the lack of evidence and consensus on what could be an appropriate approach. Directions to move forward include involving several stakeholders in their design, building on research evidence and ensuring that they are well aligned with other guidelines on implementing curriculum frameworks.
- In countries where digital technologies can be used in ECEC settings, guidelines need to provide principles and examples of good practices that are based on recent and robust research. Principles that have led to a consensus so far include the importance of an active role for children (instead of passive consumption of digital media), group activities and a focus on creating material.
- In countries where the use of digital technologies is not recommended or restricted in ECEC settings, children can be introduced to digital literacy without direct exposure to digital tools, through so-called "unplugged approaches", which can also be included in guidelines. More generally, there is potential to expand "unplugged approaches" that are particularly appropriate for the youngest children.
- Digital technologies can be used to support other areas of learning and development, e.g. literacy, numeracy, curiosity and co-operation. However, there is no evidence that this can be easily done with a relatively large group of children of that age. Activities using digital technologies should therefore complement or enhance rather than replace other activities.
- Not all technologies offer the same pedagogical potential. It is important to carefully choose technologies and prioritise those that are appropriate to the children's age, can be used in group activities with an active role of children, provide the possibility to create things easily, and support multiple combinations and solutions. While tablets are often prioritised, other types of material (e.g. robotics kits) can offer valuable experiences to children, including some that do not lead to screen exposure. Guidelines can also recognise the interconnectedness between digital and traditional play, children's right to make choices and the role of adults in guiding those choices.

Policy pointer 3: Complement changes in the curriculum framework in light of digitalisation with aligned workforce training, funding and assessment plans

- Curriculum frameworks alone cannot trigger changes in the right direction. Changes in the curriculum framework brought about by the digital transformation need to be accompanied by workforce training (see Chapter 5).

- Introducing digital activities in ECEC settings can be costly in terms of material, workforce training and the required number of staff per child. Ambitions to develop digital literacy need to be accompanied by adequate funding to ensure that all settings are equipped to develop these approaches (see Chapter 7).
- As for other areas of the curriculum framework and any practices with children, it is important to monitor the effects of introducing digital technologies on process quality in ECEC settings as well as on the development of children's early digital literacy (see Chapter 8).

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5 The early childhood education and care workforce in the digital age

In the context of the evolving demands digitalisation places on early childhood education and care (ECEC) staff, this chapter explores how countries are preparing and supporting ECEC staff to meet these demands, as well as how technology can be integrated into ECEC staff practices more generally (e.g. for administrative tasks, work with parents). The chapter proposes a model for considering ECEC staff competencies around digitalisation, with foundational skills and knowledge for the entire workforce at the base, enhanced abilities for some groups of staff, and finally, the possibility for a group of ECEC digital specialists. The chapter ends with policy pointers.

Key findings

The ECEC workforce is essential for advancing policy goals around digitalisation in the early childhood sector. These goals are centred on children's experiences and exposure to digital technologies, from the safeguards in place to protect them from risks in the digital world to the curricular and pedagogical approaches for introducing early digital literacy. However, demands on the ECEC workforce also encompass the use of digital tools for administrative and management tasks, communicating with families and other stakeholders, and using digital tools to develop staff's own knowledge and professional engagement.

Results from the *ECEC in a Digital World* policy survey (2022) show that preparing ECEC professionals to use digital technologies safely and effectively in their pedagogical work with young children is a policy challenge rated as being of "very high" or "high" importance by most of the countries and jurisdictions that responded to the survey. Yet, frameworks for specifying the digital competencies needed by ECEC staff are scarce. A model for considering ECEC staff competencies around digitalisation includes foundational skills and knowledge for the entire workforce at the base, enhanced abilities for some groups of staff, and finally, the possibility for a group of ECEC digital specialists.

The *ECEC in a Digital World* policy survey (2022) shows that digital competencies are not generally required in initial education programmes for ECEC teachers, although many of the digital competencies are considered commonly included in these training programmes.

In most countries and jurisdictions, ECEC authorities provide some funding or support for training to develop the digital competencies of ECEC staff.

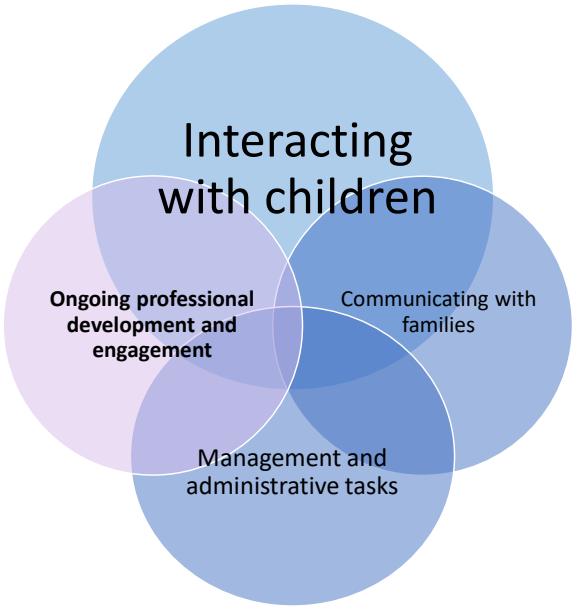
A majority of countries and jurisdictions support traditional online approaches to continuous professional development (e.g. online courses, seminars or massive open online courses) and blended online/in-person training activities. In contrast, a minority of countries and jurisdictions financially support staff induction activities that use digital tools (e.g. online content, communication or networking tools) or mentoring or coaching activities supported by digital tools (e.g. online content, communication or networking tools). Research suggests that digital trainings offer many advantages, such as allowing learners to interact with content at their own pace. However, training models that combine the strengths of virtual training with the benefits of in-person training, particularly opportunities to reflect on content and discuss challenges together, appear especially promising. In addition, ECEC staff need opportunities for hands-on technical support when engaging with new digital tools.

Several countries are cultivating online repositories of resources for teachers across levels of education. Support for digital solutions that address work processes, especially to facilitate data collection and administrative services, is also common.

Introduction

The ECEC workforce is at the centre of ensuring that policy and curriculum goals around digitalisation are met. Professionals working in early childhood settings have expansive responsibilities, providing a mix of both care and education adapted to children's ages and developmental needs, as well as to goals set by applicable curriculum frameworks and specific cultural contexts. In addition to their work directly with children, ECEC staff are responsible for documenting children's well-being, development and learning; engaging with families; ensuring compliance with standards; and for their own ongoing professional development. These responsibilities are interrelated and impacted by the digital transformation. This chapter touches on all these areas (Figure 5.1), but places a strong emphasis on ECEC staff training, particularly ongoing professional development, as well as other aspects of professional engagement, such as collaboration.

Figure 5.1. Early childhood education and care staff have multiple responsibilities



A key challenge for the ECEC workforce is understanding and adapting to the digital world to effectively support children's early digital competencies and allow them to experience safe and meaningful engagement with digital tools. In addition, technology offers numerous possibilities to expand professional learning opportunities, increase possibilities for interaction among ECEC staff, facilitate administrative responsibilities, improve communication with families and otherwise support work processes. However, ECEC staff do not necessarily have the resources or time necessary to make digital tools routine or helpful for these various aspects of their jobs, let alone for their work with children. Digital technologies are changing rapidly, as are expectations for their uses in ECEC settings. In this context, challenges are compounded for ECEC staff in their efforts to effectively use digital resources now, and to prepare both themselves and children for the future.

This chapter explores how countries are preparing and supporting ECEC staff to meet these demands, as well as how technology can be integrated into ECEC staff practices more generally (e.g. for administrative tasks, work with parents). The chapter explores what digital competencies ECEC professionals need, examining existing frameworks for digital competency and proposing a model for ECEC in particular. This model includes foundational skills and knowledge for the entire workforce at the base, enhanced abilities for some groups of staff, and finally, the possibility for a group of ECEC digital specialists. The chapter then describes policies that support equipping the ECEC workforce with foundational digital competencies

through initial education programmes and continuous professional development (CPD). Existing requirements and funding for CPD are considered, as well as ECEC staff's access to CPD. Access is considered broadly, to include the provision of CPD from public and private actors, the time necessary to engage in these opportunities, and the basic digital skills that enable ECEC staff to participate in virtual or hybrid trainings. The chapter then considers promising ways to foster enhanced and specialised digital competencies in the ECEC workforce, notably through training content focused on digitalisation in ECEC and the use of digital tools to expand opportunities for professional collaboration and coaching and mentoring. The chapter concludes with policy pointers related to digitalisation and the ECEC workforce.

Challenges and opportunities for the early childhood education and care workforce in a digital world

The COVID-19 pandemic emphasised the need for and potential of digital tools in ECEC, while also highlighting its limitations. To understand how digital technologies were deployed for early education during the pandemic in 2020, in early 2021, the OECD, in partnership with the G20, conducted a survey that was completed by 34 countries and jurisdictions (OECD, 2021[1]). Results from the survey show that with ECEC settings closing or serving fewer children to minimise the spread of COVID, in 69% of the responding countries, pre-primary staff had to continue their work remotely. For many this meant not only carrying out administrative tasks and communication with families remotely, but also interactions with the children. For both families and staff, this required resources to connect online (e.g. a stable Internet connection, personal digital devices) as well as knowledge about how to use digital devices. However, 60% of the surveyed countries reported the lack of digital skills for teaching among pre-primary teachers as being a challenge.

As only 16% of the countries expected pre-primary teachers to use digital technology in their work with children to a great extent prior to the pandemic, it is perhaps not surprising that teachers were not well prepared for this shift in expectations and working methods. Due to the sudden increase in technology use, both teachers and parents/caregivers were faced with helping children to engage with technology in age-appropriate ways (e.g. limiting passive screen time). Accordingly, 25% of the surveyed countries and jurisdictions adopted new training in 2020 for pre-primary teachers to help children and parents/caregivers use technology in age-appropriate ways. The pandemic highlighted the potential of digital technologies in ECEC settings and accelerated the need to ensure staff are equipped to make use of them in the full range of their work, even as remote work becomes once again the exception for this field.

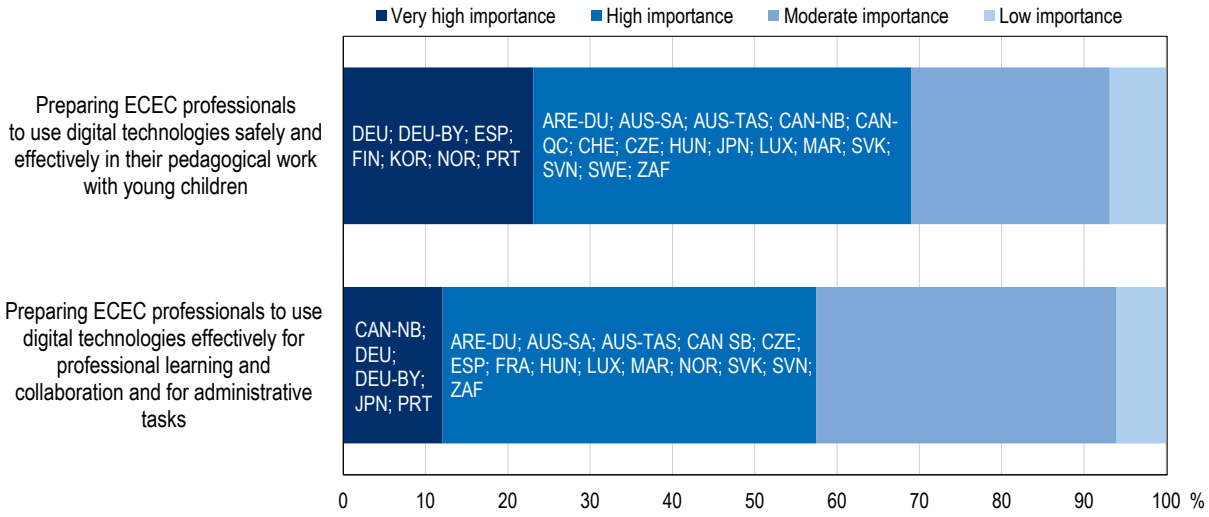
As the pressures of the COVID-19 pandemic ease, challenges around integrating technology into ECEC remain, and specific characteristics of the ECEC workforce make it complex to develop and implement effective supports. These challenges include fragmented training opportunities and requirements, goals and expectations depending on the settings in which staff work (e.g. school-, centre- or home-based settings), as well as staff's role within these settings (e.g. teacher or assistant) (Akaba et al., 2022[2]; Campbell-Barr et al., 2020[3]; OECD, 2022[4]). In many places, overall levels of education and training are low for staff in many settings, particularly for assistants (OECD, 2019[5]). Furthermore, the range of developmental stages covered by ECEC means that ECEC staff working with the youngest children (e.g. ages birth to three years) need different skill sets – especially related to digital technologies – than those working with somewhat older children (Caronongan et al., 2019[6]; OECD, 2020[7]). Staff's different backgrounds within the sector pose difficulties for developing training requirements adapted to the various capabilities, needs and circumstances.

Digital technologies themselves can address some of these challenges, by allowing for learning opportunities that are more tailored to individual staff and by connecting ECEC staff learners with similar needs or interests regardless of their geographic proximity, as well as streamlining work processes in ECEC settings (Minea-Pic, 2020[8]). Despite the potential for digital technologies to be a positive force, preparing ECEC professionals to use them safely and effectively in their pedagogical work with young

children is the policy challenge rated as being of "very high" or "high" importance by the most countries and jurisdictions having responded to the *ECEC in a Digital World* policy survey (2022) (see Chapter 2 and Figure 5.2). Moreover, this was the challenge selected as being of "very high" importance by the greatest number of countries and jurisdictions (7). Likewise, more than half of responding countries and jurisdictions rated preparing ECEC professionals to use digital technologies effectively for professional learning and collaboration and for administrative tasks as being of "very high" or "high" importance. Still, countries and jurisdictions identified other policy challenges as being important as well, and these have implications for the work of ECEC staff. For instance, preparing young children for the digital world and adapting the goals of ECEC to the changing importance of cognitive and social-emotional skills in the digital age are also among the top five policy challenges identified by respondents, and ECEC staff are at the centre of all of this work.

Figure 5.2. Policy challenges for equipping the early childhood education and care workforce for the digital world

Percentage of countries and jurisdictions identifying the following policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category "very high importance" was limited to three out of ten response items maximum.
CAN SB: School-based sector in Canada.
Items are sorted in descending order by the share of countries selecting response categories "very high importance" or "high importance".
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.2.

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Aside from questions around digitalisation in ECEC, workforce preparation and ongoing training is a fundamental challenge for governments (OECD, 2021[10]). As attention to ECEC as a component of education systems grows, so too do expectations for a professionalised ECEC workforce (Oberhuemer, 2005[11]; Peeters, 2008[12]). Identifying core digital competencies for ECEC staff, to support their roles as education professionals and for providing high-quality care to young children, and integrating these digital competencies into training programmes is a key challenge for governments.

Digital competency frameworks for early childhood education and care professionals

Digital competency comprises a far-reaching set of areas, all of which have relevance for ECEC professionals. For example, the European Commission's analysis of frameworks on digital competency identifies seven competency areas (Ferrari, 2012[13]); Table 5.1 illustrates how each of these can be important in the context of ECEC.

Table 5.1. Digital competencies and their relevance to early childhood education and care staff

Core competencies	Examples of relevance for ECEC
Information management	Track attendance and information on individual children, such as health/allergy/medication needs
Collaboration	Plan activities with colleagues or develop ideas with professional networks, outside the early childhood education and care (ECEC) setting
Communication and sharing	Inform families about the ECEC setting or individual children
Creation of content and knowledge	Develop resources to use in work with children or help children learn to create with digital tools
Ethics and responsibility	Protect children's privacy, well-being and health
Evaluation and problem solving	Monitor children's well-being, development and learning
Technical operations	Access ongoing professional development opportunities

Note: Examples are illustrative and not exhaustive of the ways each competency area may relate to ECEC practice.
Source: Ferrari (2012[13])

Several frameworks for digital competency focus specifically on teachers, recognising that taking individual digital competencies and moving them into pedagogical settings is yet another skill set compared to what is required for other types of jobs. Frameworks that look more specifically at competencies for teachers include the European Commission's DigCompEdu (Redecker, 2017[14]) and the Technological Pedagogical and Content Knowledge (TPACK) framework (Mishra, 2019[15]) (Box 5.1). Although these frameworks cover education broadly and not ECEC specifically, their content can be informative for the early childhood sector.

Box 5.1. Digital competency frameworks for teachers

DigCompEdu (European Commission)

The DigCompEdu framework aims to promote the digital competencies of educators regardless of their nation, region, position or level of education (Redecker, 2017[14]). It consists of 22 elementary competencies in 6 areas: 1) digital technologies for professional engagement; 2) effective and responsible use of digital technologies for creating and sharing in an educational setting; 3) managing digital technologies in teaching and learning; 4) digital strategies to improve assessment; 5) the potential of digital technologies for empowering learners; and 6) facilitating learners' digital literacy. The 22 basic competencies are captured through various typical tasks that assign educators' digital competencies to one of six levels. These levels are called Newcomer, Explorer, Integrator, Expert, Leader and Pioneer. The first two levels involve processing new information and developing basic digital practices. In the next two levels, knowledge is further developed and structured in digital practices. At the two highest levels, educators can share their knowledge, but also critique and develop new practices.

TPACK

The Technological, Pedagogical, and Content Knowledge (TPACK) framework proposes a holistic approach to the knowledge required of teachers for the successful integration of technology in teaching. It describes the relationship between the areas of technological, pedagogical and content knowledge and their interactions (Mishra, 2019[15]). This framework, therefore, makes it possible to identify approaches to overcoming the problems teachers face when using digital technology in their teaching, based on content and pedagogy. The possible combinations of domains can enhance teachers' knowledge in a sub-domain and reinforce the implementation of technology in a school setting with supportive pedagogical approaches, taking into account students' prior understanding and learning needs. The intersection of technological and pedagogical knowledge addresses the relationship and interaction of technological tools and pedagogical practices. The pedagogical and content knowledge shows the interaction of pedagogical practices and specific learning goals. The technological and content knowledge shows the interaction of technologies and learning objectives. This framework does not propose a progression of competencies, but rather a way to understand how teachers engage with and balance different aspects of their work. An extension of the framework to early childhood education and care proposes that the "A" in TPACK should stand for "affective" elements, such as teacher confidence and motivation to use technology (Dardanou et al., 2023[16]; Park and Hargis, 2018[17]).

Sources: Dardanou et al. (2023[16]); Mishra (2019[15]); Park and Hargis (2018[17]); Redecker (2017[14]).

Similarly, some countries have developed digital frameworks for their educators, which are generally intended to cover professionals working across the full age range covered by the education system. For instance, Luxembourg has developed a Media Compass, which is a national reference guide for education about and through media. It is intended to develop, promote and deepen the media literacy of educators at all levels of education (Case Study LUX – Annex C). In Norway, the Professional Digital Competence Framework for Teachers has two areas of focus recognising the different needs and requirements in the profession: teachers' professional development and their practices with children (Dardanou et al., 2023[16]). In Spain, the National Institute of Educational Technologies and Teacher Training's Teaching Digital Competence Framework 2022 adapts DigCompEdu to the national context, and is part of the overall Plan of Digitalisation and Digital Competences of the Educational System in Schools. It offers teachers a descriptive framework for training purposes as well as evaluation, certification and accreditation processes (Dardanou et al., 2023[16]).

In other countries, clear goals for what children should learn about digital technologies are linked to expectations for teachers. This is the case in Australia, for example, where according to the curriculum, teachers should be able to adequately guide young children to develop digital literacy and computational thinking (Murcia, Campbell and Aranda, 2018[18]) (see also Chapter 4). This means teachers should know and understand digital systems, but also how to collect and manage data, and how to develop digital solutions to problems. Similarly, in Finland, the ECEC curriculum framework views teachers' digital competencies as developing children's transversal competencies (Dardanou et al., 2023[16]).

Foundational, enhanced and specialised competencies for early childhood education and care staff

Digital competency frameworks targeted to ECEC professionals are rare (Dardanou et al., 2023[16]). Despite the value of aligning digital competencies for teachers and staff throughout the educational system and overall applicability of general frameworks for teachers' digital competencies, some aspects of working in ECEC merit specific attention. The model presented in Figure 5.3 illustrates some of these specificities, describing three levels of competencies that are relevant for staff in the ECEC sector, building on ideas from more general digital competency frameworks (Mishra, 2019[15]; Redecker, 2017[14]). For each of the

three levels, competencies are described in three areas: 1) pedagogy; 2) management and leadership; and 3) knowledge development and professional engagement. The three levels of the model (foundational, enhanced and specialised) recognise that not all staff need the same level of expertise regarding digital technologies. Assistants, teachers, leaders and more specialised staff are likely to need different digital competencies. However, all ECEC staff need competencies to ensure they can participate in and benefit from increasing digital opportunities as well as protect and support the children with whom they work. A balance is needed between ensuring foundational competencies with digital technologies for all staff and supporting a deeper level of skill and expertise for some staff.

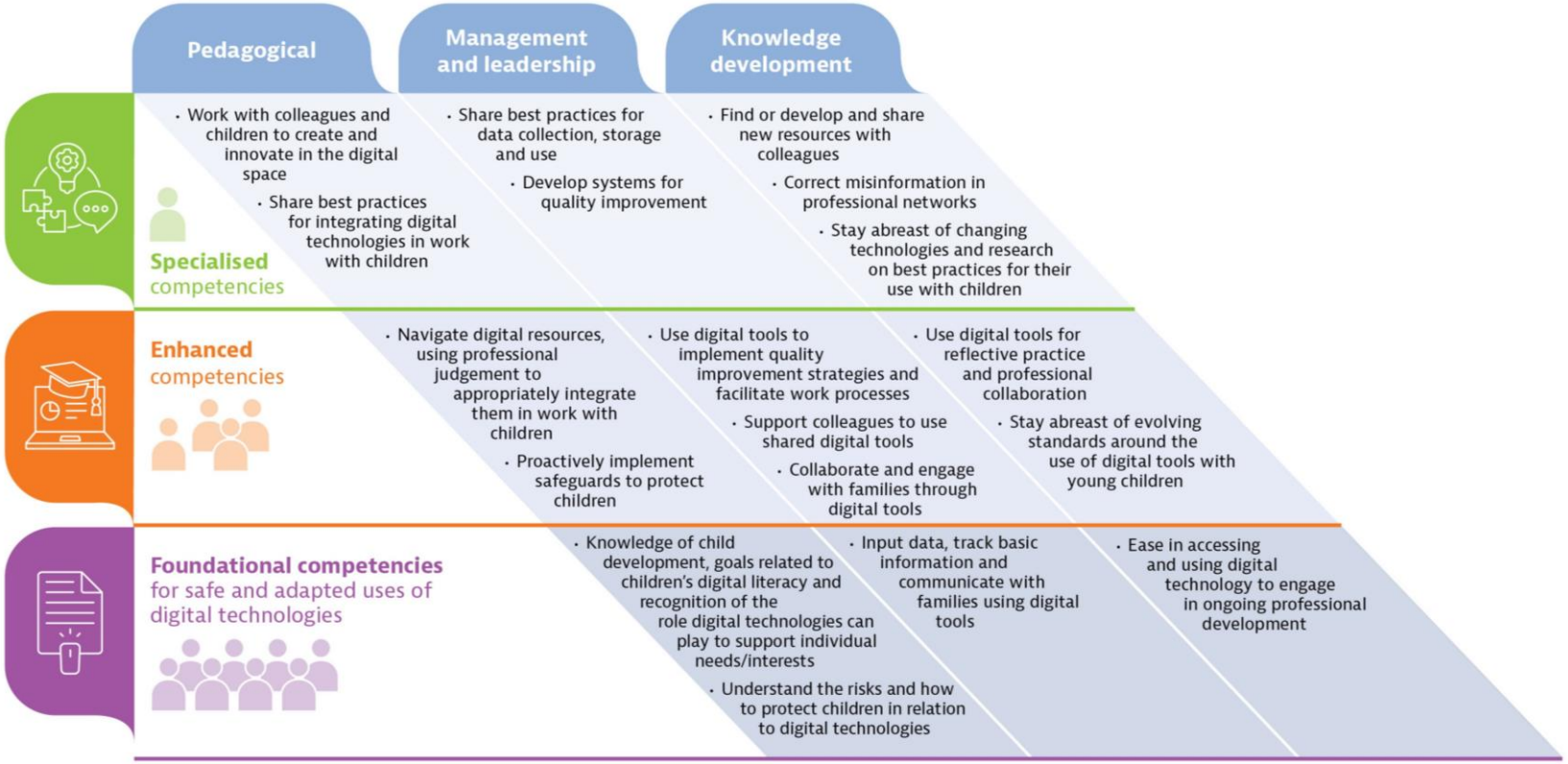
The base of this model describes foundational competencies. These are the skills and abilities related to digital technologies that all ECEC staff should be supported to develop. In particular, this level acknowledges that foundational knowledge of child development is essential for ECEC staff to successfully foster children's development, learning and well-being, and is a prerequisite for understanding how digital technologies can be safely and meaningfully integrated into ECEC settings. From a pedagogical perspective, at this level, ECEC staff should have a general understanding of the risks associated with using digital technologies in ECEC settings and how to protect children from these risks. They need good knowledge of relevant curriculum frameworks and goals related to children's digital literacy. More generally, ECEC staff at this level should recognise the role digital technologies can have in ECEC and be aware of how these technologies can be adapted to different purposes and age groups, in particular regarding differences for children under age 3 and their slightly older peers. In other words, staff at this level should understand that practices involving digital technologies at later levels of schooling may not be well adapted to ECEC contexts, and that even within the context of ECEC, best practices will differ based on the age and developmental stage of the children in the group.

With regard to management competencies, at this foundational level, ECEC staff should be supported to develop their skills around data management to store and track basic information (e.g. attendance records or lesson plans), as well as to use digital tools to support other forms of communication with families. In addition, all ECEC staff need foundational competencies to support their own knowledge development to ensure continuing professional learning. At this level, staff need to feel confident accessing and using digital technology to engage in ongoing professional development, regardless of its focus.

The next levels of the framework assume that staff retain and build on these foundational competencies. At the second level of the model are enhanced competencies for using digital technologies in ECEC. Not all staff need to reach this level, but it is important for ECEC leaders as well as some ECEC teachers/lead staff to develop the competencies described here. In terms of pedagogical competencies, staff at this level should proactively implement safeguards to protect children from risks, using their understanding of both digital risks and child development to go beyond basic required protections, as appropriate. Furthermore, staff at this level should be able to navigate available digital resources, using professional judgement to appropriately and selectively integrate them into their work with children. This level of pedagogical skill goes beyond being able to make age-appropriate adaptations in the use of digital technologies that are provided or easily available to taking a critical stance that considers what types of digital resources could be the most meaningful in the context of the particular ECEC setting and with individual children.

Also at this level, staff should be capable of routinely using digital tools for management and leadership tasks. This includes informing and implementing ongoing quality improvement strategies at the ECEC setting, as well as facilitating work processes, such as meeting reporting and monitoring requirements, tracking children's enrolment, and managing human resources in the setting. In addition, as digital leaders in their ECEC settings, these staff should be able to provide some support to their colleagues in accessing and using common digital tools. With regard to knowledge development, at this level of competence, staff should also be using digital resources to proactively engage with the profession, in addition to continuing their knowledge development. For instance, staff at this level should effectively use digital tools to engage in reflective practice and professional collaboration, as well as to stay informed of evolving recommendations and requirements around the use of digital tools with young children.

Figure 5.3. Digital competency framework for early childhood education and care staff



Finally, the third level of competencies in the model is relevant for only a subset of ECEC staff, referred to here as ECEC digital specialists, and similar to media literacy specialists described elsewhere (Guernsey, 2014[19]). This group of specialised staff can be viewed as similar to librarians or others who work in targeted ways with both staff and children. The ECEC digital specialists' competencies may be most relevant for staff who work across ECEC settings, supporting their peers as well as engaging directly with children in focused ways, although some ECEC settings may wish to cultivate this level of expertise within their own programmes. Pedagogical competencies for ECEC digital specialists involve working with both colleagues and children to create and innovate in the digital space, as well as sharing best practices for integrating technologies into work with young children. From the perspective of management and leadership, competencies at this level include sharing best practices for data storage and use, and developing systems for quality improvement that make good use of the benefits of digital tools. Lastly, regarding knowledge development and professional engagement, staff at this level should be able to find and share new resources with colleagues, correct misinformation and outdated information in professional networks regarding the use of digital technologies in ECEC, and stay abreast of changing technologies and research on best practices for their use with children.

In many cases, ensuring staff reach the level of foundational competencies for safe and adapted uses of digital technologies is not straightforward. Recommendations for safely and effectively integrating technology and media into early childhood settings underscore the importance of staff's professional judgement to identify when and how to use technology with young children (National Association for the Education of Young Children and Fred Rogers Center for Early Learning, 2012[20]) (see Chapter 4). Such principles are also visible in countries' policies. For example, Sweden's digital strategy for the education system highlights the role of leaders, in particular, but also of staff, for making the education system (including ECEC) responsive to digitalisation (2022). This need for a workforce to navigate the intersection of ECEC and the digital world is consistent with growing expectations more generally for the professionalisation of the ECEC workforce (OECD, 2021[10]).

Foundational competencies around digital technologies for ECEC staff depend largely on having a workforce with strong knowledge of child development, applicable curriculum frameworks and relevant pedagogies. However, this is challenging to ensure, given the limited initial training for much of the ECEC workforce (OECD, 2022[4]; 2020[21]). With the myriad demands placed on ECEC staff aside from those in the digital space, ensuring that training and expectations around digitalisation are complementary, and ideally supportive, to other existing requirements is of paramount importance for policy efforts to bring into and engage the ECEC workforce in the digital world (Dardanou et al., 2023[16]).

In response to the urgent requirement of protecting children in the digital world, guidelines and recommendations for ECEC staff are needed (see Chapter 3). Supporting staff to harness the opportunities of digital tools in different aspects of their work is critical to developing segments of the ECEC workforce with enhanced and even specialised skill sets with regards to digital technologies, building on a solid foundation of protecting children from risks. This evolution in expectations for ECEC staff can promote their management and leadership practices, facilitate their knowledge development and professional engagement, and align their pedagogies with the reality of the digital experiences children bring with them to their ECEC settings (Mertala, 2019[22]; Schriever, 2021[23]).

Building foundational competencies for safe and adapted uses of digital technologies

Staff need foundational training and skills to take professional decisions about the best way to use technology in their contexts, and to avoid using digital tools in ways that could introduce or magnify risks for children (see Chapter 2). The OECD Recommendation of the Council on Children in the Digital Environment calls on governments to support educators in identifying the opportunities and benefits of the

digital environment for children, and to evaluate and mitigate the possible risks. It also emphasises the importance of helping educators to ensure children become responsible participants in the digital world (see Chapter 3). However, it is not always evident how ECEC staff should undertake these tasks, especially for the youngest children or in age-integrated settings where curriculum frameworks may provide less specific perspectives on digitalisation compared to pre-primary curriculum frameworks (see Chapter 4).

In ECEC, requirements for initial education and CPD vary greatly across countries as well as within countries by segment of the workforce (OECD, 2021[10]). The emphasis placed on initial education requirements versus CPD also varies: A relatively stronger emphasis on CPD may complement and compensate for a more limited focus on initial education requirements and vice versa. It is, therefore, important to look across initial education and CPD and how these can work together and complement each other to develop foundational competencies for safe and adapted uses of digital technologies for all ECEC staff (Dardanou et al., 2023[16]). Both initial education and CPD are needed to develop ECEC staff's digital competencies generally, and in particular to support learning goals for children around digitalisation, as these evolve based on changing circumstances, needs and values (see Chapter 4).

This section first discusses the initial education for ECEC staff, highlighting the range of requirements in general, and specifically those related to digital competencies. It then considers CPD, first focusing on requirements to develop digital competencies and available government funding for this purpose. The section next addresses a wide range of issues that are relevant for ECEC staff to access digital CPD, including the time, availability of digital resources (e.g. hardware and software) and the sources of existing training opportunities. Particular attention is paid to the need to develop practical skills to support ECEC staff in successfully accessing and capitalising on digital tools across their various work responsibilities, ultimately in order to successfully support children. As training opportunities become increasingly digital themselves (e.g. online courses), the ECEC workforce (and prospective workforce) needs foundational skills and access to digital tools to fully engage in professional learning.

Initial education programmes

ECEC staff need solid training in child development in general, and in understanding children's development in digital contexts in particular. Initial education programmes are a central mechanism through which policies can shape staff's preparedness to provide high-quality ECEC. The level of qualification required for teachers in ECEC varies across countries but is typically above secondary schooling (International Standard Classification of Education [ISCED] level 3); however, requirements for those entering assistant roles are most often at ISCED level 3 (OECD, 2021[10]). Importantly, research highlights the value of initial education programmes that focus on ECEC specifically, providing specialised training adapted to the overall level of qualification, for the future professionals who will be working directly with young children (Bendini and Devercelli, 2022[24]; OECD, 2018[25]). These initial training programmes have the potential to equip staff with a good understanding of the goals of ECEC, relevant curriculum frameworks, and a range of topics related to protecting and supporting children in the digital world, in addition to the range of other tasks they will encounter in their jobs (e.g. engaging with families).

As higher entry-level qualifications are typically required for teachers than for assistants in ECEC, thus permitting greater breadth and depth in the topics covered, the OECD *ECEC in a Digital World* policy survey (2022) asked specifically about the inclusion of different topics related to digitalisation in initial education programmes for teachers (Table 5.2). Results show that digital competencies are not generally required in initial education programmes for ECEC teachers, with notable exceptions in Denmark and Luxembourg, where all eight of the competencies included in the survey are required for pre-service teachers. In other countries and jurisdictions, many of the digital competencies are considered commonly included in these training programmes, albeit not formally required.

