

Enhancing Learning Through Digital Tools and Practices: How Digital Technology in Compulsory Education Can Help Promote Inclusion

Final Report: October 2021

Request for Services EAC/08/02/2020

Education and Training

EUROPEAN COMMISSION

Directorate-General for Education, Youth, Sport and Culture

Directorate A – Policy Strategy and Evaluation

Unit A.1 — Strategy and Investments

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European Commission
B-1049 Brussels

Enhancing Learning Through Digital Tools and Practices: How Digital Technology in Compulsory Education Can Help Promote Inclusion

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Directorate-General for Education, Youth, Sport and Culture

2021 Unit A.1 – Strategy and Investment EN

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Luxembourg: Publications Office of the European Union, 2021

PDF ISBN 978-92-76-42316-4 doi 10.2766/365846 NC-03-21-407-EN-N

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Acknowledgements

This research was commissioned by the Directorate-General for Education, Youth, Sport and Culture (DG EAC) of the European Commission and undertaken by Ecorys.

The study was managed by Maria Melstveit Roseme and directed by Laurie Day from Ecorys, with quality assurance provided by Janet Looney from the European Institute of Education and Social Policy (EIESP). We would like to thank Tom Fellows, Francois Staring and Letizia Vicentini for their valuable written contributions to the interim and final reports, and Panos Deoudes for overseeing the quantitative analysis and the development of the Digital Inclusion Index that informed the country selection.

We are indebted to our High-Level Experts, or their invaluable advice and guidance during the study. They include Kay Livingston (Professor of Educational Research Policy and Practice, at the University of Glasgow), Dr Ilkka Tuomi (Founder and Chief Scientist at Meaning Processing), and Barry van Driel (Independent Consultant).

In addition, we would like to thank the Ecorys study team members who undertook desk research and conducted case studies. They include: Niklas Olausson, Paula Calabuig, Eugenie Delzenne, Lucija Kilic, Andrea Broughton, Marianna Georgallis, Marie Shaikovski, and Charlotte Ruitinga. Our thanks also go to the external researchers who undertook the EU27 mapping exercise and supported the case study research under the coordination of Ecorys.

We also acknowledge the valuable steer provided by DG EAC throughout the study, in particular from Anja Janum, Marta-Monika Markowska, Veronica Mobilio and Maria Spyridonos.

Finally, the team would like to thank the many consultees who gave their time for interviews and who participated in the two rounds of the Virtual Policy Delphi.

Country abbreviations

Country abbreviations	Country
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia

1.0 Introduction

Ecorys is pleased to submit this Final Report for the study: ***Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion* (EAC/08/02/2020).**

Carried out over 12 months between September 2020 and September 2021, this EU comparative educational study aimed to assess the actual and potential role of digital technologies in promoting access, quality and equity in compulsory school education across Europe, and their role in complementing and enhancing traditional forms of teaching and learning. The findings are based on a mixed methods design, combining EU and country level desk research and interviews, with a Virtual Policy Delphi to consult on the interim findings with a wide range of key stakeholders across Europe. It also included a set of eight (8) country case studies and 32 examples of promising practice measures, which were selected using a sampling framework.

This report presents a final summative analysis of the study findings. The structure was agreed with DG EAC prior to submission and complies with the tender specifications. The case study outputs are also presented separately in a Case Study Compendium. In Chapter 1, we provide an overview of the context, aims and objectives of the study, a definition of key concepts, and we present a brief outline of our methodology.

1.1 Overall context for the study

It is important to highlight that this study has been commissioned within the context of **a fast-evolving policy and research context**. The latest Eurostat and OECD statistics point to a stark "digital divide" within Europe. This term refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access and use digital tools[1]. This divide is apparent at multiple levels within the EU, from the wide variations between Member States regarding household internet access, to the use of classroom technologies, and digital competences of teachers, learners and parents[2].

The COVID-19 crisis has abruptly exposed and accelerated the scale and implications of this digital divide. For instance, with the sudden and unanticipated move to emergency remote learning, it has become increasingly clear that it is young people from disadvantaged backgrounds who have been hit hardest by the crisis, evidenced by the attainment gap widening at an accelerated rate.[3] At the same time, while the pandemic has undoubtedly caused challenges for quality and inclusive education delivery, **emergency remote learning has also created unforeseen opportunities for the integration of digital education and communication tools across EU education systems.** Substantiating this observation, EU-wide open public

[1] OECD (2001), "Understanding the Digital Divide", OECD Digital Economy Papers, No. 49, OECD Publishing, Paris, https://doi.org/10.1787/236405667766.
[2] Eurostat (2020) *Digital economy and society database*. Eurostat: Brussels.
[3] Iacovone, L. (2020). Mitigating Educational Disadvantage during COVID-19 Crisis. Paris: OECD.

consultations carried out within the context of the Digital Education Action Plan showed that 95% of consulted citizen and stakeholders viewed the COVID-19 crisis as "marking a point of no return" for how technology is used in education and training[4].

Finally, the COVID-19 crisis has highlighted **the importance of learner, teacher and parental agency**, as all have been asked to take part in reshaping their learning environments and to take on more individual responsibility. In adapting to the new ways of working and studying in this unprecedented situation, this has in turn resulted in shifting roles and interactions between teachers, students, parents and other key stakeholders.[5] For instance, this includes stakeholders such as families and social workers collaborating to support vulnerable learners, and strong examples of whole-school approaches. As such, in many respects, the crisis represents not only a potential accelerator of progress in digital education, but also in moving from a crisis response to a broader 'reimagining' of the educational landscape and the roles of key stakeholders.

At the same time, while technology holds tremendous potential both in terms of widening access and enhancing teaching, learning and assessment, the literature indicates that **a strategic approach is needed to effectively integrate technology into the classroom**, with adapted pedagogical practice and appropriate curricula[6]. What works in ECEC settings is somewhat different to pedagogical needs within general education or VET. There is also evidence that ICT can create more harm than good where classroom technologies are poorly integrated[7]. This shows the importance of not losing sight of the rich evidence-base of "what works'' pre-dating the crisis, and its crucial value for future practice.

Last, and of particular significance, are **the rapid developments at the EU level that have foregrounded the commissioning of this study**. Most importantly, building on the EU's first framework for digital education from 2018-2020, the new Digital Education Action Plan (2021-2027) outlines the European Commission's vision for high-quality, inclusive and accessible digital education in Europe [8]. The Plan has two strategic priorities, firstly to foster the development of a high-performing digital education ecosystem and secondly to enhance digital skills and competences for the digital transformation. It represents a call to action for stronger cooperation at European level in order **to learn from the COVID-19 crisis** and **to make education and training systems fit for the digital age**.

The Commission has swiftly put this strategic vision into action. Key examples of this includes: the launch of a **European Digital Education Hub** to improve cooperation on digital education at the EU level and to promote cross-sectoral collaboration linking to strategic priority one of the Action Plan[9], as well as specific **Commission digital**

[4] European Commission (2020). Digital Education Action Plan 2021-2027: Resetting education and training for the digital age. Summary of the Open Public Consultation. Karpiński Z., Di Pietro G., Castaño Muñoz J. and Biagi F. with contribution and support from Bultynck L., Mobilio V., Petkova S., Juraga I., Haegemans K. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12453-Digital-Education-Action-Plan/public-consultation
[5] Looney, J. (forthcoming) Analysis of Stakeholders Survey on the OECD Global Forum the Future of Education and Skills 2030
[6] McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of research on technology in education*, 48(3), 194-211.
[7] Denoël, E., Et. al. (2017) Drivers of student performance: Insights from Europe. New York: McKinsey & Company
[8] European Commission (2020). Digital Education Action Plan 2021-2027: Resetting education and training for the digital age. https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en
[9] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan/european-digital-education-hub_en

education expert groups on i. tackling disinformation and promoting digital literacy through education and training[10] and ii. artificial intelligence and data in education and training[11] linking to Action 7 and 8 of priority two of the Action Plan respectively. Both initiatives were launched already mid-2021.

Moreover, in building on the pre-existing knowledge-base at EU level, the key staff working document accompanying the Communication on the Digital Education Action Plan 2021-2027 provides important evidence and analysis of the opportunities and challenges that the digital transformation brings to education and training today.

1.2 Aims, objectives and scope

The overall **aim** of the study, as stated in the tender specifications, is as follows:

> *To assess the actual and potential role of digital technologies in promoting access, quality and equity in compulsory school education across the EU27, and in complementing and enhancing traditional forms of teaching and learning.*

By primary, we mean ISCED Level 1 and by secondary we mean ISCED Levels 2 & 3. By VET we mean any vocational or technical education at ISCED Levels 1-3. As agreed at the kick-off meeting, the study will also learn from practices within Early Childhood Education and Care (ISCED 0) where relevant, but this is not a principal focus.

The study is concerned with how digital technologies can promote the inclusion of all learners, but also specifically to identify their role with regard to learners with different learning needs, those living in remote areas, migrants, those from disadvantaged socio-economic backgrounds, and other learners facing additional challenges. The results of the study will serve as an evidence-base and offer recommendations to European education institutions and policy makers.

In meeting the overarching aim, the **specific objectives** for this study are as follows:

- **Objective one:** To understand how technology is being used in compulsory education and VET settings across the EU27 to ensure access to a quality education, particularly for those groups at risk of marginalisation.
- **Objective two:** To explore the extent to which compulsory education systems across the EU27 are equipping students for lifelong learning, citizenship, and with the skills needed for the "digital economy".
- **Objective three:** To consider the barriers and obstacles which impede young people's and schools' ability to access and use digital technology to promote inclusion, and how these are being overcome.
- **Objective four:** To understand how the COVID19 pandemic has impacted upon the use of technology in compulsory education, and how schools are responding.

[10] https://ec.europa.eu/education/news/call-for-experts-tackling-disinformation-promoting-digital-literacy_en
[11] https://ec.europa.eu/education/news/apply-expert-group-artificial-intelligence-data-education-training_en

- **Objective five**: To assess the effectiveness with which digital technologies have been integrated within teaching and learning across the EU27, and their role in promoting student choices and voices with regard to their learning and wellbeing.
- **Objective six**: To assess the readiness and needs of school leaders and teachers regarding the use of digital technologies and any adjustments that may be required (e.g. relating to professional development, workload, or access to networks and resources).[12]
- **Objective seven:** Through a detailed exploration of objectives one to six, isolate "lessons learned" relating to how technology has been used to promote quality education, access for all and improved equity.

Linked to our research objectives, an overview of the research questions which guides this study can be found in Annex I. These have been carefully crafted to link both to the literature identified as well as the overarching research objectives.

Study scope

The study covers the EU27, at both EU and country levels, encompassing all 27 EU Member States, and drawing upon the wider international literature where relevant.

The scope includes primary, secondary and Vocational Education and Training (VET). By primary, we mean ISCED Level 1 and by secondary we mean ISCED Levels 2 and 3. By VET we mean any vocational or technical education at ISCED Levels 1-3. As agreed at the kick-off meeting, the study also aims to learn from practices within Early Childhood Education and Care (ISCED 0) where relevant to the objectives. It should be noted that the start, end and duration of 'compulsory education' varies substantially across EU Member States, with differences in the start and end points and overall duration[13].

Key concepts and definitions

The study addresses a number of key themes and concepts regarding digital education and inclusion. Here, we provide working definitions for how we have presented them throughout the report, to ensure clarity and consistency.

Digital inclusion

Following a detailed review of the literature, **we define digital inclusion as leveraging digital tools to widen access and enhance the quality of teaching and learning for the purpose of delivering a fair and equitable education**. This

[12] This may also relate to structural changes, such as the (re)organisation of in-service training and ensuring sufficient time for learning/implementation of digital pedagogies around school timetables.

[13] In most European education systems, compulsory education/training lasts 9-10 years ending at the age of 15-16. In Belgium, Luxembourg and Portugal, however, the duration is 12 years, while in Hungary and the Netherlands 13 years' attendance is mandatory for all. In Germany, the duration varies between the Länder. It is 12 years in the majority of them and 13 years in some. In France, as of September 2020, compulsory education and training now lasts 15 years. Compulsory education usually covers primary and lower secondary education levels (ISCED 1 and 2). In Belgium, Germany, the Netherland and Portugal, it is compulsory to stay in education/training until age of 18-19. However, in these countries, between ages 15-16 and 18-19, students can attend compulsory education/training programmes combining part-time school based and part-time workplace courses. Ref: European Commission/EACEA/Eurydice, 2019 *Compulsory Education in Europe – 2019/20*. Eurydice Facts and Figures. Luxembourg: Publications Office of the European Union.

section aims to preview these three dimensions of digital inclusion to ensure clarity around the terms from the onset of the report.

Equal access to education

We consider two elements to access within the context of digital inclusion – one relating to **access to digital tools** and another relating to **access to education**. Firstly, there is a key relationship between inclusive digital education and ensuring that individuals, schools and Member States have access to purchase (resources) and use (competences) digital tools. As seen in the above policy context section, it is apparent that there is a clear digital divide both within Member States and across the European continent.

Secondly, a modern quality and inclusive education system looks to use digital tools to break down barriers for young people who struggle to access learning. These barriers may relate to their ability to attend good quality provision, or provision of their choice, due to living in a rural or disadvantaged area, or cultural barriers which may impede young people from accessing school. Ensuring access is also about making provision to enable those with physical disabilities or learning difficulties engage with learning in a meaningful way. This may include technology designed to allow learners to access education remotely (e.g. distance or blended learning), as well as tools which enable those with complex needs to engage with learning (e.g. through assistive technology).

As such, for the purpose of this study, our definition of access is two-fold:

1. At a macro (i.e. country or inter-country) level, it relates to ensuring that schools have an equitable level of tools (including digital tools) and resources.

2. at a micro (i.e. school) level, it is about leveraging digital tools to support traditional measures in ensuring that all learners have access to educational opportunities or environments that support their (diverse) learning needs.[14]

Quality of teaching and learning

Within the context of this study, we understand quality teaching and learning to be about **ensuring that all students within compulsory education receive a high standard of education**. Specifically, two areas are relevant to this study.

First, is **the extent to which technology has been integrated into pedagogical** practice and curriculum delivery to enhance the quality of learning for all learners, and low-achieving learners in particular. We understand enhancing learning through digital tools to mean how technology can support specific pedagogical aims. Within this definition, we consider digitally enhanced learning to be learning that results in a direct increase in learning outcomes (e.g. assessment pointing to improved subject-knowledge and understanding, cognitive development, and/or higher order thinking skills), but also strategic use of digital tools to promote richer, more dynamic learning environments that benefit learners (e.g. by boosting engagement, communication and assessment). Second, is the extent to which technology has been incorporated into educational **planning and infrastructure**. This includes exploring political and school leadership and stakeholder buy-in, as well as teacher training and development.