Table 5.2. Digital competencies in initial education programmes for early childhood education and care teachers

	Number of required elements	Basic operational skills for digital tools	Understanding and identifying risks and benefits of using digital technologies with young children	Using digital technologies for professional communication, collaboration and learning	Sourcing, selecting and creating/ modifying digital educational materials to be used with young children	Using digital technologies for documentation and assessment of young children's learning and development	Personalising learning and development experiences and promoting young children's engagement and agency with digital technologies	Facilitating young children's content creation, collaboration and problem-solving with digital technologies	Facilitating young children's safe and responsible uses of digital technologies
Australia	0								
Australia *(Tasmania)*	0								
Australia *(Victoria)*	0								
Belgium (Flanders PP)	0								
Belgium (Flanders U3)	0								
Canada CB	1			m	m	m		m	m
Canada SB	2			m	m	m		m	m
Canada *(Alberta)*	0								
Canada *(British Columbia)*	0								
Canada *(Manitoba)*	0								
Canada *(New Brunswick)*	0								
Canada *(Quebec)*	1								
Czech Republic	2								
Denmark	8								
Finland	1								
France	3						m		
Germany	0								
Germany *(Bavaria)*	0								
Iceland	5								
Ireland	0								
Israel	0								
Italy	0								

	Number of required elements	Basic operational skills for digital tools	Understanding and identifying risks and benefits of using digital technologies with young children	Using digital technologies for professional communication, collaboration and learning	Sourcing, selecting and creating/ modifying digital educational materials to be used with young children	Using digital technologies for documentation and assessment of young children's learning and development	Personalising learning and development experiences and promoting young children's engagement and agency with digital technologies	Facilitating young children's content creation, collaboration and problem-solving with digital technologies	Facilitating young children's safe and responsible uses of digital technologies
Japan	4								
Korea	0								
Luxembourg	8								
Morocco	0								
Norway	4								
Portugal	0								
Slovak Republic	0								
Slovenia	2								
South Africa	1								
Spain	0								
Sweden	0								
Switzerland	0								
United Arab Emirates *(Dubai)*	0								
Percentage of countries requiring the element in most programmes		33	29	20	8	16	13	12	24
Percentage of countries commonly including the element in most programmes not formally		56	52	54	61	50	41	64	40
Percentage of countries without the element in most programmes		0	2	10	11	11	17	7	15

Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
Required in most programmes / Commonly included but not a formal requirement / Absent from most programmes / Not known / m: Missing
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.11.

StatLink https://stat.link/ps40jd

Notably, only 29% of participating countries and jurisdictions reported that understanding and identifying the risks and benefits of using digital technologies with young children is a required element of most initial education programmes for teachers, and 52% reported that it is commonly included but not formally required. Furthermore, 24% reported that facilitating young children's safe and responsible uses of digital technologies is a required element of teachers' education programmes, and 40% that it is commonly included but not formally required, compared to 15% reporting that it is absent from most programmes.

This situation reflects the relative autonomy of higher education programmes in many countries, with curriculum design and discretion often occurring more at the level of individual programmes than at a systems level (OECD, 2022[4]). Data from the OECD's *Quality beyond Regulations* policy questionnaire show that at least 70% of content areas considered in the questionnaire are required to be included in teachers' initial education and training programmes in the majority of participating countries and jurisdictions, indicating that a good breadth of topics is covered (OECD, 2021[10]). However, even the topic of child development was not a required learning area in initial education in all of the 26 countries that responded to the questionnaire, underscoring the limitations of policy regulation in this area. Furthermore, training requirements for assistants were less common in most countries, highlighting the variability in knowledge and skills with which staff enter the ECEC workforce. The OECD Teaching and Learning International Survey (TALIS) Starting Strong 2018 data similarly show that ECEC staff report a range of content that was included in their initial training programmes, with gaps favouring a breadth of knowledge for teachers compared with assistants. Furthermore, while most staff participating in TALIS Starting Strong 2018 had training specifically to work with children, this was not universally the case (OECD, 2020[21]).

Looking across countries, some digital competencies are more often required or commonly included in initial education programmes than others. These differences reflect, to some extent, a progression from more foundational to more enhanced digital skills. Among the competencies included in the *ECEC in a Digital World* policy survey (2022), the most commonly required digital aspects of initial education for ECEC teachers are "basic operational skills for digital tools" and "understanding and identifying risks and benefits of using digital technologies with young children." In contrast, the least commonly required aspect is "sourcing, selecting and creating/modifying digital educational materials to be used with young children." As this aspect of digital competencies reflects an enhanced or even specialised skill set for ECEC staff, it is not surprising that it is less commonly required in high-level regulations.

Although approaches to including digital competencies in initial education for future ECEC staff may not be comprehensive, countries and jurisdictions are nonetheless finding innovative strategies to improve training on digital skills (Box 5.2). For example, the College of Education in Iceland offers an elective on "information technology in learning and teaching" that can be taken at any point during the bachelors-level programme of kindergarten teacher studies (University of Iceland, 2021[26]).

Box 5.2. Integrating digital competencies in initial education programmes for future early childhood education and care staff

In **Germany (Rhineland-Palatinate)**, a pilot project entitled "Media Education at the Technical Schools for Social Work in Rhineland-Palatinate" was introduced in 2018 (Türen zur Medienerziehung, 2020[27]). The project aimed to train future early childhood education and care (ECEC) professionals in digital technologies by using them in their training. In the first phase of the project, vocational college instructors took part in a two-day training event. This event dealt with the topics of age-appropriate teaching of media competency, the possibilities of using media in portfolio work, transfer of learning modules of the vocational college curriculum, educational work with parents and how to align digital technologies with educational recommendations for ECEC centres. In the second phase, the training also included students from the technical schools who are becoming future ECEC professionals. The

focus was on the practical implementation of digital technologies in ECEC settings. Nine classes received equipment (e.g. tablets) as well as learning materials, such as articles, to support their work.

In **Slovenia**, the project "Developing Teachers' Skills to Educate Preschool Children with and through Digital Technologies" aims to support future and current preschool teachers in developing children's digital competencies and support computational thinking. It is based on the DigCompEdu framework (Redecker, 2017[14]) and the principles of unplugged approaches, to scaffold young children's computational thinking without the use of computers. The project is funded for a two-year development period (2021-23), after which the materials will be freely available to ECEC staff throughout the country and integrated into elective courses in a bachelor's level training programme for future preschool teachers (Case Study SVN_2 – Annex C).

Sources: Redecker (2017[14]); Türen zur Medienerziehung (2020[27]).

As governments consider how to equip staff with digital skills to conduct their work efficiently and protect and support children in the digital world, initial education programmes have the potential to provide key foundational competencies to the next generations of ECEC staff. Yet, as broader findings on staff training profiles show, integrating requirements on digital training should not be done in isolation, but rather in conjunction with other foundational training requirements (Edwards, 2015[28]; OECD, 2020[29]). Ensuring staff are prepared for work with young children and understand basic principles of child development is a component of ensuring digital technologies are safely adapted to ECEC settings. This type of training can be facilitated through alignment with curriculum frameworks, enabling staff to understand curricular goals in context, as well as any specific goals around children's access to and engagement with digital tools. In addition, practical experience is essential to ensure staff are prepared to implement the tools and strategies they learn in their courses (Botturi, 2019[30]); without this, staff may feel their training was inadequate, despite having been exposed to relevant content (Masoumi, 2020[31]). Strengthening initial training can help future staff engage in the full range of activities with digital tools that will be required of them in their careers.

The importance of continuous professional development

Continuous professional development complements initial training and is critical to support staff to adapt as technologies change and new best practices emerge. CPD is a strong tool for ensuring quality in ECEC and a key mechanism for ensuring ECEC staff keep up-to-date, or receive foundational skills for those with limited initial training, on digital technologies and children's development in a digital world (OECD, 2018[25]; OECD, 2022[4]).

TALIS 2018 data show that, on average across 31 participating OECD countries, only 43% of lower secondary school (ISCED level 2) teachers felt "well" or "very well" prepared for using information and communications technology (ICT) in teaching, a finding echoed in other data sources (Guernsey, 2014[19]; OECD, 2019[32]). Moreover, teachers who had participated in online courses or seminars as part of their professional development were also those who reported greater comfort with and use of ICT in the classroom (Minea-Pic, 2020[8]). These data highlight that CPD is indispensable for bringing educators in general into the digital world. As digital technologies become increasingly part of initial training programmes, teachers and ECEC staff may become more and more confident using such tools in practice. Nonetheless, given the pace of technological change as well as the need to further train the existing workforce, CPD is important for helping all staff acquire foundational digital competencies, especially until these skills become more embedded in initial preparation.

ECEC staff need specific skills and training, adapted to the particular needs of working with young children. The flexibility of digital CPD to connect ECEC staff with similar training needs and interests, and to address

learning goals in a timely manner, is a clear advantage of digitalisation. However, when efforts to engage in CPD become a demand on ECEC staff that is not appropriately balanced with pay, flexibility in working hours and direct contact time with children, or professional recognition, an expectation to engage in digital CPD can create stress. These demands on staff and the instability of the workforce can have an impact on the quality of ECEC children experience overall.

Requirements and funding for continuous professional development

Policies can support CPD on digital competencies by ensuring training is available to ECEC staff, as well as by funding and/or making participation in the training mandatory (Figure 5.4). The types of CPD opportunities that are funded (Figure 5.5) can also have an important influence on the extent to which staff engage with digital tools and, ultimately, the potential for improving quality in ECEC settings. This section looks at the different ways countries require or fund opportunities to develop digital competencies for ECEC staff, as well as some specific types of CPD using digital tools that receive government funding. Digital tools are considered both a topic for CPD and a mode of accessing it.

The most appropriate approach depends on the governance and systems in place for the ECEC sector. The national or federal authority is responsible for determining policies for professional development on digital competencies for ECEC staff and leaders in only 15 of the 37 countries and jurisdictions that responded to the *ECEC in a Digital World* policy survey (2022). This responsibility is often shared across multiple levels of governance (i.e. regional/state, local/municipal, ECEC centre/governing board, leaders/staff in the ECEC setting) and may depend on the type of management of the ECEC setting (i.e. public or private). For instance, in Slovenia, where the national government shares responsibility for professional development on digital competencies with ECEC leaders/staff, the Ministry of Education defines priority themes for CPD. Each year the ministry publishes a catalogue of trainings available to teachers and leaders across levels of education. The courses' content is updated regularly to reflect identified needs and many are co-financed by the ministry. For several years now, one of the priority themes has been "Teaching, learning and evaluating achievements in the learning and study process with a focus on modern learning technology and innovative teaching and learning approaches."

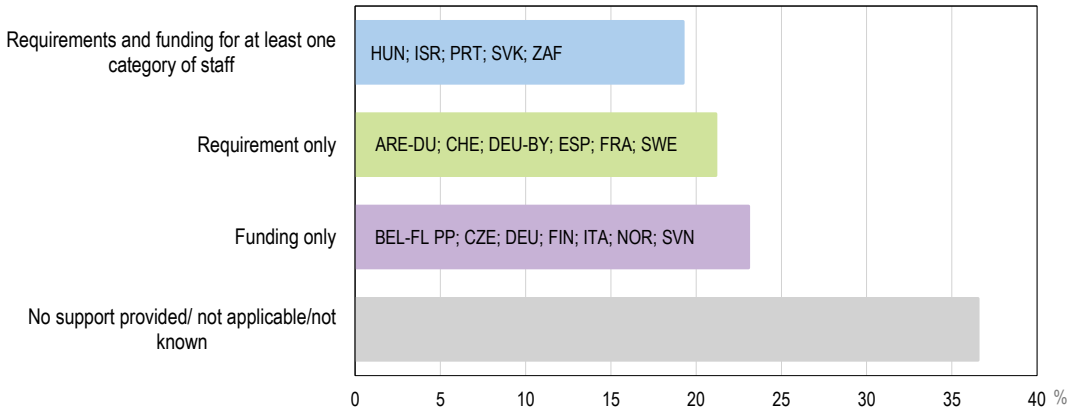
The *ECEC in a Digital World* policy survey (2022) asked whether countries and jurisdictions have requirements or funding for CPD on digital competencies for different groups of staff: leaders, teachers and assistants. Overall, both requirements and funding are more common for leaders and teachers than for assistants. Only five countries have both requirements and funding to participate in CPD that support staff to develop digital competencies, although countries may have strategies to encourage participation, such as by providing funding for relevant CPD, even when it is not required. For example, in Estonia, although it is not compulsory, as of 2022, 99% of kindergartens had participated in the ProgeTiger programme, which offers resources for procuring digital tools and materials, but also ongoing training opportunities to advance teachers' digital skills (Case Study EST – Annex C). However, of the countries that responded to the survey, a plurality (37%) indicated there was no support provided for digital competencies in CPD or that the question was not applicable in their context (Figure 5.4). These data underscore the varying degrees to which CPD for ECEC staff is supported in general across countries, particularly regarding supporting this workforce in the digital world.

The *ECEC in a Digital World* policy survey (2022) further asked about the funding for specific types of digital CPD activities, regardless of the roles of ECEC staff targeted by these funds (Figure 5.5). Responses show that a majority of countries and jurisdictions support traditional approaches to CPD, with 53% of respondents indicating that online courses, seminars or massive online open courses (MOOCs) receive government support for ECEC staff participation, and the same percentage of countries and jurisdictions provide funding support for blended online/in-person training activities. In contrast, only 19% of respondents indicate funding for mentoring or coaching activities supported by digital tools (e.g. online content, communication or networking tools), and 18% of respondents indicate financial support for staff

induction activities that use digital tools (e.g. online content, communication or networking tools). The potential for mentoring/coaching and induction programmes to improve staff practices is great, and discussed in more detail later in this chapter. Funding this type of CPD could be a meaningful strategy to build quality in ECEC, making the most of what digital tools can offer.

Figure 5.4. Digital competencies in continuous professional development

Percentage of countries and jurisdictions supporting in-service training on digital competencies for ECEC professionals implemented at a national/jurisdiction level for any category of staff, 2022

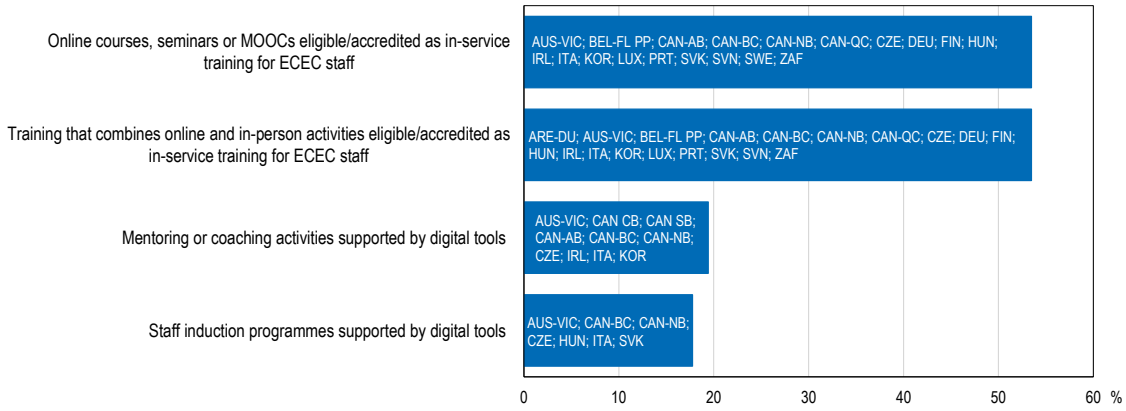


Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Staff include leaders, teachers, assistants or any other unspecified staff groups.
BEL-FL PP: pre-primary education in Belgium (Flanders).
Items are sorted in ascending order of the share of countries selecting each option.
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.12.

StatLink https://stat.link/5gal0v

Figure 5.5. Funding for participation in continuous professional development

Percentage of countries and jurisdictions where ECEC authorities provide funding for in-service training that uses digital tools, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
MOOCs: massive open online courses.
BEL-FL PP: pre-primary education in Belgium (Flanders). CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada.
Items are sorted in descending order of the share of countries selecting each option.
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.13.

StatLink https://stat.link/p0n5wq

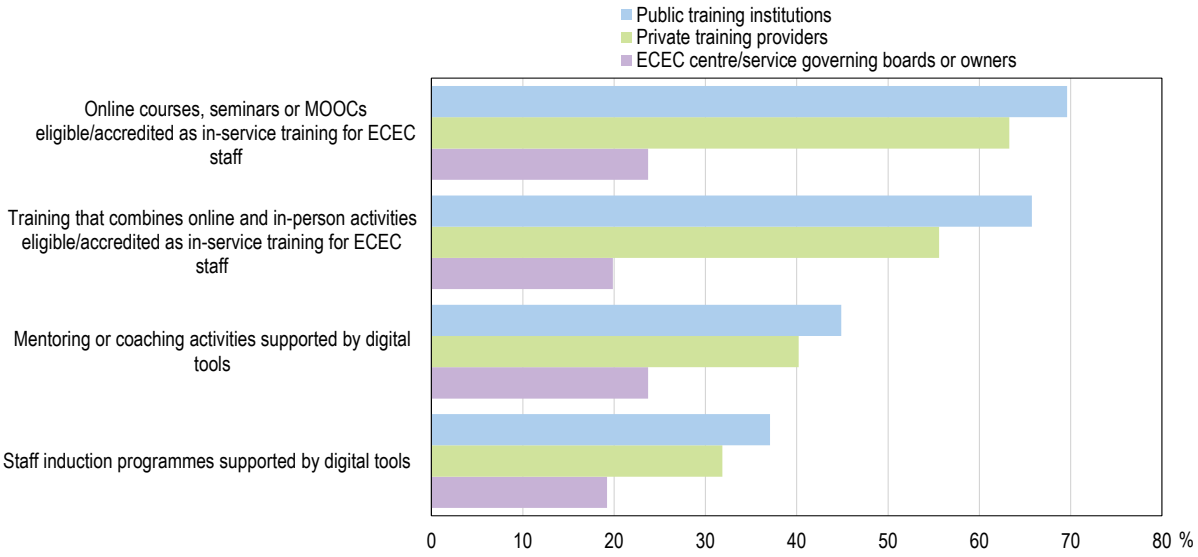
Participation in digital continuous professional development

Staff must have access to and be able to successfully engage with digital technologies to participate in many types of CPD. In these instances, digital tools are the mode of training, meaning staff digital resources and competencies can hamper participation in digital CPD or, alternatively, accelerate their access to a wide array of training opportunities. Digitalisation itself can be the topic of CPD that is delivered using digital technologies, but this is not necessarily the case.

As the responses from the *ECEC in a Digital World* policy survey (2022) show, online or combined online and in-person training activities are available in most countries (Figure 5.6). However, data from ECEC staff participating in TALIS Starting Strong 2018 and from teachers participating in TALIS 2018 indicate that participation in online courses/seminars as part of professional development is not widespread, averaging only 34% of lower secondary teachers across OECD countries with available data (Minea-Pic, 2020[8]). Across the nine countries included in TALIS Starting Strong 2018, participation of ECEC staff in online CPD is even lower, under 25% in all countries, with the exception of Korea, where 81% of staff reported having online professional development (OECD, 2019[5]).

Figure 5.6. Digital technologies for continuous professional development

Percentage of countries and jurisdictions supporting the continuous professional development of ECEC professionals, by type of provider, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Response categories are not mutually exclusive: countries and jurisdictions could select all applicable responses.
MOOCs: massive open online courses.
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.13.

StatLink https://stat.link/2lv7ma

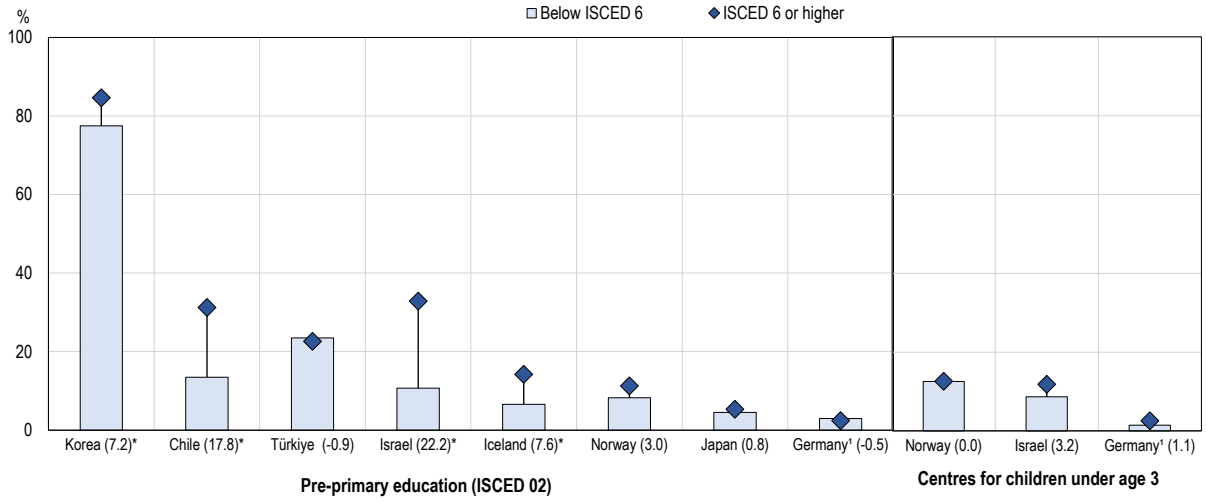
The mismatch between the high availability of online training resources and low participation by ECEC staff may be partly related to shifts that occurred beginning in 2020 due to the COVID-19 pandemic to make online resources more available, which was two years after the data collection for TALIS Starting Strong 2018. Yet, available evidence on adult learning highlights that the skills and equipment necessary to access or take full advantage of digital learning opportunities should not be taken for granted. For example, it is generally younger, more skilled and more educated people who engage in open online

courses and distance education (OECD, 2019[33]). Among teachers specifically, there is a higher online course dropout for those with less experience participating in online professional development (Dash et al., 2014[34]). Furthermore, teachers' participation in distance learning for professional development occurs mainly outside working hours, suggesting an element of convenience to take these courses at any time. However, this situation also underscores the fact that these learning opportunities are often in addition to other professional demands (Minea-Pic, 2020[8]).

Given the heterogeneity of the ECEC workforce and the low levels of education required to work in many ECEC roles, challenges of accessing CPD through digital platforms are likely to be accentuated. Data from TALIS Starting Strong 2018 confirm that in several participating countries, staff with a higher level of education are more likely than their colleagues to participate in online CPD (Figure 5.7). In addition, a strong link exists between staff and leaders participating in *online* courses or seminars and those participating in *in-person* courses or seminars, indicating that the uptake of online trainings is led by those more engaged in training activities in general. This finding suggests that online trainings may currently complement rather than replace in-person trainings. Although this situation is not necessarily problematic, it does suggest a missed opportunity to capitalise on digital tools to expand CPD opportunities to a wider group of ECEC staff.

Figure 5.7. Early childhood education and care staff participation in online courses/seminars

Staff reports of their participation in online courses/seminars during the last 12 months, by educational attainment, 2018



1. Estimates for sub-groups and estimated differences between sub-groups need to be interpreted with care. See OECD (2019[5]) for more information.

Notes: Differences in participation rates based on staff's educational attainment are shown next to the country name. Statistically significant differences are marked with an asterisk. See Annex A.

Countries are ranked in descending order of the total proportion of staff who participated in online courses/seminars.

Source: OECD (2019[35]), *TALIS Starting Strong 2018 Database*, https://www.oecd.org/education/school/oecdtalisstartingstrongdata.htm (accessed on 10 December 2022).

StatLink https://stat.link/308jma

It is also clear that the ECEC workforce does not have sufficient time to engage in CPD as part of their regular professional duties, compared with teachers at other levels of education (OECD, 2022[36]; Dardanou et al., 2023[16]). A lack of time to engage with and explore the potential of technology can itself limit how teachers implement these tools in their practice (Kontovourki et al., 2017[37]). Across countries,

pre-primary teachers generally have less paid time outside of their work with children than primary teachers; however, there is great variation from country to country (OECD, 2022[36]). In Germany, although paid hours outside of work with children tend to be low for pre-primary teachers, other strategies are emerging to support ECEC staff engagement with digital technologies. For instance, in Germany (Bavaria), the government identified through a pilot project that staff needed more support to engage with digital tools and has thus developed guidelines in several areas, such as "Tablets in day-care centres – Clues for getting started" and "App list for educational activities in day-care centres" (Case Study DEU_Bav – Annex C). Although in-service training is compulsory in many countries, only a few countries offer financial and time compensation for ECEC teachers' ongoing training. This can impact their participation in CPD, whether online or in-person, particularly in countries where in-service training is not compulsory. It may also limit the extent to which teachers engage in available CPD beyond meeting the minimum requirements.

The *ECEC in a Digital World* policy survey (2022) on the use of digital technologies for early education during COVID-19 shows that, with the first wave of COVID-19 in 2020, many ECEC facilities were closed worldwide and staff in many places had to continue their work remotely (OECD, 2021[1]). While before COVID-19, digital technologies were mainly used for communication with parents/caregivers, during COVID-19 they were also expected to serve as a platform for education and care for young children. In this context, a lack of digital resources such as tablets or Internet connections was observable in both pre-primary and primary school, although shortages were more widespread at the pre-primary level: about 40% of the participating countries reported that these shortages were a challenge at the pre-primary level, versus about 30% at the primary level.

In addition to staff's skills and competencies to engage with digital CPD, the sources of these training opportunities are important to consider to fully understand how and what ECEC staff can access. Provision of CPD for the ECEC workforce often comes from a wide variety of actors, both public and private. This is the case for digital CPD as well (see Figure 5.6). While this model of mixed provision of CPD is essential in many countries to ensure a sufficient supply of ongoing training opportunities for ECEC staff, this situation can contribute to variability in the quality of training staff receive (OECD, 2022[4]). Perhaps even more than for CPD that occurs only in-person, it is important to consider which actors are offering CPD through digital platforms. For instance, companies with commercial interests that offer digital trainings may encourage or even require participants to purchase specific software or resources for use with children. Country-level data from the OECD's *Survey of the Use of Digital Technologies for Early Education During COVID-19* (OECD, 2021[1]) show that the use of commercial distance education platforms and apps was common for primary school settings during the pandemic, with 33% of countries indicating they were used to a great extent and another 42% indicating they were used to a moderate extent. The use of these commercial products was somewhat less for pre-primary settings (7% and 57%, respectively), but with the increasing use and awareness of digital tools in ECEC, this situation has the potential to evolve rapidly. Although such commercial tools and products can be useful, there is a need for monitoring to ensure ECEC staff receive ongoing training that is relevant to their work, of good quality and consistent with policy goals for engaging the ECEC sector with digital tools.

Across countries, it is most common for the types of digital CPD covered by the *ECEC in a Digital World* policy survey (2022) (including induction programmes, where relevant) to be provided by a mix of public and private actors (see Figure 5.6 and Box 5.3). Only a handful of countries and jurisdictions rely exclusively on publicly provided CPD using digital resources for ECEC staff, and even fewer rely exclusively on private providers. In addition, in a relatively small share of countries and jurisdictions (19-24%), these types of CPD are provided by the ECEC centre/service governing boards or owners, although typically, this is in conjunction with public and/or private training institutions as well (there are exceptions in South Africa and the United Arab Emirates). While it is important to ensure the quality of the CPD programmes offered across different types of providers through oversight and monitoring, supporting local ECEC programmes to implement CPD opportunities using digital tools could help improve staff's

access. If ECEC centres are engaged with the provision of CPD, staff may have better hands-on support to overcome any barriers to digital participation, and receive necessary foundational training on digital tools from their colleagues. In general, training to develop basic digital skills, of the sort that would help staff take part in digital CPD, can be relatively easily developed, but it is not clear that there are consistent mechanisms to reach the ECEC workforce with these kinds of trainings (Guernsey, 2014[19]).

Finally, while online training expands the possibilities for CPD, face-to-face CPD offers the opportunity to reflect with colleagues, receive feedback, get support, and share challenges in real-time and with a greater focus on interpersonal connections. This is an important strength of this approach to training (Dunst, 2015[38]; Lawless and Pellegrino, 2007[39]).

Training approaches that combine the strengths of both virtual and face-to-face experiences are gaining momentum. For example, evidence suggests that training models that allow learners to familiarise themselves with information, such as through videos, before meeting face-to-face for reflection and support, are highly promising for promoting teachers' integration of technology in their teaching (Yurtseven Avci, O'Dwyer and Lawson, 2020[40]). Similarly, the effect of virtual CPD can be strengthened when combined with support from a responsive coach or colleagues (Crawford et al., 2021[41]). Furthermore, a review of 11 experimental or quasi-experimental studies that integrated technology-delivered CPD with in-person contact for ECEC staff shows that these models were effective in changing teaching practices, and also generally demonstrated impacts on children's learning as well (Snell, Hindman and Wasik, 2019[42]).

Box 5.3. Connecting early childhood education and care staff to digital training resources

The **Australian** eSafety Commissioner has developed a series of free online learning modules for educators and service leaders (Case Study AUS – Annex C). While the modules for educators focus on the practical benefits and risks of technology, primarily as a communication, creativity, information and entertainment tool, the module for leaders addresses policies and processes. These are designed to ensure a safe environment in early childhood education and care (ECEC) facilities. In general, educators should strengthen the child's self-regulation skills and critical thinking and build good habits regarding digital technologies through the four messages of being safe, being kind, asking for help and making good choices.

The provincial government of **Manitoba** in **Canada** has partnered with the Science of Early Child Development platform to provide free access to online self-study materials to everyone in the province (Science of Early Child Development, 2022[43]). This is designed to support the continuous professional development of ECEC staff, and to be relevant for parents and others interested in early childhood. The platform also offers a wide range of resources, such as virtual textbooks, that are freely available in the provinces of British Columbia, Manitoba, and Newfoundland and Labrador.

In **Costa Rica**, the National Child Care and Development Network began offering training webinars for ECEC staff in May 2020, both as a response to the COVID-19 pandemic and to address a need for training in the sector more generally (Case Study CRI – Annex C). The initiative provides technical support to ECEC staff as needed. By using common videoconferencing technology and providing free webinars, the initiative has reached staff across the country.

Italy has launched the Scuola Futura platform as part of the National Plan for Recovery and Resilience in the wake of the COVID-19 pandemic (Scuola Futura, 2021[44]). It offers staff from all levels of education the opportunity to adapt to the digital transformation through training. The courses are run by three different institutions that are spread all over Italy and offer different face-to-face and online

courses. The courses address the digital transformation of schools and ECEC settings as organisations, and offer tools and materials for digital teaching.

In **Korea**, the i-Nuri Portal was established to disseminate resource materials developed by central and local governments for the play-based Nuri Curriculum (OECD, 2022). The portal has five domains: 1) Nuri for Learning (disseminating materials developed at the national level); 2) Nuri for Sharing (sharing materials for practices by themes); 3) Nuri for Supporting (providing up-to-date trends on play and materials to respond and prevent COVID-19); 4) Nuri for Communication (an online community among users, such as experts, teachers, parents); 5) Nuri for Parents (providing materials for parents). There are more than 2 700 resource materials, including distance learning contents, video clips, forms for observational records and more.

Spain has developed a mobile application, EduPills, which offers teachers across ECEC and school education access to micro-learning opportunities to strengthen their digital competency across the domains reflected in their Digital Competence Framework (INTEF, 2017[45]).

Sources: INTEF (2017[45]); OECD (2022[9]); Science of Early Child Development (2022[43]); Scuola Futura (2021[44]).

Building enhanced and specialised competencies for using digital technologies

Foundational training through initial education and access to CPD are core to ensuring all ECEC staff are able to navigate the digital world in ways that protect children from risks and recognise the role digital technologies can have in ECEC settings. With regular access to digital tools (e.g. Internet, computers) and ease of using them, staff can move beyond the basics of navigating digital resources and begin to integrate them into practice in meaningful ways. Building on foundational competencies, some ECEC staff will be ready to engage more deeply with digital technologies to bring added value to their pedagogical work with children, grow further as professionals, and streamline management and leadership tasks.

A lack of information on what works best with young children in terms of ideal or optimum engagement with digital technologies creates another layer of challenges for developing ECEC staff's digital competencies (see Chapters 2 and 4). The speed of development of new technologies and emerging research on their use with young children mean that knowledge and best practice are constantly evolving. Likewise, identifying who is responsible for ensuring staff are successfully making use of digital tools, with success defined in the context of national/subnational goals for digitalisation in ECEC and with the reality of ECEC systems that are often highly decentralised, creates further complexity for developing a digitally competent ECEC workforce.

Staff with enhanced digital competencies are well positioned to use these skills to benefit from digital resources to stay abreast of changes in the field and generally to engage proactively with these tools in a professional capacity. Specialised staff have an important role to play in supporting the ECEC workforce, and are already part of the workforce to varying degrees (OECD, 2022[46]). Further developing a specialised workforce in ECEC systems could permit the most motivated and competent staff with regards to digital technologies to take on roles to support both staff and children to benefit from and navigate risks associated with the digital world.

This section addresses how professional development activities (in any format, online or in-person) can help staff enhance their engagement with digital technologies in all aspects of their work, going beyond the foundational issues of requirements, funding and access discussed in the previous section. It then turns to how digital tools can facilitate the professional engagement of ECEC staff through opportunities for professional collaboration as well as continuous quality improvement through coaching and mentoring. Opportunities to support ECEC staff to become digital specialists and for such specialists to bring benefits

to the work of their colleagues and the experiences of children in ECEC settings are noted throughout the section.

Continuous professional development to enhance staff's digital skills in their work with children and beyond

The content of ongoing training for ECEC staff needs to be tailored to working with young children with digital tools as both a professional resource and a pedagogical tool. This is consistent with the idea of skilled integration of technology into pedagogy that is proposed in the TPACK model (Mishra, 2019[15]) (see also Chapter 4). In addition, CPD for ECEC staff should address how digital tools can facilitate the full range of their work, including for management and leadership tasks as well as engaging effectively with families, and beyond.

The content of CPD is essential to support countries' and jurisdictions' goals for children in a digital world (see Chapters 2 and 4). Several countries are developing and offering trainings for ECEC staff based on the recognition that developing children's early digital literacy is essential for them to grow into engaged digital citizens, making the most of the opportunities technology affords while mitigating risks (Box 5.4). For example, Spain has set goals of empowering children to thrive and have agency in a constantly evolving society, while supporting digital equity across gender and socio-economic background (Case Study ESP – Annex C). Recognising the core role of teachers in achieving this outcome, the country is offering training modules to teachers, and specifically pre-primary teachers, to enhance their digital pedagogy. It is also supporting school-based project work. Similarly, the ProjeTiger programme in Estonia includes digital pedagogy as a target for 2035, ensuring educators (including in ECEC) are familiar with trends, opportunities, risks and methodologies related to new technologies (Case Study EST – Annex C).

Unfortunately, Mertala (2019[22]) finds that training for ECEC staff is often overly focused on using technology to teach academic subjects, leaving out uses around socialisation and care that are fundamental to ECEC. Staff also tend to view technology more positively related to education themes (e.g. academic performance) than to care themes (e.g. physical and emotional well-being).

Box 5.4. Early childhood education and care staff professional development designed to support children's early digital literacy

The National Education Institute in **Slovenia** organises ongoing training in various forms (e.g. conferences, seminars, study groups) for professionals throughout the education system. In the school year 2021/22, the theme for early childhood education and care (ECEC) staff was on how to provide a stimulating learning environment and optimal opportunities for children's learning and development, along with the principles and approaches of innovative learning environments for the 21st century. These trainings aim to highlight the importance of safe and meaningful uses of digital technology in the group of children, and for collaboration between professionals and parents as well as for improving their own digital competencies. Examples and suggestions for ways to use technology directly with young children are a central component (OECD, 2022).

Similarly, in **Germany**, the foundation Little Scientist's House (*Haus der kleinen Forscher*) is working to provide children ages 3-10 with their first experiences in computer science, with or without computers (Case Study DEU_2 – Annex C). To accomplish this goal, the foundation offers training for ECEC staff: a one-day in-person training as well as two one-hour online courses. The in-person course is offered at a low fee through a network of local partners, and the online modules are available for free through the foundation's learning platform. These trainings aim to foster ECEC staff's motivation to use an

unplugged approach to introducing computer science to children, and are an opportunity for staff to explore technologies (e.g. robotics kits) that they may implement as appropriate in their settings.

Source: OECD (2022[9]).

In addition to content on using digital technologies pedagogically, CPD is important for updating and developing staff's capabilities to use digital tools for management and leadership tasks. As business practices in the sector, including requirements around reporting for monitoring and quality assurance, become more digital, ECEC staff and leaders need a range of skills to navigate new software for these purposes. While there is tremendous potential to streamline the work required around record-keeping and reporting with digital tools, shifting requirements and changing digital systems necessitate retraining and investing staff time that can impose steep burdens on a workforce already responsible for a wide range of tasks in addition to their core work with children.

Responses to the *ECEC in a Digital World* policy survey (2022) show that in a majority of countries and jurisdictions, ECEC authorities provide support for specific work processes with digital solutions (Table 5.3). This is especially the case for supporting digital solutions for ECEC settings to facilitate data collection and administrative services. For example, in Ireland, an online tool is available from the government for ECEC settings to manage participation in the ECEC subsidy system. In Japan, to reduce administrative burdens on staff, the government subsidises ECEC centres' investments in digital systems for planning and record-keeping, for instance to track changes in child enrolment (Ministry of Health, Labour and Welfare of Japan, 2022[47]). Nonetheless, in nearly a quarter of countries and jurisdictions, this kind of support is up to the ECEC setting to provide. This is the case in Canada (British Columbia), where ECEC centres receive funding from the province to support operating expenses, but it is up to the ECEC centre whether to use any of this funding to support digital solutions for administrative tasks. However, the ECEC authority in British Columbia supports other aspects of work processes, such as by providing an online platform to assist ECEC staff in finding relevant training opportunities, as well as keeping track of their participation to meet requirements for CPD (earlyyearsbc.ca). Support for digital solutions for facilitating communication and engagement with parents/families is the least often provided by ECEC authorities: it is left to the ECEC setting in a third of countries and jurisdictions with available data (see Chapter 6).

Table 5.3. Digital technologies to support work processes in early childhood education and care settings

Percentage of countries and jurisdictions supporting work processes with digital solutions in ECEC settings, by source of support, 2022

	Digital solutions for ECEC settings to facilitate data collection and administrative tasks	Digital solutions for professional collaboration and peer learning	Digital solutions for the exchange of learning or pedagogical materials	Digital solutions for facilitating communication and engagement with parents/families
Australia				
Australia *(South Australia)*				m
Australia *(Tasmania)*				
Australia *(Victoria)*				
Belgium (Flanders PP)				
Belgium (Flanders U3)				
Canada CB			m	
Canada SB				
Canada *(Alberta)*				

	Digital solutions for ECEC settings to facilitate data collection and administrative tasks	Digital solutions for professional collaboration and peer learning	Digital solutions for the exchange of learning or pedagogical materials	Digital solutions for facilitating communication and engagement with parents/families
Canada *(British Columbia)*				
Canada *(Manitoba)*				
Canada *(New Brunswick)*				
Canada *(Quebec)*				
Czech Republic				
Denmark				
Finland				
France				
Germany				
Germany *(Bavaria)*				
Hungary				
Iceland				
Ireland				
Israel				
Italy				
Japan				
Korea				
Luxembourg				
Morocco				
Norway				
Portugal				
Slovak Republic				
Slovenia				
South Africa				
Spain				
Sweden				
Switzerland				
United Arab Emirates *(Dubai)*				
Percentage of countries with support from ECEC authorities AND ECEC centre/service governing boards or owner	32	27	27	28
Percentage of countries with support from ECEC authorities only	41	36	41	25
Percentage of countries with support from ECEC centre/service governing boards or owner only	22	25	24	33

Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
ECEC authorities AND ECEC centre/service governing boards or owner
ECEC authorities only
ECEC centre/service governing boards or owner only
No
Not applicable or Not known
m: Missing
Source: OECD (2022[9]), *ECEC in a Digital World* policy survey, Table B.14.

StatLink https://stat.link/apfhyq

Professional collaboration

Digital technologies offer expanded possibilities to connect with colleagues and reflect on practice in meaningful ways, promoting continuous improvement in practice and deepening professional engagement. Professional collaboration can take place through digital platforms, connecting ECEC staff across settings and geographies, but it can also be a tool through which staff within an ECEC setting support one another to develop digital competencies. Staff beliefs about technology and how to use it are shaped by discussion and reflection within ECEC centres; this is particularly true for interns learning from ECEC staff in their practicum placements (Mertala, 2019[22]).

As Table 5.3 shows, it is common for ECEC authorities to support digital solutions for professional collaboration and peer learning and exchanging learning and pedagogical materials. Once again, however, the ways in which countries/jurisdictions implement these supports can vary widely, and generally ECEC services have autonomy to engage with the supports as they see fit (see Box 5.5). In Israel, the "Physital Spaces" programme is designed around this principle, that the ECEC setting needs to adapt digital pedagogy to match its needs and expertise (Case Study ISR – Annex C). Leaders and staff receive training on how to combine physical and digital environments for young children, as well as needed materials (e.g. computers) and technical support. ECEC leaders are then expected to help staff implement these approaches at a level that matches their own digital competency.

Several countries are cultivating online repositories of resources for teachers across education levels. For example, in Finland, the Ministry of Education and Culture and the Finnish National Agency for Education are developing a Library of Open Educational Resources. In Belgium (Flanders), KlasCement is a government-organised platform for teachers to share resources with one another, covering all ages and subjects. There is a dedicated segment of the platform for pre-primary teachers, as well as possibilities to ask questions and dialogue with other educators on the platform. In Canada (British Columbia), the provincial government supports several privately run digital initiatives to share resources and promote collaboration among ECEC staff. These include the Westcoast Early Learning Library, a publicly accessible collection of more than 12 000 loanable early learning resources, and a range of work in collaboration with the group Early Childhood Educators of British Columbia (ECEBC). The ECEBC is a partner for the Early Years Professional Development Hub, a platform connecting ECEC staff to one another and to CPD opportunities. In Germany (Bavaria), the ECEC Hub provides free online resources: the platform is being scaled up with the goal of eventually becoming available to all ECEC staff, although at present, it is only available to staff participating in affiliated CPD (Case Study DEU_Bav – Annex C). The European Commission also supports a free, online educational community of teachers at every level of schooling, known as eTwinning (European Commission et al., 2021[48]).

While collaboration with other ECEC staff can be a powerful strategy to enhance professional development, with the breadth of available information and resources online, staff may not always know how to find tools that are tailored to their needs and interests. In this context, the European Education Area launched the online tool, "Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies" (SELFIE) in October 2021 (SHERPA, 2022[49]; European Commission, n.d.[50]). SELFIE is based on DigCompEdu (Redecker, 2017[14]) and uses reflection questions to assess staff confidence and experience in using digital technologies. Based on the answers, a personal report with suggestions for improvement is produced. The areas covered are: learner empowerment, teaching and learning, assessment, digital resources, and promoting learners' digital literacy. Although SELFIE is aimed primarily at primary and secondary teachers, it is available to teachers at all levels around the world. A version of the tool specifically for ECEC staff is expected to be released in 2023 (European Commission, 2023[51]).

Box 5.5. Digital resources to support professional collaboration

In **Iceland**, learning communities in participants' workplaces include courses for teachers, staff and administrators from pre-primary through secondary school (Menntamidja, 2022[52]). The courses are offered remotely, using videoconferencing tools, but are embedded in both daily work and practice, with in-person meetings for small groups scheduled regularly. Visits from the course instructors to the early childhood education and care (ECEC) settings during working hours are also part of the learning process. This model aims to ensure the successful development of all participants and involves constant communication and dialogue between professionals, which can have the side effect of more successful professional development. Central to this is a shared vision and values around learning and teaching, reflection, support for professional development, trust and job satisfaction, a culture of collaboration, and distributed and supportive leadership. In general, leaders are an important component of successful development. They can encourage their staff and provide an appropriate framework, e.g. time for reflection and discussion. For example, one course is about science, technology and language development in kindergarten. In a first step, the participants familiarise themselves with the topics and prepare questions, they then discuss with the team how the topic can be implemented in practice. Next, the implementation is observed and, finally, discussed again with the team.

The **Norwegian** curriculum focuses on digital judgement, especially the rules for protecting privacy on the Internet, and on developing an ethical understanding of digital media (Norwegian Directorate for Education and Training, 2017[53]) (Case Study NOR – Annex C). To support staff's professional development, the Norwegian government provides online competency packages as well as informative web pages (Norwegian Directorate for Education and Training, 2022[54]). The competency packages are kindergarten-based, and aim to increase staff knowledge and support planning for activities to test new practices, followed by sharing, reflecting on and discussing these practices. This process is expected to support continuous improvement. The packages are divided into several modules: an introduction, contextualisation and definition of digital judgement, learning how to use the Internet safely and securely, developing skills to assess the credibility of online content and to interact with children to develop these skills, understanding copyright laws and finding open-access products, followed by a final feedback section. Each module includes reading and visual material, audio clips, activities and discussion topics. The website is accessible to all in the education field. For ECEC, it provides films and guiding questions appropriate for children and adults. Another website has been created specifically for kindergarten (*Rammeplan for barnehagen*), and conferences have also been held to connect more easily with kindergarten leaders and teachers.

In **Slovenia**, the initiative Kindergarten Litija brings ECEC staff together for the purpose of shared critical reflection through peer observation (Case Study SVN_1 – Annex C). Recognising that observation from external actors can be threatening for staff who may fear negative evaluation, and that engaging with digital tools to fully engage in this type of work entirely remotely can be a barrier, this programme aims to provide opportunities for teachers and assistants to collaborate and reflect with their colleagues locally. The observation is filmed so that staff can revisit and continue to reflect on the strengths and areas for improvement, and as needed, the discussions among staff can also take place through videoconferencing tools. The government supports ECEC settings to purchase the digital tools needed to make and store these recordings, and also have access to technical assistance, such as help setting up the equipment. Through this process, staff in ECEC centres can build a common understanding of quality practice, learn from each other and improve.

Sweden has implemented a continuous learning approach for digitisation in its 2018 preschool curriculum. To this end, both staff and leaders can participate in various competency packages provided by the Swedish National Agency for Education. In these courses, staff are introduced to the topic theoretically, followed by a practical exercise, after which they are encouraged to discuss the topic with their colleagues in a reflection phase. Finally, they are encouraged to find a way to integrate the course content into their work with children (Skolverket, 2021[55]). Training content targeted to ECEC leaders is also available. The National Agency for Education provides free online resources to help leaders establish a plan for developing digital competencies in their settings, which should be tailored to each setting through the organisation of a local, collaborative working group (Skolverket, 2022[56]). Ideally, each working group has a process manager and a supervisor, appointed by the ECEC leader. The process manager informs participants about the purpose of the skills development and organises working group sessions. Supervisors lead the groups and are responsible for becoming familiar with the online training content in advance of the working group meetings. Recently, another course was implemented in Sweden on the digitalisation of teaching practice and its impact on children. Each teacher familiarises themselves with the topic using the materials provided, then discusses what they have learnt with their colleagues. This is followed by classroom visits where notes for improvement can be made and a follow-up reflecting on the classroom visits (Skolverket, 2018[57]).

Sources: Menntamidja (2022[52]); Norwegian Directorate for Education and Training (2022[54]); Skolverket (2022[56]; 2018[57]; 2021[55]).

Coaching and mentoring

Coaching and mentoring are highly promising strategies for ongoing improvement in ECEC staff practices (Kraft, Blazar and Hogan, 2018[58]). Research shows strong outcomes from participation in coaching, and there are clear possibilities for expanding and enhancing coaching capabilities through the use of digital technologies. The benefits of coaching programmes include their ability to tailor professional development to individual staff or teams of staff working together, as opposed to more traditional coursework where staff are left to make the connections to practice on their own (Elek and Page, 2018[59]). In addition, coaching typically takes place over an extended period of time, allowing staff to try new things and reflect on their practice with the coach as they learn to adapt new resources and strategies. Integrating digital tools into the provision of coaching and mentoring can allow coaches to meet more regularly with staff (e.g. through video-chat), provide a wider variety of support and expertise to staff in rural areas, and permit staff to reflect on their own practices with children by watching video recordings of themselves.

Policy data show this is an area of investment for countries that responded to the *ECEC in a Digital World* policy survey (2022) as well, with 45% of countries providing mentoring or coaching activities through public training institutions (Figure 5.6). In addition, these services are offered by private training institutions in 40% of countries, and by the boards or owners of ECEC settings in 24%. Nonetheless, compared to other types of CPD, overall opportunities to participate in coaching and mentoring are rather low. For example, the possibility of online courses, seminars or MOOCs offered by public education institutions is reported by 70% of the countries. To some extent, countries such as Estonia and Lithuania are using digital tools to provide rapid feedback to training course participants (Case Studies EST and LTU – Annex C). This type of feedback is not as extensive or in-depth as other coaching models (Box 5.6). It is, nonetheless, a strategy to capitalise on the strengths of digital technologies to offer professional development that is more tailored to individual learners.

Box 5.6. Combining online learning with coaching to improve early childhood education and care staff practices

In **Canada (British Columbia)**, a peer-mentoring programme is being developed and expanded through combined public and private funding (Doan, 2019[60]; Early Childhood Educators of British Columbia, 2022[61]). This programme aims to build infrastructure to support early childhood education and care (ECEC) staff and reduce turnover in the sector. In the first year of funding, mentors and mentees met monthly in person at group gatherings, with opportunities to meet weekly in person, online or by phone. Communities of practice were developed and groups were given a private online platform to post and engage in discussion; facilitators posted weekly. Findings from the pilot phase of this initiative show that ECEC staff valued the opportunity for mentorship, noted increased self-efficacy and had suggestions for further developing the peer-mentoring model, including through expanded use of digital resources.

One example of many from **Germany** is the project "Quality development in ECEC through a web-mediated training of supportive interactions between ECEC practitioners and children of heterogeneous groups of toddlers" (iQuaKi) (Binational Center for Early Childhood, 2022[62]). The project is funded by the German Federal Ministry of Education and Research. In the first phase of the project, an online training for ECEC practitioners was created which presents theoretical content about the quality of interactions with the aid of videos. For a reflection with the coaches and colleagues, ECEC practitioners are encouraged to record themselves in a daily situation. The coaching part is divided into three sessions. The first session aims to understand on what and how the ECEC practitioners have been working and to set some goals for the next two sessions. The second and third coaching sessions focus on the video recordings, which will first be analysed alone then discussed together. In these sessions, ECEC practitioners are encouraged to analyse their own pedagogical actions and identify their strengths and weaknesses.

To address the shortage of qualified ECEC staff in **US** military ECEC settings, the Virtual Lab School (VLS) was developed, and has now been implemented in community-based settings as well (Lang, 2022[63]; Virtual Lab School, 2022[64]). VLS aims to ensure all ECEC staff have core knowledge and skills by providing courses through an online platform. In addition to these courses, completed on a self-paced schedule, staff receive ongoing support from highly trained coaches. Course topics are adapted to staff working with children in different age groups. Specialised topics include safe media and technology use, guidelines for incorporating technology in practice, and developing language through media literacy. As VLS participants complete lessons and activities, their results are reviewed by their coaches to highlight areas for improvement. Research findings show that participants in VLS have significant knowledge gains, and participating ECEC centres show greater improvement on external monitoring assessments than non-participating centres.

Sources: Binational Center for Early Childhood (2022[62]); Doan (2019[60]); Early Childhood Educators of British Columbia (2022[61]); Lang (2022[63]); Virtual Lab School (2022[64]).

ECEC digital specialists

Countries are recognising the need to equip ECEC staff with competencies to support children in a rapidly evolving digital world, but the challenges are great. Fortunately, there is also great capacity in the ECEC workforce to develop and adapt to new demands in the context of necessary supports. As the preceding sections highlighted, ongoing training that includes interpersonal connections, such as collaboration and coaching, has important potential for achieving learning goals among participants. Supporting a segment

of the ECEC workforce to develop specialised skills around applications of digital technologies for early childhood can have far-ranging potential to provide ongoing training opportunities for ECEC staff, as well as safe and innovative digital experiences for children. Developing ECEC digital specialists is a way to capitalise on interest and motivation within the sector while promoting goals for children (Box 5.7).

Box 5.7. Early childhood education and care digital specialists

Finland's New Literacies Development Programme

Finland's New Literacies Development Programme (2020-22) aims to strengthen media literacy, ICT and programming skills in early childhood, pre-primary and basic education (Ministry of Education and Culture of Finland, 2022[65]). As part of the programme, teams of teachers and experts have developed and piloted detailed descriptions of key related competencies. For media literacy, this includes skills related to digital safety, well-being, positive interactions and digital responsibility. To support staff to engage with and apply the descriptions, Finland has developed a user guide for early childhood and preschool educators; a video training series disaggregated by education level; a free, accredited study package for early childhood education and care (ECEC) staff which combines online study and workshops; and a curated list of useful, practical tools. The ministry has also granted financial support to 46 project groups to develop related teaching and learning modules.

Bavaria's ECEC digital coaches

In Germany (Bavaria), the government supports a network of coaches as part of the overall Bavarian Digitalisation Strategy for ECEC (Case Study DEU_Bav – Annex C). These coaches typically work in a freelance capacity, providing ongoing training to ECEC through different partners in Bavaria. They have specific additional training from the State Institute for Early Childhood Research and Media Literacy and the Institute for Media Research and Media Education to provide trainings for ECEC staff as part of the Digitalisation Strategy. Thus, these coaches have media educational expertise in the early childhood field, and typically provide support beyond the courses they teach, such as around technical and legal issues ECEC settings are facing.

Lithuania's Innovations in Kindergarten

In Lithuania, a commitment to improving practices in general in ECEC settings, and specifically practices regarding the practical use of digital tools, has led to the project "Innovations in Kindergarten" (2018-22) (Case Study LTU – Annex C). This is an effort to respond to challenges found through research and consultation with the ECEC sector, highlighting that all kindergartens in Lithuania use technology, but that uptake and application of various tools are uneven. To maximise limited resources, the country has essentially built specialised competencies among 89 lecturers, who then train their colleagues throughout the country. Training sessions for ECEC staff make use of blended in-person and online tools, allowing staff to freely explore digital tools (e.g. apps and recommended software) while also having access to all materials and rapid feedback from the lectures on proposals for integrating these tools into practice through an open-source digital learning management system.

Luxembourg's Media Compass: A national reference guide for education about and through media (2020)

One of the four pillars of Luxembourg's national digital education strategy, the Media Compass, aims to support teachers across formal education (ages 3-18) to confidently integrate media and digital literacy into their teaching (Case Study LUX – Annex C). The reference guide defines media and digital literacy across 15 competencies, 5 of which relate to digital safety (i.e. "netiquette", protecting equipment, protecting personal data and privacy, protecting health and well-being, and evolving

responsibly in the digital world). Each of these has a description and illustrative examples of their practical application. The guide has been adapted from European frameworks to the national context.

To support implementation, Luxembourg has developed the Media Passport to record learners' progress in acquiring each competency, targeted to each cycle of education. Teachers can access a curated online library of lesson ideas and materials – created by fellow teachers – and professional development opportunities covering technical and pedagogical skills in various formats (e.g. online learning, seminars, events, coaching). A cohort of specialised "digital competency teachers" was established in 2021 to support teachers in applying the Media Compass in classrooms and schools. They support teachers in pre-primary and primary education (ages 4-12).

Source: Ministry of Education and Culture of Finland (2022[65]).

Policy pointers

With the breadth of training profiles of ECEC staff, as well as the scope of digital demands, a wide range of policies is needed to support the ECEC workforce in the digital world.

Policy pointer 1: Ensure ECEC staff and settings have resources to engage with digital tools

- Responsibility for the education and training of the ECEC workforce is often diffuse, with many levels of governance and different actors involved. In addition, Chapter 3 shows that ECEC staff are not always part of countries' overall digital education strategies, and previous findings highlight that the pre-primary education sector often lacks digital tools and resources to a greater extent than the primary education sector. Basic infrastructure is necessary to ensure staff can easily and reliably engage with digital tools: Internet access and appropriate devices are needed in ECEC settings to facilitate staff's regular engagement with and exploration of digital tools.
- Foundational trainings as part of initial education and through access to CPD are key to building the human resources necessary for an ECEC workforce that can confidently and selectively use digital tools across the range of their work responsibilities. Guidelines and recommendations leave the burden of responsibility with the individual staff member. Integrating the teaching of digital safety skills into curriculum frameworks for ECEC staff's initial education and other formal training requirements can more evenly share responsibility across ECEC actors, and take advantage of pre-existing accountability/compliance mechanisms through these training systems. Developing standards for required training around digitalisation can help ensure that both initial training and CPD reach all ECEC staff, complementing funding that is provided for these purposes. Strong partnerships with providers of education and training, including higher education institutions, are also needed to achieve this goal.
- Ensuring that education and trainings address the risks and opportunities that change and grow with children can allow staff to work confidently across the full age range covered by early childhood, or to specialise as appropriate for work with infants and toddlers (ages 0-2) or preschool age children (from age 3). ECEC staff must clearly understand their responsibilities for safeguarding children in digital environments.
- Implementing quality assurance programmes for ECEC staff training is especially important given the mix of providers (public, private, local) of CPD. The pace of technology change means governments need to have ongoing mechanisms to check the quality of related trainings staff are receiving. Developing an assessment process for the purpose of understanding ECEC staff's

access to and the quality of training through and on digital tools is a key component of this ongoing monitoring (see Chapter 8).

Policy pointer 2: Tailor supports to specific digital needs

- Efforts to develop digital competencies, whether for professional engagement or use with children, need tailored supports. This should include specific trainings as new curricula are developed/implemented that address children's digital learning goals, particularly when guidelines and curriculum frameworks are broad and unspecific (see Chapter 4). As the field develops and research progresses to show best practices for engaging children with digital resources, staff need updated trainings on how to adapt their pedagogies to make the best use of new tools while continuing to protect children from risks.
- Similarly, as administrative and monitoring infrastructure are modernised, or as digital tools become part of assessment frameworks, staff need to be trained to make these investments work efficiently rather than as additional burdens. The timing is also important: staff should not be trained after new systems are in place, but rather included in their development and deployment.
- Digital systems to connect with families and other community resources are increasingly common, and preferred by many partners (see Chapter 6). ECEC staff need training on best practices for engaging with families and other partners using digital tools, including on data protection and privacy when using different digital platforms.
- It is unclear whether digital delivery of training content is sufficient for all purposes, and notably for developing practices that integrate safe and meaningful uses of digital technologies in direct work with children. Hybrid training approaches can capitalise on the benefits of virtual learning while also offering the expertise and resource of human connections, such as through coaching or mentoring. Initial education programmes that involve a practical component are needed. In addition, in-person technical support, whether provided by colleagues or by someone with more specialised expertise, can allow staff to confidently use new digital tools and reduce barriers to participating in online training. Ongoing evaluations are needed to identify successful CPD programmes, as well as to distinguish core components of their success (e.g. individual or team coaching; availability of self-paced course content).

Policy pointer 3: Differentiate staff roles to enable a broader range of digital competencies in ECEC settings

- Not all staff need to develop the same digital skills, although all need a strong foundation in this aspect of their work. Countries do this to some extent with differentiated requirements for leaders, teachers and assistants, although more nuance is needed to build on the foundational training available to all staff. For those interested in pursuing the topic in more depth, and for leaders or lead teachers whose jobs demand more engagement in the digital world, more advanced opportunities are needed to develop enhanced and specialised competencies to then trigger/disseminate best practices within settings and across the sector. Creating clear career pathways within the ECEC profession can help current and future staff understand their roles and responsibilities, as well as offer directions for personal career growth. Developing digital competencies should not be restricted to certain groups of staff (e.g. teachers, leaders), but should be fostered throughout the sector.
- Mechanisms are needed to assess ECEC staff’s training needs and interests, as well as to address those needs and interests. By capitalising on motivation from some staff to enhance their digital competencies, countries can support segments of the workforce to move beyond foundational digital competencies. Regularly surveying staff and leaders to determine the types of trainings that are useful is a first step, with strategies to implement relevant trainings in response as a crucial

next step. In addition, appropriate sequencing of training content is needed to support the mastery of more fundamental aspects of working with digital technologies before expecting staff to successfully attain more advanced skills.

- Coaching and mentoring are especially valuable given the range of backgrounds and training among ECEC staff. Ensuring that investments in CPD on or with digital technologies include this type of support for ECEC staff can enable more staff to attain foundational digital competencies. In addition, creating mechanisms to develop a segment of the workforce to provide mentoring and coaching around digital technologies will embed enhanced and specialised digital competencies in the sector and provide opportunities for career growth to those who are motivated to engage in this aspect of work.

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6 Family and community engagement in early childhood education and care in the digital age

This chapter discusses the use of digital technology to engage families in early childhood education and care (ECEC) settings. The use of digital technology is widespread in ECEC settings and family contexts. The chapter discusses how digital technology can change the frequency and outreach of interactions between ECEC staff and family members, while shedding light on the challenges of doing so, to promote high-quality family and community engagement. The chapter offers some suggestions on how policy can help better prepare ECEC settings and staff to balance digital and face-to-face engagement of families for the benefit of the entire ECEC community.

Key findings

Family engagement in ECEC is a well-established practice, with clear benefits for the relationships between families and ECEC staff, staff-child interactions, and children's development and well-being. Digital technologies offer new ways for ECEC to engage with families, but they also bring new challenges.

Results from the *ECEC in a Digital World* policy survey (2022) indicate that the majority of countries and jurisdictions find promoting digital channels for communication and involvement with families/parents of young children in ECEC a policy challenge of "high" or "moderate" importance.

On a positive note, there seems to be some evidence for the advantageous use of smartphones, apps and texts to increase real-time communication and engagement of multiple and more linguistically diverse family members, as was not possible before. The potential outreach to engage with a more diverse group of families seems promising and families seem to appreciate the flexibility offered by technology in terms of how and when they can be involved in meetings or events and decision making in ECEC.

At the same time, there is limited evidence associating the use of technology-abled engagement strategies with the quality of the interactions between ECEC staff, family members and children. Some efforts by ECEC staff to digitally engage families seem to lead to one-way forms of communication, while deeper engagement with families and parents still relies on face-to-face interactions. When using apps and other digital tools, more of the ECEC teacher's time is spent on screen, not in face-to-face interactions with parents and children.

There is a potential risk that some types of digital communication can reduce the quality of interactions and real engagement between ECEC settings and parents. There are also concerns about teachers' privacy and respect for personal time, particularly with texting and the use of social media. Finally, ECEC settings and staff still find using technologies challenging and unsupported, and report little pre-service training or available continuous professional development on how to establish meaningful parent-family communication and engagement through digital technologies.

Policy can help direct how to best promote family and community engagement in ECEC through digital technology.

Introduction

Family engagement in ECEC includes a variety of practices that allow for developing meaningful relationships between families and ECEC staff, which in turn can improve staff-child interactions in the settings, and children's development and well-being. The benefits of family engagement practices also extend to the home environment, facilitating parenting and reducing the gap between the home and ECEC learning environments.

Digital technology is not the barrier for ECEC settings that it was once thought to be (Burris, 2019[1]; Murcia, Campbell and Aranda, 2018[2]), and it is now being widely adopted in early education systems (Donohue, 2016[3]). ECEC settings and teachers report using digital technologies and strategies to engage with families, irrespective of programme size (i.e. number of children enrolled), type (i.e. for-profit private, non-profit public, religious) and location (i.e. urban or rural) (Burris, 2019[1]).

Many families are now equipped with their own devices to benefit from this heightened level of engagement. The rise of mobile technologies presents novel opportunities for using technology to support family engagement and successful child development (Hall and Bierman, 2015[4]). COVID-19 has quickened the pace of digitalisation in ECEC settings and practices, and further changed expectations. Settings and families learnt in dramatic ways the importance of collaborating to support child development and well-being while not being able to rely on face-to-face contact (Charania, 2021[5]). Many settings had to suddenly create new communication strategies with families but, given existing digital divides, not all families and children were able to benefit from these new digital communication strategies.

This chapter reviews the potential and challenges of using digital technology to engage families in ECEC settings. It starts by setting the scene on the prevalence of digital technologies in home environments. It then discusses how technology can change the frequency, outreach and quality of interactions between ECEC staff and family members. The question is not anymore about stopping the use of technology in ECEC, but there is a need to better understand how such practices actually contribute to process quality and children's development and well-being. The chapter concludes with some policy pointers.

The changing landscape of the use of digital technology in home environments

Children today live in media-rich households with access to a variety of different devices and digital technologies that are a central part of their everyday lives (see, for example, OECD (2019[6]); Kapella, Schmidt and Vogl (2022[7])). Young children are using digital technologies in home environments with increasing frequency and intensity, for many different activities, and often in combination with or under the supervision of their parents. Parental surveys provide evidence that, over the last decade, for a large share of young children, their initiation using digital devices and online activities has been occurring earlier than before, and well before age 6 (see Chapter 2).

Digital technologies in the home environment and their role in family interactions

Digital technologies have become common tools for mediating family interactions. A recent study of parental mediation strategies integrating digital technology demonstrated that digital technologies can contribute to "doing family" in several dimensions. Using four country case studies (Austria, Estonia, Norway and Romania), Kapella, Schmidt and Vogl (2022[7]) demonstrated how experiencing digital technologies actively together within the family can shape family identity and create a feeling of "we-ness", and co-use of digital technology can also serve as a springboard for conversations regarding (sensitive) topics and strengthen children's resilience. Parents, for example, can function as positive role models, guides and supervisors of online activities, home teachers and filters of content that should not reach the child. Digital technology can also support the family care aspect, for example by obtaining and maintaining

digital and media competences and supporting others' well-being, staying in contact and connected with each other, and contributing to a feeling of security and being cared for beyond face-to-face interactions. These aspects become especially true for transnational families or families with members that are not co-present (Kapella, Schmidt and Vogl, 2022[7]).

However, there are differences across and within countries in terms of families' access to digital devices and the Internet, as not all families and children have access (Ayllón, Holmarsdottir and Lado, 2021[8]). Moreover, parents are challenged with the mediation of digital technologies, since they require a certain level of know-how, while the rapid development of digital technology demands that parents constantly adapt to new situations, information, new devices, etc. (Kapella, Schmidt and Vogl, 2022[7]). Finally, digital technologies can contribute to exacerbating the vulnerability of children or to the emergence of new vulnerabilities, for example, through children's lack of digital competences, overprotection of parents, children as the main instructors and mediators on digital technology in the family, exposure to specific content or experiences, and exclusion of the child by other family members during their digital activities.

A changed landscape of expectations regarding the use of digital technology with and by children in post-pandemic times

During the COVID-19 pandemic, many countries implemented nationwide restrictions to slow the spread of the virus. These restrictions included the closure of ECEC centres and all other education services for children, the prohibition of visiting playgrounds, and strict social distancing measures, e.g. no contact with more than one person from outside one's household. Emergency childcare was only available to a small number of families in relevant occupations.

This created a challenging situation for families with young children (Andresen et al., 2020[9]; Huebener et al., 2021[10]). Children stayed at home all day and parents had to provide early education and care while simultaneously having to meet all other demands, e.g. employment, household tasks. Some parents found it enriching to be able to spend more time with their child/children, while others experienced intense stress caused by the difficulty balancing work and family during confinement (Cohen, Oppermann and Anders, 2020[11]). Concerns about potential health risks and infection were a further burden and source of stress.