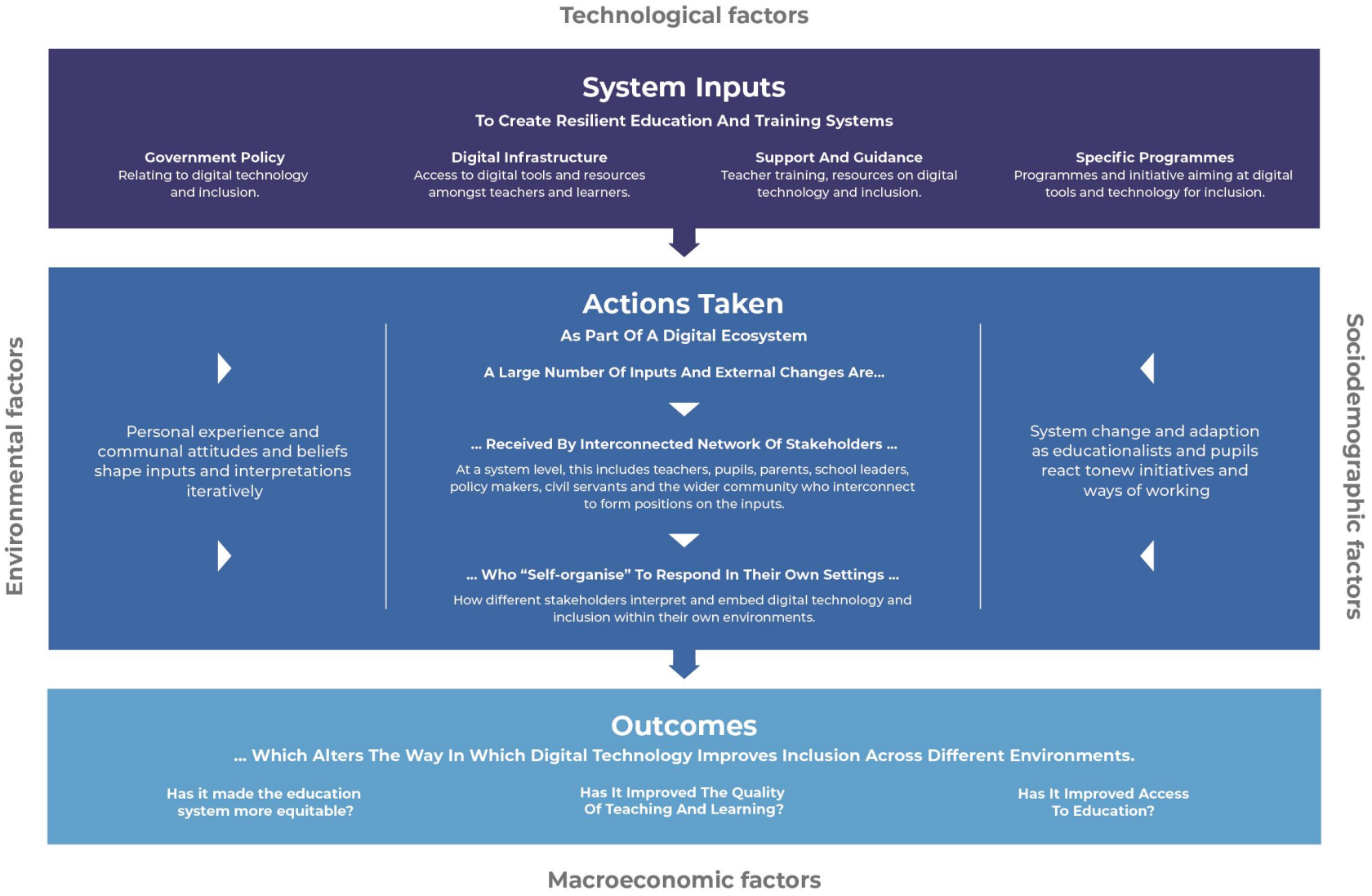
[14] Schuelka, M. J. (2018). Implementing inclusive education. London: Institute of development studies.

Equitability

Within the context of this study, equitability is **linked to both access and quality as it concerns creating a 'level playing field' across education and allowing all to reach their full potential**. However, it goes beyond access and quality of education by ensuring that all students leave with the baseline key competences to participate fully in society. Furthermore, it is also linked to removing barriers which make education unfair. As such, equity in education will feature throughout this report as a transversal theme.

The conceptual model overleaf provides a visual representation of how these key themes interrelate within the context of our theoretical framework for the study.

Figure 1-1 Conceptual framework for the study



1.3 Methodology

Our research methodology was designed to gather and analyse evidence in relation to the main objectives outlined above, as well as to closely follow the tender specifications. Our research activities were based on a mixed methods design, structured around four key stages. The activities carried out under each stage are described in order below.

Inception and scoping research (September-October 2020): The main objective of this stage was to refine and further develop the methodology and overarching analytical framework for the study. This was done by conducting semi-structured interviews with representatives from the European Commission, other EU Agencies and ENGOs representing the main stakeholder groups for the study (*n*=16 in total), as well as an initial review of key literature and statistical datasets on digital inclusion, conducted using a Rapid Evidence Assessment (REA) methodology[15]. All statistical datasets reviewed as part of our research are included in full in Annex III.

Desk research (November 2020-February 2021): The main objective of this methodological stage was to carry out systematic desk research across all 27 EU Member States to map the current state of digital education generally, and the use of digital tools for inclusion purposes specifically, across ECEC and compulsory education. The task was coordinated by the study lead and director and carried out by a team of carefully selected national experts. The 27 templates produced through this work form the initial basis for the findings, conclusions and recommendations presented in this report. The country mapping template used at this stage can be found in Annex II.

Case study research (March-May 2021): The main objective of this stage was to select a sample of EU Member States and individual measures for a deeper dive, combining qualitative interviews (*n*=80 in total) with documentary analysis. In total, 8 countries and 33 measures were selected (up to 4 per country). A sampling framework was devised to provide broad coverage of the EU according to geography and national education systems, and to reflect varying levels of digital infrastructure and digital competences among learners and teachers providing the backdrop to how EU Member States have developed digital education and inclusion measures. The resulting sample included: Belgium, Bulgaria, Denmark, Estonia, France, Italy, Spain and Sweden. The individual measures were selected to include only those with promising evidence of outcomes and impact, and to ensure a mix of types and levels of education and learner characteristics. Full details of the sampling framework can be found in Annex III.

EU-level consultation - Virtual Policy Delphi (May-June 2021): Prior to final reporting stage, a *Virtual Policy Delphi* was carried out with key experts and representative organisations at EU-level across the key themes of education, social inclusion and digitalisation, as well as a selection of national stakeholders from across the EU27 (*n*=30)[16]. The purpose was to clarify and contextualise the emerging findings

[15] See https://bit.ly/33pXRpr for more details.

[16] The Delphi technique, a widely applied methodological tool in applied social research, involves a series of rounds of structured consultation. The approach is designed to examine stakeholder's perceptions of a policy issue, through an iterative process. Whereas a traditional Delphi method aims to reach consensus on a given question or topic, *a Virtual Policy Delphi* aims to examine potential options and their acceptability. See, for example: de Loë, R.C., Melnychuk, N., Murray, D., and Plummer, R. (2016) Advancing the State of Policy Delphi Practice: A Systematic Review Evaluating Methodological Evolution, Innovation, and Opportunities. *Technological Forecasting and Social Change*, 104, pp.78-88.

and to shape the recommendations. This managed as a two-step process, with the stakeholders providing feedback on the draft findings in a first iteration of a short paper and accompanying online questionnaire, before being requested to co-produce some preliminary recommendations in a second round based on their initial feedback. The questionnaires employed for the Delphi exercise can be found in Annex III.

Final analysis and reporting (June-August 2021): The main objective of this task was to conduct a transversal analysis of the findings collected through the scoping research, the EU27 desk research and the case study research, to develop evidence-based conclusions and policy recommendations regarding how digital technologies can support inclusive education for i. all learners and for ii. specific vulnerable groups. The findings were tested through a process of triangulation, to establish the extent to which the different strands of evidence support or refute each other. The study team drew upon the quantitative and qualitative evidence to answer the research questions, and to revisit and test the conceptual framework. The resulting conclusions and recommendations are presented in Chapter 6.

Data limitations and caveats

With regard to study limitations, it is important to note the data collection periods when interpreting the data. The country mapping exercise with individual EU Member States took place in autumn 2020 and the description of national policy measures reflects the state of play concerning responses to the Covid-19 pandemic at that time. The report has documented an unprecedented period of digital transformation, and the pace of these developments means that the EU27 digital landscape is constantly evolving.

The study included consultations with EU and national level organisations and networks representing learners, parents and teachers, and to draw on secondary data (e.g. literature, country reports) to document their views and experiences. However, it was not feasible to undertake larger scale primary data collection with these stakeholder groups, and the conclusions and recommendations should be understood in this context. Indeed, the study recommends that the voices of leaners, parents and teachers are amplified through further research and through policy dialogue mechanisms.

1.4 Structure of the report

The remainder of this report is structured as follows:

- **Chapter 2** presents the findings from a comprehensive literature review conducted in the context of this study drawing upon findings from 118 articles, books and reports to establishes familiarity with and understanding of existing research on the use of digital tools to promote inclusion in educational settings.
- **Chapter 3** provides an overview of the latest developments at EU level, before identifying the main learner groups at risk of marginalisation and the specific challenges they face across the EU27.
- **Chapter 4** addresses the question of access, examining how EU Member States have used digital technologies to ensure that all learners have access to education, and to remove barriers for learners with additional needs. It also considers the steps taken by Member States to widen access to digital infrastructure and to provide learners with opportunities to acquire digital competences at ISCED levels 0-3.

- **Chapter 5** outlines the potential of digital tools to enhance learning across ECEC, primary and secondary education (including VET). The section present examples of how key digital tools have been used to enhance learning for all learners, as well as for specific groups at risk of marginalisation. It also explores the role of teacher education and training, as well as parents and the whole-school community, in delivering effective and inclusive digital education.
- **Chapter 6** lastly reflects on the overall findings, presenting the study's conclusions and highlighting a number of themes that stand-out for i. all learners as well as for ii. specific vulnerable learner groups, before issuing recommendations for key education stakeholders.

The annexes include:

- **Annex I**: An overview of the study's research questions.
- **Annex II**: Scoping and EU-27 mapping research tools: including our country mapping template, interview topic guide and key interview findings.
- **Annex III**: Case study research tools: including our digital inclusion index, case study sampling matrix, matrix for selection of measures; case study template; case study interview guide and virtual policy Delphi questionnaires.
- **Annex IV**: Key datasets.

2.0 Literature review

Box 1 Literature review: key messages

Key messages

This section presents the findings from a rapid evidence assessment of the literature on the use of digital tools for inclusive practices in compulsory education. The key findings from this section are that:

- **Socio-economic background and family and school contexts influence the extent to which individuals access digital tools and receive a fair and equitable education**. Family circumstances and income, parental mediation, school infrastructure and teacher competences all play a contributory role.
- **There is a wide literature on the use of technology for inclusion**, which includes: assistive technologies; e-learning, open education and MOOCs; Robotics and Artificial Intelligence; and phone, computer and internet technology. The literature emphasises technologies' potential to provide higher quality and more frequent learning opportunities by bridging issues of physical, cognitive or cultural access. This, in turn, provides learners with more agency to shape their learning pathways and manage their own learning if used effectively.
- **The literature also emphasises the important role of schools and parents in instilling digital skills and competences for young people.** With digital tools playing a key role in economic and social integration, digitally competent and responsible citizenship is vital for inclusion.
- If not designed or used effectively, however, **technology can harm student achievement, stifle agency, and reinforce barriers to equitable access to education**. This is why the literature emphasises that "it is not whether technology is used (or not) which makes the difference, but how well the technology is used to support teaching and learning".
- The **literature also emphasises several factors which influence how effectively technology is implemented in schools for inclusive practices**. While access to resources is important, leadership, teacher competences and attitudes/ beliefs are equally if not more important factors to using technology effectively.
- **While the literature is still emerging on COVID-19, it demonstrates that digital technology is not a panacea for inclusive education**. The emerging evidence confirms the importance of using digital tools effectively to maximise the benefits it presents for inclusive practices.

2.1 Introduction

This chapter presents the findings from a literature review conducted in the context of this study. It sets out the current understanding of using digital technology to promote inclusivity in compulsory education, drawing upon findings from 118 articles, books and reports within a Rapid Evidence Assessment (REA) framework. As outlined in chapter 1, the definition of inclusion underpinning this literature review relates to the project's theoretical framework. This definition has three dimensions:

1. **Equal access to education.** At a micro (i.e. school) level, this is about putting appropriate measures in place to ensure that learners have access to the same opportunities or environments that support their different needs.[17] At a macro (i.e. country or inter-country) level, it relates to ensuring that schools have an equitable level of tools (including digital tools) and resources.

2. **Quality teaching and learning**. This is about ensuring that all students within compulsory education receive a high standard of education.

3. **Equity.** [18] This is linked to both access and quality as it concerns creating a 'level playing field' across education and allowing all to reach their full potential. However, it goes beyond access and quality of education by ensuring that all students leave school with the baseline key competences to participate fully in society.

The chapter first looks to articulate issues of educational exclusion which digital technology may help overcome, including educational barriers facing marginalised groups and issues relating specifically to the "digital divide". It then explores how technology may address these barriers to provide inclusive education and the facilitating factors and challenges of effectively integrating digital tools into inclusive classrooms. Finally, it explores digital competence and confidence issues before looking at the implications of COVID-19 on the use of digital tools for inclusion in schools. The "key messages" box above presents the main findings from this chapter.

2.2 The context behind 'digital inclusion'

The literature emphasises two distinct elements of inclusivity related to digital tools. These are: (1) educational inequity, consisting of the factors and conditions which impede students from realising their full potential; and (2) the "digital divide", which looks to explore inequalities in terms of access and skills related to digital technology. An overview of these factors will set the stage for a broader discussion on how digital tools can provide learners with better quality and access in order to support all learners to achieve. It will also explore the steps required to narrow the digital divide.

Educational inequity

Evidence from across Europe and internationally, covered in more detail in chapter 3 of this report, shows statistically significant differences in educational participation, outcomes and choices depending on special needs and disability status, socioeconomic

[17] Schuelka, M. J. (2018). Implementing inclusive education. London: Institute of development studies.
[18] While there are numerous meanings of equity, we refer to "*the situation in which everyone is treated fairly and equally*" according to the Cambridge Dictionary.

status, migrant background, ethnicity, and gender. The following are some of the factors which make young people less likely to reach their full potential, gleaned from a broad review of the literature:

- **Childhood poverty and adversity**. Research shows that young people are more likely to suffer from lower educational outcomes and school attendance/ behaviour issues if they have suffered adverse childhood experiences (ACE) or come from homes with poor mental health or inter-parental conflict[19]. Furthermore, a "growing body of evidence indicates that poverty is highly comorbid with ACE exposure, and that children living in poverty are more likely than their peers to experience frequent and intense adversities"[20] .

- **Parental mediation**. Parental support for learning, including playing educational games, practising core skills (such as reading and maths), and visiting educationally stimulating environments, are critical components in early childhood development [21]. This, in turn, impacts student outcomes throughout schooling. Parents from low-SES backgrounds or with poor education outcomes are less likely to support educational development in the home [22]. They are more likely to have lower expectations of their children and lower aspirations for higher education [23] . Cultural norms [24], a poor home learning environment [25], and poor parent-school relationships [26] can also impact on young people's outcomes.

- **Barriers to accessing provision which meets students' specific needs**. Students with learning difficulties and special needs face obvious barriers to accessing education provision, and depending on particular needs, this greatly restricts the educational choices that these students have.[27] Language barriers are also an issue. Those from migrant backgrounds often have the added burden of learning a new instructional language in the early years of primary education to access learning, leading to attainment and progress gaps compared to their peers.[28] Finally, geography is a significant consideration, with research showing lower education levels in rural areas compared to urban towns and cities.[29] Some

[19] Crenna-Jennings, W. (2018). Key drivers of the disadvantage gap: Literature Review. Education Policy Institute: London.
[20] Walsh, D., McCartney, G., Smith, M., & Armour, G. (2019). Relationship between childhood socioeconomic position and adverse childhood experiences (ACEs): a systematic review. *J Epidemiol Community Health*, *73*(12).
[21] HM Government and National Literacy Trust. (2018). Improving the home learning environment: A behaviour change approach. HM Government: London.
[22] Dubow, E. F., Boxer, P., & Huesmann, L. R. (2009). Long-term effects of parents' education on children's educational and occupational success: Mediation by family interactions, child aggression, and teenage aspirations. *Merrill-Palmer quarterly (Wayne State University. Press)*, *55*(3), 224.
[23] Gorard, S., See, B. H., & Davies, P. (2012). The impact of attitudes and aspirations on educational attainment and participation. *York: Joseph Rowntree Foundation.*; R. Pallister & J. Wilson (1970) Parents' Attitudes To Education, Educational Research, 13:1, 56-60.
[24] Bornstein, M. H., Putnick, D. L., & Lansford, J. E. (2011). Parenting Attributions and Attitudes in Cross-Cultural Perspective. *Parenting, science and practice*, *11*(2-3), 214–237; European Union Agency for Fundamental Rights. (2014). Education: the Situation of Roma in 11 EU Member States. Roma Survey–Data in Focus.
[25] Melhuish, E. C., Phan, M. B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school
[26] Powell, D. R., Son, S. H., File, N., & San Juan, R. R. (2010). Parent–school relationships and children's academic and social outcomes in public school pre-kindergarten. *Journal of school psychology*, *48*(4), 269-292.
[27] European Commission. (2019). Access to quality education for children with special educational needs. European Commission: Luxembourg.
[28] European Commission. (2008). Migration and mobility: Challenges and opportunities for EU education systems. *COM*, *423*.
[29] Vaishar, A., Vidovićová, L., & Figueiredo, E. (2018). Quality of Rural Life. Editorial 16 June 2018. *European Countryside*, *10*(2), 180-190.

Roma communities are also highly mobile, making regular and persistent school attendance challenging.[30]

- **School attitudes and practices**. Poor teaching practices that do not provide differentiated opportunities mean that low and high achieving students' needs may not always be adequately met in schools[31]. The literature also emphasises that certain groups, such as those from a Roma background, face systemic discrimination and are "often forced into segregated schools, or into special/remedial programs".[32] Teacher expectations play a critical role in learning outcomes.[33] Bias (both conscious and unconscious) impacts teacher expectations, with evidence of lower expectations for pupils from marginalised groups than their peers, and therefore lower outcomes.[34]

While some students from marginalised backgrounds will face none of the issues outlined above, others will face multiple disadvantages beyond those listed. Furthermore, students from non-marginalised families can also experience barriers to education. Many of these factors are interconnected, with pupils from marginalised groups disproportionately likely to be diagnosed with complex needs – demonstrating an interrelation trend between poverty, ethnicity and special needs status.[35] It is also important to note that providing an inclusive education is about meeting the needs of the individual child at a school level. Inclusion is, therefore, a highly personalised endeavour linked to individual student needs.

The digital divide

The literature covers four levels of the "digital divide": (1) primary access to digital technology and infrastructure; (2) digital and technological skills and competences, including online safety and citizenship; (3) the ability to translate online opportunities into real-life benefits; and (4) the ability to make connections and create online "environments conducive of the realisation of personal goals".[36] Commentators also define a fifth element of the digital divide, which revolves around attending a school with adequate ICT equipment.[37] From the user's perspective, Van Dijk also adds that, as well as structural issues, "access motivation" also impacts upon the extent to which

[30] European Union Agency for Fundamental Rights. (2014). Education: the Situation of Roma in 11 EU Member States. Roma Survey–Data in Focus.
[31] Morgan, H. (2014). Maximizing student success with differentiated learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *87*(1), 34-38.
[32] Catto, L. (2012). Xenophobia and Structural Violence: Barriers to Education for Roma Youth. *Pure Insights*, *1*(1), 5.
[33] Hattie, J. (2020). Visible Learning: Hattie Ranking. Available online: https://visible-learning.org/hattie-ranking-influences-effect-sizes-learning-achievement/
[34] Dee, T., & Gershenson, S. (2017). Unconscious Bias in the Classroom: Evidence and Opportunities, 2017. *Stanford Center for Education Policy Analysis*.
[35] Kvande, M. N., Belsky, J., & Wichstrøm, L. (2018). Selection for special education services: the role of gender and socio-economic status. *European Journal of Special Needs Education*, *33*(4), 510-524; Catto, L. (2012). Xenophobia and Structural Violence: Barriers to Education for Roma Youth. *Pure Insights*, *1*(1), 5.
[36] Hooft Graafland, J. (2018). New technologies and 21st century children: Recent trends and outcomes . In OECD Education Working Papers. OECD Publishing, Paris; Van de Werfhorst, H., Kessenich, E., & Geven, S. (2020). The Digital Divide in Online Education. Inequality in Digital Preparedness of Students and Schools before the Start of the COVID-19 Pandemic; Hamburg, I., & LÃtgen, G. (2019). Digital divide, digital inclusion and inclusive education. Advances in Social Sciences Research Journal, 6(4), 193-206.
[37] Van de Werfhorst, H., Kessenich, E., & Geven, S. (2020). The Digital Divide in Online Education. Inequality in Digital Preparedness of Students and Schools before the Start of the COVID-19 Pandemic.

individuals engage with technology which, in turn, is influenced by cultural, demographic and personal factors.[38]

Evidence across the literature, covered in more detail in the next chapter, demonstrates that young people from marginalised communities are disproportionately likely to face structural barriers that increase their inability to access and use technology effectively. Beyond the broad issues facing individual groups, there are also divides across national borders. Poorer countries, or those with less advanced infrastructure, can impede access to digital tools and resources for all citizens, not just those from marginalised groups. Access issues can permeate across both private and public spheres. The data show that "the proportion of students attending highly equipped and connected schools differs widely across Europe, ranging from 35% to 52% or 72% depending on the level of education (ISCED 1,2,3), and is higher in the Nordic countries".[39]

Beyond schools, computer and internet access is also uneven across the Member States. The Digital Economy and Society Index (DESI) compares countries by connectivity, human capital, internet services, integration of digital technology, and digital public services. Finland, which is the highest performing DESI country, has integrated digital technology into public services, uses nearly double the amount of mobile data compared to other EU countries, and has declared that all citizens have a legal right to broadband access. Unsurprisingly, nearly three-quarters of citizens have at least average digital skills.[40] By contrast, under 60% of households in Bulgaria have internet access. There is low integration of digital technology into public services and the economy, and only 29% of the population have at least basic digital skills.[41]

The digital divide is a high priority issue given the importance of digital tools and technologies for the future digital economy. Research shows that "more than a third of the EU labour force lacks the basic digital skills required in most jobs across sectors, and over half of EU companies report difficulties in filling vacancies for ICT specialists" [42]. This is the case in Southern and Central Europe "where economies try to catch up with the technology frontier" [43]. Research also shows that current uptake for ICT jobs does not match the economic needs going forward. The European Commission notes that "digitally enabled automation and [Artificial intelligence] … are set to become the primary drivers of the next technological revolution … [and] … companies all over Europe struggle to find qualified workers who are able to develop and deploy AI".[44]

[38] Van Dijk, J. A. (2017). Digital divide: Impact of access. The international encyclopedia of media effects, 1-11.
[39] Deloitte & Ipsos MORI. (2019). 2nd Survey of Schools: ICT in Education - Objective 1 & 2. Publications Office of the European Union: Luxembourg.
[40] European Commission (2020). Digital Economy and Society Index (DESI). European Commission: Brussels; Zeledin, W. (2010). Finland: Legal Right to Broadband for All Citizens. Library of Congress: Law.
[41] Ibid.
[42] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[43] Jamet, S., Canton, E., & Thum-Thysen, A. (2018). Investing in Europe's future: the role of education and skills. European Commission: Brussels.
[44] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels. European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.

Beyond the economic benefits of ICT use and integration, Reisdorf and Rhinesmith also outline that:

> *While dependence on digital devices and reliable internet increases, it is also becoming more and more obvious that being digitally excluded also means that [a] person is socially excluded.*[45]

As shown by the illustrative examples in the table 3.1 below, marginalised groups are at risk of lower digital skills and competences than their peers. They also have less access to (cultural and physical) resources to stay safe online and make the most out of digital technology. With regard to the gender dimension, girls perform better than boys overall across all 27 Member States in "computer and information literacy", but there is no gap in terms of "computational thinking".[46]

Table 2—1 Examples of digital issues affecting marginalised groups.

Roma Children	Studies show that "Roma/Gitano children frequently have no Internet plan or data connection (or only have one on a sporadic basis). Many do not even have a Wi-Fi connection at home. As such, they may have to share their parents' data allowance or go to the homes of friends or relatives in order to use their Wi-Fi network".[47] Roma children face huge structural barriers to digital inclusion. Namely, that families' "social position …. largely determines the digital capacities and skills of the individuals". This is because families have little recourse to use digital technology in everyday life, as they are often out of work".[48]
Diverse learners	A 2012 study across the EU found that people with disabilities made less use of the internet in all 27 Member States. Of the 17.5% who self-declared a disability, just over half (52.2%) used the internet, compared to nearly three-quarters of those without a disability (73.6%). One of the confounding factors is that disabled people are more likely to be early school leavers and more likely to be poor.[49] Research shows that those with special needs can struggle to access "conventional" digital tools, with research demonstrating that dyslexic pupils were "less likely to have good learning outcomes in a conventional online learning environment".[50] Further research which

[45] Reisdorf, B., & Rhinesmith, C. (2020). Digital Inclusion as a Core Component of Social Inclusion. Social Inclusion, 8(2), 132-137.
[46] Directorate-General for Education, Youth, Sport and Culture. (2019). The 2018 International Computer and Information Literacy Study (ICILS): Main findings and implications for education policies in Europe. Publications Office of the European Union: Luxembourg.
[47] Karrera, I., & Garmendia, M. (2019). ICT use and digital inclusion among Roma/Gitano adolescents. Media and Communication, 7(1), 22-31.
[48] Ibid.
[49] Scholz, F., Yalcin, B., & Priestley, M. (2017). Internet access for disabled people: Understanding socio-relational factors in Europe. Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 11(1).
[50] Cheng, S. C., & Lai, C. L. (2019). Facilitating learning for students with special needs: a review of technology-supported special education studies. Journal of Computers in Education, 1-23.

	looks at mobile phones' use to take pictures and link this with text, showed that learners with complex needs struggled, since the technology is not adaptable to meet their needs.[51]
Rural students	Research demonstrates that schools in rural locations face several obstacles to accessing digital tools. This includes "diseconomies of scale… [through] …. higher rural district fixed costs based on lower student enrolment". The evidence, therefore, suggests that rural schools are required to "do more with less".[52] Studies also point to those living in rural areas being less likely to diagnose Special Needs or disabilities, thus restricting access to assistive technologies for those that rely on diagnosis to access this resource [53].
Low-SES	Low-SES students "underperform in computer and information literacy and computational thinking".[54] Research also shows that those from low-SES backgrounds are less likely to purchase digital devices for educational purposes (such as e-readers or tablets), restricting access to digital tools for these groups and having an effect on the reading opportunities of disadvantaged young people.[55] This evidence is support by patterns of use reported in the *EU Kids Online* survey, which shows that disadvantaged pupils are less likely to use digital resources for educational purposes.[56]
High and low performing students	There is a disparity in the use of digital tools for both high and low performing students. On the one hand, "high achieving students are not only more likely to use technology for interest-driven activities such as researching topics or collaborating online to create new media but are also more likely to have adult guidance in its use. Lower-achieving students are more likely to use it for socially driven activities such as chatting or playing games with friends using social media, following pop-ups, or surfing through links of celebrities and sports figures".[57]

[51] Cheng, et. al.. *op. cit.*
[52] Sundeen, T. H., & Sundeen, D. M. (2013). Instructional technology for rural schools: Access and acquisition. Rural Special Education Quarterly, 32(2), 8-14.
[53] Hersh, M., & Mouroutsou, S. (2019). Learning technology and disability — Overcoming barriers to inclusion: Evidence from a multicountry study. British Journal of Educational Technology, 50(6), 3329-3344.
[54] Directorate-General for Education, Youth, Sport and Culture. (2019). The 2018 International Computer and Information Literacy Study (ICILS): Main findings and implications for education policies in Europe. Publications Office of the European Union: Luxembourg.
[55] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[56] Smahel D., Machackova H., Mascheroni G., Dedkova L., Staksrud E., Ólafsson K., Livingstone S., Hasebrink U. (2020). EU Kids Online 2020: Survey results from 19 countries. EU Kids Online.
[57] Biancarosa, op. cit.