To handle these many demands, many families had to resort to digital technology to maintain their jobs. Parents and family members suddenly became role models for work practices in home office situations, normalising large amounts of (adult) screen time often under considerable stress, and with little or no training for this sharp transition. There is evidence of increases in children's screen time during the COVID-19 pandemic (see Chapter 2). At the same time, parents suddenly felt in charge of the majority of their children's learning activities. A study in Germany during the first lockdown in 2020 demonstrated that parents engaged, on average, in more home learning activities with their children during the lockdown, compared to before the lockdown. However, whereas most parents offered more home learning activities, some of the very stressed parents offered fewer home learning activities than before the lockdown (Oppermann et al., 2021[12]).

Engaging parents and families in early childhood education and care through digital technologies

Research has shown that parental engagement, especially when it ensures high-quality learning for children at home and good communication with ECEC staff, is strongly associated with children's later academic success, socio-emotional development and adaptation in society (OECD, 2011[13]; 2019[14]; Sylva et al., 2004[15]). One purpose for ECEC staff to engage with parents is to raise parents' awareness of the importance of activities in the centre, get their support for what is happening, and ensure that families

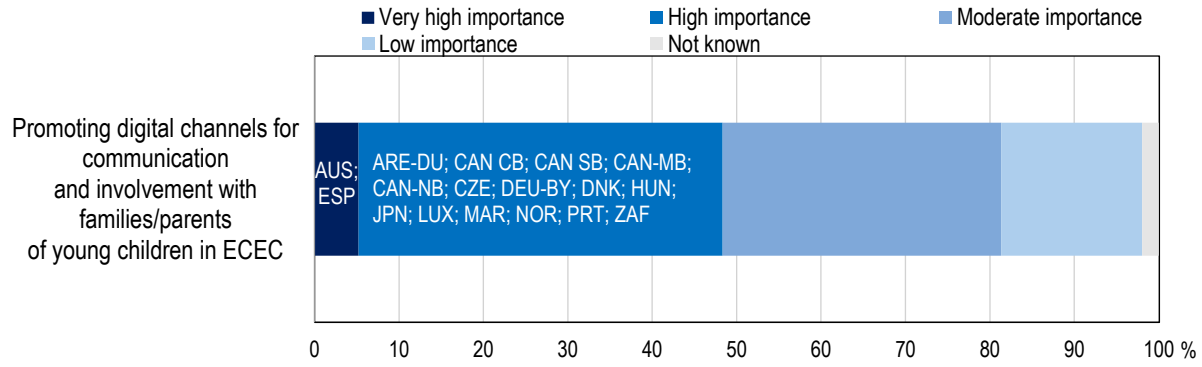
and children develop good feelings about early education. These engagement initiatives can help improve the child's interactions with adults inside the playroom, classroom or setting.

Practices that engage families and guardians in ECEC centres are well-established, and these include exchanging information with parents regarding daily activities and children's development and well-being, as well as encouraging parents to play and carry out learning activities at home with their children. Several examples of effective ECEC services that promote parental engagement (such as Head Start, the Perry Preschool and the Chicago Parent Centers in the United States) offer evidence that parental engagement matters (Bennett, 2008[16]).

Digital technologies offer new ways for ECEC to engage with families, but also bring new challenges. The *ECEC in a Digital World* policy survey (2022) asked countries about the important policy challenges regarding digitalisation and young children generally and digitalisation and ECEC specifically. Despite the potential for digital technologies to be a positive force in engaging parents, promoting digital channels for communication and involvement with families/parents of young children in ECEC as a policy challenge was rated as being of "high" or "moderate" importance by most countries and jurisdictions that responded to the survey (Figure 6.1).

Figure 6.1. Policy challenges related to family engagement in early childhood education and care

Percentage of countries and jurisdictions identifying the following policy challenge, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category "very high importance" was limited to three out of ten response items maximum.
CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Source: OECD (2022[17]), *ECEC in a Digital World* policy survey, Table B.2.

StatLink https://stat.link/0ci2s7

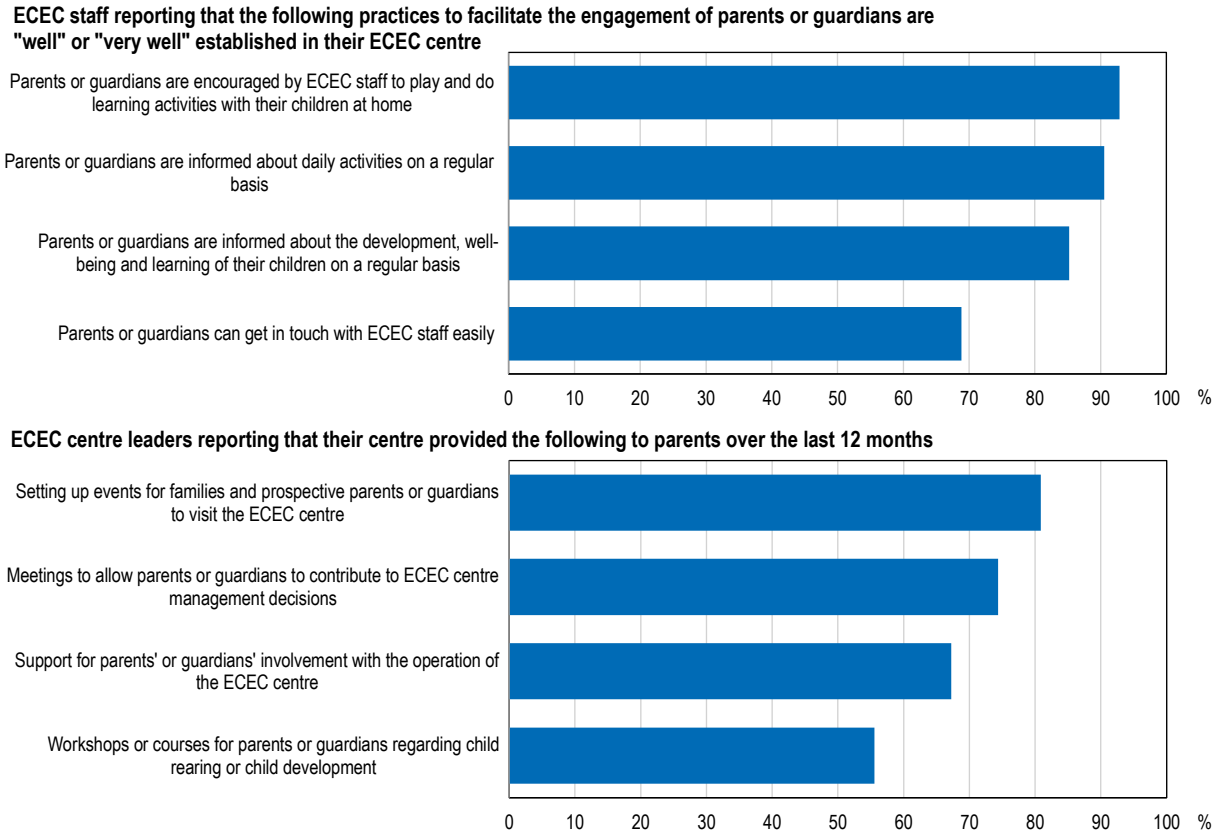
Common practices and levels of engagement

The OECD international survey of the ECEC workforce (TALIS Starting Strong) asked staff in 2018 (before the COVID-19 pandemic) to indicate the extent to which a number of practices to engage parents or guardians were well-established in their centre (OECD, 2019[14]). These family engagement practices included informal options for parents to easily contact staff, options to be informed on a regular basis about children's daily activities or their development, as well as more active forms of engagement, such as encouraging parents or guardians to do play and learning activities with their children. On average across countries participating in TALIS Starting Strong 2018, very high percentages of ECEC staff in pre-primary education centres reported that practices to engage with parents or guardians were well-established in their centres, particularly opportunities to get in touch with staff. Moreover, across countries a high

percentage of ECEC staff reported that, in their centre, parents were informed about their children's development, learning and well-being, as well as about their daily activities. Interactions between staff and parents or guardians can also facilitate family involvement in ECEC events and inform parenting practices at home. On average across countries, a large percentage of staff (albeit smaller than for other activities) reported that they encouraged parenting activities, such as doing play and learning activities with their children at home (Figure 6.2).

Figure 6.2. Practices to promote family engagement in early childhood education and care settings

Percentage of staff and centre leaders reporting the following practices, average across countries, 2018



Note: Staff include centre leaders, teachers, assistants or any other unspecified staff groups.
Centre leader refers to the person with the most responsibility for the administrative, managerial and/or pedagogical leadership at the ECEC centre.
Items are sorted in descending order of the cross-country average percentage of respondents selecting each option.
Source: OECD (2019[18]), *TALIS Starting Strong 2018 Database*; OECD (2019[14]), Tables D.2.3 and D.2.4, https://www.oecd.org/education/school/oecdtalisstartingstrongdata.htm (accessed on 10 December 2022).

StatLink https://stat.link/wuomdf

TALIS Starting Strong 2018 also asked ECEC leaders to report on whether some concrete activities were offered to parents or guardians to facilitate their engagement in the centre during the 12 months prior to the survey. On average across participating countries, a large percentage of leaders of pre-primary education centres reported setting up events for families and prospective parents or guardians to visit the centre, and setting up meetings to allow parents or guardians to contribute to management decisions. Workshops or courses regarding child-rearing or child development, which can influence interactions between children and parents, were less common (Figure 6.2). In general, the patterns observed in staff's

and centre leaders' responses followed the same direction. Parents were frequently in contact with staff to learn about the centre, but activities aiming to help parents in their interactions with children were less widespread.

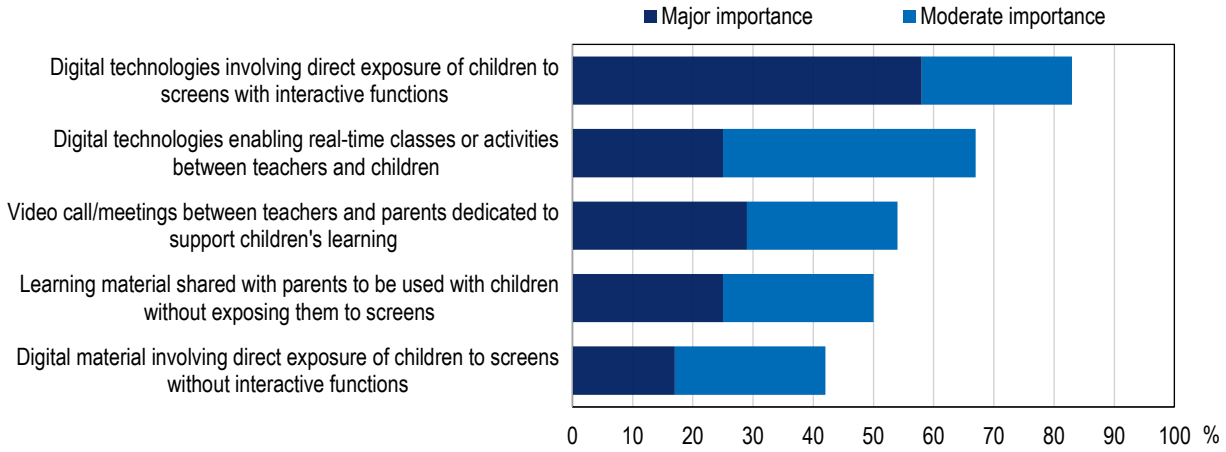
Changing ECEC approaches to the use of technology during the pandemic

The day-to-day work of ECEC settings and staff was significantly affected due to the closure of settings during the pandemic. Many settings had to suddenly create new communication strategies with families. In the OECD G20 study about how digital technology was used for maintaining education for young children in 2020, countries reported that digital communication took on a major role in maintaining relationships between parents and teachers at the primary level, but also at the pre-primary level (OECD, 2021[19]).

Prior to the pandemic, digital technologies were more commonly used as communication rather than pedagogical tools, with wide variation across countries in the extent to which digital tools were integrated into teaching practices. COVID-19 accelerated the pace of digitalisation in ECEC settings, and further changed expectations regarding the use of technologies with and by children. Settings and families learnt in dramatic ways the importance of collaborating to support child development and well-being while not being able to rely on face-to-face contact (Charania, 2021[5]). About three-quarters of the countries participating in the OECD survey on the use of digital technologies in ECEC during the pandemic reported that the main responsibility for organising educational programmes stayed with the schools and centres, even when children were at home in lockdown. Having teachers digitally share educational materials with parents and family members was reported to be of major importance by 60% of the participating countries (OECD, 2021[19]). Of note that, in the majority of countries, at the pre-primary education level the educational materials shared with parents did not require exposing children to screen time (Figure 6.3), and the estimated amount of time children were expected to be interacting with digital technology was generally low (i.e. less than an hour per day for the pre-primary level (OECD, 2021[19])).

Figure 6.3. Digital resources used for maintaining continuity of education for young children during the COVID-19 pandemic

Percentage of countries and jurisdictions reporting the importance of different types of technologies and resources in pre-primary education, 2020



Note: *Items are sorted in descending order by the share of countries selecting the response categories "major" or "moderate" importance.*
Source: OECD Survey on Distance Education for Young Children; OECD (2021[19]).

StatLink https://stat.link/b52qlf

Using digital technologies to strengthen family engagement in support of process quality

While many of the traditional frameworks of parent/family engagement in ECEC are based on face-to-face interactions (Epstein et al., 2005[20]), there are more and more examples of technology being used by ECEC teachers and settings to promote family engagement. This is increasingly common since the rapid growth in the use of smartphones. The COVID-19 pandemic is likely to have accelerated this trend.

In complement to the common methods of send-home newsletters and sometimes handwritten materials (such as notes or journals), digital technologies allow for more immediate communication, may be a less time-consuming method of sharing information and provide documentation over time. For example, applications allow ECEC staff to share photos, videos and notes with parents throughout the day, while the child is attending ECEC. Apps also allow teachers to record meals, activities and naptimes (Burris, 2019[1]). These communication strategies help parents stay informed of the day-to-day activities at the ECEC setting and feel more connected to their child while at work. At the same time, there is a concern that the time teachers spend on screens recording and reporting activities of the day may mean they have less time for face-to-face interactions between ECEC staff and children or ECEC staff and parents.

The *ECEC in a Digital World* policy survey (2022) asked participating countries and jurisdictions to indicate how common communication strategies were with parents/families through digital technologies in ECEC centres. Overall, countries seem to adopt a careful approach to technology use for information. In approximately 60% of participating countries or jurisdictions, it is estimated that at least two-thirds of centres for children ages 0-5 (or 3-5) use technology, such as websites, messages and notifications, to keep parents informed on general topics and for administrative purposes (Table 6.1).

Technology is also now being used to bridge the gap between the home and the ECEC learning environment. Some applications allow teachers to share an image of a child's artwork or a video of a child taking their first steps at school, making children's learning visual and accessible (Oke, Butler and O'Neill, 2021[21]). Families can view the child's portfolio and review and download images, videos and alerts, ultimately changing how they perceive the work developed at the setting, their child's development and their own potential involvement. In one US study, photo collages annotated with meaningful explanations of children's play were emailed to parents daily. Parents receiving emails showed increased knowledge of child development, a better understanding of learning through play and an increased understanding of what was happening in the ECEC setting (Bacigalupa, 2015[22]).

In New Zealand, portfolios for documenting children's learning are now being replaced by online ePortfolios (Goodman and Cherrington, 2015[23]). In one study of ePortfolios, parents reported that deeper conversations with children about learning, and furthering learning in the home, were a result of the inclusion of videos in the online version of the portfolios. Furthermore, teachers using ePortfolios described stronger relationships with parents (Hooker, 2019[24]). The use of digital platforms for making portfolios of children's work/activities available to parents/families is generally reported for a third or fewer centres for children ages 0-5 (or 3-5) in countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022). In the Czech Republic, Korea, the Slovak Republic, Spain and Switzerland, the majority of centres are reported to be implementing a wide variety of parent/family engagement strategies using digital tools, including the use of technology for educational purposes (Table 6.1).

ECEC staff also have the ability, supported by technology, to prepare and share lesson plans; take attendance; and convene and review important information about a child's allergies, medical information and guardians. Families can inform the teacher if their child will be away due to illness or vacation, or update information that is otherwise time-sensitive. The benefits of family engagement through technology are true for "real-time" technology, but also for asynchronous tools that do not require teachers and parents to be logged in, or online, using an application at the same time. ECEC programmes have reported using these in-the-moment technologies, such as texting and applications with photos, in tandem with other tools, such as email, because it affords for a more individualised approach (Burris, 2019[1]).

Table 6.1. Communication with families through digital technologies in early childhood education and care settings

Estimated share of settings where the following resources and practices are available, by country or jurisdiction, 2022

		Websites where general information about the centre/setting is posted for parents/families	Possibilities for parents to contact/exchange with centre leaders using digital tools	Possibilities for parents to contact/exchange with staff members using digital tools	Messages or notifications to parents/families for administrative purposes	Messages or notifications to parents/families for educational purposes	Sharing of educational materials with parents/families through digital channels	Digital platforms making portfolios of children's work/activities available to parents/families
Australia	Age 0 to 5							
Australia (*Tasmania*)								
Belgium (Flanders PP)	Age 3 to 5							
Belgium (Flanders U3: centre-based)	Age 0 to 2							
Belgium (Flanders U3: home-based)	Age 0 to 2							
Canada CB	Age 0 to 5						m	m
Canada SB	Age 3 to 5						m	m
Canada (*Alberta: Day care*)	Age 0 to 5							
Canada (*Alberta: Preschool*)	Age 3 to 5							
Canada (*Alberta: Family day home*)	Age 0 to 5							
Canada (*British Columbia*)	Age 0 to 5							
Canada (*Manitoba*[1])	Age 3 to 5							
Canada (*New Brunswick*)	Age 0 to 5							
Canada (*Quebec*)	Age 0 to 5							
Czech Republic	Age 3 to 5							
Denmark: Local-authority childminding	Age 0 to 2							
Denmark: Private childminding	Age 0 to 2							
Denmark: Local-authority day care centre	Age 0 to 5							
Finland: Early Education centre	Age 0 to 5							
Finland: Family day care	Age 0 to 5							
France	Age 3 to 5							
Germany	Age 0 to 5							
Germany (*Bavaria*)	Age 0 to 5							
Hungary	Age 3 to 5							

		Websites where general information about the centre/setting is posted for parents/families	Possibilities for parents to contact/exchange with centre leaders using digital tools	Possibilities for parents to contact/exchange with staff members using digital tools	Messages or notifications to parents/families for administrative purposes	Messages or notifications to parents/families for educational purposes	Sharing of educational materials with parents/families through digital channels	Digital platforms making portfolios of children's work/activities available to parents/families
Iceland	Age 0 to 5							
Ireland	Age 0 to 5							
Israel	Age 3 to 5							
Italy	Age 3 to 5							
Japan: Kindergarten	Age 3 to 5							
Japan: Day care centre	Age 0 to 5							
Luxembourg	Age 3 to 5							
Morocco	Age 3 to 5							
Norway	Age 0 to 5							
Portugal	Age 3 to 5							
Republic of South Africa	Age 0 to 5							
Slovak Republic	Age 3 to 5							
Slovenia	Age 0 to 5							
South Korea	Age 3 to 5							
Spain	Age 3 to 5							
Sweden	Age 0 to 5							
Switzerland	Age 3 to 5							
United Arab Emirates (*Dubai*)	Age 0 to 5							

Notes: This question relates to periods when the opening of ECEC settings is not disrupted by special circumstances like the COVID-19 pandemic or other events leading to closures of premises. Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: Centre-based sector in Canada. Canada SB: School-based sector in Canada. Canada (Manitoba): Kindergarten sector only in Canada (Manitoba).

In more than 66% of settings
Between 34% and 66% of settings
In 33% of settings or less
Not known

m: Missing

Source: OECD (2022[17]), *ECEC in a Digital World* policy survey, Tables B.15, B.16 and B17.

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Using digital technologies to engage a greater share of families

Using text messaging allows for an even more direct form of communication and, of all available technologies, texting can reach the biggest share of families, even among poor communities (Snell, Wasik and Hindman, 2022[25]). Surveys in the United States suggest that the Millennial generation (a group well-represented as parents in early childhood programmes) prefers texting as a form of communication over phone calls and email (Newport, 2014[26]). In a study of a texting approach to family engagement – Text to talk – Snell, Wasik and Hindman (2022[25]) reported that families overwhelmingly supported the use of texting as a preferred form of communication, while teachers reported how using texting built warm and engaged relationships with families. Due to the ease, accessibility and low (or no) cost of texting, messages were sent and shared across many family members almost immediately, offering a bridge between the many family members participating in the child's life (e.g. the one dropping the child off, the one picking the child up and the one where the child spent occasional nights).

There are, nevertheless, concerns surrounding the use of texting between teachers and parents. Some teachers may not feel comfortable using their own private phone to communicate with parents, or with sharing children's information in such concise segments of information to be contained in a text message. Moreover, there is perhaps more risk of inappropriate messaging from parents to staff than in face-to-face interactions, and possible effects on teacher stress of receiving such messages in written format and at all possible hours of the day. To address some of the concerns with teachers' privacy and respect for personal time, digital service providers have developed services to allow teachers to text families privately and securely without using their own personal mobile phone number, making texting more practical and safer (Snell, Wasik and Hindman, 2022[25]). Some of the other concerns remain unaddressed.

One of the commonly reported advantages of using digital technologies in ECEC family engagement is the outreach to multiple and more diverse family members. This is important because previous studies had demonstrated that ECEC staff and leadership may have clear strategies and goals for creating a welcoming atmosphere for parents and children, but still they may fail to engage parents and guardians of children from families of diverse backgrounds (Crozier and Davies, 2007[27]). The outreach benefit of technology use is reported for texting, but also for a variety of other forms of technology (Burris, 2019[1]; Hooker, 2019[24]; Oke, Butler and O'Neill, 2021[21]; Snell, Wasik and Hindman, 2022[25]). By using technology to share pictures, updates and notes with families, ECEC teachers are able to reach out to family members even in cases where children do not live with both parents, have parents or family members who are away or travel for work, furthering the relationship between ECEC settings and family, and avoiding gaps in information with relevant family members. In one study in Ireland, the use of a cloud-based early childhood management and parental communication application allowed ECEC settings to overcome common communication barriers with families from diverse backgrounds who have limited time, employment obligations and varying expectations for their child's ECEC (Oke, Butler and O'Neill, 2021[21]). The type of personalised information that this cloud-based application allowed ECEC teachers to share with families built confidence between them, particularly when at least one member of the child's family was unable to attend face-to-face meetings. Language barriers are also more easily addressed with technology, as families can translate messages received using services on their phone or teachers can use automatic translation services to translate before sending the message (Snell, Wasik and Hindman, 2022[25]).

Using digital technologies to promote positive parenting through ECEC

Family engagement in ECEC can help improve teacher-child interactions inside playrooms, classrooms or settings; it can also promote positive parenting at home. Traditionally, ECEC staff would rely on drop-off and pick-up times, in addition to occasional parent-teacher meetings, to offer families suggestions of learning support activities to be developed at home. Using digital technologies in ECEC offers more opportunities to promote positive parenting by offering online links to resources, and access to social media

groups and conferencing options to facilitate conversations, complementing the traditional referral to parenting books and flyers. In the *ECEC in a Digital World* policy survey (2022), using technology for educational purposes, for example by using messages or notifications to parents/families, or sharing educational materials with parents/families through digital channels is limited to a smaller share of centres in participating countries and jurisdictions; less than 20% of participating countries or jurisdictions report this communication practice for at least two-thirds of centres for children ages 0-5 (or 3-5).

Evidence surrounding texting interventions for parenting shows promising results. In a US study about Head Start, parents from socio-economically disadvantaged backgrounds who received parenting tips via text message – Parent University – engaged in more learning activities at home, such as reading to children, teaching letters and/or words, talking while running errands, playing counting games, singing songs, etc. The impact of the intervention was particularly significant for fathers, who are often excluded from ECEC communication and participation, and parents of boys (Hurwitz et al., 2015[28]). Other experimental studies of texting in parenting interventions (outside or in parallel to the ECEC context) have also demonstrated significant increases in the quantity and quality of time spent by parents practising skills with preschoolers and younger children (Cortes et al., 2021[29]; Doss et al., 2019[30]; Hurwitz et al., 2015[28]; Mayer et al., 2019[31]; Meuwissen et al., 2017[32]; York and Loeb, 2014[33]). Results varied according to children's pre-intervention literacy skills (Cortes et al., 2021[29]), whether text messages were personalised (Doss et al., 2019[30]), and whether parents perceived their investment in their children as having an impact in their future skills (Mayer et al., 2019[31]).

It is important to note that the scientific evidence around the benefits of texting, albeit hopeful and rigorous, is restricted to texting interventions developed by programmes outside of ECEC, or in collaboration with ECEC settings, but not exactly implemented by ECEC teachers or other staff. More evidence is necessary regarding the benefits and tensions of the use of texting, as well as of other forms of digital communication such as social media, by ECEC teachers, as part of their day-to-day practice. Using digital communication may change aspects of the teacher-parent relationship in unexpected ways. One study reported that parents receiving more information in the texts seemed to visit their children's centre less often (Doss et al., 2019[30]). In a systematic review of teacher-student communication through social networks in higher levels of education, the use of social media platforms for communication with students seemed to decrease teacher-perceived credibility (Froment, García González and Bohorquez, 2017[34]).

Using digital technologies to encourage family involvement in ECEC setting activities

Technology is also used in ECEC settings to facilitate parent participation and volunteering in ECEC activities. Organising parent help and support in on-site and community events now requires fewer in-person meetings, which posed strains on available space in settings and limited participation for busy families. Through email and online surveys, teachers and ECEC leaders can quickly gather data on the availability and interest in events, projects and initiatives that require parent support (Burris, 2019[1]).

Technology can also support parents' decision making, which is a central feature of family involvement (Epstein et al., 2005[20]). Traditionally, parents took important decisions during face-to-face meetings of parent-teacher organisations and parent advisory boards. Such decisions are often built upon regulations and handbooks provided and available at the ECEC settings during working hours. However, some families tended to be underrepresented in these committees because of limited availability due to multiple jobs, odd work hours, other family responsibilities and other time restrictions (Burris, 2019[1]). Technology, particularly online conferencing tools, now allows busy families to participate in decision making at hours most fitted to their schedule. Additionally, regulatory documents are now available online, making it easier for parents to be and stay informed. Nevertheless, existing digital divides between families may still limit access to these benefits of technology in decision making (see Chapter 7).

Challenges in family involvement through digital technology

ECEC settings use technology to facilitate involvement and communicate with families, but in some cases these engagement efforts may lead to one-way forms of communication (Burris, 2019[1]), where families are informed rather than involved in collaborative relationships around children's development. This trend is somewhat reflected in the answers to the OECD *ECEC in a Digital World* policy survey (2022) by participating countries or jurisdictions. Possibilities for parents to contact/exchange with centre leaders or staff members using digital tools are less common than opportunities for centres to communicate with parents; approximately 45% of participating countries or jurisdictions report this communication practice for two-thirds of centres for children ages 0-5 (or 3-5).

Moreover, technology support of parents and families' decision making is often the least reported use of technology by ECEC teachers (Burris, 2019[1]). Although there is great potential in using technology to engage with more and more diverse families, better evidence is needed on how often digital technologies are used beyond routine communication on administrative matters and how they actually improve engagement. When surveying ECEC teachers and parents in a texting intervention, both groups reported that most texts were dedicated to logistical issues (Snell, Wasik and Hindman, 2022[25]). These challenges were confirmed by countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022), where possibilities for parents to contact/exchange with centre leaders or staff members using digital tools seem to be less common in centres than the use of technology in ECEC settings to send general information to parents.

The ECEC workforce still finds using technologies challenging. The topic of establishing mechanisms for meaningful parent-family communication and engagement through technology was often absent from the training of future teachers (Merkley et al., 2006[35]), including ECEC teachers, a couple of years ago and seems to now be commonly included in programmes of a small majority of countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022) (see Chapter 5). Younger ECEC staff – out of college – tend to be more skilled and comfortable using smartphones and applications, and use these technologies more often to engage families. However, there is a higher degree of turnover in these staff (Burris, 2019[1]).

Despite gaps in ECEC staff digital competencies, teachers with access to technology are increasingly using social media, text messaging, email and educational applications to engage with families. While evidence does not point towards the need to discourage these practices, there is a need to better understand how these technologies are being used to engage families (Reedy and McGrath, 2010[36]), and how such practices actually contribute to process quality and children's development and well-being.

There is also a potential risk that some types of digital communication can reduce the quality of interaction and real engagement between ECEC settings and parents. In some contexts, patterns of digital communication that developed during the COVID-19 restrictions remained in place after the restrictions were withdrawn, and in some cases, parents are still not being encouraged into settings to meet with ECEC staff face-to-face. There is a risk that ECEC centres may use digital communication tools because they are easier rather than because they are better.

These obstacles to the adequate use of technology by ECEC teachers and settings to promote family engagement offer reasons for concern in favour of a careful and supervised approach to digital communication in ECEC settings. Countries find it a challenge to promote such approaches. Even when all digital technology obstacles to family engagement are addressed in ECEC settings, existing digital divides between families may still limit access to these benefits of technology in decision making by families (see Chapter 7). Families from socio-economically disadvantaged backgrounds and families with children whose first language is different from the language(s) used in the ECEC centre may face a variety of economic and social stressors, such as the need to hold multiple jobs, limited control over work schedules

or unstable housing, all of which may limit the time and resources parents may have to regularly devote to promoting children's learning at home (Hurwitz et al., 2015[28]).

Digital technologies for communication and partnerships with communities and other actors

Involving and empowering parents or guardians as caregivers and educators of their children may require collaboration with other stakeholders, such as family support, social work and health services (Sim et al., 2019[37]). Community engagement can help connect families and ECEC services, as well as other services for children. Different services, such as formal ECEC services, day-care, health services and other child services, can work together to create a continuum of services that is reassuring for parents and can meet the needs of young children (OECD, 2011[13]).

Digital technologies may offer support for establishing and/or maintaining successful partnerships between ECEC centres and other schools, often softening transitions for ECEC children within pre-primary and to primary education. For instance, in Japan, collaboration between ECEC settings and elementary schools in the district of Minami Matsuo Hatsugano Gakuen was made difficult by the COVID-19 pandemic. To address these obstacles, casual online exchanges between leaders of integrated ECEC centres, nurseries and elementary schools were held once a month. As a result of these meetings, junior high school students demonstrated interest in engaging in "childcare training" of preschoolers through digital communication. In this "childcare training", high school students shared with preschoolers quizzes, picture-story shows, storytelling and origami classes online. After the online "childcare training" took place, ECEC and other local educational communities maintained casual exchanges among children through digital technologies, for example to address questions from anxious preschoolers preparing to enter elementary school resources (see Case Study JPN_1 – Annex C).

Fostering digital skills and incorporating digital technology in ECEC settings can also help establish stronger connections with members of the community beyond educational settings. At higher levels of education, schools that are successful in using technology effectively establish strong partnerships with key stakeholders from universities, technology companies and other organisations (Levin and Schrum, 2013[38]; Burns and Gottschalk, 2019[39]). In ECEC settings, digital technology may offer families access to other resources through the ECEC setting and staff, such as digital resources and museums, promising childhood intervention programmes (e.g. in bullying), parenting training, etc.

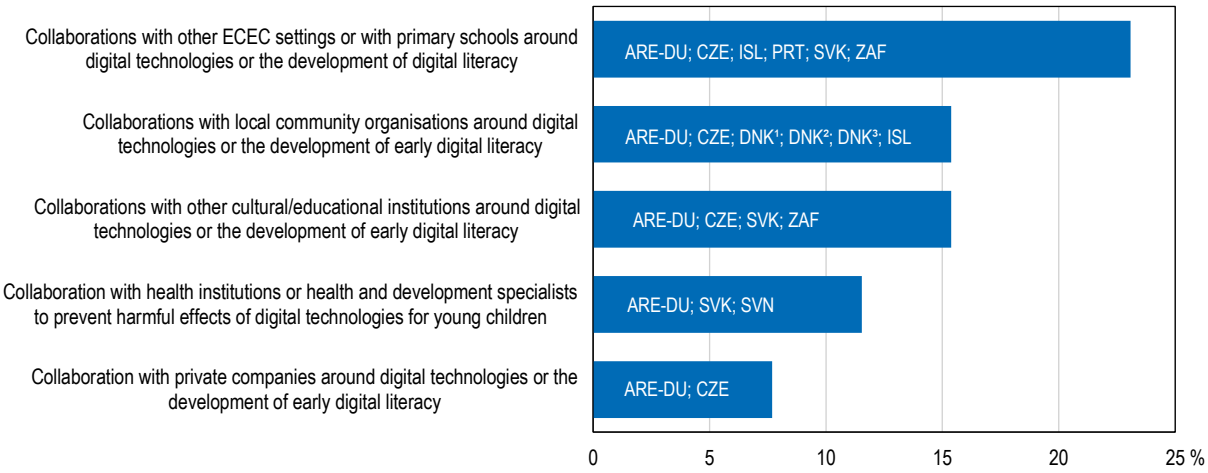
ECEC staff may also help promote early digital literacy by inviting families to use online tools to extend knowledge and competencies acquired in the class or playroom. For instance, in Germany, to encourage language development and reading proficiency, the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth provided funding for the implementation of the lesenmit.app initiative developed by the reading foundation Stiftung Lesen. The initiative offered families an overview of the apps available for promoting language and reading development, and also classified the available applications in regard to their pedagogical value, empowering families to read more and use better digital resources (see Case Study DEU – Annex C). Promoting early digital literacy through online tools may be a good complement to more traditional approaches of inviting families into the early learning environment, offering a lending library, sharing what the children are doing in the learning environment and making community connections.

Despite these advances, the potential brought by digital technologies to expand connections with other institutions, schools, higher education institutions and agencies providing services to children, and their families seems under-tapped. ECEC staff and centre leaders report minimal technical assistance in using technology in their practice. In related OECD work, countries reported a low rate of partnerships between schools and programmers and digital experts despite the growing emphasis on equipping teachers with digital competences (Burns and Gottschalk, 2020[40]).

This trend is reflected in the answers to the *ECEC in a Digital World* policy survey (2022) by participating countries and jurisdictions regarding the frequency of partnerships and collaborations between ECEC settings and external actors around digital technologies (Figure 6.4). Only in a small number of countries and jurisdictions does collaboration using digital technologies with local partners, such as other ECEC settings, schools, cultural institutions, local community organisations, private companies, and health and development specialists, happen in at least a third of centres. In striking comparison, in the Czech Republic, the majority of centres are reported to implement a wide variety of strategies for collaboration and partnership with external actors of various sectors and types.

Figure 6.4. Partnerships between early childhood education and care settings and external actors about digital technologies

Percentage of countries and jurisdictions reporting partnerships in at least 33% of settings, 2022



Note: Responses are weighted so that the overall weight of reported responses for each country equals one. Some countries and jurisdictions responded for multiple settings and therefore appear more than once with the same country and jurisdiction code. See Annex A.
DNK[1]: Local-authority childminding in Denmark. DNK[2]: Private childminding in Denmark. DNK[3]: Local-authority day care centre in Denmark.
Items are sorted in ascending order of the share of countries selecting each option.
Source: OECD (2022[17]), *ECEC in a Digital World* policy survey, Table B.21.

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Policy pointers

Debating whether or not ECEC teachers and settings should be using technology to engage and communicate with parents, families and communities no longer seems worthwhile or practical. The use of digital technology is widespread in settings and family contexts. Policy can help direct how best to promote family and community engagement in ECEC through digital technology.

Policy pointer 1: Document and understand how digital technology can contribute to higher quality family and parent engagement

- Policy can emphasise the importance of documenting by ECEC staff and leaders the process by which digital technology actually promotes high-quality approaches in family and community engagement.

- Efforts should be extended to better understand the essential conditions by which digital engagement can actually benefit children. Efforts can be put on identifying the necessary time needed for staff to engage with families through digital technologies, the types of digital technologies that can be preferred for certain goals as well as the conditions to reach all families, and the specific conditions needed to reach families that are being excluded by other forms of traditional communication and engagement.
- Research and documentation of practices on how information is provided and conveyed to, received by and accepted by/from families of children in ECEC are also needed, while bearing in mind existing digital divides. In countries with digital divides (in access) related to geographical areas or parents' socio-economic background, using digital technology for communication with parents can exacerbate inequalities.

Policy pointer 2: Balance traditional, face-to-face forms of parental engagement with digital approaches

- Because digital communication offers a faster and easier form of communication with parents, patterns of digital communication that developed during COVID-19 restrictions have, to some degree, remained in place after the restrictions were withdrawn and, in some cases, parents are still not being encouraged into settings to meet with ECEC staff face-to-face. Policy can underscore a more balanced approach to parent engagement, combining traditional face-to-face forms of parental engagement with digital approaches.
- Policy can influence the engagement of ECEC staff and parents by incorporating this balancing aspect in curriculum frameworks and other policy levers and by continuing to encourage face-to-face communication with parents to offer opportunities for in-depth conversations, handle difficult topics and promote parental involvement in decision making.
- There could be training on the respective advantages and drawbacks of face-to-face and digital modes of communication and encouragement to use digital technologies to expand, not replace, face-to-face communication unless this is clearly not needed. Consideration can be given to preparing staff to carefully and meaningfully use digital technologies for broader parental engagement, including concerning children's learning, development and well-being, beyond simple information communication.

Policy pointer 3: Prepare ECEC staff and settings to maximise the potential of digital technologies for community engagement

- Policy can direct resources to adequately prepare ECEC staff and settings to maximise the potential of using digital technologies to engage with communities, which seems under-tapped at the moment.
- To maximise the benefits of the use and application of technology to engage communities, it is important to consider implications for teacher preparation programmes as well as in-service professional development.
- Finally, although policy examples offer inspiration to countries wishing to invest in better and more impactful family and community engagement in ECEC through digital technology, actual implementation will depend on the connectivity of regions and countries' technological infrastructure.

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7 Promoting equity and inclusion in the digital age through early childhood education and care

This chapter explores differences in risks and opportunities relating to digital technologies among young children. It focuses on the exposure to digital risks and the development of emergent digital literacy skills in home environments before turning to differences in access to and the use of digital technologies in early childhood education and care (ECEC) centres, and particularly to the role of ECEC in mitigating digital divides among young children. Moreover, this chapter discusses ways in which digital technology may support a quality provision of ECEC as well as inclusion, thus strengthening the quality of ECEC for disadvantaged children in particular. The chapter concludes with a review of current funding structures aimed at reducing digital divides and issues policy pointers for promoting equity and inclusion in ECEC.

Key findings

Results from the *ECEC in a Digital World* policy survey (2022) indicate that reducing inequalities in access to digital technologies and in digital literacy among young children are challenges of high importance for many countries and jurisdictions. Early gaps in exposure to digital risks and digital literacy largely develop in the home environment. ECEC can help mitigate these digital divides by employing pedagogies that develop young children's digital literacy. This can be done with little or no exposure to screens and by placing a strong focus on learning how to protect against risks, which is appropriate for young children and addresses the fact that children from low socio-economic backgrounds are more likely to be heavy users of digital technologies at home. Additionally, by sparking young girls' interest in digital technologies, ECEC can contribute to greater female representation in science, technology, engineering and mathematics (STEM) fields in the future.

TALIS Starting Strong 2018 data show that before the COVID-19 pandemic, ECEC staff placed relatively little importance on the development of digital skills among young children and had relatively low confidence in their capacity to use digital technology to support children's learning. There were no systematic differences in these beliefs across ECEC centres relating to their children's populations. However, where differences did exist (e.g. Chile and Israel), ECEC staff in centres with larger shares of vulnerable children more often believed in the importance of developing ICT skills in children and in their capacity to use digital technology to support children's learning.

Careful introduction and purposeful use of digital technologies can improve quality in ECEC by supporting work processes such as continuous workforce development, communication with families and administrative tasks, providing avenues for improvement for disadvantaged ECEC settings.

TALIS Starting Strong 2018 data show large differences in perceived shortages in or inadequacy of digital technologies among ECEC centres for most participating countries, though these were largely not linked to the centres' shares of vulnerable children or location (urban or rural). In some countries, public ECEC centres had less access to adequate broadband connection and digital devices.

According to TALIS Starting Strong 2018 data, online learning for workforce development was not widespread. Where differences existed (e.g. Chile, Israel and Korea), ECEC staff in centres with larger shares of vulnerable children were more likely to engage in online learning.

Digital technologies can be used to make ECEC more inclusive, for instance by allowing young children with special education needs or with a different first language to participate more fully in ECEC.

Results from the *ECEC in a Digital World* policy survey (2022) indicate that public funding for ECEC centres is available more widely to provide access to a digital infrastructure than to use digital tools in the classroom. ECEC centres often have a choice in their digital equipment, though the extent of this varies across countries and jurisdictions.

Additional digital resources to promote equity and inclusion most often involve support for digital technologies for children with special education needs. General funds for vulnerable children may also be spent on digital technologies. In some countries and jurisdictions, ECEC centres in rural areas receive additional support for their digital infrastructure and materials. A few countries and jurisdictions also offer special programmes for children from minority communities.

Introduction

For many children, digital divides are already emergent in early childhood, driven by differences in the level of digital resources and skills in their family environments. ECEC can play a role in redressing these inequalities, provided that resources are allocated to those that need them the most and that policies ensure strong opportunities for building early digital literacy for all children. However, in the absence of digitalisation policies with an equity and inclusion focus, experiences in ECEC may also exacerbate digital divides as well as differences in quality across ECEC settings if centres with more vulnerable children develop digital literacy in children less than centres with more advantaged children or if ECEC settings with higher structural and process quality are able to exploit the opportunities of digital technologies better to further improve quality than centres with lower structural and process quality.

This chapter looks at ways to ensure equal opportunities for young children to learn and develop, irrespective of their background, in an increasingly digitalised environment. First, it introduces the concept of digital divides and takes stock of what is currently known in terms of unequal access to and use of digital technology among young children, focusing in particular on the outcomes of children from families with low socio-economic status, children with special education needs and children whose first language is different than the language of instruction in their ECEC centre. The analysis focuses on children's digital skills development and their exposure to digital risks in home environments and in ECEC settings. Information on ECEC settings is taken from the OECD survey TALIS Starting Strong 2018. The chapter further explores strategies to make digitalisation a driver of ECEC quality and of inclusion, and an equalising force for existing inequities among young children in ECEC settings. Last, the chapter examines current funding structures and the different ways in which countries and jurisdictions try to mitigate digital divides among young children in ECEC before concluding with policy pointers to promote equity and inclusion in early childhood with regard to digitalisation.

Unequal opportunities and risks of digitalisation for young children and early childhood education and care

Unequal opportunities and risks derived from digital technologies are conceptualised as digital divides. Digital divides refer to the gaps between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both the opportunities to access ICT and the Internet, and to the use of these for a wide variety of activities (OECD, 2001[1]).

The literature distinguishes between three main types of digital divides. The first digital divide refers to the inequalities in access to digital technologies. Today, this first digital divide is closing, with most children in OECD countries having access to high-quality Internet and digital devices like smartphones or tablets. On the other hand, there are important differences across ECEC centres in the access to high-quality Internet, digital devices and software, and many centres are currently developing their digital infrastructure. For example, in some centres, all teachers may have their own tablets to support their administrative tasks, teaching and professional development, whereas in others, computers may be available at a fixed location and shared among staff. Closing the first digital divide is a priority for policy makers: 64% of countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022) consider reducing inequalities in access to digital technologies among young children as a policy challenge of "high" or "very high" importance. For Germany, Canada (Manitoba, kindergarten sector only) and Sweden, this is of "very high" importance (Figure 7.1).

Once access to digital technologies became more universal, the digital divide evolved to a different use of digital technologies, referred to as the second digital divide. There is strong variation in children's usage patterns of digital technologies across demographics such as socio-economic background. Certain groups of young children acquire greater digital literacy skills than others, setting them up to enjoy more of the

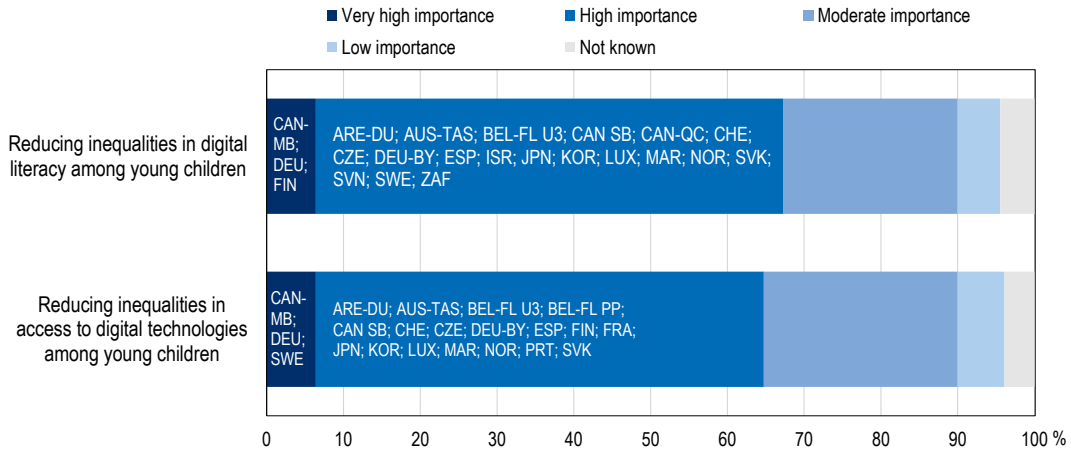
opportunities digital technologies provide throughout their lives (see Chapter 1). The second digital divide also comprises differences in exposure to digital risks across young children. Some young children develop greater digital risk awareness and portray more risk-prevention behaviours than others.

Similarly, a second digital divide exists within the ECEC sector. Centres vary in their use of digital technologies, depending on their digital resources, staff profiles and workloads, and the role of digitalisation in the ECEC centre's philosophy. This can have important implications for structural and process quality in three main areas. First, some centres leverage digital technologies to improve work processes outside the classroom, such as for administrative tasks, monitoring, taking advantage of digital workforce development, and strengthening communication with families and other services. Second, certain centres are better at mitigating differences in young children's emergent digital literacy, including by raising girls' interest in technology. Third, some ECEC centres introduce digital pedagogies as a support for other areas of learning and development, especially for children with special needs or a different first language, who tend to be marginalised in more traditional forms of learning.

Policy makers across the OECD recognise the importance of mitigating the second digital divide: 67% of countries and jurisdictions participating in the *ECEC in a Digital World* policy survey (2022) consider reducing inequalities in digital literacy among young children of "high" or "very high" importance. Canada (Manitoba, kindergarten sector only), Finland and Germany indicated this to be of "very high" importance (Figure 7.1).

Figure 7.1. Policy challenges related to digital divides

Percentage of countries and jurisdictions identifying the following policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category "very high importance" was limited to three out of ten response items maximum.
Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order by the share of countries selecting response categories "very high importance" or "high importance".
Source: OECD (2022[2]), *ECEC in a Digital World* policy survey, Table B.1.

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The concept of a third digital divide is emerging in the literature, and relates to differences in offline returns to using digital technologies across individuals despite similar access and usage patterns (van Deursen and Helsper, 2015[3]; Ragnedda, 2016[4]). The idea is that digital technologies make it easier to connect and thus allow better leveraging social capital. The third digital divide is less relevant in the context of

young children directly, but could lead existing socio-economic gaps across families and ECEC centres to widen further in the future.

Digital divides in home environments

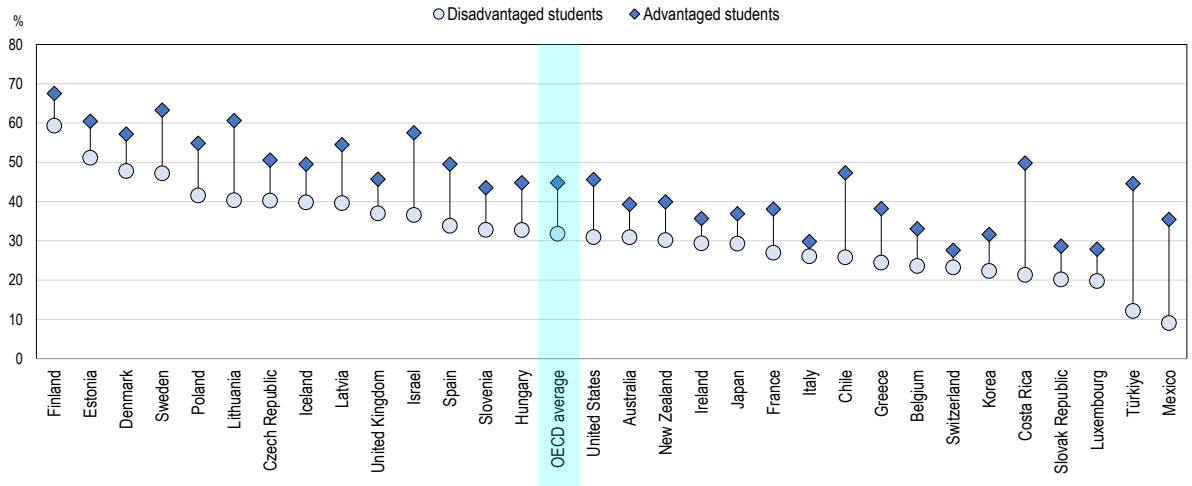
Young children acquire their digital literacy mainly at home (Chaudron, Di Gioia and Gemo, 2018[5]) and thus depend heavily on their families' access to and use of digital technologies, parenting styles, and on their other activities; this can create important inequalities.

Access to and frequency of use of digital technologies

Access to digital technologies has developed dramatically in recent years and is now almost universal for children in many parts of the world, but important differences exist between more and less advantaged children. As up-to-date internationally comparable data for young children are rare, Figure 7.2 shows differences in first access to digital media as reported in a 2018 survey of 15-year-olds. On average across the OECD, socio-economically disadvantaged students were 13 percentage points less likely to have used a digital device before the age of 6 compared to their advantaged peers, with substantial differences across countries. Similarly, 11% of 15-year-old students with low socio-economic status across the OECD did not have Internet access at home in 2018, a share that exceeds 70% in Colombia and Mexico (Clarke and Thévenon, 2022[6]). A comparable picture emerges with regard to access to a computer or tablet at home (OECD, 2018[7])]. Even when homes do have Internet access and digital devices, disadvantaged students are more likely to face barriers to device ownership. During ECEC centre closures owing to the COVID-19 pandemic, lack of Internet connectivity in children's homes and not enough tablets or computers in children's homes created challenges to maintaining education at the pre-primary level for 23% and 33% of responding countries, respectively (OECD, 2021[8]).

Figure 7.2. Socio-economic gaps in access to digital technologies during early childhood

Percentage of 15-year-olds who have used a digital device before age 6, by socio-economic background, 2018



Note: A socio-economically disadvantaged (advantaged) student is a student in the bottom (top) quarter of the index of economic, social and cultural status (ESCS) in his or her own country. See Annex A.
Countries are sorted in descending order of the percentage of disadvantaged students.
Source: OECD (2018[9]), *PISA 2018 Database*, https://www.oecd.org/pisa/data (accessed on 10 December 2022).

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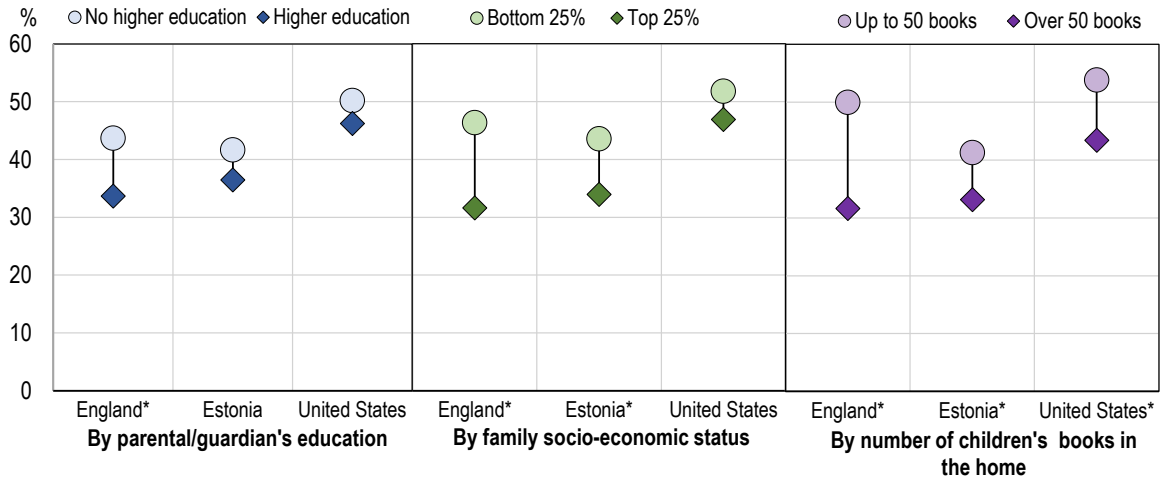
Moreover, there are differences in the frequency at which children in OECD countries use digital technologies. For example, children with low socio-economic status are more likely to be extreme users of digital technologies. In addition, excessive screen time is associated with reduced quality of sleep, obesity, lower life satisfaction, lower levels of socio-emotional well-being and lower academic performance, albeit causal relationships are difficult to ascertain (Burns and Gottschalk, 2020[10]). Links between higher media use and lower parental education and lower household income extend to young children (Barr et al., 2020[11]). The International Early Learning Study provides further evidence of this pattern. While on average in 2018, 39-49% of 5-year-old children in England, Estonia and the United States were heavy users of digital technologies (defined as daily use), this was more common among young children from disadvantaged families (OECD, 2020[12]) (Figure 7.3). In England, children from families where at least one parent or guardian graduated from higher education (International Standard Classification of Education [ISCED] level 6 or higher) are 10 percentage points less likely to use digital devices every day than 5-year-olds whose parents have lower educational attainment. Family socio-economic status is also linked to heavy use of digital devices in England and Estonia, where children of parents from the top quartile are 15 and 10 percentage points less likely, respectively, to use digital devices every day than children from families who rank in the bottom 25%. Further, in all three countries, there is an association between everyday use of digital tools and the number of books in the home. Children with at least 50 children's books in the home are between 8 and 18 percentage points less likely to use digital devices every day compared to children with fewer books available to them. This may suggest that the use of digital tools is, to some extent, replaced by stimulating offline activities such as reading. On the other hand, factors like gender, special education needs and speaking a foreign first language are not related to differences in the daily use of digital devices (see Annex B, Table B.23).

Figure 7.3. Use of digital devices among five-year-olds

Percentage of parents/guardians reporting that their 5-year-old child uses a desktop or laptop computer, tablet device, or a smartphone every day, by family characteristics, 2018



Note: Parental/guardian's education refers to the highest educational level attained by either parent/guardian. Family socio-economic status is based on the highest occupational status of parents/guardians, highest educational level of parents/guardians, and household income. Statistically significant differences are marked with an asterisk. See Annex A.
Source: OECD (2018[13]), *International Early Learning and Child Well-being Study*.

StatLink https://stat.link/n6vjyr

Types of use and digital activities

In addition to access to and the frequency of use of digital technologies, digital activities and experiences vary by socio-economic status. This constitutes the second digital divide among young children, who experience unequal digital skills development and different exposure to digital risks. While international data for young children are scarce, gaps in digital skills between teenagers from high and low socio-economic status have been documented extensively (Hatlevik, Guðmundsdóttir and Loi, 2015[14]). Such digital skills include the ability to use the Internet to search for and understand information, identify unreliable sources, learn new skills, and create new digital content. For example, disadvantaged children are less likely to use digital devices as a resource for information or to read the news online (Clarke and Thévenon, 2022[6]). As with the development of other skills, differences in digital skills likely start to develop during the early years.

A large part of the second digital divide among young children can be attributed to differences across education levels and socio-economic backgrounds in parents' approaches to the use of digital technologies in the home. Key reasons for these emerging gaps seem to be a lack of awareness of beneficial and effective parenting methods and lower levels of digital literacy and lower confidence in their own ICT skills among parents in disadvantaged families. Parents with a higher socio-economic status and more education tend to apply more effective methods for developing digital literacy in their children. For example, they more often use active mediation methods, which involve showing interest and keeping up to date with the child's digital technologies usage, co-viewing and discussing programme content to help the child understand and learn from digital media, and giving advice and parental support (Livingstone et al., 2015[15]; Mascheroni, Ponte and Jorge, 2018[16]). In addition, the pedagogical use of technology, which helps to develop digital skills and strategies to avoid risks when using digital technologies, is encouraged more by parents with a medium or high socio-economic status, greater levels of digital literacy and confidence in their own digital skills and by parents who worry less about misuse and overuse of digital tools by their children (Gee, Takeuchi and Wartella, 2018[17]).

In addition to the mediation and guidance of their child's use of digital technologies, parents' own use of digital tools in the presence of children can have important effects on a child's development, and awareness of these effects differs across parents from different socio-economic backgrounds. Parental use of digital technologies can affect children's development of a secure attachment relationship (Kildare and Middlemiss, 2017[18]). For instance, parental mobile use when they spend time with their young children has been found to result in fewer parent-child interactions among low-income mothers. This provides fewer opportunities for the children to pick up social cues and may affect their non-cognitive development in the long run (OECD, 2019[19]).

Providing information to disadvantaged families about the risks of excessive use of technology and about effective parenting methods regarding the use of digital technologies is key to addressing the second digital divide among young children. Most parents welcome guidelines and support, and tend to be more supportive of digital learning opportunities and technologies if education centres embed them in their curricula (Chaudron, Di Gioia and Gemo, 2018[5]). As discussed in Chapter 2, results of the *ECEC in a Digital World* policy survey (2022) indicate that in 2022, 62% of participating countries and jurisdictions already offered guidance or recommendations on educational uses of technology with young children at home, although this information is not necessarily oriented towards vulnerable homes. Public guidance could be developed further, focusing on disadvantaged families in particular. In addition, ECEC settings can play an important role in communicating with families on the use of digital technologies and could target families from low socio-economic backgrounds and with less digital competence and confidence.

Digital divides in early childhood education and care centres

ECEC centres may exploit digital technologies in a range of work processes outside the classroom to support structural and process quality as well as inside the classroom to make children's learning and development more inclusive. ECEC can further mitigate digital divides among young children that build in the home environment but may also exacerbate digital divides or differences in ECEC quality if centres with high shares of vulnerable children are less able to leverage the opportunities that digitalisation brings. This section analyses digital divides among ECEC centres by looking at their access to digital technologies and their use in the areas of continuous workforce development, communication with parents and other services, and in the classroom, paying particular attention to differences between centres with high and low shares of vulnerable children.

To explore differences among ECEC centres, this section draws predominantly on 2018 data from the OECD Starting Strong Teaching and Learning International Survey (TALIS Starting Strong). While the COVID-19 pandemic has likely altered the state of digitalisation in the ECEC sectors of most OECD countries since then, it is the only international survey of the ECEC workforce that allows exploring these issues to date and patterns of inequalities among centres are likely to persist, albeit to different extents. The data collection took place in pre-primary education settings (ISCED level 02) in Chile, Denmark, Germany, Iceland, Israel, Japan, Korea, Norway and the Republic of Türkiye. Four of the nine countries (Denmark, Germany, Israel and Norway) additionally surveyed ECEC settings for children under age 3. Centres with high shares of vulnerable children are identified as those where more than 10% of children come from families with low socio-economic status, where more than 10% of children have special education needs or where more than 10% of children have a different first language than the local one. These are referred to as diverse centres in the remainder of this chapter. Estimates for sub-groups and estimated differences between sub-groups may be small and need to be interpreted with care.

Availability and adequacy of digital technologies

Connectivity and appropriate equipment are a pre-condition for ECEC centres to benefit from the opportunities brought by digitalisation, but with large heterogeneities between ECEC settings in many countries in terms of resources, size and governance. A lack of broadband access and adequate equipment can be a challenge and contribute to a digital divide among ECEC centres. TALIS Starting Strong indicates uneven levels of digital infrastructure among ECEC settings within countries. Centre leaders were asked whether insufficient Internet access and shortages or inadequacy of digital technology for play and learning (e.g. computers, tablets, smart boards) hinder their ECEC centre's provision of a quality environment for development, well-being and learning. The share of leaders who responded that the provision of quality ECEC was hindered "quite a bit" or "a lot" by insufficient Internet access or inadequate digital technology ranged from 10% to 40% across countries for both questions. At the pre-primary level, Chile, Germany, Israel and Türkiye report the greatest hindrances across both questions (27% or higher); for ECEC settings under age 3 it is Germany in both instances (32%) (see Annex B, Tables B.24 and B.25). These results are in line with prior literature that documents a lack of ICT equipment and/or broadband access in many ECEC settings across countries. Often cited reasons are insufficient funding to cover the substantial cost of buying and maintaining digital infrastructure, as well as physical classroom constraints for some countries, such as too few electrical sockets that require costly adaptations (Plumb and Kautz, 2015[20]).

However, the data do not point to statistically significant differences in Internet access or shortages and inadequacy of digital equipment associated with ECEC centres' composition of children. Centres with more than 10% of children from socio-economically disadvantaged families do not differ significantly in their answers from ECEC centres with fewer shares of children with low socio-economic status. Similarly, centres with more than 10% of children with special education needs do not experience significant differences in Internet access or digital equipment compared to centres with fewer children with special

education needs. ECEC centres where over 10% of children speak a different first language than the language of instruction face similar challenges in accessing broadband and adequate digital equipment as centres with fewer multilingual children, with the exception of Germany. At both education levels, ECEC settings in Germany, with more than 10% of young children who speak a different first language are 17-19 percentage points more likely to experience difficulties with their Internet access. For ECEC settings for children under age 3, this is also true with regard to an adequate provision of digital equipment. These results should be interpreted with care. While there may be no strong variation in digital technology to the extent that it hinders a quality provision of ECEC "quite a bit" or "a lot", there may still be differences in the digital infrastructure across centres with more or less diverse populations.

General funding levels matter for access to digital technologies and their integration into work practices and processes. This implies that digitalisation may exacerbate existing inequalities in ECEC and centres with fewer resources may lag even further behind. TALIS Starting Strong 2018 suggests that different forms of shortages in digital technologies often coincide: Leaders of ECEC centres with shortages in Internet connectivity are 22-72 percentage points more likely to respond that an inadequate provision of digital devices hinders the delivery of quality ECEC "quite a bit" or "a lot" in Chile, Germany (both education levels), Iceland, Israel (both education levels), Korea, Norway (only ISCED level 02) and Türkiye. Moreover, centres with shortages of human or other material resources report insufficient access to digital technologies much more often. In Chile, Denmark (with low response rates), Israel, Japan, Korea, Norway and Türkiye at the pre-primary level and in Israel in centres for children under age 3, ECEC settings that face shortages in human resources are 12-26 percentage points more likely to experience insufficient Internet access. Similarly, ECEC centres that encounter shortages in human resources report challenges in access to digital devices 12-29 percentage points more often than centres without staff shortages in Chile, Iceland, Israel, Korea and Norway at ISCED level 02 and in Germany and Israel in settings for children under age 3. Centres with shortages in material resources other than digital technologies experience insufficient Internet access 11-30 percentage points more often at ISCED level 02 in Chile, Israel, Korea, Norway and Türkiye, and in ECEC centres for children under age 3 in Denmark (with low response rates) and Germany. ECEC settings that face other material shortages experience an insufficient provision of digital devices 9-42 percentage points more often than centres without material shortages at ISCED level 02 in Chile, Israel, Norway and Türkiye and in ECEC centres for children under age 3 in Germany and Norway.

The strong link with shortages of human and material resources suggests that differences in digital infrastructure across ECEC centres are not due to different choices on the side of centres (with a trade-off between digital and non-digital investments). Instead, digital equipment shortages tend to coincide with shortages of other types of resources, suggesting that more general resource allocation mechanisms are behind the unequal capacity of ECEC centres to integrate digital technology into work processes and activities. Even in systems where earmarked funds for digital infrastructure exist, ECEC centres with human resource shortages may be less able to perform the administrative work required to access these if their current staff are fully occupied focusing on short-term needs or do not have the resources to engage in training for these tasks. Thus, increasing general funding levels for centres with fewer resources could help ensure more equitable access to digital technologies among ECEC centres.

In some countries, TALIS Starting Strong 2018 data indicate publicly managed ECEC settings to be at greater risk of facing barriers in accessing digital technologies. In Chile, Denmark (with low response rates) and Germany, publicly managed centres report insufficient Internet access 16-19 percentage points more often than privately managed centres. In Israel the gap rises to 27 percentage points. When it comes to an inadequate provision of digital devices, leaders of publicly managed centres are 12 percentage points more likely to state that this hinders their delivery of quality ECEC "quite a bit" or "a lot" in Norway in settings for children under age 3. In Israel, the difference amounts to 15 percentage points in settings for children under age 3 and to 21 percentage points at ISCED level 02. In these countries, greater support for publicly

managed settings may reduce gaps in digital infrastructure if these have not already been addressed in response to the COVID-19 pandemic.

The size of ECEC centres could also matter for access to digital infrastructure. Centres with more children may be able to invest in better connectivity and more equipment because of lower average fixed costs and more possibilities to share and use expensive technological devices. However, data from TALIS Starting Strong do not point to a severe first digital divide along centre size: The extent to which Internet access and digital devices hinder a quality provision of ECEC according to leaders does not differ significantly between small centres with up to 50 children and large centres with more than 100.

The location of ECEC centres can sometimes create a first digital divide. Compared to urban areas, rural areas tend to have lower quality Internet access and rural regions often exhibit lower productivity levels and can thus be less prosperous, which in turn could affect centre funding (OECD, 2019[19]). Results from TALIS Starting Strong do not show strong signs of a first digital divide based on a centre's location. While rural ECEC centres in Chile tend to experience more problems with their Internet than urban ones, the opposite is true in Germany (ISCED level 02) and Korea. Furthermore, shortages or inadequacy of digital devices are perceived to hinder a quality ECEC provision less often in rural centres in Korea than in urban ones, which might reflect differences in pedagogical approaches or in awareness of how to use digital technologies in the work with children.

Overall, there is a digital divide among ECEC centres, which is not related to the composition or number of children but instead strongly associated with the centres' overall funding levels. In certain countries, publicly managed ECEC settings fare worse than their private counterparts in terms of their digital infrastructure. Policies can provide additional support for these settings to ensure all centres are able to seize the opportunities that digitalisation provides for high-quality ECEC, especially since greater inequalities among centres might arise in the future if some centres use digital technologies more extensively to improve structural and process quality. Some countries are already very active in promoting widespread digitalisation of their ECEC sectors. For instance, in 2022, the Czech Republic introduced the national initiative "Innovation in education in the context of digitisation" within its Recovery and Resilience Plan, which is aligned with long-term national and European strategies and spans from pre-primary to upper secondary education (ages 3-18). Its primary aim is to ensure that all ECEC centres and schools have adequate digital equipment to mitigate digital divides and includes training resources for staff to ensure the effective use of digital technologies to this end (see Case Study CZE – Annex C).