2.3 Using technology for educational inclusion

Given the substantial economic and societal barriers outlined above, technology and education are not the only solutions to creating a truly fair and equitable education system. However, as demonstrated in this subsection, technology does provide novel solutions to many of the barriers that impede students from reaching their full potential. This includes breaking down many of the persistent structural barriers endemic to the traditional education system. For example:

- **Assistive technology** can support learners with diverse and/ or complex needs to access education;
- **E-learning, open education and MOOCs** can provide students that have poor access (due to geographical, physical or cultural obstacles) or no home learning opportunities with access to potentially high-quality provision;
- Technologies such as **Robotics and Artificial Intelligence** can provide hyper-personalised learning opportunities as well as providing more immersive forms of engagement;
- **Phone, computer and internet technology** can break down barriers between school and home, enabling teacher-led provision in the home, better support and resources for parents, and ultimately a more equitable home learning environment.

The evidence covered below also demonstrates that, if implemented effectively, technology can also improve student outcomes and give students more agency over their own learning. Technology can have an indirect effect on learners, particularly in supporting teachers with administration and more efficient planning and assessment.

As discussed below, the literature does, nonetheless, emphasise that technology also come with clear risks – including the potential to exclude learners who do not have access/ connectivity, to restrict student agency, and the potential to negatively impact upon teaching and learning. Technology, such as social media, can also mirror and reinforce offline trends in social exclusion in an online sphere [58]. This is particularly the case if technology is poorly designed or misused. This correlates with another theme discussed later in this chapter, related to the importance of using digital technology appropriately to realise its potential for inclusive education.

Assistive technology (AT)

While AT is often associated with learners with complex needs or disabilities, it encompasses' virtually "any device or system that helps maintain or improve a person's ability to do things in everyday life".[59] AT can range in sophistication from simple crutches and spectacles to highly specialised digital hardware and software to address specific learning needs or disabilities.[60]

[58] Timmis, S., Broadfoot, P., Sutherland, R., & Oldfield, A. (2016). Rethinking assessment in a digital age: Opportunities, challenges and risks. *British Educational Research Journal*, *42*(3), 454-476.
[59] Alzheimer's Society. (2019). Using technology to help with everyday life. Alzheimer's Society: London.
[60] Hamburg, I., & LÃtgen, G. (2019). Digital divide, digital inclusion and inclusive education. Advances in Social Sciences Research Journal, 6(4), 193-206.

AT is tailored to individual user needs and changes rapidly due to innovation. There have been several studies looking to list the different ways in which digital AT can support learners. These include: tools to help learners with cognitive difficulties or language barriers access the curriculum, such as text-to-speech and speech-to-text technology; tools to overcome physical impediments, such as hearing aids for students with hearing difficulties, and audio tools/ braille readers for those who struggle with their vision; and tools for those with mobility issues, such as micro-switches (e.g. personal and accessible equipment controls).[61] The literature also emphasises AT's use to facilitate day-to-day activities for those with severe needs, such as geo-spatial trackers and "wearables", to offer more freedom to those who need constant monitoring and support [62].

The literature documents many benefits relating to AT. For example, Svensson *et al*. shows how text-to-speech technology can support learners with access to reading. He found that "children with a reading disability using AT increased reading performance" as much as those whose teachers had received and implemented training in "traditional reading remediation" [63]. Other commentators similarly emphasise that AT can "bring about adaptions for children with learning difficulties" and, in turn, offer students a "sense of belonging and interactive participation", reducing teacher workload in the process by compensating for time-intensive one-to-one support.[64]

AT therefore serves a clear goal in bringing about inclusive learning environments for specific learning needs. Nevertheless, AT can have negative impacts for learners if implemented incorrectly. For instance, a study by Klingenberg *et al.* explored the replacement of braille for audio technology in maths. The study found evidence to suggest that, although there were some positive outcomes, the audio technology restricted young people's ability to read mathematical notation and interpret graphs and tables. There was also a decline in subject satisfaction as students did not have access to physical resources like their peers.[65]

Some commentators also argue that focusing on specific examples of AT and how these might support learners with specific needs overlooks the artificial barriers present in classrooms.[66] This is because there is a tendency to treat disabilities and cognitive impairments solely as *medical* needs that can be treated instead of *social* issues. Indeed, the classroom and environmental conditions create a biased environment that better accommodates some learners more than others. A complex set of factors affect the effectiveness of AT in the classroom.

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[61] Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using Assistive Technology in Teaching Children with Learning Disabilities in the 21st Century. Journal of Education and Practice, 6(24), 14-20; Akpan, J. P., & Beard, L. A. (2013). Overview of Assistive Technology Possibilities for Teachers to Enhance Academic Outcomes of All Students. *Universal Journal of Educational Research*, *1*(2), 113-118.

[62] Garshi, A., Jakobsen, M. W., Nyborg-Christensen, J., Ostnes, D., & Ovchinnikova, M. (2020). Smart Technology In The Classroom: A Systematic Review. Prospects For Algorithmic Accountability. Arxivlabs.

[63] Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., ... & Nilsson, S. (2019). Effects of assistive technology for students with reading and writing disabilities. Disability and Rehabilitation: Assistive Technology, 1-13.

[64] Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using Assistive Technology in Teaching Children with Learning Disabilities in the 21st Century. Journal of Education and Practice, 6(24), 14-20.

[65] Klingenberg, O. G., Holkesvik, A. H., & Augestad, L. B. (2020). Digital learning in mathematics for students with severe visual impairment: A systematic review. British Journal of Visual Impairment, 38(1), 38-57.

[66] Cinquin, P. A., Guitton, P., & Sauzéon, H. (2019). Online e-learning and cognitive disabilities: A systematic review. Computers & Education, 130, 152-167.

Distance Learning and Open Education Resources

Kelland defines "distance learning, and more specifically, online learning as "… learning that can be accessed from anywhere, at any time, by anyone" [67]. Distance learning encompasses both teacher-led online courses and those with pre-populated content (e.g. PowerPoint, videos, quizzes etc.). Distance learning can also be combined with face-to-face tuition to provide the learner with "blended learning" provision. An example of blended learning is the flipped classroom model, as discussed in box 2 below.[68] Distance learning further encompasses Massive Open Online Courses (MOOCs). These are organised and run by professions as well as community groups, sharing two principles in common: (1) they are large scale (e.g. emphasising the massive), and (2) they are (predominantly) free and accessible to a large number of people (emphasising the 'open').[69]

Alongside Open Education Resources (OER) and Open Educational Practices (OEP), which are free online repositories of learning or pedagogical material, distance learning and MOOCs are a critical component in "opening up education"[70] Distance learning and OER/ OEP have the potential to allow learners without recourse to face-to-face education (e.g. due to physical, geographical or cultural barriers) to access high-quality provision. They are a way of "democratising" education, enabling more freedom of choice and more significant opportunities for students to shape their learning community.[71] Crucially, they are also an essential medium in providing second chance and lifelong learning opportunities. OER/ OEP can also create professional networks leading to collaboration and collective ownership of teaching resources, as well as opportunities for student peer learning and self-assessment.[72]

[67] Kelland, J. H. (2005). Distance learning: Access and inclusion issues.
[68] Låg, T., & Sæle, R. G. (2019). Does the flipped classroom improve student learning and satisfaction? A systematic review and meta-analysis. AERA open, 5(3)
[69] Balula, A. (2015). The promotion of digital inclusion through MOOC design and use: a literature review. Indagatio Didactica, 7(1), 145-164; Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18. Computers & Education, 145, 103693.
[70] Koseoglu, S., & Bozkurt, A. (2018). An exploratory literature review on open educational practices. *Distance education*, *39*(4), 441-461.
[71] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[72] Koseoglu, S., & Bozkurt, A. (2018). An exploratory literature review on open educational practices. *Distance education*, *39*(4), 441-461.

Box 2 'Flipped Classroom'

One blended learning approach is the **"flipped classroom" model**. This is where "most of the teacher-centred instruction [is moved] out of the classroom to free up time in the classroom for more student-centred learning activities". This may include, for instance, students carrying out independent learning through watching online videos or lectures, before engaging in discussion and analysis of the activity in the classroom.

Those that support the concept of the flipped classroom outline that it can: give students more autonomy; free up class time for activities rather than instruction; allow for more personalised and differentiated learning; and foster a sense of learner responsibility. Flipped learning also puts the spotlight on the learning process (i.e. the problem solving and cognition activities) which has been shown to be beneficial to learning. A meta-analysis of 272 studies found that there was a mean difference of 0.35 (at a 0.5% confidence level) in favour of student outcomes using the flipped classroom model, and a small increase in "student satisfaction" as a result of the flipped classroom model. However, the authors admitted small-study bias and noted significant difference between the studies analysed; suggesting a lack of understanding as to why some flipped classroom models work whereas others do not.

While distance learning opportunities can be inclusive, this does depend on their design and how they are targeted and delivered. Despite emphasising the 'open', MOOCs in particular have been criticised for being predominantly aimed at English speakers and favour those from more advantaged backgrounds with the cultural and physical resources to access courses:

> *Online education and MOOCs were seen originally as a way of opening up and democratising education, but current evidence shows that not all individuals benefit on equal footing. In their current form, MOOCs reach people with more qualifications and higher levels of organisational, self-regulation and digital skills. In order to make MOOCs more inclusive and truly useful tools for acquiring and updating the skills needed in the labour market, the offer needs to be more diverse in terms of content and language and include quality instructional designs and pedagogies.*[73]

Another barrier to inclusivity for distance learning is that students can often become disengaged from the learning process when they lack "feelings of being in control" and a "sense of belonging" to the learning communities.[74] This is a common issue for distance learning, but large-scale or non-teacher led courses lack the same type of rich social interaction that accompanies face-to-face opportunities. The literature also notes

[73] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[74] Nortvig, A. M., Petersen, A. K., & Balle, S. H. (2018). A Literature Review of the Factors Influencing E-Learning and Blended Learning in Relation to Learning Outcome, Student Satisfaction and Engagement. *Electronic Journal of E-learning*, *16*(1), pp46-55.

that the economic or academic value (e.g. credit for tertiary education) is also less than that achieved through traditional education.[75]

Encouragingly, the literature does note examples of inclusive distance learning. For instance, Lambert *et al.* carried out a meta-synthesis which identified at least 46 empirical studies of MOOCs looking to improve equity and social inclusion. This included MOOCs aimed at those with low skills and confidence, those without English language skills, learners with disabilities, and vulnerable populations. For those studies identified in the review, 87.5% "entirely or largely met their aims to enable either student equity and/or social inclusion".[76]

The literature emphasises that, where distance learning opportunities were more successful in being inclusive, students received additional support (either online, via telephone, or through teachers).[77] Commentators also emphasise tutors' role in "scaffolding" learning, making sure that students are engaged by continuously monitoring the quantity of work.[78] Balula emphasised that a genuinely inclusive open learning environment was opened up "to global audiences and potential learners through the development of inclusion/inclusive skills … by providing different options for learning activities, for learning resources, and for media/technologies to be used".[79]

Artificial Intelligence (AI)

Artificial intelligence is "that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment" [80]. AI is an emerging field in education studies, both in the EU and internationally. However, several studies have highlighted the benefits of AI for inclusion – predominantly in terms of the added benefits associated with differentiated and "hyper-personalised" learning:[81]

- **Supporting teachers**. By identifying patterns, AI can support teachers in classroom management, assessment, and teaching. For instance, teachers may assess a sample of assignments, which the computer then models to mark other assignments using the same principles. Similar patterns of learning and reproducing human behaviour enable AI to: recommend online content; generate autonomic scores/ test papers; support with moderating student forums; detect poor behaviour or emotional distress; and detect cheating or plagiarism.[82]

[75] Souto-Otero, M., Inamorato dos Santos, A., Shields, R., Lažetić, P., Castaño-Muñoz, J., Devaux, A., Oberheidt, S., Punie, Y. (2016). OpenCases: Case Studies on Openness in Education. Institute for Prospective Technological Studies, Joint Research Centre.
[76] Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18. Computers & Education, 145, 103693.
[77] Ibid.
[78] Nortvig, et. al., *op. cit.*
[79] Balula, A. (2015). The promotion of digital inclusion through MOOC design and use: a literature review. Indagatio Didactica, 7(1), 145-164.
[80] Nilsson, N. (2010). *The Quest for Artificial Intelligence: A History of Ideas and Achievements. Cambridge: United Kingdom.*
[81] Holmes, W., Anastopoulou, A., Schaumburg, H., and Mavrikis, M. (2018). Technology-Enhanced Personalised Learning: Untangling the Evidence. Stuttgart: Robert Bosch Stiftung.
[82] Tuomi, I. (2020) Research for CULT Committee - The use of Artificial Intelligence (AI) in education. CULT Committee: European Parliament.

- **Teaching and supporting students**. AI can be used to teach students through "intelligent tutoring" and "dialogue based tutoring systems". As outlined by Wayne *et al.* this involved guiding "students through each step of a problem solution by creating hints and feedback as needed from expert-knowledge databases". This includes "automatic generation of questions". AI can also differentiate between learner abilities by basing content on an algorithmic understanding of student capability built up over time. AI can, amongst other things, also offer students virtual "collaborative learning" and "learning companion" opportunities, support "self-reflection", and mimic a virtual teacher through chat-bot technology.[83]
- **Supporting schools and the education system**. The literature shows how AI can support schools by recognising complex needs, collecting and automatically analysing data trends, and acting as a "learning research tool". Research has also explored the potential of "synthetic teachers" which attempt to replicate intuitive teaching through mimicking other teachers and machine learning.[84]

Similar to the above, criticism can also be levelled against the use of AI in education. Tuomi notes that because AT learns from "historical data" and past human input, it can perpetuate bias and promote previously constructed ideas of success. This can ultimately stifle agency which "requires capability to make authentic choices", with AI having "great difficulties in dealing with people who are creative, innovative, and not only average representations of vast collections of historical examples". There is also a risk that AI might be "used to scale up bad pedagogical practices". As such, Tuomi emphasises that while "AI … has the potential to have a broad impact in society, economy, and education … it needs to be treated with care".[85]

Robotics

Robotics, like AI, are another form of new technology with the potential for inclusive practices. In particular, the use of robotics for "telepresence" has "been described as one of the most promising prospects for connecting students with significant illness or injury with school".[86]

This technology involves a mobile robotic device taking the place of a student in the classroom which is controlled by the learner remotely through a rotational camera, microphone and (in some cases) wheels for movement. As opposed to distance learning or video conference technology, this provides a more immersive learning environment and enables students to socialise and interact better with their peers. This is because the robot provides a medium by which the learner can interact more freely, and peers can refer to the robot by the learner's name as if they were in the room. Empirical research examining the use of telepresence robotics for young people with severe illnesses found that this type of interaction reduces loneliness, increases outcomes, and improves student wellbeing. The literature emphasises the importance of teacher

[83] Holmes, W., Anastopoulou, A., Schaumburg, H., and Mavrikis, M. (2018). Technology-Enhanced Personalised Learning: Untangling the Evidence. Stuttgart: Robert Bosch Stiftung.
[84] Tuomi, *op. cit.*
[85] Ibid.
[86] No Isolation (2020). Impact of AV1 on children with long-term illness and school absence.

training, and consideration of where the robot is placed, for telepresence robotics to be effective.[87]

Virtual Augmented Reality (VAR)

VAR can be defined as follows:

> *A 3D environment in which a person can become immersed, using a dedicated headset, powered by a computer, game console or smartphone. The VR experience can be enhanced thanks to 3D audio sounds and by using haptic devices that use sensors to transfer body movement into the virtual space. Augmented Reality (AR) refers to a real-world environment enhanced with computer-generated information such as sound, video or graphics.*[88]

VR technology can offer immersive experiences for young people, including virtual field trips and engagement in cultural events.[89] The most common AR uses markers (e.g. GPS) to pinpoint a location and superimpose a 3D image onto a map. Mobile phones (e.g. apps) are used 68% of the time and superimpose images or videos through a person's camera and GPS location. Other types of AR include "devices/ screens mounted on the head" used predominantly for those with hearing, vision or autism needs and glasses for those with hearing difficulties.[90] Less expensive use of VAR may also provide students with the opportunity to practice and/or demonstrate problem-solving competences.