Digital technologies to support continuous workforce development

Digital technologies can provide opportunities for distance learning for ECEC staff and centre leaders (see Chapter 4). Such continuous workforce development can benefit children through improvements in staff's practices with children as well as in staff's other areas of work. Participation in online courses or seminars may be particularly attractive for staff who are unable to travel to in-person trainings or for those in regions with lower training offers, for learning about specific or rarer needs of children for which local in-person training may be less frequently available, and for staff from smaller centres that may have fewer own training resources or a smaller peer learning infrastructure.

TALIS Starting Strong 2018 data show that online learning among the ECEC workforce is more common in some countries than in others, and that it did not constitute a large part of workforce development in most countries at the time of the survey (see Annex B, Tables B.26 and B.27). For instance, 81% of staff and leaders in Korea reported having attended courses or seminars online within the previous 12 months. For Denmark (with low response rates), Germany and Japan, the proportion is under 5% for staff and 5-10% for centre leaders. In all countries but Korea, the share of staff or leaders who attended online courses or seminars over the year before the survey was at most 46% of that of in-person courses or seminars.

Participation in online professional development is largely similar across diverse centres and non-diverse centres for both staff and leaders. However, there are a few exceptions and, in these countries, staff in diverse centres are more likely to participate in online training. In Chile, the difference is 7 percentage points in socio-economically diverse centres (over 10% of children from disadvantaged backgrounds) and 8 percentage points in centres where over 10% of children have special education needs. Leaders of socio-economically diverse centres are 17 percentage points more likely to participate in online trainings in Korea. In Israel at ISCED level 02, leaders are 19 percentage points more likely to attend online trainings in centres with more than 10% of children with special education needs and 14 percentage points more in centres where over 10% of children speak a different first language. The slightly higher participation in online training by staff working with more vulnerable children could indicate that this is a promising way to support workforce development in diverse centres. Greater flexibility to participate in workforce development can benefit vulnerable children as staff working in diverse centres tend to attend trainings on working with a variety of children more often (OECD, 2020[21]).

Digital technologies to support communication with families and other services

Family engagement with centre activities is shown to create a better ECEC experience for children and support current and future child development (Kral et al., 2021[22]). In addition, regular exchanges with ECEC staff and centre leaders permit parents or guardians to learn about effective pedagogies and gain confidence in their parenting. The knowledge about centre activities allows families to extend the child's learning and development into the home. However, centres with higher proportions of children with socio-economically disadvantaged backgrounds, with special educational needs or who speak a different language at home than the language of instruction report lower levels of parental engagement across OECD countries. Suggested reasons for the lower engagement are work/family circumstances that impose time constraints on the participation in centre activities, language barriers that make communication more challenging and lack of knowledge among staff about the effective engagement of families with different backgrounds than their own.

Digital communication with families has increased substantially in OECD countries during the COVID-19 pandemic as a response to initial centre closures and could provide a meaningful, additional communication channel for centres with high shares of families who face constraints with traditional communication methods (OECD, 2021[8]). Parents may benefit from an additional, asynchronous communication channel that provides access to information about centre activities irrespective of time and location (see Chapter 6). Reduced communication barriers may serve caretakers of children with special education needs in particular, since these children may require more frequent exchanges between families and ECEC staff. For families with language barriers for communicating with ECEC staff and centre leaders, translation software can be an inexpensive way to overcome this barrier. In addition, staff can access resources online to increase their knowledge of families' backgrounds and cultures, which may help engage these families in the centre's activities.

In addition, digital communication with families could support the learning and development of children by teaching and encouraging families to engage in educational activities such as book reading at home. This is a very cost-effective intervention, with the potential to support children from low socio-economic backgrounds in particular, as their parents tend to engage less in learning activities with their children (Guryan, Hurst and Kearney, 2008[23]; Kalil, 2014[24]). A meta-analysis of technology-based interventions has shown positive results of text messages on the time parents spend on educational activities with their young children (Escueta et al., 2020[25]).

ECEC centres with high shares (over 10%) of children from socio-economically disadvantaged homes, with special needs or whose first language is different from the language(s) used in the centre tend to co-operate with child, family or social services more frequently. Digitalisation can facilitate and strengthen co-operation and communication between the different services, allowing for more holistic support for these

children and their families. Since disadvantaged children benefit more often from these additional supports outside their ECEC centre, they would benefit the most from greater horizontal connectedness.

While digital technologies provide many advantages in certain areas for ECEC centres' communication with families and other services, they cannot replace face-to-face interactions and may not be useful for all children. They should serve a clear purpose and have a large enough advantage over traditional means of communication that makes up for costing additional staff time and resources. Moreover, when introducing digital communication, staff, families and other services will likely need time to adapt and it is important to not overburden staff in the transition and in the long run while ensuring that disadvantaged families benefit from and are not penalised by this form of communication.

Developing digital literacy in all young children

ECEC centres may vary in their capacity to support digital literacy development and to mitigate digital divides that develop in home environments among young children. While ECEC curriculum frameworks increasingly recognise digital literacy as an important developmental area for children starting at an early age (see Chapter 3), the beliefs and practices of ECEC staff are crucial factors for translating these goals into outcomes. Otherwise, the introduction of digital literacy in curricula may be ineffective or even reduce process quality for certain children if not implemented well. If ECEC staff have different views on the need to develop digital literacy depending on children's characteristics, or if ECEC staff who are more aware of the benefits of digital literacy or better able to teach digital literacy are allocated to advantaged ECEC centres, differences in opportunities to develop digital literacy that build up in the home environment can continue in education systems. This section looks at staff's personal beliefs about developing digital literacy in young children and at their confidence in their own abilities to use digital technologies in their practices to support digital literacy development or other levels of development.

TALIS Starting Strong 2018 gives some insights into ECEC staff's beliefs about the importance of developing digital literacy. Specifically, it asks staff to what extent they consider it important for their ECEC centre to develop ICT skills in children to prepare them for life in the future. The share of ECEC staff who responded it was of "high" importance (as opposed to "low" or "moderate" importance) varies substantially across countries, from 5% in Japan to 60% in Israel. However, within countries, ECEC staff in disadvantaged centres consider the development of digital literacy in children no less important than their colleagues in less diverse centres. On the contrary, in some instances, the opposite is true: In Chile and Israel, staff in ECEC centres with more than 10% of children from families with low socio-economic status answered more often that developing ICT skills in children was of "high" importance for their ECEC centres (a 10 and 9 percentage point difference, respectively). Similarly, in Israel and Iceland, staff in centres with more than 10% of children with special education needs gave children's digital literacy development greater importance (a 10 and 8 percentage point difference, respectively) (see Annex B, Table B.28).

High-level support can encourage staff to develop early digital literacy among children (Blackwell, Lauricella and Wartella, 2014[26]; Becta, 2004[27]). Centre leaders' views on the importance of digital skills development in young children are likely to affect the support they provide to their staff for this. TALIS Starting Strong shows that in five out of nine countries, ECEC staff are more likely to believe that it is important for their ECEC centre to develop children's ICT skills when the ECEC centre leader believes it is important (see Annex B, Table B.28). Overall, leaders of diverse centres did not have significantly different views than leaders from other centres (with the exception of Chile and Germany), and the results from leaders are broadly similar to those from staff (reported on above) (see Annex B, Table B.29).

It should be noted that there are many ways to develop young children's digital literacy, including some that do not require children to be directly exposed to screens (see Chapter 3). So-called "unplugged approaches" may be particularly suited for more diverse classrooms with high shares of disadvantaged young children. Limiting their screen time in ECEC settings is of greater concern for these children as they tend to spend more time on digital devices at home. Unplugged approaches may also be preferred by

teachers with strong cultural or personal beliefs and value systems who are opposed to the use of digital technologies with children (Parette, Quesenberry and Blum, 2009[28]). Equally, ECEC centres may prefer unplugged approaches if they are a better fit for their overall philosophy and values.

However, unplugged approaches are not broadly used in ECEC (see Chapter 3), and curriculum frameworks generally mention digital technologies as the most direct way to support literacy development. Furthermore, digital technologies can be used more broadly in practices with children, for instance to support literacy or numeracy development. Employing digital teaching methods for these various goals successfully depends on the teachers attitudes towards using digital technologies and their confidence in their own abilities (Gong, Xu and Yu, 2004[29]; Teo, 2010[30]; Zhao and Cziko, 2001[31]). TALIS Starting Strong 2018 asks staff about their perceived ability to use technology to support children's learning in their work. Again, staff responses vary widely across countries: the share of ECEC staff reporting that they can use digital technology "quite a bit" or "a lot" to support children's learning ranges from 2% in Japan to 73% in Türkiye (see Annex B, Table B.30). It is important to note that while this indicator gives interesting insights into the need for staff support, it cannot be interpreted as a direct measure of staff preparedness; for instance, the answers can vary if staff have different expectations about how much digital technology should be used or if their work environment imposes restrictions on their use of technology with children. Looking at differences within countries, staff working in diverse centres do not judge their own ability to use digital technologies to support children's learning lower than staff from other centres. On the contrary, staff in centres with more than 10% of children from low socio-economic background are 10 percentage points more likely to be confident in their own abilities in Israel (ISCED level 02), and staff in centres with more than 10% of children with special education needs in Chile report more often (+9 percentage points) that they feel confident in their own ability to use digital technologies in the classroom.

Overall, TALIS Starting Strong 2018 data suggest that before the pandemic, there were large differences among staff, ECEC centres and countries in factors that can influence the development of digital literacy and the use of digital technologies with children in ECEC. While these factors were not less favourable in centres with high shares of vulnerable children compared to centres with low shares of vulnerable children, leaders and staff that place a high importance on developing ICT skills in ECEC tended to accumulate in centres. This suggests that some centres experienced better preconditions to mitigate digital divides than others. Since then, the COVID-19 pandemic may have increased staff's beliefs in their own ability to use digital technologies and support children's learning and may also have altered staff and leaders' views on the importance of their ECEC centre to develop digital literacy in young children. Countries also invest in support for ECEC staff to adapt pedagogies that develop digital literacy in children to provide equal opportunities across the sector. Box 7.1 highlights some examples.

Box 7.1. Supporting the widespread adaptation of high-quality digital literacy development

In 2012, **Estonia** introduced the ProgeTiger programme to promote the development of digital literacy in preschool, primary and vocational education. The aim is to spark children's interest in the fields of engineering sciences, design and technology and engineering sciences and to develop their algorithmic thinking, problem-solving skills and programming skills. At the preschool level, the programme seeks to develop basic knowledge of coding, digital media and digital safety in young children through age-appropriate activities and play. To implement these objectives, ProgeTiger finances the purchase of digital devices for teachers and supports the development of teachers' competencies to employ digital technologies in the classroom through trainings and the creation of publicly available digital learning materials, methodological guidelines and teaching examples. In addition, it facilitates peer exchange among practitioners.

The programme was part of the Estonian Lifelong Learning Strategy 2020 and is further integrated into the Estonia Education Strategy 2021-35 under the target relating to digital pedagogy. Nearly all (99%) Estonian kindergartens have already participated in the programme (see Case Study EST – Annex C).

In **Norway**, the Directorate for Education and Training finances a scheme where developers can receive financial support to develop specifically adapted pedagogical materials for ECEC, which are connected to subject areas from the Framework Plan for Kindergartens. These materials aim to support the widespread development of digital literacy in young children.

Source: OECD (2022[2]); see Case Study EST – Annex C.

Digital technologies as a pedagogical tool for more inclusive early childhood education

There is a wide range of opportunities to employ digital technologies to personalise learning and, therefore, employ more inclusive pedagogical practices. These pedagogies are characterised by a greater adaptation of teaching to the individual context, needs and interests of children to support their learning, development and well-being. Inclusive digital pedagogies can prevent separate classrooms for vulnerable children, which poses risks to equity and quality in ECEC (OECD, 2018[32]). Digital technologies further allow better acknowledging children's identities, beliefs and realities, which contributes to forming stronger ties with their families and communities by making them feel welcome and understood (Rowe and Miller, 2016[33]). Disadvantaged children can therefore benefit substantially from inclusive learning methods with digital technology (Bers, Strawhacker and Sullivan, 2022[34]). However, disadvantaged children may also experience the greatest learning losses if digital pedagogies are not implemented well and thus become less effective than traditional methods.

There are three groups of children for which inclusive digital pedagogies may be especially promising: girls, to develop their digital literacy during early childhood and beyond, and students with special needs or with a different first language than the language(s) spoken at the ECEC centre to allow them to participate in ECEC more fully and as a support for their overall learning and development. The opportunities that technology bears for these three groups are outlined below.

Sparking greater interest in technology among girls

Currently, digital literacy levels and representation in ICT domains are unevenly distributed in the population. In most countries, there is a strong gender imbalance. For example, women's median share of employment in the ICT sector is less than one-third across 116 countries (ILO, 2019[35]). This pattern is also observable in higher education, where 17% of ICT students are women across the EU (Eurostat, 2019[36]). The gender divide in the use of digital technologies and interest in ICT starts at a young age and increases as children transition into adulthood, pre-empting many girls and women from taking advantage of the opportunities technology provides. By developing digital literacy and exposing children to science and technology in a manner that nurtures their interest, ECEC has the potential to reduce the divide, with substantial benefits to children's trajectories in later years.

Inclusive pedagogies are vital to help girls identify with ICT subjects and jobs. The root cause for the lower engagement of girls and women in ICT is commonly cited as a lack of identification with the subject, stemming from gender-based stereotyped beliefs with regard to interests and careers in ICT, and (lack of) confidence in their own abilities. Research shows that experiences with technology during early childhood can reduce gender-based stereotypes, influence girls' attitudes towards digital technologies in adolescence and ensure greater success in these fields later in life (Sullivan and Bers, 2018[37]).

Engaging pedagogies typically draw on examples and resources that reflect children's interests and identities, which already differ across gender in early childhood (Stephen and Plowman, 2014[38]). At age 5, young children have internalised gendered roles, which reflects in their choice of play and their career aspirations (OECD, 2018[13]). To spark girls' interest in technology, it is thus important to frame teaching in the context of their interests, explore questions that matter to them and connect to their everyday life (Lehrer and Schauble, 2015[39]; UNICEF, 2022[40]; Metz, 2011[41]). Focusing on social issues or highlighting the possibilities to be creative and make a positive impact with technology also tend to strengthen girls' identification with ICT, as it draws on the gendered stereotype that depicts women more often as "helpers" (Carlone, Scott and Lowder, 2014[42]). Further, exposure to role models sparks girls' interest in technology and technology-related jobs, leading to greater uptake of these fields. Finally, pedagogies that rely on a growth mindset, i.e. that reward the process and effort of learning, are very conducive to keeping girls interested in technology because they help overcome self-doubt or a lack of confidence in the children's own abilities (Microsoft, 2018[43]). While this latter effect is mostly documented for teenage girls and women in the literature and research on younger girls is still scarce, equipping children with a growth mindset may at least set important foundations for girls' interest in ICT in later years.

Digital technologies for children with special education needs

Digital technologies can aid the integration of children with special education needs into ECEC settings. Applications cover a range of areas, such as improving young children's learning, behaviour, attention or communication. By enhancing the functional capabilities of children with disabilities, assistive technologies allow children to participate more fully in ECEC.

Digital technologies may provide an additional mode of teaching and expression, which can benefit children with visual, speech or hearing impairments as well as those who struggle to develop literacy skills traditionally identified in curricula. For example, augmenting traditional reading activities with short films may help some children better understand certain story elements. Equally, digital elements like photos or voice recordings provide children with new ways of self-expression that do not require traditional emergent literacy skills and make it easier to have multiple contributors to multimodal stories, including from children's home environments (Eiserman and Blatter, 2014[44]).

Digital technologies can augment pedagogies through the personalisation of learning. Individual and immediate digital feedback, for instance through sounds or images for having recognised the correct shape or colour, could provide additional learning support to children and help engage them in learning activities. This can support, in particular, the development of children with learning or behavioural difficulties, such as children diagnosed with attention deficit disorder.

While there can be many benefits to using digital technologies with young children with special education needs in ECEC, attention needs to be paid to effective and healthy use. Risks such as overexposure to digital technologies may become more substantial for children with special needs if they increasingly rely on them to perform tasks. Moreover, mainstream technology may not be adequate for the special needs of these children and can require adaptations or special software or equipment.

Policy can facilitate and guide the adaptation of high-quality inclusive digital pedagogies in ECEC. For instance, Norway's national service for special needs education, Statped, has developed the Digital Didactics and Inclusion programme to promote inclusion through digital technologies in ECEC and schools. ECEC centres or entire municipalities can apply to participate in the programme, which offers a course for ECEC staff on inclusive digital pedagogies and digital literacy development, provides continued guidance and resources during implementation, and builds a learning community to facilitate peer exchange among staff. In addition, the website provides educational materials for and examples of inclusive digital pedagogies and informs about suitable digital software and relevant research. Resources may highlight inclusive pedagogies for specific children, or the programme can provide ideas for slight adaptations to digital pedagogies that allow children with special education needs to participate in digital classroom

activities as well. For an overview of current uses of digital assistive technology in ECEC to support children with special needs, and of beneficial conditions for their successful application, see Wyeth et al. (2023[45]).

Supporting language development and inclusion for children with different first languages

Digital technologies in classrooms can have wide-ranging benefits for children who speak a different language at home, including greater well-being and improved literacy development [for an extensive review, see (Hsin, Li and Tsai, 2014[46])]. They can do so by acknowledging children's cultural backgrounds, supporting the development of more positive identities and multiculturalism; and by overcoming linguistic barriers these children may face.

When young children's home cultures and experiences are represented in ECEC settings, they are more engaged in literacy activities and form more positive identities (Peleman, Vandenbroeck and Van Avermaet, 2020[47]). Digital technologies facilitate the use of multicultural resources in teaching, both through the Internet and by offering easy ways for families or communities to provide images, text and oral recordings from children's environments and/or in their heritage language (Rowe and Miller, 2016[33]) Using children's heritage languages as assets in ECEC settings affirms these children's value of multilingualism and supports their vocabulary and literacy development, as children acquire a new language more effectively when they continue to use and develop their heritage language (Cummins, 2000[48]).

Digital technologies can support emergent multilingual children in communicating and collaborating with others. For example, asking children to take photos at home or during their other experiences and to bring them to the classroom can provide visual anchors for conversations with adults, in which children are the experts (Rowe and Miller, 2016[33]). This way, children acquire the vocabulary in the language of instruction in addition to their heritage language, and it helps adults interpret children's communication and learn about children's lives at home and in the community (Kucirkova, Messer and Whitelock, 2010[49]; Kucirkova, Messer and Sheehy, 2014[50]). In addition, digital technology may serve as a translation device, thus facilitating communication between ECEC centres and children, as well as with their families.

Box 7.2. Fostering literacy and inclusion among children with a different first language through digital technologies

In 2015, the **Australian** government funded a digital, game-based learning programme for preschool children called Early Learning Languages Australia (ELLA) for an initial trial (ELLA, 2022[51]). ELLA is aligned with the learning outcomes of the Early Years Learning Framework of the National Quality Framework for early childhood education and care (ECEC) and consists of 7 different apps with 13 selectable languages (C&K Forestview Community Kindergarten, 2019[52]). These apps introduce children to different topics (e.g. cooking, art, role play, music) in the chosen language through words, phrases and songs. The aim is to support children in learning another language besides English and to expose them to different cultures, which enhances their problem-solving and social skills and strengthens their cultural awareness. Moreover, the programme provides children with a different first language the opportunity to share their mother tongue with peers. After a successful first trial, the programme now includes over 4 000 participating preschools.

In **Germany**, the Sprach-Kitas programme was launched in 2016 to provide supplementary financial and human resources to ECEC centres with a high share of children with need for additional language support, including migrants, refugees and children from educationally disadvantaged families (BMFSFJ, n.d.[53]). The programme aims to employ inclusive pedagogies, embed learning into children's individual

environments and strengthen collaboration with families. In 2021, an additional focus was placed on employing digital technologies for young children's language development.

Examples of initiatives funded through this programme include the purchase of tablets in ECEC centres to create multilingual digital picture books with children (Stadt Ingolstadt, 2022[54]). The digital apps used for these books allow families to access the work from home using the child's login. Creating multilingual digital picture books can strengthen children's emerging literacy skills and is especially helpful for children with a different mother tongue, as they can "read" a book in both languages with their peers.

In **Canada**, the Government of **Ontario** published a handbook in 2007 to provide support to educators in their work with children who learn English as a second language (Government of Ontario, 2007[55]). The handbook states that digital technologies can be useful in incorporating the child's language into the classroom and thereby promote progress in language development. Recommendations include equipping children with a different first language with a digital device to take home and asking them to document their surroundings or to record their parents' storytelling. The handbook suggests that digital technologies help create stories that can be shared with educators and peers, leading to greater integration of children with a different first language.

Similarly, individual ECEC centres rely on digital storytelling as inclusive digital pedagogies for groups with children who speak a different first language. For instance, in the **United States (Georgia)**, an ECEC centre worked closely with the University of Georgia to analyse the use of digital technologies for early language development in children with a different first language (NAEYC and Fred Rogers Center, 2012[56]). Studying the case of a Chinese boy in the ECEC centre who didn't speak any English, they found that the use of a tablet to document his surroundings including his home, family, toys and interests, helped his integration into the ECEC centre and fostered his language skills (NAEYC, n.d.[57]). In his case, an interpreter helped the boy arrange the pictures he took and together they added names in Chinese and/or English. The boy then told the other children about his home while sharing the pictures with them. Another example is the Zaleo State Preschool in **Spain**, where 15% of children are non-Spanish (European Agency for Special Needs and Inclusive Education, 2016[58]). One of its projects includes digital photo books, called *unos libros muy especiales*, where the children, together with their families, take photos from their experiences outside of the ECEC centre and use them to create their own storybooks, which they then show to their peers.

Sources: **Australia:** ELLA (2022[51]); C&K (2019[52]); **Germany:** BMFSFJ (n.d.[53]); Stadt Ingolstadt (2022[54]); **Canada:** Government of Ontario (2007[55]); **United States:** NAEYC (n.d.[57]); NAEYC and Fred Rogers Center (2012[56]); **Spain**: European Agency for Special Needs and Inclusive Education (2016[58]).

Public funding structures to close digital divides in and through early childhood education and care

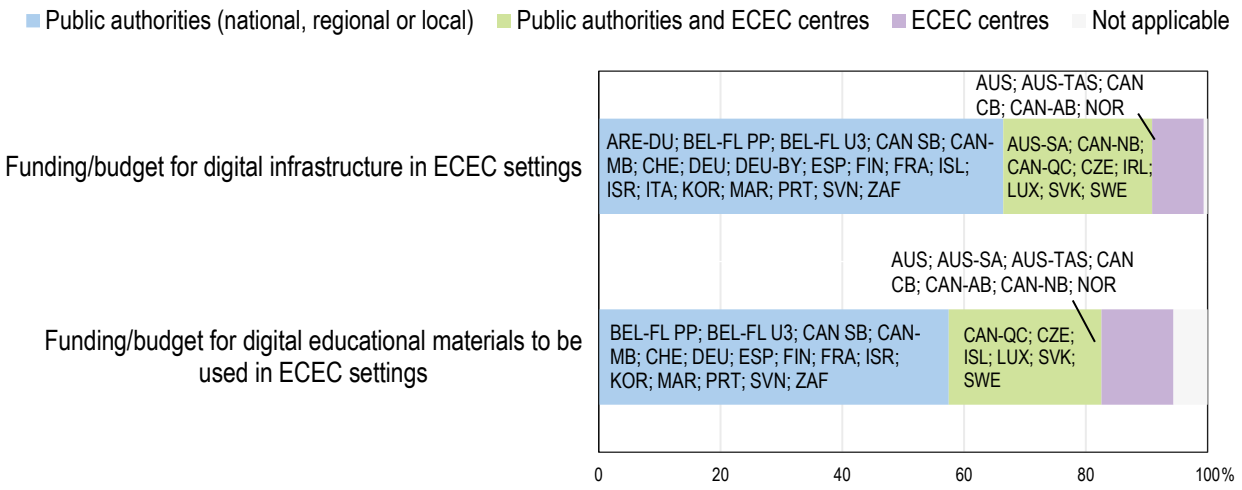
This chapter has outlined existing digital divides among children and the potential of ECEC systems in mitigating these as well as digital divides between ECEC centres and their implications on ECEC quality. This section discusses funding mechanisms that may help explain (and mitigate) some of the variation among ECEC centres in using certain digital opportunities.

By providing adequate funding for digital infrastructure and digital educational materials, countries can ensure all ECEC centres are well-equipped to make the most of digital technologies in their work with and without children, thus reducing the first and second digital divides. While the data on funding for digital resources cannot measure to what extent governments are addressing the second digital divide, the types of materials that receive public financial support can give indications that some countries may target a broader range of applications of digital technologies, with a greater potential to also mitigate the second

digital divide and improve ECEC quality in all centres. According to the *ECEC in a Digital World* policy survey (2022), public authorities assume greater public funding responsibility for ECEC centres' digital infrastructure (connectivity, devices) compared to educational materials (e.g. digital books, videos, games, robotics or programming kits) (Figure 7.4).

Figure 7.4. Provision of funding for digital technologies in early childhood education and care settings

Percentage of countries and jurisdictions specifying different sources of funding for digital technologies, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Only responses categories that were selected in survey responses are shown.
Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
Source: OECD (2022[2]), *ECEC in a Digital World* policy survey, Table B.3.

StatLink https://stat.link/jz2g5q

In most countries and jurisdictions responding to the *ECEC in a Digital World* policy survey (2022), the budget for spending on basic digital infrastructure is decided by public authorities at the national, regional and/or local level. In several other countries and jurisdictions, both public authorities and ECEC centres decide on the amount of funding for digital infrastructure expenditures. Only in a few countries and jurisdictions does the responsibility lie entirely within the governance structures of ECEC centres. In comparison, responsibility for funding educational materials is, to a greater extent, in the hands of ECEC centres. This may suggest that ECEC systems where public authorities fund both digital infrastructure and digital educational materials – Belgium (Flanders), Canada (school-based sector; Manitoba, kindergarten sector only), Finland, France, Germany, Israel, Korea, Morocco, Portugal, South Africa, Slovenia, Spain and Switzerland – place a stronger emphasis on reducing both the first and second digital divides among young children and are better able to mitigate emerging differences in digital literacy. On the other hand, where no specific funding exists, the use of digital educational materials tends to be rare in ECEC settings (e.g. Ireland).

However, there may still be structural differences in ECEC funding for digital technologies and devices among centres and children. For example, many countries and jurisdictions report funding for either digital infrastructure or digital materials depending on the type of management (public or private): Denmark, Finland, France, Germany (Bavaria), Hungary, Italy, Japan, Korea, Portugal, the Slovak Republic, Sweden, Switzerland and the United Arab Emirates (Dubai). Moreover, the public provision of certain materials may be restricted to specific groups of children (e.g. children with special education needs in Slovenia).

In the majority of responding countries and jurisdictions, ECEC facilities can decide how to spend publicly provided funding for digital infrastructure and educational materials. However, their degree of autonomy in spending decisions varies significantly. In some systems, ECEC centres may decide freely whereas in other countries and jurisdictions, public authorities are partly included in the decision-making process. For instance, in Slovenia, kindergartens or municipalities may apply to national tenders to receive funding for specific digital technologies.

Besides general funding mechanisms, many countries also provide targeted funding to ECEC centres or families that may require extra support for their children. Among the equity and diversity measures around digital technologies listed in the *ECEC in a Digital World* policy survey (2022), the most common are funds targeted towards children with special education needs (Figure 7.5). Nearly 40% of countries and jurisdictions – Belgium (Flanders, pre-primary sector), Canada (school-based sector; Manitoba, kindergarten sector only), Ireland, Israel, Italy, Japan, Korea, Portugal, Slovenia, Spain and Sweden – provide specific support for digital infrastructure or materials for ECEC centres attended by these children and over 20% – Belgium (Flanders, pre-primary sector), Iceland, Israel, Korea, Spain and Sweden – also offer such provision to their families.

General funding targeting vulnerable children, which may be spent on digital infrastructure or resources, is also common among countries and jurisdictions. This is available for ECEC centres in 36% of responding countries and jurisdictions – Australia, Belgium (Flanders, pre-primary sector), Canada (school-based sector; Manitoba, kindergarten sector only), France, Hungary, Ireland, Israel, Italy, Korea, Luxembourg and Portugal – and for families in 18% of countries and jurisdictions – Belgium (Flanders, pre-primary sector), Canada (school-based sector), Italy, Korea, Luxembourg and Portugal.

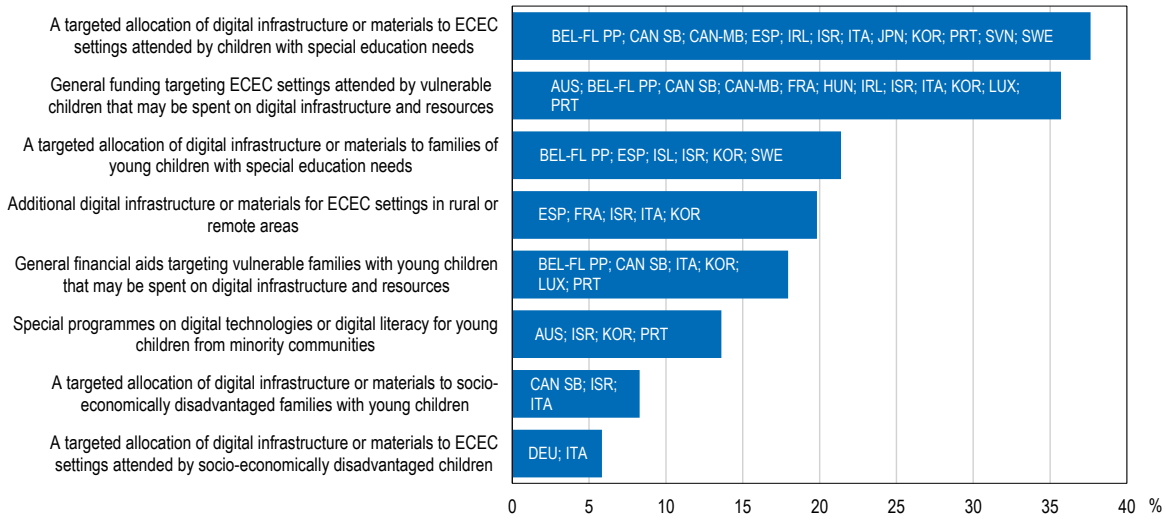
Few countries and jurisdictions earmark funds for digital infrastructure or materials for socio-economically disadvantaged children, and it is more often available for families than for ECEC centres. ECEC centres receive such support in Germany and Italy (6% of responding countries and jurisdictions), and in Canada (school-based sector), Israel and Italy, such funds are available for families.

In 20% of responding countries and jurisdictions – France, Israel, Italy, Korea and Spain – ECEC centres in rural or remote areas receive additional support for digital infrastructure or materials to reduce or prevent digital divides. Nearly one in seven countries and jurisdictions provide additional measures for young children from minority communities: In Australia, Israel, Korea and Portugal, there are special programmes on digital technologies or digital literacy for them.

It is important to note that countries and jurisdictions may have replied “no” to some of the answers due to their funding model and even though equity and inclusion measures exist. For example, in Luxembourg, primary responsibility for using funds lies with local authorities (with national mechanisms that redistribute resources across municipalities) and thus measures may vary across geographic zones. Similarly, an important number of countries and jurisdictions responded “not known” or “not applicable”. In some cases, this reflects that funding is granted occasionally but not in a structural way. In other instances, such as the Czech Republic and Denmark, additional support is only available to specific ECEC centres.

Figure 7.5. Equity and inclusion measures around digital technologies in early childhood education and care

Percentage of countries and jurisdictions specifying the following measures currently in place, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
Belgium (Flanders PP): pre-primary education in Belgium (Flanders). Belgium (Flanders U3): ECEC for children under age 3 in Belgium (Flanders). Canada CB: centre-based sector in Canada. Canada SB: school-based sector in Canada. Canada (Manitoba): kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order of the share of countries selecting each option.
Source: OECD (2022[2]), *ECEC in a Digital World* policy survey, Table B.18.

StatLink https://stat.link/es3va8

Policy pointers

Public policy can promote equity and inclusion in ECEC with regard to digitalisation in three main ways: First, it can support digitalisation in work processes as a force that leads to greater (as opposed to less) equalisation of structural and process quality across ECEC centres. Second, public policy can help ECEC centres level the playing field for developing children's digital literacy. Third, digital pedagogies can make ECEC and learning more inclusive, especially for certain vulnerable children.

Policy Pointer 1: Reduce differences in the quality of digital infrastructure across ECEC centres, and target centres with vulnerable children

- Pre-pandemic, ECEC centres differed in their preparedness to employ digital technologies for improving quality. By providing targeted support for ECEC centres with insufficient digital infrastructure or by making general resource allocation mechanisms more equitable, policy can ensure that all centres are able to invest in their digital infrastructure and seize the opportunities that digitalisation provides for supporting structural and process quality in ECEC.
- ECEC centres with large shares of children from vulnerable groups, who tend to have fewer opportunities to develop literacy skills at home and for whom certain digital pedagogies may be particularly valuable, can benefit from additional support.

- Effective monitoring systems and practices allow for an efficient and equitable distribution of digital resources (see Chapter 8).

Policy Pointer 2: Identify and support strategies to bridge the second digital divide among children and use digital pedagogies for inclusion purposes

- Pedagogies can mitigate divides in digital literacy that emerge in home environments. By teaching young children about digital technologies (see Chapter 3), ECEC can help them face digital risks and benefit from the opportunities of digital technologies. This may be done with or without the use of digital technologies themselves (e.g. unplugged approaches).
- Inclusive pedagogies can benefit groups of children that tend to miss out on current and future opportunities brought about by digitalisation, such as girls. In this case, for example, presenting and employing digital technologies in a context and manner that speaks to them can spark their interest in digital technologies and mitigate the gender divide among older children and adults in STEM fields.
- Furthermore, countries can support the use of digital technologies to strengthen the inclusion and learning of vulnerable children, such as children with special needs or children with a different first language than the one(s) spoken in the ECEC centre. Inclusive digital pedagogies can help them access materials in an additional and different manner.

Policy Pointer 3: Increase the ECEC workforce's preparedness to employ digital technologies, especially when working in disadvantaged settings

- To support equitable digitalisation in ECEC, public policy should ensure that all staff and leaders have opportunities to develop competences for using digital technology in their work processes, at least at a foundational level (see Chapter 4). When working in disadvantaged settings, staff and leaders would then be equipped to exploit the potential of digital technologies to improve the quality of ECEC provision in their settings.
- It is important to guide the ECEC workforce to adopt practices that make good use of digital technologies, and on how to make the transition. Particular attention can be placed on building on digital technologies to strengthen communication with families of vulnerable children. However, developing digital communication channels should not increase staff's workload excessively or replace in-person interactions with families completely. Furthermore, it is important to ensure that these families effectively engage with digital modes of communication.
- Online training could be developed further as a promising way to support workforce development where in-person training is less accessible, especially in more diverse ECEC centres where children's individual needs may be more complex.

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8 Data and monitoring in early childhood education and care in the digital age

Digitalisation brings new opportunities and demands for quality monitoring in early childhood education and care (ECEC). This chapter discusses challenges for establishing robust data management and quality monitoring systems at a time when data are increasingly available and digital technologies increasingly present in ECEC settings. Building on responses to the *ECEC in a Digital World* policy survey (2022), the chapter examines the availability of ECEC data systems across countries and their most prevailing goals and features. It then looks at the inclusion of digitalisation-related elements in ECEC quality monitoring frameworks.

Key findings

The expansion of evidence plays a key role in informing ECEC policy and practice. Digital technologies bring opportunities to set up robust data infrastructures in the ECEC sector, with the potential to support policy design and evaluation. In turn, there are demands on quality monitoring frameworks to adapt to the gradual integration of digital technologies in a variety of processes in ECEC settings.

A large majority of the countries and jurisdictions participating in the ECEC in the Digital World policy survey (2022) have a data system in place that maintains longitudinal information about their ECEC sector and facilitates analysis and reporting for the ECEC authorities. The breadth of these data systems' coverage tends to reflect the governance of the sector within each country or jurisdiction. There are greater challenges for data sharing and integration when responsibilities for different services or age groups are shared across multiple government agencies and/or service providers.

Supporting evaluation, accountability and management processes are "high"-priority functions for all the ECEC data systems reported on in the policy survey. Most often, data systems inform these processes by aggregating information at the country or jurisdiction level, but systems are also widely used to support monitoring and management at the setting level. Enabling research is another commonly reported purpose served by ECEC data systems.

The features and granularity of the information maintained by ECEC data systems vary across countries and jurisdictions. Unique identifiers for ECEC settings are available in almost all data systems, whereas personal identifiers for children and staff members are available in more than two-thirds and about half of the systems, respectively. Demographic information on individual children and staff as well as staff's qualifications and experience records are also maintained by a majority of systems. The capacity to link setting-level to child-level data within their ECEC data system is reported by around half of the countries and jurisdictions, while fewer report linkages between setting-level and staff-level data.

Less than half of the participating countries and jurisdictions currently evaluate aspects related to the use of digital technologies in ECEC settings as part of their quality monitoring frameworks. The more commonly monitored aspects are ECEC professionals' competencies for integrating digital tools into their pedagogical work with children, and in administrative and collaboration work processes. This suggests room for further aligning ECEC quality monitoring frameworks with ongoing responses to digitalisation in curriculum and pedagogy and in workforce preparation programmes.

Introduction

Data has emerged as a strategic asset to improve policy making and public service delivery across sectors, including education. However, the stakes for data misuse have also increased, and consistent data governance frameworks are needed to maximise the benefits of data while addressing related risks, both of which derive primarily from increased data openness (OECD, 2022[1]).

Data and monitoring are powerful levers to promote quality and support evidence-based policy making in ECEC. Within the Starting Strong framework, data is understood as the collection of strategic information on ECEC, while monitoring refers to the ongoing evaluation of ECEC services by systematically tracking a variety of aspects related to quality (OECD, 2012[2]; 2015[3]). Policy-oriented analysis building on the Starting Strong VI review identifies optimising the use of data and strengthening the focus of monitoring on process aspects as two major policy pointers for advancing quality assurance and improvement in the ECEC sector (OECD, 2022[4]).

Digitalisation brings new opportunities and demands regarding data use and quality monitoring in ECEC. A wealth of data is routinely collected in the ECEC sector, from demographics about children and their families to enrolment records for different services and programmes and assessments of the quality of provision and of children's developmental pathways. Data collection on structural quality standards (e.g. group size) is an established practice and information on the profiles and conditions of the ECEC workforce (e.g. qualifications, turnover) is becoming increasingly available. However, in many countries, the lack of framework policies for data collection and management has resulted in a fragmented data architecture in ECEC systems, with multiple data silos and limited interoperability between the tools that serve to access and analyse these data. This fragmentation restricts opportunities for obtaining a comprehensive and in-depth view of the ECEC sector, as it could arise from the combination of complementary data sets covering its different aspects. However, recent improvements in digital infrastructure have greatly enhanced ECEC systems' capacity to efficiently collect and link data about different settings and programmes. At the same time, new privacy protection regulations are being introduced which set limits on the collection and processing of personal data of young children and ECEC professionals. Hence, a major challenge for countries is strengthening their data systems to support monitoring and improvement in ECEC without compromising on the need to protect privacy.

In addition, as many ECEC systems review their curriculum and pedagogy frameworks and their workforce preparation programmes in light of digitalisation, new demands emerge for quality monitoring, for instance regarding the digital competencies of ECEC staff or the quality of the interactions that young children may have with digital tools in ECEC settings.

Exploring strategies to activate the data and monitoring policy lever, this chapter first discusses the benefits of robust ECEC data and quality monitoring systems, as well as some of the policy challenges for establishing those. Second, it explores the availability of comprehensive ECEC data systems across countries and jurisdictions having participated in the *ECEC in a Digital World* policy survey (2022), the purposes for which these data systems are most often used and their most prevailing features. Third, it looks at the inclusion of digitalisation-related elements in ECEC quality monitoring frameworks. It concludes with policy pointers for strengthening data management and quality monitoring in ECEC in the digital age.

Robust early childhood education and care data and monitoring systems: Benefits and policy challenges

Research developments and social changes over recent decades have elevated ECEC in policy agendas, resulting in growing levels of enrolment and increasing recognition of the value of high-quality ECEC in

supporting young children's learning, development and well-being (OECD, 2021[5]). Parallel to these developments is the expansion of evidence about ECEC programmes and its growing role in informing policy and practice. For instance, indicators on ECEC structural and process quality dimensions can contribute to increased knowledge about the level of quality provision, while information on the demographic and background characteristics of children in ECEC can be used to determine programme effects on target groups. Often gathered through monitoring systems, these data are important for gaining a solid understanding of the workings and performance of ECEC systems, which is essential not only for accountability purposes, but also for policy design and implementation, and to inform families about the quality of ECEC services. Most importantly, monitoring is key to assessing whether and how ECEC supports children's development and well-being and what can be done to improve its quality and equity (OECD, 2018[6]).

ECEC monitoring systems and the indicators they produce vary notably across countries, reflecting the wide variety of configurations of ECEC settings and types of provision internationally. Nonetheless, past Starting Strong reviews have identified common trends in ECEC quality monitoring policies and practices, including the increasing intensity of monitoring practices; improvements in monitoring methodologies and processes; the integration of monitoring areas; alignment with primary school monitoring systems; and the increasing availability of monitoring results for the general public (OECD, 2015[3]). Common to these trends are enhanced efforts to collect and integrate an expanding range of data elements about ECEC services, and to derive relevant indicators about quality.

However, without a clear understanding of why data are needed, data collections may just respond to compliance requirements, rather than being guided by the potential of adequate indicators to help improve services. These indicators need to be determined in accordance with countries' ECEC quality and equity frameworks and their specific institutional and socio-cultural contexts. Therefore, the scope of data collection, needs to reflect the purposes of monitoring. An important effort in this direction is to establish a robust data infrastructure that aligns with ECEC quality and equity monitoring frameworks agreed upon at the national/jurisdiction level (OECD, 2012[2]). Data systems, also known as information systems, are a particular type of general-purpose technology that facilitates data collection, storage and use. In the ECEC sector, data systems typically maintain and link a range of setting- and individual-level data elements collected at different points in time, thus potentially enabling longitudinal analysis of these data. This can include multiple types of information about children, from their socio-demographic backgrounds to their participation in ECEC, and also information about ECEC staff. Generally, data systems are also designed to facilitate data access and data use through a range of reporting and analysis tools (Data Quality Campaign, 2017[7]).

A first policy challenge towards achieving this goal relates to the fragmented data architecture that arises from the co-existence of diverse ECEC programmes and governance structures. To provide a holistic understanding of the ECEC system for policy makers, providers and other stakeholders, ECEC data systems must have the capacity to collect and link data on children, programme characteristics and workforce across multiple programmes and bodies with different responsibilities. For instance, in countries with "dual" or "split" systems where different authorities are in charge of childcare and early education, as well as in countries with decentralised monitoring and accountability procedures, data may not always enable country-wide comparisons on shared measures of high-quality ECEC that apply to all settings and children. This may happen when data collection is not sufficiently harmonised, but also when data are not shared and integrated despite adequate standardisation. A split in responsibilities for different aspects of the quality assurance process in the ECEC sector is common internationally, and agencies in charge of different monitoring arrangements often report to different departments or ministries within government. Further, in many countries and jurisdictions, a large number of small ECEC providers operate with limited resources, some of which may have difficulties coping with the demands of quality systems, including those related to data collection and processing (OECD, 2022[4]). Therefore, setting up a robust ECEC data

system can be particularly challenging, but also particularly beneficial, in countries with a greater variety of ECEC programmes and governance structures.

A second challenge for enhancing the use of evidence relates to the multifaceted nature of quality in ECEC and, more tangentially, to the dearth of research about the impact that digital technologies can have on the quality of interactions in ECEC settings. Monitoring the quality of ECEC services and measuring their effectiveness at a system level is challenging (OECD, 2015[3]). Among the many requirements is the capacity to implement a strategic collection of data that maintains high standards of reliability over time and across multiple providers and programmes, and that is based on a solid understanding of the defining components of quality and on adequate measurement methodologies. To support these efforts, ECEC data systems need to integrate accurate and comprehensive inputs that relate to both structural and process quality, as well as rich contextual information, all of which can be combined to support robust analysis on quality and effectiveness. A more specific challenge concerns the collection of information about the extent and types of uses of digital technologies in ECEC settings, provided that these become approved practices. Many countries and jurisdictions have begun to adapt their ECEC curriculum and pedagogy frameworks (see Chapter 4) and their ECEC workforce development strategies (see Chapter 5) to respond to digitalisation trends, but the evidence base on the impact that digital technologies can have on the quality of ECEC is still very limited. As a result, many open questions remain with regards to the type of information that quality monitoring frameworks would need to collect about digitalisation-related aspects.

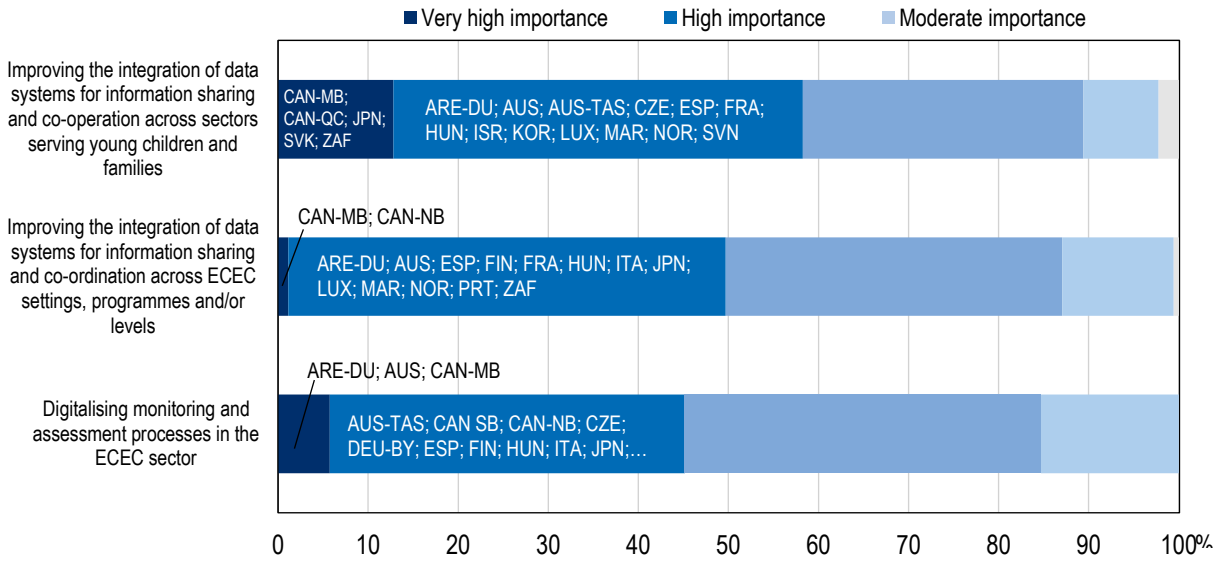
There can be many benefits to setting up robust ECEC data systems to support different aspects of broader quality systems. A major potential contribution relates to supporting accountability and improvement processes. Data systems can be instrumental in meeting demands for public accountability in the ECEC sector while also generating information on the strengths and weaknesses of specific services and of the sector as a whole. Systematic data collection and reporting can give users of ECEC services access to valuable information to help them make choices between different providers, a particularly relevant function in a sector that, in many countries, heavily relies on private providers in combination with state-run provision. A system that maintains comprehensive and reliable ECEC data is important to assist inspectorates and inform evaluations that support quality assurance. In addition, ensuring that providers also have access to a coherent package of quality indicators can be a starting point for promoting self-evaluation (OECD, 2022[4]). A recent study identified the effective use of data as a common feature of the ECEC systems of Australia, Hong Kong (China), England, Finland, Korea and Singapore. All these systems have developed a data infrastructure to systematically gather and mobilise ECEC data, using it to understand strengths and areas for improvement in their ECEC provision, generate evidence to evaluate policy impact, and inform changes in their strategies. All also face common data challenges, including confidentiality, consistency and fidelity of instruments, as well as timely and effective data integration and use (Kagan et al., 2019[8]).

Another potential benefit of data systems is to strengthen the infrastructure for research on ECEC. Central to the research value of the administrative or large-scale data sets that ECEC data systems typically maintain is making it possible to use methodologies that approximate experimental research designs and facilitate causal inferences with a strong potential to inform policy analysis and evaluation (Murnane and Willett, 2010[9]). This possibility stems from three critical features of large-scale data sets: 1) covering the entire or a very substantial share of the population of interest (large “n”), which leads to gains in statistical power and opportunities to study “rare” populations; 2) including a wide range of variables (large “k”), which allows exploring a wide range of inputs, outputs and correlates of ECEC; and 3) providing repeated, individual-level observations (large “t”), which improves opportunities to assess change over time (Saw and Schneider, 2016[10]). The use of administrative data is a growing trend in educational research, and multiple examples exist of studies drawing on such data sets to look at the effects of ECEC experiences on various life outcomes (Figlio, Karbownik and Salvanes, 2016[11]).

The research and policy potential of ECEC data systems can be further accrued through their integration with data about other levels of education or other sectors. In the United States, state- and local-level integrated data systems are supporting policy design and evaluation in various sectors, including education, health and social services (Fantuzzo and Culhane, 2015[12]). These integrated data systems combine data from multiple government agencies, are designed to serve a general purpose rather than specific research projects and link individual-level data. This type of data infrastructure can engage stakeholders across sectors and administrative silos and facilitate the analysis of outcomes for large populations attending to a broader range of factors than it would be possible by using ECEC or education data alone. As an example of application to ECEC research and policy, an integrated data system was used in the city of Philadelphia (United States) to identify neighbourhoods with a greater share of children exposed to cumulative risks and a lower share of high-quality ECEC slots. The combination of health, education and human service data enabled the estimation of demand indicators based on multiple early risk experiences, as well as of supply indicators based on actual counts of the number of slots in preschool centres with a high-quality rating, in both cases improving the quality of previously available estimates. Policy makers used findings to inform the planning for and roll-out of expanding the city's ECEC services (Fantuzzo et al., 2021[13]). The effective implementation of these integrated data systems is, however, complex and requires multiple supporting measures, including specific governance models and legal agreements for data sharing and privacy protection, adapted technology and security solutions, and common data standards (Culhane et al., 2017[14]).

Figure 8.1. Policy challenges related to digitalisation and data and monitoring in early childhood education and care

Percentage of countries and jurisdictions identifying the following policy challenges, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
The response category "very high importance" was limited to three out of ten response items maximum.
CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order of the share of countries selecting the response categories "very high importance" or "high importance".
Source: OECD (2022[15]), *ECEC in a Digital World* policy survey, Tables B.1 and B.2.

StatLink https://stat.link/nzo0s9

Besides the development of data systems, responses to digitalisation within the monitoring policy lever can also include adaptations in quality monitoring frameworks to align with changes in other policy levers, in particular those of curriculum and workforce development. For instance, developmental goals in relation to children's early digital literacy or uses of digital tools in ECEC settings may begin to be targeted by quality monitoring systems following their introduction in curricular or pedagogical frameworks. Similarly, levels of digital competencies among ECEC staff and the quality of related training opportunities may be monitored if the development of these competencies becomes an expectation or requirement for ECEC professionals.

Responses to the *ECEC in the Digital World* policy survey (2022) indicate that improving the integration of ECEC data systems is a policy challenge considered of "very high" or "high" importance by more than half of participant countries and jurisdictions (Figure 8.1). Data integration can serve the purpose of information sharing and co-ordination with other sectors, also supporting young children and their families (e.g. health or social services), within the ECEC sector itself (across ECEC settings and programmes, including also for children in different age groups), or with other levels of education (e.g. ISCED 1). Over 40% of countries and jurisdictions also identified the digitalisation of monitoring and assessment processes as a significant policy challenge, which suggests that the introduction of digital tools to support these processes is receiving substantial attention in ECEC systems.

Data systems in early childhood education and care

Robust data systems hold great potential to enhance quality monitoring and policy analysis in ECEC, but major challenges exist for developing such systems, as discussed in the previous section. This section explores the scope, purposes and features of current ECEC data systems across countries and jurisdictions.

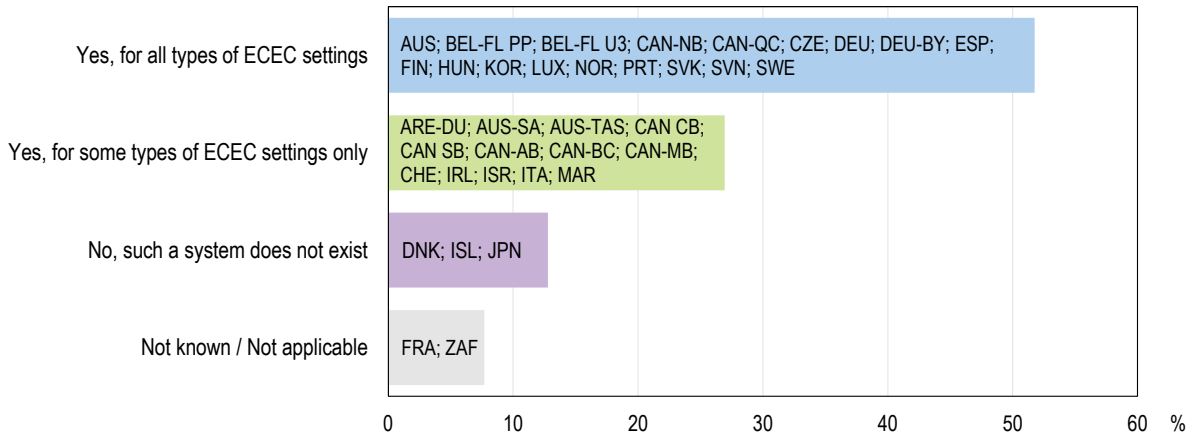
Availability and scope of ECEC data systems

A large majority (79%) of the countries and jurisdictions participating in the *ECEC in the Digital World* policy survey (2022) report having a data system in place that maintains longitudinal records about their ECEC services and facilitates analysis and reporting for the relevant authorities. This includes 18 cases where the coverage extends to all types of ECEC settings within the country or jurisdiction and 13 cases where the coverage only applies to some types of ECEC settings (Figure 8.2).

ECEC data systems with universal or near-universal coverage of the sector are often found in countries with a strong infrastructure of population-wide administrative registers, such as the Nordic countries. In Finland, for instance, the Varda (*Varhaiskasvatuksen tietovaranto*) National Data Warehouse for ECEC launched in 2019 maintains nationwide information from all types of early childhood education operators, including municipalities, joint local authorities and private ECEC service providers, making it possible to automate data transfers between operators' own data systems and Varda. The system was designed to eliminate the need for different national, regional and local authorities to maintain duplicate registers on ECEC, with expected efficiency gains in data collection and management. The Finnish National Agency for Education is responsible for the general operations of Varda and can combine its data with data in other national repositories for primary education, secondary education and tertiary levels of education. Similarly, in Norway, all registered ECEC centres (*kindergartens*) submit an annual electronic report to the national data system BASIL (*BArnehage Statistikk Innrapporterings Løsning*), a reporting platform which is the main source of official statistics about the Norwegian ECEC sector. BASIL is managed by the Norwegian Directorate for Education and Training, and Statistics Norway is responsible for linking the data from BASIL to other administrative data sets, for instance to calculate ECEC enrolment rates for different groups of children.

Figure 8.2. Availability and scope of data systems in early childhood education and care

Percentage of countries and jurisdictions reporting having in place a data system that maintains longitudinal records and facilitates analysis and reporting on ECEC services, 2022



Note: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). BEL-FL U3: ECEC for children under age 3 in Belgium (Flanders). CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order of the share of countries selecting each option.
Source: OECD (2022[15]), *ECEC in a Digital World* policy survey, Table B.20.

StatLink https://stat.link/9cmdqz

In other cases, ECEC data systems maintain information about specific types of settings or segments of the sector only, with responsibilities for data collection and management generally reflecting the governance models of the ECEC sector within countries and jurisdictions. For instance, in Ireland, a data system integrates information on all ECEC settings that receive public funding from the Department of Children, Equality, Disability, Integration and Youth, which is the vast majority within the country, but the few settings relying on private funding only are not covered by the system. In Canada, it is common for ECEC data systems to maintain data on school-based settings for children ages 3-5, whereas data on settings for children ages 0-5 are only integrated in some provinces and territories. For instance, Alberta's Child Care Information System maintains data on licensed day care, preschool, and family day homes for children aged 0 to school entry, encompassing over 2 500 facilities accredited with the Alberta Child Care Licensing System. In British Columbia, the data system covers licensed childcare participating in government funding provided to children ages 0-3 or 3-5 across the jurisdiction.

Responses to the *ECEC in a Digital World* policy survey (2022) from several countries illustrate the challenges that the fragmentation of responsibilities within the ECEC sector poses to the development of comprehensive data systems. This can be due to different authorities being in charge of services for children in different age groups. For instance, in Portugal, data about children under age 3 are collected and maintained by the Ministry of Labour, Solidarity and Social Security, whereas data about children aged 3-5 years attending pre-primary education are managed by the Ministry of Education. Challenges may also arise when data about different aspects of ECEC provision are managed by different actors. For instance, in the Czech Republic, statistical data about ECEC settings are collected by the Ministry of Education, whereas data on structural and procedural quality of preschool education are collected by the Czech School Inspectorate. In Slovenia, the Ministry of Education is responsible for collecting the majority of records in the country's ECEC data system, both for public and private pre-primary centres, but financial information about ECEC settings is maintained separately by the Ministry of Finance, while determining

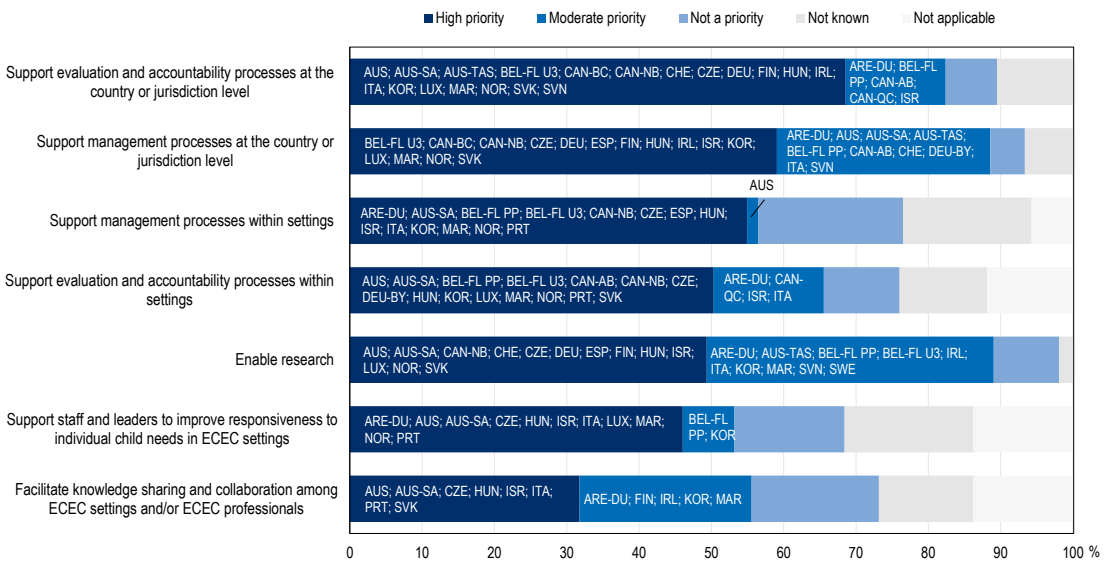
families' eligibility for subsidies of ECEC fees further requires using data maintained by the Ministry of Labour, Family and Social Affairs. Nonetheless, data-sharing arrangements between these different agencies compensate for the lack of a system integrating different types of data.

Purposes of ECEC data systems

When asked to identify the main purposes of their ECEC data systems, about two-thirds of countries and jurisdictions participating in the survey indicated that supporting evaluation, accountability and management processes at the country/jurisdiction level were "high" priority functions for their systems, with an additional number of respondents listing those same functions as a "moderate" priority (Figure 8.3). Supporting evaluation and accountability may involve the production of statistical indicators to measure progress in relation to stated objectives for ECEC services, whereas uses to support management can include analysing data to inform staffing or other resource allocation decisions. Data systems can support these processes at different levels, depending on how the data are aggregated and the types of analysis conducted with them. While a majority of countries and jurisdictions noted that supporting evaluation, accountability and management processes within ECEC settings more specifically is also a "high" priority for their data systems, the results suggest that a stronger emphasis is placed on mobilising data for whole-of-system policy analysis and evaluation, compared to using data to support decision making at the setting level.

Figure 8.3. Main purposes of early childhood education and care data systems

Percentage of countries and jurisdictions reporting the following purposes for their early childhood education and care data systems, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). BEL-FL U3: ECEC for children under age 3 in Belgium (Flanders). CAN-AB: Only childcare in Canada (Alberta). CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order by the share of countries selecting the response category "high priority".
Source: OECD (2022[15]), *ECEC in a Digital World* policy survey, Table B.22.

StatLink https://stat.link/1wv8t9

However, nearly half of participant countries and jurisdictions reported that helping staff and centre leaders improve responsiveness to individual child needs in ECEC settings is also a “high” priority for their data systems. Additionally, close to a third indicated that facilitating knowledge sharing and collaboration among ECEC settings and professionals is a “high” priority. The potential role of data systems as a research infrastructure is also visible in the responses to the survey, with nine in ten countries and jurisdictions listing enabling research as a “high” or “moderate” priority.

This ranking of potential goals of ECEC data systems may be seen as reflecting the evaluation and reporting approach that has traditionally guided the use of data in the education sector. Another way to interpret the ranking is by identifying the stakeholders (e.g. policy makers, settings, ECEC professionals and researchers) whose needs are served by different potential uses: this lens suggests that ECEC data systems most often remain a tool for policy makers and evaluators. However, responses to the survey suggest that an ambition to support the use of data with a greater potential to impact practices at the setting level is also present in many countries, including Australia, the Czech Republic, Hungary, Israel, Italy and Portugal.

Elements and functionalities of ECEC data systems

The capacity of data systems to support monitoring and improvement practices in ECEC depends critically on their internal architecture and the variety and granularity of the information they maintain. These features include a range of potential data elements and functionalities, and chiefly the possibility to link different types of data. Responses to the *ECEC in the Digital World* policy survey (2022) reveal significant variation across countries and jurisdictions in the design of their ECEC data systems (Figure 8.4).

Unique and permanent identifiers for ECEC settings are the most common feature of ECEC data systems, being available in 81% of countries and jurisdictions reporting to have such a system in place. Unique personal identifiers for children participating in ECEC are, in turn, present in 65% of the systems across countries and jurisdictions, whereas unique personal identifiers for ECEC staff members are only reported by 53% of countries and jurisdictions. These identifiers – be it at the setting or individual level – distinguish longitudinal data systems from repositories of cross-sectional data sets and are a necessary condition for linking information gathered at different points in time and thus to assess change over time. Unique identifiers are also required to sort data entities into nested structures, for instance children within settings or classrooms. Identifiers may be specific to an ECEC data system or shared with other data systems, for instance ID numbers of census or social security registries, or “unique learner numbers” that remain with individual children throughout their progress in the education system. Shared identifiers facilitate the linkage of data from different sources and can thus reduce the data collection burden, but they may also bring increased privacy risks. Setting-level identifiers are essential for supporting monitoring and evaluation efforts at the school and system levels, but individual-level permanent identifiers are also required for ECEC data systems to be able to document children’s developmental and learning trajectories, identify their needs, and sustain robust analyses of the impact of different ECEC programmes and practices. The availability of demographic data for individual children (e.g. date of birth, gender, family characteristics, special needs) is another common feature of ECEC data systems, with such elements being reported by 75% of countries and jurisdictions. Individual-level data on staff members, including both demographic characteristics and information on their qualifications and experience, is slightly less commonly available but also reported by around two-thirds of countries and jurisdictions.

Less than 40% of survey respondents indicated that financial reports and monitoring or inspection results for ECEC settings are integrated into their data systems. This may again point to governance models where responsibilities for these activities are assigned to different agencies and where limited data-sharing agreements exist. At the individual level, data on children’s development and learning is an element available in less than 20% of the countries and jurisdictions, suggesting that assessments of children’s outcomes are not generally integrated into the evaluation and monitoring processes supported by these

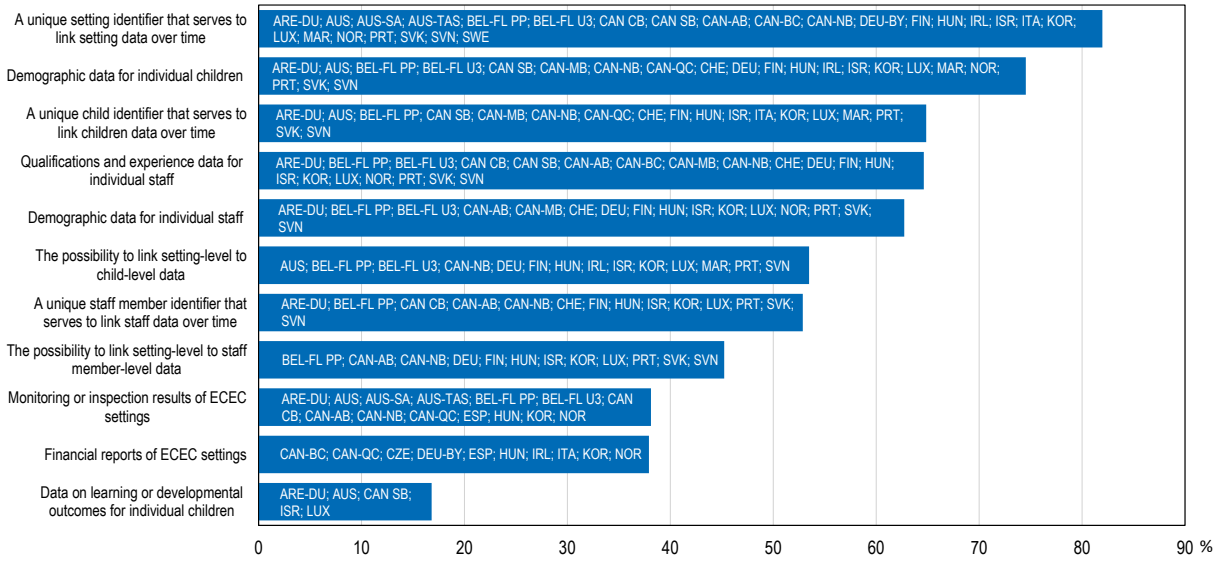
ECEC data systems. This might be explained by the prevalence of non-formal or non-standardised monitoring practices such as observation, documentation through portfolios or narrative assessments for children of that age.

Lastly, the capacity to link setting-level to child-level data within the data system is reported by 55% of the countries and jurisdictions, while linkages between setting-level and staff member-level data are reported by 44% of them. Where present, those linkages may bring important policy analysis and research opportunities, including at the system level. While countries may choose to focus quality monitoring and reporting at an aggregate level (e.g. setting, programme, jurisdiction), the possibility of linking setting- and individual-level data is critical to inform policies aiming to assess and foster quality in ECEC and to mitigate inequalities through ECEC.