Most studies that explore VAR focus on primary schools and those with disabilities – with relative gaps in the knowledge of other marginalised pupil groups and other year groups. Emerging evidence suggests that VAR can have practical uses, enabling students to perform hands-on tasks that are challenging to perform in real life without training (e.g. flight, surgery, architecture etc.).[91] VAR may also allow for the assessment of complex skills that cannot be as effectively measured through traditional testing approaches (e.g. paper or computer based).[92] The literature also emphasises that VAR can create a more engaging learning experience, offering students a sense of "immersion, navigation, and manipulation". The research further shows how VAR can

[87] Weibel, M., Nielsen, M. K. F., Topperzer, M. K., Hammer, N. M., Møller, S. W., Schmiegelow, K., & Bækgaard Larsen, H. (2020). Back to school with telepresence robot technology: A qualitative pilot study about how telepresence robots help school-aged children and adolescents with cancer to remain socially and academically connected with their school classes during treatment. *Nursing Open*, *7*(4), 988-997; No Isolation (2020). Impact of AV1 on children with long-term illness and school absence.

[88] Bezegová, E., Ledgard, M., Molemaker, R., Oberc, B., & Vigkos, A. (2016). Virtual Reality and its Potential for Europe. European Commission: Brussels.

[89] Ibid.

[90] Quintero, J., Baldiris Navarro, S. M., Rubira, R., Cerón, J., & Velez, G. (2019). Augmented Reality in Educational Inclusion. A Systematic Review on the Last Decade. Frontiers in psychology, 10, 1835.

[91] Garshi, A., Jakobsen, M. W., Nyborg-Christensen, J., Ostnes, D., & Ovchinnikova, M. (2020). Smart Technology In The Classroom: A Systematic Review. Prospects For Algorithmic Accountability. Arxivlabs.

[92] O'Leary, M., Scully, D., Karakolidis, A., & Pitsia, V. (2018). The state-of-the-art in digital technology-based assessment. *European Journal of Education*, *53*(2), 160-175.

positively impact students with vision, hearing and autism.[93] Other studies found that VAR could support autistic students in interpreting and recognising emotions.[94]

Interactive Whiteboards (IWB)

Interactive whiteboards (IWB) are commonplace in modern-day classrooms. Results from the European Commission's latest survey of ICT show that, across the EU, there were 56 students per IWB in ISCED 1, 109 per IWB in ISCED 2, and 166 per IWB in ISCED 3 in 2012/13.[95] IWBs enable the teacher to mirror their laptop/ desktop and interact with the screen using digital pens and touch-screen technology. IWBs contain "facilities to save and reuse material, drag and drop, present in sharp colours, movement and animation, get immediate feedback, [and] to manipulate and annotate image".[96]

Kyriakou and Higgins found that while the interactive whiteboard functionality enables teachers to do a lot with the hardware, few teachers use it effectively to "improve teaching and learning". This is because "teaching processes mirror patterns of previously applied teaching methods. The research instead found effective teaching using IWB linked to dialogic practices (*e.g.* interactive student-teacher communication). Kyriakou and Higgins noted that IWBs were not necessary for dialogic practices, but if integrated with traditional teaching methods, they could help facilitate better discussion and connectivity in the classroom.[97]

Computers, tablets and smartphones

While many of the examples included above require access to expensive devices, some of them (such as distance learning) simply require access to smartphones, tablets, desktops and laptops.[98] These devices are also widely available both in the home and in schools. "Bring your own device" initiatives, if devices are provided for those students who do not have home access, are an effective way to supplement school resources.[99]

Beyond those already mentioned, these tools offer simple solutions to meet pupils' needs, including expanding the size of text on a screen, using widely available "text-to-speech" features, and using the internet for team working exercises.[100] Mobile applications can also support "anytime, anywhere" learning. The use of digital games

[93] Passig, D. (2011). The impact of immersive virtual reality on educators' awareness of the cognitive experiences of pupils with dyslexia. Teachers College Record, 113(1), 181-204.
[94] Quintero, J., Baldiris Navarro, S. M., Rubira, R., Cerón, J., & Velez, G. (2019). Augmented Reality in Educational Inclusion. A Systematic Review on the Last Decade. Frontiers in psychology, 10, 1835.
[95] Deloitte & Ipsos MORI. (2019). 2nd Survey of Schools: ICT in Education - Objective 1 & 2. Publications Office of the European Union: Luxembourg.
[96] Kyriakou, A., & Higgins, S. (2016). Systematic review of the studies examining the impact of the interactive whiteboard on teaching and learning: What we do learn and what we do not. Preschool and primary education, 4(2), 254-275.
[97] Ibid.
[98] National Foundation For Educational Research (NFER). (2009). Using digital technologies to promote inclusive practices in education. FutureLab; Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[99] Bruder, P. (2014). Gadgets go to school: The benefits and risks of BYOD (bring your own device). *The Education Digest*, *80*(3), 15.
[100] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.

through smartphones or computers offers learners the ability to apply prior knowledge or learn new skills in a more engaging virtual environment.[101]

Research looking at the effect of computers and smartphones on reading performance shows that this technology can help support learning across the phases.[102] For those in ISCED 0 to 1, computer technology has shown improvements to student "phonological awareness, word reading skills, and vocabulary knowledge". For those in ISCED 2, "individualised e-reading… opportunities" enhance students' knowledge. Finally, programmes and projects aimed at ISCED 3 show marked improvements for students in "speech-recognition". For those from low-SES households and migrant backgrounds, e-learner technology can close "both procedural and conceptual skill gaps in literacy". This technology also offers "self-paced tutorials" that leads to "gains in self-questioning, error detection, inference, summarisation, and concept-mapping skills and strategies to enhance readers' use of reading strategies and comprehension texts".

Computer and mobile tools can also allow teachers to supplement and expand learning through online repositories. This enables more differentiated learning by providing students with different material depending on their particular ability level. Online tools allow students to engage with "authentic source material" such as primary historical sources scanned and saved online.[103] Web 2.0 offers pupils access to resources and information beyond their local sphere of knowledge and provides a platform for young people to be content creators and consumers.[104] Video conferencing also provides young people with opportunities to engage with content and experts outside of the classroom setting, further increasing their exposure to different opportunities.[105]

Computer and mobile technology also enable more convenient communication with parents and carers, including keeping them updated and engaged in learning. Evidence suggests that regular communication between schools/teachers and parents can lead to improved relationships and better outcomes for pupils. Schools still need to follow good practice in terms of "whole-school approaches" to parental engagement, provide precise and targeted information, and have well-trained staff who can communicate with a diverse range of parents.[106] If organised well, technology can effectively enhance relationships, but it can also make them worse. This is because electronic communications "appear to reflect and reinforce – rather than reconfigure – existing patterns of school/parent engagement".[107]

Finally, sophisticated computerised learning management and feedback systems also allow for improved monitoring of school strategies to support inclusive learning

[101] Bhagat, K. K. and Spector, J. M. (2017). Formative Assessment in Complex Problem-Solving Domains: The Emerging Role of Assessment Technologies. Educational Technology & Society, Vol 20, No. 4, 312–317.
Groff, J.S. (2018). The potentials of game-based environments for integrated, immersive learning data. European Journal of Education, Vol 53, No. 2, 108 – 201
[102] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[103] Ibid.
[104] Luckin, R., Logan, K., Clark, W., Graber, R., Oliver, M., & Mee, A. (2008). Learners' use of Web 2.0 technologies in and out of school in Key Stages 3 and 4.
[105] National Foundation For Educational Research (NFER). (2009). Using digital technologies to promote inclusive practices in education. FutureLab.
[106] Goodall, J., & Vorhaus, J. (2011). Review of best practice in parental engagement.
[107] Selwyn, N., Banaji, S., Hadjithoma-Garstka, C., & Clark, W. (2011). Providing a platform for parents? Exploring the nature of parental engagement with school learning platforms. *Journal of computer assisted learning*, *27*(4), 314-323.

environments and individual student progress and attainment [108]. Computer and smartphone technology has also facilitated "clear, immediate, and individual collective feedback that mimics teachers but on a scale that individual teachers cannot hope to replicate".[109]

2.4 Approaches to incorporating technology into inclusive learning practices

The above discussion provides an overview of how the literature can support effective teaching and learning and inclusive practices, particularly for marginalised communities. The literature emphasises technology's potential to remove structural barriers – providing higher quality and more frequent learning opportunities regardless of issues of physical, cognitive or cultural access. This, in turn, provides learners with more agency to shape their learning pathways and manage their own learning if used effectively (e.g. to promote participatory rather than algorithm-based learning, for example). ICT and technology have also provided more sophisticated routes to communication and collaboration. For example, the European Internet Foundation predicts that, by 2025, education will revolve around "participative, digitally-enabled collaboration within and beyond the individual educational institution".[110]

While the literature above offers numerous examples of how technology can *potentially* benefit all learners, including those from marginalised backgrounds, empirical research shows that technology can negatively affect outcomes. Commentators note that it is difficult to attribute cause and effect to technology due to the range of different methodologies and applications across different contexts, making meta-analysis challenging to carry out.[111] Livingstone, for instance, points to "ad hoc patterns of significant and insignificant findings which defy researchers' ability to explain" the utility of digital tools in the classroom. Part of the problem is branding both hardware and software under the broad "umbrella of ICT" which makes it difficult to pin down the efficacy of technology in the classroom.[112]

Despite contradictory evidence on the effectiveness of technology, there is a broad consensus in the literature that the application of digital tools is more important than the digital tools themselves:

> *The range of impact identified [across a large meta-synthesis] suggests that it is not whether technology is used (or not) which makes the difference, but how well the technology is used to support teaching and learning. There is no doubt that technology engages and motivates young people. However, this benefit is only an advantage for learning if the activity is effectively aligned with what is to*

[108] Rubin, B., Fernandes, R., Avgerinou, M. D., & Moore, J. (2010). The effect of learning management systems on student and faculty outcomes. *The internet and higher education*, *13*(1-2), 82-83.
[109] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[110] Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., ... & Hoogveld, B. (2011). The future of learning: Preparing for change. Joint Research Centre, EUR 24960 EN.
[111] Higgins, S., Xiao, Z., & Katsipataki, M. (2012). The impact of digital technology on learning: A summary for the education endowment foundation. Durham, UK: Education Endowment Foundation and Durham University
[112] Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. Oxford review of education, 38(1), 9-24.

be learned. It is therefore the pedagogy of the application of technology in the classroom which is important: the how rather than the what [113].

Using technology is, therefore, not a pre-requisite to positive outcomes. As outlined by the European Commission, "the effectiveness of digital technologies for teaching and learning hinges on teacher practice and on how they integrate these tools into their teaching process".[114]

In general, the literature emphasises that less is often more when integrating technology into the classroom. According to the OECD, schools that 'over-use' ICT (more than the OECD average) were more likely to negatively impact student outcomes.[115] In contrast, limited use of ICT may have a positive impact if used effectively. Furthermore, the OECD also found that, when used effectively, moderate-intensity ICT users were more likely to experience positive outcomes than low and high-intensity users.[116] Research has also found that ICT should facilitate and complement rather than replace other teaching methods and classroom practices [117]. Meta-synthesis evidence from a range of studies shows that focused, remedial, and targeted ICT use is a sustainable and positive approach.[118]

Barriers and enablers to effective integration of ICT for inclusive education

The above discussion has demonstrated that, while technology can positively impact student outcomes, this depends on its use. Research also shows that using ICT in schools for teaching and learning has limits at a practical level. Teachers often prefer to use ICT for "logistical" rather than "intellectual" benefits.[119] A 2012 survey of 868 English teachers found that the most common uses for ICT were preparing lessons using computers, presenting information (e.g. through interactive whiteboards), managing student data, and working with other teachers in the school.[120] Since publication, there have been a number of significant developments across the EU (e.g. DigiComp tool for example) yet more recent findings shows that ICT is still underutilised across EU classrooms. Teachers serving more impoverished communities are also less likely to use technology for instruction than those serving wealthier communities.[121]

The literature demonstrates that certain conditions need to be met in order for practitioners to use technology to facilitate inclusive practices. Above all, teachers need a solid understanding of what an equitable and equal teaching environment looks like before they can then understand how digital tools can best facilitate this. Table 3-2 provides a brief introduction to some of the considerations schools and teachers need to make for education to be inclusive.

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[113] Låg, T., & Sæle, R. G. (2019). Does the flipped classroom improve student learning and satisfaction? A systematic review and meta-analysis. AERA open, 5(3), 2332858419870489.
[114] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[115] OECD. (2015). Students, Computers and Learning: Making the Connection. In PISA. OECD Publishing, Paris.
[116] Ibid.
[117] European Agency for Special Needs and Inclusive Education. (2016). Raising the Achievement of All Learners in Inclusive Education – Literature Review. European Commission: Brussels.
[118] Higgins, S., Xiao, Z., & Katsipataki, M. (2012). The impact of digital technology on learning: A summary for the education endowment foundation. Durham, UK: Education Endowment Foundation and Durham University
[119] Perrotta, C. (2013). Do school-level factors influence the educational benefits of digital technology? A critical analysis of teachers' perceptions. British Journal of Educational Technology, 44(2), 314-327.
[120] Ibid.
[121] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.