While the *ECEC in a Digital World* policy survey (2022) did not specifically enquire about data on pedagogical practices and other types of interactions between children and staff in ECEC settings, the fact that only 38% of countries and jurisdictions indicated that monitoring and inspection results of ECEC settings were integrated into their data system suggests that the collection of data on process quality could be expanded. Incorporating this type of information into ECEC data systems may represent a promising avenue for advancing research and policy analysis with a focus on process quality. The LinkB5 data system in the state of Virginia, in the United States, provides an example of integrating data on the quality of teacher-child interactions measured at the classroom level (Box 8.1).

Figure 8.4. Data elements and linkage possibilities in early childhood education and care data systems

Percentage of countries and jurisdictions reporting the following elements and functionalities in their early childhood education and care data system, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders). BEL-FL U3: ECEC for children under age 3 in Belgium (Flanders). CAN-AB: Only childcare in Canada (Alberta). CAN CB: centre-based sector in Canada. CAN SB: school-based sector in Canada. CAN-MB: kindergarten sector only in Canada (Manitoba).
Items are sorted in descending order of the share of countries selecting each option.
Source: OECD (2022[15]), *ECEC in a Digital World* policy survey, Table B.21.

StatLink https://stat.link/bhoil7

Box 8.1. Incorporating process quality data into early childhood education and care data systems

LinkB5: The data system for Virginia's Unified Quality Birth to Five System

In 2020, the Virginia General Assembly passed legislation to establish a unified public-private system for early care and education, administered by the Virginia Department of Education. Among the key actions required from the Department of Education is to implement a new quality measurement and improvement system, called Virginia Quality Birth to Five System (VQB5), with the goals of monitoring and improving quality across all publicly funded ECEC settings for children from birth to five years-old in the state and of supporting families to choose quality options. This requires collecting consistent information about different types of programmes, including Head Start, Mixed Delivery, public schools and family day homes, to better understand quality challenges across the entire landscape of Virginia's ECEC system.

LinkB5 is the data system for Virginia's unified measurement and improvement system. It collects information on a variety of dimensions of ECEC programmes. Information about sites includes filled and open enrolment slots, pay ranges for educators, and information about the physical spaces where children play and learn. Information about site administrators and teachers includes years of experience, educational background and language proficiency. Importantly, LinkB5 is also used to collect information related to the quality of children's ECEC experiences down to the classroom level: the system houses systematic data about the quality of teacher-child interactions, as measured by the Classroom Assessment Scoring System assessment and collected twice a year since 2021, as well as data on curricular adoption, both at the classroom level.

Source: University of Virginia (n.d.), LinkB5 Project for Early Childhood Data Collection, https://education.virginia.edu/research-initiatives/research-centers-labs/center-advanced-study-teaching-and-learning/castl-research-projects/infant-toddler-prek-research-projects/linkb5-project-early-childhood-data-collection (accessed on 10 December 2022).

Digitalisation-related elements in early childhood education and care quality monitoring

ECEC systems are responding to digitalisation challenges in multiple ways. Many countries are reviewing their curriculum frameworks to position early digital literacy among the multiple developmental and learning goals for young children, and providing pedagogical guidance to ECEC staff on using digital tools with children in ECEC settings (see Chapter 4). Workforce development strategies are also being adapted in many of these countries to integrate demands for promoting digital competencies among staff (see Chapter 5). This section looks at the extent to which quality monitoring frameworks are beginning to cover aspects related to the use of digital technologies in ECEC.

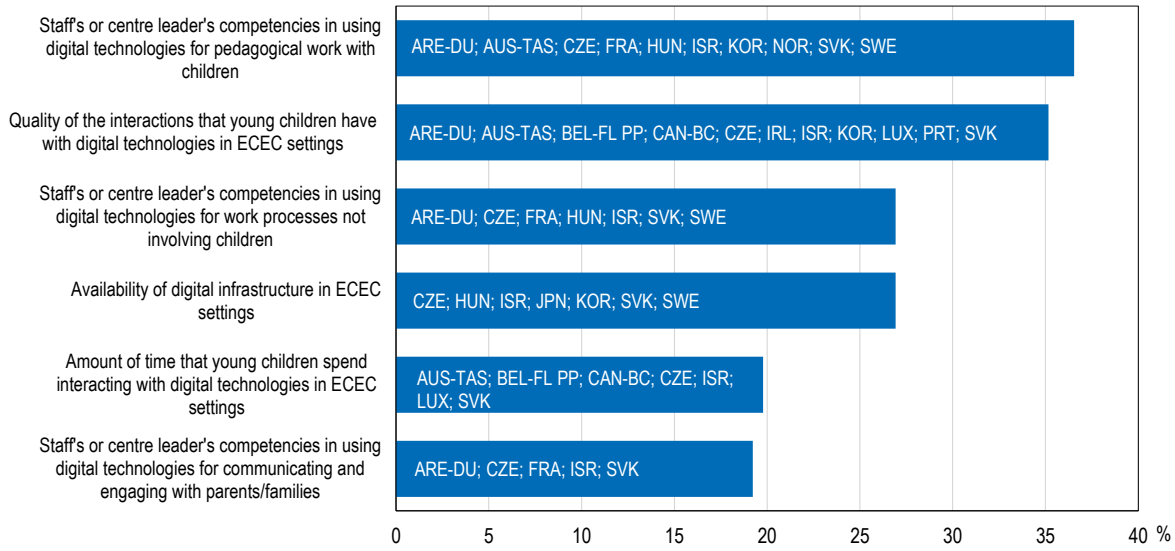
Responses to the *ECEC in a Digital World* policy survey (2022) suggest that the monitoring of these aspects is not yet the norm in ECEC systems, with less than half of the participant countries and jurisdictions reporting that any of the digitalisation-related aspects listed in the questionnaire are included in their evaluations of quality in ECEC settings, as carried out by inspectors or agencies external to the settings (Figure 8.5). The most commonly monitored aspect is the competencies of staff or centre leaders in using digital technologies for pedagogical work with children, as defined by a relevant framework or quality standards (almost 40% of the countries and jurisdictions), while professional competencies for the use of digital tools in other types of work processes (e.g. administrative tasks, professional collaboration) or in communicating with and engaging with families are less often the object of evaluations (27% and 19%

of countries and jurisdictions, respectively). The availability of digital infrastructure in ECEC settings is evaluated in 27% of the participating countries and jurisdictions.

The same holds for aspects where digital technologies may affect process quality more proximally. The quality of the interactions that young children may have with digital technologies in ECEC settings, as defined by a relevant framework or standards, is monitored in 35% of the participating countries and jurisdictions, whereas the amount of time they may spend interacting with digital technologies within settings, also in reference to a pre-defined framework or set of standards, is monitored in 19% of the countries and jurisdictions. Generally, monitoring is gradually being extended from structural aspects of quality (e.g. safety, class size, etc.) to process quality aspects. This trend is still not very developed in many countries (OECD, 2021[5]; 2022[4]). Results with regard to the use of digital technologies in ECEC may be seen to reflect this trend, with only a relatively small share of countries currently monitoring their potential contribution to process quality.

Figure 8.5. Digital practices and competencies included in early childhood education and care quality monitoring frameworks

Percentage of countries and jurisdictions where the following aspects are part of evaluations of quality in early childhood education and care settings, 2022



Notes: Responses are weighted so that the overall weight of reported responses for each country equals one. See Annex A.
BEL-FL PP: pre-primary education in Belgium (Flanders).
Items are sorted in descending order of the share of countries selecting each option.
Source: OECD (2022[15]), *ECEC in a Digital World* policy survey, Table B.19.

StatLink https://stat.link/sivnuq

The Czech Republic, Israel and the Slovak Republic are the countries reporting more extensive monitoring of these aspects (all elements). In Norway, staff's or centre leaders' competencies in using digital technologies for pedagogical work with children are monitored in line with the requirements listed in the Framework Plan for Kindergartens, which includes guidance on kindergartens' digital practice. In Luxembourg, the quality of interactions and the time children spend with digital tools are monitored as part of the support that ECEC teachers receive, from specialised teachers, to implement the Mediekompass reference framework for media literacy (see Case study LUX – Annex C). And in Australia, while the

availability of digital infrastructure and the use of digital technologies in ECEC settings are not explicitly part of the quality monitoring in ECEC settings, they can be implicitly considered in the monitoring of areas such as educational practices, children's health and safety, and collaborative partnerships with families and communities.

Policy pointers

Policy pointer 1: Strengthen the data infrastructure of the ECEC sector to support quality monitoring as well as policy analysis and research

- Promoting data sharing across bodies with different responsibilities in the ECEC sector and setting up comprehensive data systems is crucial to bring evidence together to facilitate holistic and periodic evaluations of the ECEC system and in-depth analyses of ECEC policies and practices. Besides their own monitoring and research efforts, ECEC authorities can create conditions for external accredited researchers to access data about the ECEC sector safely and responsibly in order to carry out independent studies.
- A wide range of data is generated in the ECEC sector. The different types of evidence can be reviewed with the goal of integrating data about its multiple aspects, including both structural and process quality as well as contextual information, and of supporting quality monitoring and policy analysis. Semantic standards for ECEC indicators can help different audiences make sense of the data and build trust in the consistency of the information across reports.
- Ensuring strong data security and strong privacy protection, for both children and staff, and across the entire data life cycle, from collection to processing and release, is essential to promote trust in data management practices in the ECEC sector. This requires specifying desired data uses and expected benefits, identifying threats and vulnerabilities to privacy, and implementing appropriate security and privacy controls that are consistent with those uses, threats and vulnerabilities.

Policy pointer 2: Align quality monitoring frameworks with responses to digitalisation in other policy levers to ensure consistent policy strategies

- The ongoing trend towards extending ECEC quality monitoring from structural to process quality dimensions can be further supported by monitoring any potential adaptations and novel targets introduced in curriculum and learning frameworks in response to digitalisation, including objectives around children's early digital literacy and the roles expected from digital technologies in pedagogical interactions with children and in engagement with families.
- Promoting digital competencies among ECEC professionals requires adequate training opportunities. ECEC systems need to monitor the quality of workforce preparation programmes that target these competencies, including both initial education and in-service training. The types and levels of digital competencies among staff can be monitored according to their specific roles and responsibilities.
- Monitoring the quality of the digital infrastructure across the ECEC sector is important to ensure that all settings have adequate digital resources to meet the demands placed on them, and to identify and reduce digital divides.

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Annex A. Technical annex

Data informing the *Empowering Young Children in the Digital Age* report and its supplementary outputs (online tables, country notes and case study compendium) were derived from two main sources, developed specifically for the Early Childhood Education and Care in a Digital World project carried out throughout 2021 and 2022:

1. A policy survey prepared by the OECD Secretariat and distributed to the OECD's Early Childhood Education and Care (ECEC) Network and some non-member countries.
2. A collection of case studies building on a template prepared by the OECD Secretariat and distributed to the OECD's ECEC Network.

The *ECEC in a Digital World* policy survey

Design and administration of the questionnaire

In the early stages of the project, the OECD's ECEC Network was consulted about the structure of the survey questionnaire and a draft instrument was circulated for review in December 2021. Building on the feedback received from the ECEC Network, the Secretariat prepared a final version of the questionnaire, including both multiple-choice and open-ended questions, which was then administered online to members of the OECD's ECEC Network and some non-member countries between February and April 2022. Thirty-seven responses were received from 26 countries for the reference year 2022 (Table A A.1).

Guided by the project's analytical framework, the substantive sections of the survey covered the following areas:

- **Policy challenges**, aiming to identify policy challenges in relation to the impact of digitalisation on young children generally, and ECEC more specifically.
- **Governance and standards**, exploring roles and responsibilities in decision making about digital technologies in ECEC and standards to protect and guide young children in their interactions with digital technology.
- **Curriculum and pedagogy frameworks**, investigating how ECEC curriculum and pedagogy frameworks respond to or reflect digitalisation trends.
- **Workforce development**, examining whether and how professional development programmes for ECEC staff address digital competencies, as well as opportunities for using digital technologies to support their professional growth.
- **Engagement with families and communities**, exploring whether and how digital technologies are used in ECEC settings to engage with families and communities.
- **Monitoring and data**, investigating how goals and practices related to digital technology are integrated into ECEC quality monitoring, as well as the availability and uses of ECEC data systems.

Table A A.1. Countries and subnational jurisdictions that responded to the policy survey

Australia[1]	Denmark	Morocco
South Australia	Finland	Norway
Tasmania	France	Portugal
Victoria	Germany[1]	Slovak Republic
Belgium[2]	*Bavaria*	Slovenia
Flemish Community	Hungary	South Africa
Canada[1]	Iceland	Spain
Alberta	Ireland	Sweden
British Columbia	Israel	Switzerland
Manitoba	Italy	United Arab Emirates[2]
New Brunswick	Japan	*Dubai*
Quebec	Korea	
Czech Republic	Luxembourg	

1. Countries that responded to the questionnaire at both national/federal level and jurisdictional level.
2. Countries that responded to the questionnaire only at jurisdictional level.
Note: Not all countries and jurisdictions responded to all questions and for all types of settings.

Following the online administration of the survey, the OECD Secretariat reviewed responses from participating countries and jurisdictions in order to clean and harmonise the data. A file with harmonised responses was circulated for validation by participating countries and jurisdictions. The final responses to the survey used for the analysis presented in this report are available in table format (see Annex B).

Scope of the policy survey

Given the goal of providing internationally comparative indicators, the Starting Strong VII policy review focused on collecting national data from all participating countries. However, for some federal countries where subnational authorities are responsible for ECEC, information was also collected from some subnational jurisdictions.

Generally, countries and jurisdictions were asked to report on their policies based on the structure of their ECEC systems, including whether the system is integrated for children aged 0-5, or split for children under age 3 and children aged 3-5/primary school entry. Regarding policy challenges, governance and standards, and monitoring and data, the questionnaire requested information with reference to country-wide or jurisdiction-wide policies. To address questions around curriculum frameworks and family and community engagement, countries and jurisdictions were asked to report with reference to specific age groups of children, as discussed below. Regarding curriculum and pedagogy frameworks, countries and jurisdictions were given the opportunity to report information with reference to both official curriculum frameworks and other documents and frameworks such as directives, statements or strategies on digitalisation with potential application to ECEC. Countries and jurisdictions could provide sets of responses for up to three relevant frameworks. Regarding engagement with families and communities, countries and jurisdictions were asked to report about settings belonging to their regulated ECEC systems, regardless of type, funding, opening hours or programme content. Regarding questions on workforce development, countries and jurisdictions were asked to report on three main categories of ECEC staff: teachers, assistants and leaders, with some questions focusing exclusively on teachers.

Further details on the scope of the policy review and the questionnaire are available in the Reader's guide.

Application of standardised age groups to curriculum frameworks and types of settings

Building on the experience of the Starting Strong VI policy review, ECEC curriculum frameworks and types of settings were categorised by standardised age groups to facilitate the use of information, enable comparisons across age groups within and across countries and jurisdictions, and ensure consistency with the development of ECEC indicators included in other OECD databases such as *Education at a Glance*.

When responding to the questionnaire, countries and jurisdictions were asked to select among three standardised age groups prior to providing information about ECEC curriculum frameworks and types of settings. Standardised age groups were defined according to the following rules:

- **Age 0-2**: if the majority of years of a setting or curriculum target or cover ages 0-2. This includes settings or curricula which start after 0 years (e.g. 12 weeks, 3 months, etc.) and end by age 3.
- **Age 3-5/primary school entry**: if the majority of years of a setting or curriculum target or cover ages 3-5. This includes settings or curricula which start earlier than age 3 (e.g. 2.5 years) or later than age 3 (e.g. 4 years).
- **Age 0-5/primary school entry**: if a setting or curriculum targets or covers ages below and above the cut-off point of 3 years to a similar extent (e.g. 0-12 years).

These age groups were standardised by the OECD Secretariat and may not correspond exactly to the organisation of ECEC systems within specific countries and jurisdictions.

Calculation of indicators presented in the report

Weighting of countries and subnational jurisdictions

For the calculation of percentages in tables and charts, responses were weighted so that each country is equally represented; that is, by setting the total weight of each country equal to one. This aims to ensure that countries with responses for subnational jurisdictions are not over-represented in calculated statistics. When multiple responses were received from the same country, each response was given an equal weight. For example, the same weighting of 0.143 was applied to each of the seven responses from Canada in Figure 4.1, which include two Canada-level responses and five responses from provinces and territories. Thus, the total weight for all Canadian responses is the same as the total weight for other countries having submitted only one response.

Weighting of ECEC curriculum frameworks

The *ECEC in a Digital World* policy survey collected some data on ECEC curriculum frameworks as classified by the standardised age groups described above. In these cases, weights and percentages were calculated for each age group separately so that each country's total weight equals one in the responses for each age category.

In some countries and jurisdictions, information was provided for more than one curriculum framework. For example, Germany provided data on two curriculum frameworks for the age group "0-5/primary school entry". The total weight for Germany was therefore split equally between these curricula so that each had a weight of 0.5 for the given age category in the results presented in Figure 4.4.

Weighting for questions with multiple items

Several questions in the *ECEC in a Digital World* policy survey included multiple items, asking respondents to choose from a selection of response categories. Figure 4.1 shows an example of the results from one such question, where question items included "Preparing young children for social and political participation in the digital age" and "Promoting young children's agency and empowerment as users of digital technologies". For each item, respondents could report "do not know" or assign a level of importance from "low" to "very high".

If a country or jurisdiction did not select any response category for any question item (that is, all data were missing for a question), they were excluded from the calculation of weights. For example, Australia (Victoria) was excluded from Figure 4.1 because its response to each item on policy challenges regarding digitalisation and young children and ECEC was missing (see Tables B.1 and B.2). However, countries and jurisdictions were included in the calculation of weights if they included at least one non-missing answer to a relevant item. For example, Australia (South Australia) was included in the calculation of weights for Australia in Figure 4.1.

The same weight was used for each country and jurisdiction across every item relating to the same question. Thus, Australia and Australia (Tasmania) were given a weight of 0.33 across all items, even though Australia (South Australia) had a missing response for some items.

Weighting for questions with multiple response options

In some questions of the *ECEC in a Digital World* policy survey, countries and jurisdictions could select multiple response categories in response to a single question item. For example, in the Canada-level response for school-based programmes, it was reported that digital devices are provided to ECEC settings by both regional and local authorities (see Table B.10).

In these cases too, the total weight assigned to responses for each country was set to one. Within each country, this total weight was equally divided between the number of jurisdictions that provided at least one answer (in any response category) to one of the relevant question items. For example, all countries' and jurisdictions' responses were included in the calculation of weights for Table 5.3 because they all gave at least one non-missing answer to at least one of the four relevant question items. Here, similarly, the same weight was used for each country or jurisdiction across every item relating to the same question.

Treatment of "not applicable" and "not known", and missing responses

Information reported by countries or jurisdictions as "not applicable" or "not known" was checked against explanatory notes provided by countries and jurisdictions and sometimes recoded to enhance the comparability of information. In cases where questionnaires presented blank items (missing responses), comments provided by countries and jurisdictions were considered for the interpretation of the data.

Weighted percentages were calculated using the weights assigned to each country or jurisdiction as described above. Generally, "not applicable" and "not known" answers were included in the calculation of weighted percentages.

However, countries or jurisdictions with missing data for a question item were excluded from the calculation of weighted percentages for that item. For example, Australia (South Australia) was excluded from the total *N* in the calculation of weighted percentages of countries and jurisdictions identifying of "Preparing young children for social and political participation in the digital age" as a policy challenge in Figure 4.1.

Significance tests

Where appropriate, tests of statistical significance were conducted to understand whether observed differences in sampled data are likely to represent actual differences within the population. In this report, differences are labelled as statistically significant when a difference would be observed less than 5% of the time if there was actually no difference in corresponding population values (statistical significance at the 95% level). In other words, the risk of reporting a difference as significant when such difference, in fact, does not exist, is contained at 5%.

Calculation of indicators in Chapter 1

Tables 1.2 and 1.3 list countries and jurisdictions that have been identified as active on a particular policy lever and as addressing a particular policy challenge, respectively. The selection of countries and jurisdictions was informed by responses to the policy survey and case studies submitted by countries and jurisdictions, as well as by desk research by the OECD Secretariat and qualitative analysis presented

throughout the report. Concerning selection on the basis of the policy survey, respondents' answers to a selection of relevant items were computed in weighted averages to identify countries and jurisdictions scoring above a predefined threshold.

Case studies

Countries and jurisdictions participating in the policy review were invited to submit case studies about recent or ongoing policy initiatives regarding digitalisation and ECEC, using a template provided by the OECD Secretariat to enhance the consistency and comparability of the information. In total, 20 case studies were received from 16 countries and jurisdictions. The OECD Secretariat reviewed the submissions and light copy editing was performed where necessary. References to case studies in the report are based on qualitative analysis of templates completed by countries and jurisdictions.

For more information, see Annex C.

Country notes

Country notes were produced for six countries that engaged in the policy review in greater depth: Canada, Finland, Japan, Korea, Norway and Sweden. These country notes follow a standardised format and address a common set of issues but vary also in focus with the goal to explore questions deemed of particular relevance to these countries. The notes were prepared by the OECD Secretariat and reviewed by the countries and jurisdictions. The preparation of the notes followed the same methodological procedures implemented for the main report.

The format of the figures in the country notes varies slightly from the format of those in the main report, whereby the responses for the country in question are displayed in the left-hand section of the chart, for reference. In the right-hand section, all non-missing responses were included in the calculation of the share of all countries' responses, including the country featured in the note. The calculation of shares followed the same methodology of weighted percentages as in the main report.

Additional data sources

OECD Teaching and Learning International Survey (TALIS) Starting Strong 2018

Figures 2.6, 5.7 and 6.2 well as Tables B.24-30 rely on data from TALIS Starting Strong 2018, the first large-scale international survey that focuses on the ECEC workforce. Questionnaires were administered to staff and leaders to collect data on their characteristics, practices at work and views on the ECEC sector, with an emphasis on those aspects that promote conditions for children's learning, development and well-being.

Nine countries participated in TALIS Starting Strong 2018: Chile, Denmark, Germany, Iceland, Israel, Japan, Korea, Norway and the Republic of Türkiye. All these countries collected data from staff and leaders in pre-primary education (ISCED level 02) settings. In addition, four of the nine countries (Denmark, Germany, Israel and Norway) collected data from staff and leaders in settings serving children under age 3. For each level of ECEC in which these countries participated, the study aimed to survey a representative sample ECEC staff and centre leaders.

For more information, see the *TALIS Starting Strong 2018 Technical Report* (OECD, 2019[1]).

OECD International Early Learning and Child Well-being Study (IELS)

Figure 7.3 relies on data from IELS, an international survey that assessed the skills of children at age 5 attending early childhood education centres or schools in Estonia, the United Kingdom (England) and the United States in 2018. The study aimed to identify key factors that drive or hinder the development of early learning.

IELS data in Figure 7.3 are disaggregated by various measures of children's social and economic backgrounds. Information on parental/guardian's education comes from the parent questionnaire, with levels of parental education classified following ISCED. Figure 7.3 reports on the highest educational level of either parent. ISCED levels 0-5 (short-cycle tertiary education and below) were categorised as "no higher education" and ISCED levels 6-8 (bachelor's level tertiary education or higher) were categorised as "higher education". The measure of socio-economic status was derived nationally, based on three indices: 1) highest parental occupational status of parents; 2) highest educational level of parents (in years of education according to ISCED); and 3) household income. The number of books in the home refers to the number of children's books that parents reported as present in the home environment.

For more information, see the *IELS Technical Report* (OECD, 2021[2]).

OECD Programme for International Student Assessment (PISA) 2018

Figures 2.2, 2.3 and 7.2 rely on data from PISA 2018. PISA is a triennial survey of 15-year-old students around the world that assesses the extent to which they have acquired key knowledge and skills essential for full participation in social and economic life. In addition, PISA uses student questionnaires to collect information from students on various aspects of their home, family and school background, and school questionnaires to collect information from schools about various aspects of organisation and educational provision in schools. There are also optional questionnaire modules for students, including about familiarity with information and communications technology (ICT). PISA 2018 was conducted in 37 OECD countries and 42 partner countries/economies.

Results in Figure 7.2 refer to students' socio-economic background as "advantaged" and "disadvantaged". Measures of socio-economic background are based on the PISA index of economic, social and cultural status (ESCS). This index is based on three variables related to family background: 1) parents' highest level of education; 2) parents' highest occupational status; and 3) home possessions, including books in the home. A socio-economically disadvantaged (or advantaged) student is a student in the bottom (or top) quarter of the ESCS index in his or her own country.

For more information, see the *PISA 2018 Technical Report* (OECD, 2020[3]).

Glossary of key terms

The OECD Secretariat provided a glossary to facilitate the completion of the policy questionnaire.

Data system, also known as an information system, refers to a technology that facilitates the collection, storage and use of data. In the ECEC and education sectors, data systems typically maintain and link a range of centre/school-level or individual-level data elements collected at different points in time.

Digital competencies broadly refer to the set of knowledge, skills and values that ECEC professionals need to be able to seize the potential of digital technologies in the context of their work.

Digital content refers to any content published in computer-readable format. For the purposes of this questionnaire, digital educational material refers to digital content designed and intended to be used for educational and pedagogical purposes.

Digital service provider refers to any natural or legal person that provides products and services, electronically and at a distance. Examples of providers include online search engines, online marketplaces, Internet service providers, news providers, entertainment providers (e.g. music, movies) or social media.

Early digital literacy refers to the set of knowledge, skills and values that enable young children to confidently and autonomously play, learn, socialise, prepare for work and participate in civic action in digital environments in a way that is appropriate for their age, local language and local culture.

Digital technologies broadly comprise any product or service that can be used to create, view, distribute, modify, store, and transmit and receive information electronically in a digital form. Generally, digital technologies include computer networks (e.g. the Internet) and online services supported by these (e.g. websites, social networks, online libraries, etc.); software (e.g. programmes, apps, virtual environments, games); hardware, devices or "connected" objects (e.g. computers, mobile devices, digital whiteboards; programming or robotics kits; "smart" objects or toys with sensors); and digital content.

Early generally refers to the age group 0-6, corresponding to ages when children may be enrolled in ECEC.

ECEC teachers refers to individuals with the most responsibility for a group of children at the class- or playroom-level. They may also be called core practitioners, pedagogues, educators, pedagogical staff, pre-school, pre-primary, kindergarten or early childhood teachers. In small settings, teachers may also be head of the setting while still working with children.

ECEC assistants refers to individuals working alongside teachers/core practitioners with a group of children or class on a daily basis. Assistants usually have to meet lower qualification requirements than teachers/core practitioners, which may range from no formal requirements to, for instance, vocational education and training. This role does not exist in every country.

ECEC centre leader refers to the person in an ECEC centre with the most responsibility for administrative, managerial and/or pedagogical leadership. They may also be called the head of the ECEC centre. Centre leaders may be responsible for the monitoring of children; the supervision of other staff; contact with parents and guardians; and/or the planning, preparation and carrying out of the pedagogical work in the centre. Leaders may also spend part of their time working with children.

Young children refers to infants, toddlers and pre-schoolers aged birth to six years (or primary school entry age, if different from six).

References

OECD (2021), *International Early Learning and Child Well-being Study: Technical Report*, OECD, Paris, https://www.oecd.org/education/school/early-learning-and-child-well-being-study/Technical%20Report_with%20covers_v1.pdf. [2]

OECD (2020), *PISA 2018 Technical Report*, OECD, Paris, https://www.oecd.org/pisa/data/pisa2018technicalreport. [3]

OECD (2019), *TALIS Starting Strong 2018 Technical Report*, OECD, Paris, https://www.oecd.org/education/talis/TALIS-Starting-Strong-2018-Technical-Report.pdf. [1]

Annex B. List of tables available online

The following tables are available in electronic form only:

Early Childhood Education and Care in a Digital World policy survey (2022)

Table B.1	Policy challenges regarding digitalisation and young children
Table B.2	Policy challenges regarding digitalisation and early childhood education and care
Table B.3	Decision making regarding digital technologies in early childhood education and care
Table B.4	Regulations for digital service providers for protecting children in digital environments
Table B.5	Guidelines for families and early childhood education and care professionals for protecting children in digital environments
Table B.6	Digitalisation in the early childhood education and care curriculum or other relevant frameworks (first framework)
Table B.7	Pedagogical approaches in the early childhood education and care curriculum or other relevant frameworks (first framework)
Table B.8	Digitalisation in the early childhood education and care curriculum or other relevant frameworks (second framework)
Table B.9	Pedagogical approaches in the early childhood education and care curriculum or other relevant frameworks (second framework)
Table B.10	Digital infrastructure and educational materials in early childhood education and care settings
Table B.11	Digital competencies in pre-service preparation programmes for early childhood education and care teachers
Table B.12	Support for continuous professional development on digital competencies in early childhood education and care
Table B.13	Digital technologies to support continuous professional development in early childhood education and care
Table B.14	Digital technologies to support work processes in early childhood education and care settings
Table B.15	Communication with parents/families through digital technologies and partnerships with external actors (first type of setting)
Table B.16	Communication with parents/families through digital technologies and partnerships with external actors (second type of setting)
Table B.17	Communication with parents/families through digital technologies and partnerships with external actors (third type of setting)
Table B.18	Equity and diversity measures around digital technologies in early childhood education and care
Table B.19	Digitalisation and quality monitoring frameworks in early childhood education and care
Table B.20	Data systems in early childhood education and care
Table B.21	Elements in data systems in early childhood education and care
Table B.22	Purposes of data systems in early childhood education and care

StatLink https://stat.link/l4p0wq

Supporting tables for Chapter 7

International Early Learning Study (IELS)	
Table B.23	Use of digital devices among five-year-olds, by family and child characteristics
TALIS Starting Strong (2018)	
Table B.24	Insufficient Internet access in early childhood education and care centres, by centre characteristics
Table B.25	Shortage of digital technology in early childhood education and care centres, by centre characteristics
Table B.26	Early childhood education and care staff's recent participation in online training activities, by centre characteristics
Table B.27	Early childhood education and care centre leader's recent participation in online training activities, by centre characteristics
Table B.28	Early childhood education and care staff's views on the importance of children's ICT skills to prepare them for the future, by centre characteristics
Table B.29	Early childhood education and care centre leaders' views on the importance of children's ICT skills to prepare them for the future, by centre characteristics
Table B.30	Early childhood education and care staff's sense of self-efficacy for using digital technology to support children's learning, by centre characteristics

StatLink https://stat.link/xsm90y

Annex C. Case studies compendium

Seeking to investigate ways in which early childhood education and care (ECEC) can respond to digitalisation, the Starting Strong VII policy review built on a variety of inputs, including a collection of case studies. Countries and jurisdictions participating in the policy review were invited to submit case studies of recent or ongoing policy initiatives regarding digitalisation and ECEC in 2022. The case studies were to focus on how these policy initiatives are put into practice in a particular national or subnational context to shed light on the success factors and challenges of policy implementation.

To enhance the consistency and comparability of the information, the OECD Secretariat prepared a case study template after consultation with the OECD's ECEC Network. In total, 20 case studies were received from 16 countries and jurisdictions. This includes 13 OECD countries (Australia, Costa Rica, the Czech Republic, Estonia, Germany, Israel, Japan, Korea, Lithuania, Luxembourg, Norway, Slovenia and Spain); Brazil, an accession candidate country; and two subnational jurisdictions – Australia (South Australia) and Germany (Bavaria). Table A C.1 lists the 20 case studies and the codes used to refer to them in this report.

As a supplement to the report, a compendium brings together these case studies. The compendium first provides a descriptive overview of the policy initiatives put forward by countries and jurisdictions, including how they align with the policy roadmap of the Starting Strong VII policy review. It then presents the 20 case studies as submitted to the OECD Secretariat, in alphabetical order by country and jurisdiction of provenance. Cover pages provide key summary information for each case study.

The compendium is available on the OECD iLibrary at: https://doi.org/10.1787/50967622-en.

Table A C.1. Case studies included in the compendium

Country or jurisdiction	Policy initiative or programme	Code
Australia	eSafety Early Years Program	Case Study AUS
Australia (South Australia)	STEM in the Early Years	Case Study AUS_SA
Brazil	Support Program for the Implementation of the National Common Curricular Base	Case Study BRA
Costa Rica	Webinars for ECEC Teams	Case Study CRI
Czech Republic	Innovation in Education in the Context of Digitalisation	Case Study CZE
Estonia	ProgeTiger in ECEC	Case Study EST
Germany (Bavaria)	Digitalisation Strategy for ECEC	Case Study DEU_BAV
Germany	Readingwith.app	Case Study DEU_1
Germany	Discovering Computer Science – With or Without a Computer	Case Study DEU_2
Israel	Physital Spaces	Case Study ISR
Japan	Online Exchanges for Collaboration	Case Study JPN_1
Japan	Quest for Soil Learning Activity	Case Study JPN_2
Japan	ICT to Expand Children's Learning Experiences	Case Study JPN_3
Korea	Distance Learning in Early Childhood Education	Case Study KOR
Lithuania	Innovations in Kindergarten	Case Study LTU

Country or jurisdiction	Policy initiative or programme	Code
Luxembourg	Media Compass	Case Study LUX
Norway	Online Competence Packages for Digital Practice in ECEC	Case Study NOR
Slovenia	Remote Peer Observation	Case Study SVN_1
Slovenia	DIGICHILD	Case Study SVN_2
Spain	School of Computational Thinking and Artificial Intelligence	Case Study ESP

Annex D. Network member contributors

Starting Strong VII is a product of continued collaboration between the OECD Secretariat and the OECD Network on Early Childhood Education and Care (ECEC). Participants in the policy review made multiple contributions, including by providing responses to the policy survey, case studies, feedback on draft data collection instruments and draft chapters, and presentations at project meetings.

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