Table 2—2 Framework for inclusive education in schools

Access to education	Quality of T&L	Equity
Provide additional support for groups of students at risk of marginalisation, failure and early school leaving.	Develop appropriate and relevant curricula.	Make provision as flexible as possible to accommodate all learners.
Bringing classrooms closer to children" by ensuring access to digital devices to support remote learning, and school-based learning.	Target funding to initiatives and programmes that support inclusive education.	Ensure that those living in poverty, or in remote areas, are given the same educational choices as those in more affluent areas and have access to schools and to digital learning.
Empower young people to take ownership of their learning, and to participate in decisions that affect them.	Ensure that teaching, learning, and assessment are adapted so that those who do not speak the native language can still learn.	Ensure young people's education is not adversely affected by things outside of their control (*e.g.* lack of parental support, lack of access to devices).
Ensure that there are inclusive approaches to both the curriculum and pedagogy.	Ensure that teachers are equipped with the appropriate competences to support student-centred learning and to address a broad range of student needs.	-

Source: adapted from Singh, V. (2010)[122].

Looking at the use of digital tools to meet these inclusion needs; the literature emphasises the importance of infrastructure and support mechanisms. This includes national frameworks "supporting economic growth", "promoting social development", "advancing educational reform", and "supporting educational management" which in turn creates the conditions which enable incorporation of technologies into inclusive classrooms. Schools need to have a "minimum acceptable infrastructure" and have "content [which is] appropriate for the local context".[123] The literature also states that

[122] Global Campaign for Education. Equity and Inclusion for All in Education. London: Education UK; Singh, V. (2010). Making the links: Equity pedagogy, pre-service teacher dispositions and technology for inclusion. Literacy Information and Computer Education Journal (LICEJ), 1(3), 204-10.
[123] Voogt, J., Knezek, G., Cox, M., Knezek, D., & ten Brummelhuis, A. (2013). Under which conditions does ICT have a positive effect on teaching and learning? A call to action. Journal of computer assisted learning, 29(1), 4-14.

technology needs to be easily accessible and useable and provide a "timely, skilled response" to challenges schools might face.[124]

Despite this, evidence from the latest European Commission survey of ICT in schools found that equipping classrooms can be expensive. The "average cost per student per year to equip and connect an average EU classroom with advanced components of the Highly Equipped Connected Classroom model is in the range of 224-536 EUR. This cost range includes costs for digital technology equipment, network requirements, professional development of teachers, and access to content".[125]

While infrastructure is essential, the literature suggests that other factors matter more. Even in cases where schools have excellent access to technology, it is not very meaningful unless teachers integrate it effectively in their inclusive practices. For example, analysis of mobile learning across six countries (5 of which are Member States) provided "strong evidence that teachers are worried about mobile phone leading to distractions that disturb classroom work". This subsequently led to missed opportunities for mobile technology to be used in the classroom.[126] The European Commission subsequently acknowledged that incorporating ICT into schools is complex. Accordingly, the staff working document for the DEAP states that effective integration of ICT:

> *Requires robust digital capacity, including planning for organisational change, ongoing monitoring and adaptation, and a strong focus on learning-driven pedagogy. As confirmed by the results of the public consultation, other relevant factors include leadership, professional development, and a shared understanding and approach to using technology to support and enhance teaching and learning.*[127]

Other studies also emphasise that software, training, collaboration, teacher self-efficacy and teaching practices are more prominent determinants of ICT use than infrastructural considerations.[128]

Exploring these factors in more detail, early research found that "although technology infrastructure is important, technology leadership is even more necessary for effective utilisation of technology in schooling".[129] Several researchers emphasise the importance of ICT specialist leaders and leadership models that "support teachers in transforming policies into realistic goals while teachers can put these goals into action in the everyday teaching practice".[130] Data from a survey of 683 teachers in the UK found that "teachers who perceived their school leadership to be supportive of innovative practice were also

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[124] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[125] Deloitte & Ipsos MORI. (2019). 2nd Survey of Schools: ICT in Education - Objective 1 & 2. Publications Office of the European Union: Luxembourg.
[126] Monteiro, A., Bento, M., Lencastre, J. A., Pereira, M., Ramos, A., Osório, A. J. & Silva, B. (2017). Challenges of mobile learning – a comparative study on use of mobile devices in six European schools: Italy, Greece, Poland, Portugal, Romania and Turkey. Revista de Estudios e Investigación en Psicología y Educación, Vol. Extr. (13), 352-357.
[127] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[128] Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. Computers in Human Behavior, *68*, 441-449.
[129] Anderson, R. E. & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. Educational Administration Quarterly, vol. 41, no. 1, pp. 49-82.
[130] Pettersson, F. (2018). On the issues of digital competence in educational contexts–a review of literature. Education and information technologies, 23(3), 1005-1021.

more inclined to report benefits".[131] Researchers also outline that collaborative leadership models are more conducive to the effective integration of ICT, emphasising the importance of enabling staff to take the lead in developing and implementing ideas and actions.[132] Summarising factors which enable the effective use of ICT amongst teachers, Pettersson emphasises that: (1) goals for learning should be present within policy documentation at all political levels, which lead to tangible goals for individual schools; (2) infrastructures should be in place to support staff CPD for technology; (3) school leaders should help staff create individual goals, and address needs as they emerge; (4) "digital competent leadership" should be embedded across school, not just in one person; (5) there should be a sense of individual responsibility for digital CPD; and (6) initial teacher training should deliver digital instruction for new teachers.[133]

Attitudes and beliefs are also important indicators of the effective use of technology for inclusive practices[134]. Linked to models of collaborative leadership, researchers emphasise that "intrinsic motivation" works better than "compliance" when it comes to integrating ICT into teaching and learning.[135] The literature emphasises that changing attitudes and beliefs involves: clear communication about the importance of introducing digital technology; changing institutional ethos toward the use of digital technology, including making sure that being "inclusive" is given a high enough priority in school; enabling time and space for the use of digital technology; giving all students a voice in their learning; and a commitment to training for ICT and inclusive education.[136]

Finally, teachers need to be competent and confident in the use of ICT.[137] Research shows that teachers are less likely to use ICT if they have "limited ICT knowledge".[138] The literature emphasises that teacher training and guidance is vital for developing competences and assisting teachers in using ICT effectively and making classrooms inclusive.[139] Some commentators emphasise that teachers need at least a full-day training or ongoing CPD to effectively integrate technology into the classroom, whereas others emphasise the importance of "independent learning".[140]

One perceived barrier to the effective use of ICT of particular significance is time and teacher workload. As Sabaliauskas and Pukelis outline, "shortage of time is the major and crucial barrier to change in the school culture and integrating ICT into the school and teaching/learning process" [141]. Various studies from the USA have shown that if

[131] Perrotta, C. (2013). Do school-level factors influence the educational benefits of digital technology? A critical analysis of teachers' perceptions. British Journal of Educational Technology, 44(2), 314-327.
[132] Kelly, D. P. (2015). Overcoming barriers to classroom technology integration. Educational Technology, 40-43.
[133] Pettersson, F. (2018). On the issues of digital competence in educational contexts–a review of literature. Education and information technologies, 23(3), 1005-1021.
[134] Voogt, J., Knezek, G., Cox, M., Knezek, D., & ten Brummelhuis, A. (2013). Under which conditions does ICT have a positive effect on teaching and learning? A call to action. Journal of computer assisted learning, 29(1), 4-14.
[135] https://www.jstor.org/stable/pdf/44430356.pdf?refreqid=excelsior%3A13030ea645445995ce2479fcf1f138ec
[136] National Foundation For Educational Research (NFER). (2009). Using digital technologies to promote inclusive practices in education. FutureLab [available at] https://www.nfer.ac.uk/publications/FUTL05/FUTL05.pdf.
[137] European Agency for Special Needs and Inclusive Education. (2015). Empowering Teachers to Promote Inclusive Education. Literature Review. European Commission: Brussels.
[138] Balanskat, A., Blamire, R., & Kefala, S. (2007). The ICT impact report: A review of studies of ICT impact on schools in Europe. European SchoolsNet.
[139] Rodrigues, M. (2018). Can digital technologies help reduce the immigrant-native educational achievement gap? Joint Research Centre, No. JRC109246.
[140] Higgins, S., Xiao, Z., & Katsipataki, M. (2012). The impact of digital technology on learning: A summary for the education endowment foundation. Durham, UK: Education Endowment Foundation and Durham University
[141] Sabaliauskas, T., & Pukelis, K. (2004). Barriers to integration of information and communication technologies into the teaching and learning process. In *ECER 2004: Paper presented at the European conference on education research [Elektroninis išteklius]: University of Crete, 22-25 September 2004. Greece: University of Crete, 2005*.

teachers do not have the time and resources to support the use of ICT, the integration will not be sufficient.[142] However, the relationship between ICT and workload is controversial and may, again, revert to attitudes. This is because some teachers believe that ICT reduces the workload and increases classroom productivity.[143]

On this point, a survey of teachers found 86.9% reported "significant benefits" from integrating ICT into their practice: "the most prevalent benefit identified by teachers related to digital technology giving access to a wider range of learning content and resources".[144] Others, such as Costley, note a wider variety of benefits:

> *Technology integration [into the curriculum] has the following benefits: 1) increased student motivation; 2) increased student engagement; 3) increased student collaboration; 4, increased hands-on learning opportunities; 5) opportunities for learning at all levels; 6) increased confidence in students, and 6) increased technology skills.* [145]

Research shows that teachers in more deprived areas are more likely to "see more benefits of digital technology use compared with teachers from schools that were better performing and serving less deprived communities".[146]

2.5 Digital competences

So far, this chapter has discussed the use of digital tools for improving teaching and learning. However, one of the key criticisms of the literature on digital tools for education is the overemphasis on measured educational outcomes (i.e. formal assessment) as the only benefit of ICT. As Livingstone and others state, "the alternative proposition is that digital technologies can support a more flexible, learner-centred notion of education that facilitates the soft skills vital for the new demands of the twenty-first-century global service and information economy" [147]. There is a wealth of literature exploring the importance of teaching young people digital skills and competences and providing them with the tools they need for online citizenship and staying safe in the digital world.

The literature emphasises a range of different skills that need to be incorporated into the curriculum to support students in using digital technology, including basic "operational, navigation, social and creative skills" which all impact a user's ability to use digital tools effectively.[148] More advanced use of ICT also included "computational thinking and related concepts (e.g. coding, programming, algorithmic thinking)" which improve creativity and critical thinking skills and "together with digital literacy, can equip

[142] Biancarosa, G. and Griffiths, G. (2012). Technology tools to support reading in the digital age. The Future of Children, 22(2), 139-160.
[143] Balanskat, A., Blamire, R., & Kefala, S. (2007). The ICT impact report: A review of studies of ICT impact on schools in Europe. European SchoolsNet.
[144] Perrotta, C. (2013). Do school-level factors influence the educational benefits of digital technology? A critical analysis of teachers' perceptions. British Journal of Educational Technology, 44(2), 314-327.
[145] Costley, K. C. (2014). The Positive Effects of Technology on Teaching and Student Learning. Online Submission.
[146] Perrotta, C. (2013). Do school-level factors influence the educational benefits of digital technology? A critical analysis of teachers' perceptions. British Journal of Educational Technology, 44(2), 314-327.
[147] Vuorikari, R., Punie, Y., Cabrera, M., (2020). Emerging technologies and the teaching profession: Ethical and pedagogical considerations based on near-future scenarios. Publications Office of the European Union, Luxembourg; Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. Oxford review of education, 38(1), 9-24.
[148] Hooft Graafland, J. (2018). New technologies and 21st century children: Recent trends and outcomes . In OECD Education Working Papers. OECD Publishing, Paris.

students with the complementary skills to become active, critical and creative users of digital technologies".[149]

There is a wide body of evidence that shows that, while access and use of digital tools is essential, the primary precursor to strong ICT skills is a solid basis in maths and reading.[150] An OECD study found that students in Korea and Singapore had far superior web navigation skills than their counterparts in other countries. This was not because Korea and Singapore students had more exposure to the internet in school but, instead, was related to their maths and reading competences. This led the OECD to conclude that "to reduce inequalities in the ability to benefit from digital tools, countries need to improve equity in education first. Ensuring that every child attains a baseline level of proficiency in reading and mathematics will do more to create equal opportunities in a digital world than can be achieved by expanding or subsidising access to high-tech devices and services".[151]

This variance largely explains the skills gap between those from migrant and non-migrant backgrounds. Looking across 15 EU countries, Costa and Araújo found that children from a migrant background, who are behind their peers in digital skills, caught up once issues of reading comprehension were resolved.[152] However, the literature also emphasises that those with the digital competences and skills to navigate online improve their reading comprehension, while those *without* these skills need to improve their reading comprehension to gain online skills.[153]

Those from low-SES backgrounds continue to have issues regardless of whether reading issues are solved are not. This suggests that other variables also make a difference [154]. In addition to structural issues (such as access in the home), OECD evidence shows that while disadvantaged students may spend slightly more time online than their counterparts, they are less likely to engage in activities such as sending emails, reading the news or obtaining information. Only 84% of disadvantaged students saw the internet as a "good resource to obtain information" compared to 93% of advantaged students [155]. This is linked to young people's ability to critically access the credibility of different sources of information online, which is particularly key given the amount of misinformation and fake news available through the internet.[156]

Beyond digital competence and confidence, Passey *et al.* outline that digital accountability is the third main components needed to ensure students have "digital

[149] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[150] Passey, D., Shonfeld, M., Appleby, L., Judge, M., Saito, T., & Smits, A. (2018). Digital agency: Empowering equity in and through education. Technology, Knowledge and Learning, 23(3), 425-439; Azzolini, D., & Schizzerotto, A. (2017). The Second Digital Divide in Europe: A Cross-National Study on Students' Digital Reading and Navigation Skills. Research Institute for the Evaluation of Public Policies, 2017-02.
[151] OECD. (2015). Students, Computers and Learning: Making the Connection. In PISA. OECD Publishing, Paris.
[152] Dinis da Costa, P & Araújo, L. (2016). Digital Reading in PISA 2012 and ICT Uses: How do VET and General Education Students Perform?; Joint Research Council Technical Report Series, EUR 28291 EN.
[153] Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. Oxford review of education, 38(1), 9-24; Rodrigues, M., & Biagi, F. (2017). Digital technologies and learning outcomes of students from low socio-economic background: An Analysis of PISA 2015. Joint Research Council Technical Report Series, EUR 28688 EN.
[154] Azzolini, D., & Schizzerotto, A. (2017). The Second Digital Divide in Europe: A Cross-National Study on Students' Digital Reading and Navigation Skills. Research Institute for the Evaluation of Public Policies, 2017-02.
[155] Hooft Graafland, J. (2018). New technologies and 21st century children: Recent trends and outcomes. In OECD Education Working Papers. OECD Publishing, Paris.
[156] National Literacy Trust. Fake news and critical literacy. National Literacy Trust: London.

agency".[157] In this context, Passey *et al.* define digital accountability as digital responsibility for oneself and for others regarding one's digital actions; knowledge of the digital world and its ethical issues; understanding concerns and ensuring security and privacy, and; understanding the impact of one's digital activities. This links in with digital citizenship, which, as defined by the Council of Europe, "involve[s] not only digital and media literacy competences, but also other skillsets that appear in related discussions of participation, democracy, social engagement and human rights".[158] Again, the literature emphasises a vital role for both families and schools in growing these digital competences. As recommended by the OCED, there is growing evidence that schools should look beyond a narrow focus on safety, by increasingly working closely with parents to focus on digital citizenship, given that "children with moral and ethical sensitivity are more likely to engage in positive online behaviour".[159]

2.6 The impact of COVID-19

Most literature, and therefore the bulk of this chapter, covers a period before COVID-19. However, as new evidence emerges on impact of emergency remote learning during the pandemic, it is clear that the crisis presents not only a " 'turning point' for digital education" but an exposé of social and economic inequalities across Europe.[160] Ultimately, it has brought to the fore the barriers and opportunities for using digital tools for inclusive practices. Many of the innovative approaches adopted by the Member States are covered later in this report. However, this section provides a general overview of the emerging literature on the issues presented by COVID-19 for inclusion and digital technology.

The literature estimates that nearly three-quarters of all children across 186 countries were affected by the crisis. This led many schools to close and continue teaching and learning virtually. The provision generally included synchronous (e.g. live lessons via video conferencing), and non-synchronous (e.g. pre-recorded and self-learning material) learning delivered by schools [161]. Governments, private and charitable organisations also facilitated learning through open access resources, television, and radio to reach children through the crisis [162].

For students to engage with this learning provision, access to the internet and a digital device was necessary. Given the digital divide issues (discussed on page 23), it is

[157] Passey, D., Shonfeld, M., Appleby, L., Judge, M., Saito, T., & Smits, A. (2018). Digital agency: Empowering equity in and through education. Technology, Knowledge and Learning, 23(3), 425-439.
[158] Frau-Meigs, D., O'Neill, B., Soriani, A., & Tomé, V. (2017). Digital citizenship education: Volume 1: Overview and new perspectives. Council of Europe.
[159] Hooft Graafland, J. (2018). New technologies and 21st century children: Recent trends and outcomes . In OECD Education Working Papers. OECD Publishing, Paris.
[160] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[161] Di Pietro, G., Biagi, F., Costa, P., Karpinski, Z., & Mazza, J. (2020). The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets. Publications Office of the European Union: Luxembourg.
[162] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels. European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels; Di Pietro, G., Biagi, F., Costa, P., Karpinski, Z., & Mazza, J. (2020). The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets. Publications Office of the European Union: Luxembourg.

therefore not surprising that access to the necessary resources and skills for distance learning has been unequal:

> *In Europe, a substantial number of children live in homes in which they have no suitable place to do homework (5%) or have no access to the internet (6.9%). Furthermore, 10.2% of children live in homes that cannot be heated adequately, 7.2% have no access to outdoor leisure facilities, and 5% do not have access to books at the appropriate reading level.*[163]

> *Significant differences between and within countries in terms of digital capacity and competences as well as learners' connectivity and access to devices, meant that entire groups of learners, including those from remote areas, migrant and refugee children and other learners from disadvantaged backgrounds, risked being excluded from distance and online teaching and learning".*[164]

Manca, F., and Meluzzi, F. (2020) also point to regional gaps within OECD countries, and between affluent and non-affluent families, regarding access to a computer or laptop during the crisis. Indeed, they note that:

> *In many OECD countries, fewer than half of rural households are located in areas where fixed broadband at sufficient speeds is available. In addition, children need to have access to devices such as computers and the necessary software to participate in online learning activities, which is often a challenge for lower-income households.*[165]

Countries have adopted different approaches of varying quality and scope to overcome these issues, including providing access to hardware and software for pupils in need, partially opening schools, and providing non-digital home-learning packs.[166]

Beyond accessibility, motivation and skill have also been big factors in students' engagement in online learning. Lack of engagement and motivation was one of the largest risk factors associated with marginalisation during the crisis. [167] Research shows that some students have more capacity for self-regulated study than others, particularly those from more affluent backgrounds.

The literature emphasises that support from parents and parent-school relationships (particularly for younger children) is critical in ensuring that students can effectively transition to distance learning. [168] Observations from the OECD 2030 working group found that the quality of the relationships between teachers and students, and also with families, was crucial to the effectiveness of emergency remote learning.[169] Pre-existing

[163] Van Lancker, W., & Parolin, Z. (2020). COVID-19, school closures, and child poverty: a social crisis in the making. The Lancet Public Health, 5(5), e243-e244.
[164] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[165] Manca, F., And Meluzzi, F. (2020). Strengthening Online Learning When Schools Are Closed: The Role Of Families And Teachers In Supporting Students During The COVID-19 Crisis. OECD Publishing, Paris.
[166] Gouëdard, P., Pont, B., & Viennet, R. (2020). Education responses to COVID-19: Implementing a way forward. OECD Education Working Papers No. 224.
[167] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[168] Garbe, A., Ogurlu, U., Logan, N., & Cook, P. (2020). COVID-19 and remote learning: Experiences of parents with children during the pandemic. *American Journal of Qualitative Research*, *4*(3), 45-65.
[169] Discussion (2020). 7th Meeting of the Working Group Schools(2018-20), Online Meeting, 7 May.

strong connections meant that relationships were generally more positive and compensated for lack of face-to-face time in classrooms. Teachers and peers were particularly more likely to check in about learning progress as well as emotional well-being if pre-existing relationships were in place. This presents a challenge for certain pupils to receive an equitable education online. A range of factors impact on parental support and connectivity, including prior relationships with the school, language barriers, academic capability, and motivation/ behaviour management practices at home.[170]

Schools have put in place measures to address these issues, using "various simple tools (SMS, U-Report, messaging apps) to gather quick feedback from parents and caregivers to improve remote learning".[171] Nevertheless, reports still show that parental engagement concerns disproportionately affect those from marginalised groups. A recent JRC report, for instance, noted that "in the US 61.5% of workers in the highest wage quartile can telework whereas the corresponding figure for those in the lowest wage quartile is less than 10%". Thus, more affluent working families have made more flexible arrangements that enable parents to support their children's learning during the pandemic.[172] For parents of children with complex or gifted and talented needs, there has also been an added burden on them to meet their child's learning requirements and provide the same level of differentiated learning they would receive in school.[173]

A common theme throughout this chapter has been the importance of effectively aligning pedagogy with digital technology for it to be effective. There is some evidence that specific learning approaches have better facilitated learning during the pandemic, including the "flipped classroom model" (see p.29).[174] Not surprisingly, teacher and school preparedness has also been a contributor to the quality of provision. Those schools with some experience of using digital technology for teaching and learning were generally able to offer better provision than those that did not have such experience. Analysis of teacher preparedness before the pandemic shows that "only 39% of teachers in the EU felt well or very well prepared to use digital technologies for teaching", and only 65% of headteachers believed that digital provision in their ISCED 3 settings was adequate to handle the pandemic. [175] Research has also shown that teachers have previously raised concerns about their ability to meet learners' diverse needs online.[176] This has led to an increased focus on digital CPD, with almost half of UNESCO surveyed countries providing teacher education related to distance learning.[177]

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[170] Di Pietro, G., Biagi, F., Costa, P., Karpinski, Z., & Mazza, J. (2020). The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets. Publications Office of the European Union: Luxembourg.
[171] Dreesen, T., Akseer, S., Brossard, M., Dewan, P., Giraldo, J. P., Kamei, A., ... & Correa, J. S. O. (2020). *Promising practices for equitable remote learning Emerging lessons from COVID-19 education responses in 127 countries* (No. inores1090).
[172] Sostero M., Milasi S., Hurley J., Fernández-Macías E., Bisello M. (2020). Teleworkability and the COVID-19 crisis: a new digital divide?, Joint Research Council, No. JRC121193.
[173] Garbe, A., Ogurlu, U., Logan, N., & Cook, P. (2020). COVID-19 and remote learning: Experiences of parents with children during the pandemic. *American Journal of Qualitative Research*, *4*(3), 45-65.
[174] Tao Tang, Atef M. Abuhmaid, Melad Olaimat, Dana M. Oudat, Maged Aldhaeebi & Ebrahim Bamanger (2020) Efficiency of flipped classroom with online-based teaching under COVID-19, Interactive Learning Environments.
[175] European Commission. (2020). Commission staff working document for the Digital Education action Plan 2021-2027. European Commission: Brussels.
[176] Balanskat, A., Blamire, R., & Kefala, S. (2007). The ICT impact report: A review of studies of ICT impact on schools in Europe. European SchoolsNet.
[177] European Data Portal. (2020). Education during COVID-19; moving toward e-learning. European Commission: Brussels.

While other parts of this report cover the innovative practices for digital inclusion, many commentators take a cautious approach to recommending beneficial digital tools from COVID-19. Dhawan makes the critical point that "disasters and pandemic such as COVID-19 can create a lot of chaos and tensions" and that it is essential to be proactive rather than reactive to harness the potential of technology effectively in the future. [178] One of the main learning points from COVID-19 is to invest time in creating robust models of distance learning to avoid similar disruption going forward. Looking to the immediate future, the potential for technology to support small group work and remedial provision (as discussed earlier in this chapter) provides a promising avenue for further integration of technology in teaching and learning. Indeed, an essential element of the pandemic recovery is overcoming learning losses through "inclusive reopening" of schools and "remedial or accelerated learning programmes".[179]

[178] Dhawan S. Online Learning: A Panacea in the Time of COVID-19 Crisis. Journal of Educational Technology Systems. 2020;49(1):5-22.
[179] United Nations. (2020). Policy Brief: Education during COVID-19 and beyond. United Nations: New York.

3.0 Setting the scene: outlining key challenges and groups at risk

Box 3 Key messages: key challenges and groups at risk

Key messages

- **In compulsory education, digital infrastructure is strongest in lower secondary education**, with 42% of primary, 66% of lower secondary and 54% of upper secondary schools being 'highly digitally connected and equipped' across the EU. Digitalisation in VET lags behind as compared to general education, while digitalisation in ECEC is on the rise despite being a more contested area.
- While many Member States have investment in IT infrastructure in schools high on the agenda, there has been a **limited focus on supporting schools to acquire and use digital tools for inclusion purposes specifically**.
- Evidence shows that **students with a Roma background** are systematically excluded from education. They often find themselves in segregated schools or classes, with insufficient language proficiency and support. Early school leaving rates are amongst the highest in Europe for Roma learners – only 12 % on average aged 18 to 24 have completed upper-secondary general or vocational education.[180]
- **Students with disabilities** in the EU are twice as likely to be in the Not in Education, Employment, or Training (NEET) category as their peers who do not have disabilities.[181] They also experience barriers to completing tertiary education and are less likely to participate in lifelong learning as they often need extra learning support and resources that they do not always have access.
- **Students with mental health difficulties** also face challenges in accessing education, in fact, mental health difficulties can affect children and young people in a variety of ways and varying degrees in the classroom and they can often have 'good days' or 'bad days', which renders treatment and support difficult.
- **Children living in rural or isolated areas** may face difficulties accessing education in certain Member States. In fact, enrolment in pre-primary education is generally lower in rural than in urban areas across PISA participating countries.[182] Access to digital tools also varies greatly between urban and rural settings, with internet access being lower for households in rural areas, and rural households having a lower level of computer use compared to urban households.
- **Students with a migrant background** face important challenges in relation to achievement. PISA data show that 30% do not have basic reading skills at age 15, and only 9% are among the top achievers[183]. Additionally, foreign-born

[180] European Union Agency for Fundamental Rights (2016). Education: the situation of Roma in 11 EU Member States. Roma survey – Data in focus. Luxembourg: Publications Office of the European Union
[181] Eurostat, Disability statistics - access to education and training, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Disability_statistics_-_access_to_education_and_training&oldid=196899
[182] OECD. Trends Shaping Education Spotlight 9, Country Roads: Education and Rural Life. Paris: OECD.
[183] OECD. (2015). Indicators of immigrant integration 2015: Settling in. OECD Publishing.

students have a lower level of computer use in a number of EU Member States compared to their European peers and are often over-represented in ESL data.

- **Refugee children** can also face barriers to accessing education. Although they are entitled to access education under the same conditions as nationals and children of EU born migrants, they are not automatically entitled to associated benefits. Additionally, while asylum-seeking children are also legally entitled to access the host State's education system through temporary accommodation centres, these centres often do not offer the same full curriculum as national schools nor meet the teaching standards of local schools.
- One of the groups with the biggest challenges in relation to digital education and inclusion are **students coming from low socio-economic backgrounds**. There is a strong link between leaving early leaving from education and training (ELET), social disadvantage and a low level of parental education. There is also an important correlation between income quartile and the access to internet and computers, with lower-SES learners less likely to access ICT tools and the internet than their peers.
- **Both low and high school achievers** can face issues with regards to not receiving sufficient educational support. Underachieving students may be able to overcome obstacles through educational policies, which may include creating personalised and supportive learning environments; involving parents and communities; inspiring students to take-up available opportunities; etc. Conversely, gifted students may face issues accessing relevant (*i.e*. tailored and challenging) educational support and gifted education varies considerably from country to country across the EU.
- **Learners suffering from long-term or chronic illnesses** face additional academic and socio-emotional challenges, arising from extended periods of school absenteeism.[184] Upon return to school after cancer treatment, for example, studies show that around 50% of children and adolescents experience social, psychological, or school-related problems resulting in 20% of affected learners repeating a grade.[185] Commonly cited reasons for challenges in returning to school include psychosocial problems, such as social exclusion, fear of peer rejection and bullying.
- There are also important challenges for other groups at risk of marginalisation:
  - **Parental ill health and disability, unemployment, poverty, and poor housing**, are all risk factors for exclusion from education.
  - **Learners in detention and care facilities** emerge as being a potentially overlooked group, with regard to educational access and quality.
  - **Learners suffering from addictions,** including screen addictions such as gaming, often suffer from exhaustion in class which disconnects them from the social environment for learning.

[184] For example: Helms, A. S., Schmiegelow, K., Brok, J., Johansen, C., Thorsteinsson, T., Simovska, V., & Larsen, H. B. (2016). *Facilitation of school re-entry and peer acceptance of children with cancer: A review and meta-analysis of intervention studies*. European Journal of Cancer Care (Engl), 25(1), 170–179. https://doi.org/10.1111/ecc.12230 *or* Sandeberg, M., Johansson, E., Bjork, O., & Wettergren, L. (2008). *Healthrelated quality of life relates to school attendance in children on treatment for cancer*. Journal of Pediatric Oncology Nursing. 265–274. https://doi.org/10.1177/10434 54208 321119

[185] For example: Helms, A. S., Schmiegelow, K., Brok, J., Johansen, C., Thorsteinsson, T., Simovska, V., & Larsen, H. B. (2016). *Facilitation of school re-entry and peer acceptance of children with cancer: A review and meta-analysis of intervention studies*. European Journal of Cancer Care (Engl). 170–179. https://doi.org/10.1111/ecc.12230

- **Young male students** consistently under-perform in compulsory education compared to girls and are also more likely to be early school leavers.
- **LGBTQI+ students** can face a series of additional challenges when accessing education because of domestic violence, stronger levels of depression and anxiety, and higher rates of suicide attempts, ideation and completions, bullying at school and discrimination and lack of visibility.

3.1 Introduction

In this section, we first provide an overview of the latest developments in relation to digital inclusion at EU level, followed by an overview of the key challenges facing EU Member States in relation to digital access, teaching and learning and equity at different levels of education (i.e., ECEC, primary, secondary education and VET). The third section presents the main challenges facing specific groups at risk of marginalisation (i.e., migrant, Roma, rural, socio-economically disadvantaged and SEN learners). Box 3 above provides an overview of key findings from the section.

3.2 EU policy context on digital inclusion

Both technology and inclusion are among the central pillars of the European Commission's current political agenda for education. The link between digital education and social inclusion is well documented in Commission President Ursula von der Leyen's political agenda for 2019-2024, which was presented in September 2019. The Communications on achieving a European Education Area by 2025[186] and a new Digital Education Action Plan for 2021-2027,[187] which were both presented only a year later, are a clear testament to this high-level political commitment of the EU to driving forward the digital inclusion agenda in education, fuelled in particular by the COVID-19 crisis.

A digitally resilient and inclusive Europe

In her agenda for Europe, President Von der Leyen conveys her ambition for Europe to become a global leader of the digital transformation.[188] With regards to innovation and digitalisation, the agenda presents three main priorities, two of which are highly relevant to digital inclusion:

- The first is **technological advances**, whereby the President acknowledges the impact of Artificial Intelligence (AI): *"data and AI are the ingredients for innovation that can help us to find solutions to societal challenges, from health to farming, from security to manufacturing".* In addition to this, she says that her priority will be *"to get Europe up to speed on digital skills for both young people and adults"*.

[186] https://ec.europa.eu/education/sites/default/files/document-library-docs/eea-communication-sept2020_en.pdf
[187] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en
[188] Von der Leyen, U. (2019). A Union that strives for more My agenda for Europe. Brussels: EC.

This is an essential part of her ambition to *"change the culture of education towards lifelong learning that enriches us all".*[189]

- With regards to **demography and social inclusion**, the agenda states: *"we need equality for all and equality in all of its senses. […] Innovation happens when people from different backgrounds and perspectives blend together. With the demographic challenges ahead of us, we cannot afford to leave any potential behind"*.[190] The President references the European Pillar of Social Rights[191] and the United Nation's Sustainable Development Agenda[192] as the two key instruments to build *"an economy that works for people".*[193]

Digitalisation and innovation are important political and financial concerns for Europe and making sure that digital technologies reach all Europeans equally is a significant aim for the European institutions. These priorities have a direct impact on digital skills and digital education. Digital skills have been prioritised in lifelong learning since the first European Recommendation on **key competences for lifelong learning** was published in 2006.[194] In the latest revision of this Recommendation, published in May 2018, digital competence is defined as the **"***confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society".*[195]

Inclusion is an equally important priority for Europe, as the EU is founded on the values of respect for human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities, as outlined in **Article 2 of the Lisbon Treaty**.[196] The EU has implemented a series of directives to fight discrimination at all levels, from education to employment, starting with the Directive 2000/43/EC against discrimination on grounds of race and ethnic origin implemented in 2000.[197] Inclusive and high quality education for both older and younger European citizens are vital for creating and maintaining a cohesive European society which upholds the European core values mentioned above.

The two main policy frameworks through which the Commission is to implement President Von der Leyen's vision for a digitally resilient and inclusive Europe in education are the European Education Area and the Digital Education Action Plan:

- In relation to the European Education Area, she stated to be *"fully committed to making the **European Education Area a reality by 2025**. We need to bring down barriers to learning and improve access to quality education. We need to enable learners to move more easily between education systems… And we need to change the culture of education towards lifelong learning that enriches us all"*.[198]

[189] Ibid.
[190] Ibid.
[191] European Commission. (2017). The European Pillar of Social Rights in 20 principles. Brussels: EC.
[192] United Nations. (2016). The Sustainable Development Agenda. New York: United Nations
[193] Von der Leyen, U. (2019). A Union that strives for more My agenda for Europe. Brussels: EC.
[194] Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 10-18.
[195] Council Recommendation of 22 May 2018 on key competences for lifelong learning, OJ C 189, 4.6.2018, p. 1-13.
[196] European Union. (2007). Amending the treaty on European Union and the treaty establishing the European community. Brussels: Official Journal of the European Union.
[197] European Council. (2000). Council Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin. European Council: Brussels.
[198] Von der Leyen, U. (2019). A Union that strives for more My agenda for Europe. Brussels: EC.

- In relation to the Digital Education Action Plan, she announced that a priority would be *"to get Europe up to speed on digital skills for both young people and adults by updating the **Digital Education Action Plan**. We need to rethink education by using the potential the internet provides to make learning material available to all, for example by the increased use of massive open online courses. Digital literacy has to be a foundation for everyone".*[199]

1. Towards a digital and inclusive European Education Area

The COVID-19 pandemic forced Member States to accelerate the digital transformation of their education and training systems in order to continue offering education through distance learning, thereby exposing weaknesses in their digital education infrastructure and pedagogical approaches, and also exacerbating existing inequalities and structural barriers to learning and skills development. Therefore, two of the six dimensions of the Commission's 2020 Communication on achieving the European Education Area (EEA) by 2025[200] include a specific focus on supporting EU education and training systems with the digital transition and achieving social inclusion, as illustrated in Figure 3.1 below.

A recent Proposal for a Council Recommendation was published in August 2021 as part of the immediate response to the lessons learned from the COVID-19 pandemic.[201] This proposal for **a Council Recommendation on blended learning for high quality and inclusive primary and secondary education** reflects the Commission's ambition to improve the quality and inclusivity of primary and secondary education and gives value to the concept of blended learning (blending virtual and physical learning). Blended learning is believed to promote inclusivity by reducing physical barriers between the place of studying and education provision and including a variety of students in different positions (e.*g.* in rural areas, hospitals, isolated communities, *etc.*). The European Commission recommends that Member States develop longer-term strategies to blended learning, for instance, by providing additional learning opportunities and targeted support to young people facing difficulties (those from disadvantaged groups for instance). This could include, for example, enhanced individualised support and personal tutoring, mentoring systems (including peer mentoring), additional learning time during the school year and/or holiday period, access to additional learning environments, such as public libraries and community spaces, and to afterschool services with pedagogical support.[202] The proposal for a Council Recommendation also states that it's important to make sure physical and mental well-being of learners and their families is a priority, for instance, by developing guidance for mental health. Moreover, the Recommendation also encourages investment at school and community level for what concerns digital devices and connectivity in order to boost digital skills. The document also goes on to provide further guidelines to support recovery and the longer-term preparedness of education and training, educators, and schools.

[199] Ibid.
[200] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0625
[201] European Commission, (2021), Proposal for a Council Recommendation on blended learning for high quality and inclusive primary and secondary education. Available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2021:455:FIN&from=EN
[202] European Commission, (2021), Proposal for a Council Recommendation on blended learning for high quality and inclusive primary and secondary education. Available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2021:455:FIN&from=EN p.13

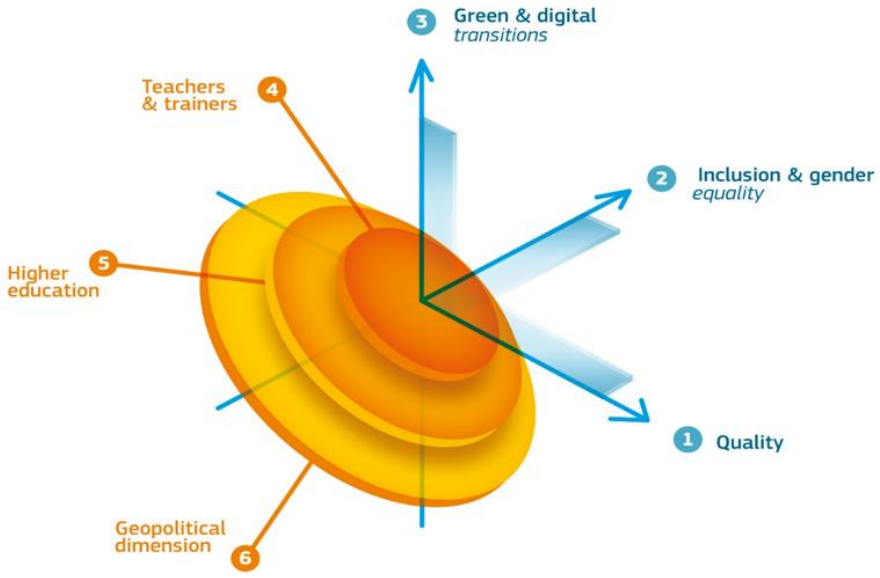
In relation to the **digital pillar**, the Commission set out the following priorities for the EU's education and training systems:

- Education and training systems should **equip people with digital skills** in order to navigate the labour market transformed by technological change, especially after the COVID-19 pandemic.
- As a target for the EU by 2030, the Council committed to reducing the share of **low-achieving eight-graders in computer and information literacy below 15%**. A 2019 European Commission report, reviewing the findings of participating EU Member States in the International Computer and Information Literacy Survey (ICILS) of 2013 and 2018, shows that the share of underachievers in computer and information literacy in 2018 ranged between 63% in Italy and 15% in Czechia.[203]

In relation to the **inclusion pillar**, the Communication on achieving the European Education Area mentions the following priorities:

- Educational attainment and achievement should be decoupled from social, economic and cultural status, as evidence shows that **students from migrant backgrounds and living in rural areas** fare worse in school.
- Education and training systems should also cater for the learning needs of **pupils with high learning potential** in an inclusive way.
- Special attention to **students with disabilities** in particular by complying with the UN Convention on the Rights of Persons with Disabilities.

Figure 3-1 Six constituent dimensions of the EEA vision



Source: Communication on achieving the European Education Area by 2025, COM(2020) 625 final

[203] https://ec.europa.eu/education/resources-and-tools/document-library/the-2018-international-computer-and-information-literacy-study-icils-main-findings-and-implications-for-education-policies-in-europe_en (p.12).

2. Digital Education Action Plan

The new Digital Education Action Plan (DEAP), which sets out the Commission's vision for high-quality, inclusive and accessible digital education between 2021 and 2027, is probably the most important tool driving the implementation of the EEA's digital dimension. The actions listed in the Communication build on the results from a public consultation on the revision of the DEAP, carried out between June and September 2020,[204] The results of which are included in the Communication's accompanying Staff Working Document.[205] More than 95% of the respondents to the consultation believed that distance and online teaching and learning, as a result of the COVID-19 crisis, would have a long-term impact on approaches to education. When asked about the potential of digital tools for educational inclusion, many believed that digital education raises important challenges for equality. Almost 50% of all respondents believed it would exacerbate inequalities between learners, and 70.6% believed that the combination of face-to-face teaching with distance learning would exclude learners who do not have access to suitable technology. At the same time, almost half of respondents (49.6%) felt that the effective combination of face-to-face teaching and online learning offers opportunities to better support learners from disadvantaged groups. Thus, respondents believe that, when done right, digital education can support educational inclusion.

The DEAP builds on the Digital Competences Frameworks, which were developed by the JRC, and aim to facilitate the process of digitalisation in education and training for individuals, educational institutions, and education systems.[206] The Digital Competences Frameworks consist of the European Digital Competence Framework (DigComp), which offers a tool to improve citizens and learner's digital competence skills,[207] and of the Digital Competence Framework for Educators (DigCompEdu), which is a tool that aims to support the development of specific digital competences for educators in Europe.[208] Building on these, DigCompOrg/SELFIE offers a self-reflection tool for primary, secondary and vocational schools. SELFIE helps schools assess and compare their digital education systems with other European schools. [209]

To support EU education and training systems to achieve high-quality, inclusive and accessible digital education systems, building on EU tools, frameworks, guidance and technical expertise and research such as the Key Competence and DigComp Frameworks, or DigCompOrg/SELFIE, the new DEAP states that it will support EU Member States (through dedicated funding, policy coordination as well as knowledge sharing through the identification, sharing and scaling up of good practices) on the following two priorities:[210]

- **The development of a high-performing digital education ecosystem**: this includes ensuring all schools have the required infrastructure, connectivity and digital equipment in place for digital education; that teachers are digitally competent and confident; and that digital tools are used to develop high-quality

[204] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12453-Digital-Education-Action-Plan/public-consultation
[205] https://ec.europa.eu/education/sites/default/files/document-library-docs/deap-swd-sept2020_en.pdf
[206] Beblavý, M., Baiocco, S., Kilhoffer, Z., Akgüç, M., & Jacquot, M. (2019). Index of Readiness for Digital Lifelong Learning Changing How Europeans Upgrade Their Skills FINAL REPORT NOVEMBER 2019.
[207] European Commission. (2016). DigiComp. European Commission: Brussels
[208] European Commission. (2017). DigiCompEdu. European Commission: Brussels
[209] European Commission. (2020). Digital Education Action Plan - Action 2; European Commission. (2018). SELFiE self-reflection tool & mentoring scheme for schools. European Commission: Brussels
[210] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1602778451601&uri=CELEX%3A52020DC0624

learning content, user-friendly tools and secure platforms that respect privacy and ethical standards.

- **Enhancing digital skills and competences for the digital transformation**: this includes ensuring all children, from an early age, have basic digital skills and competences in order to access and fully participate in education and the labour market; and fostering the development of advanced digital skills to produce more digital specialists, especially among girls and young women, so they are equally represented in digital studies and careers.

As of early fall 2021, the European Commission has already introduced a series of initiatives emerging from the Digital Education Agenda. For one, DG EAC is preparing the launch of a **Digital Education Hub,** which will facilitate the exchange of experiences and solutions for digital education and support cross-sector collaboration on digital education across Europe. The Hub foresees the creation of a European community of practice and will engage a wide variety of stakeholders, ranging from education policy-makers and practitioners to ed-tech.[211] Additionally, as of early fall 2021, DG EAC, jointly with DG CONNECT, has launched **two Expert groups** to inform the implementation of Action 6 'Ethical guidelines on artificial intelligence (AI) and data usage in teaching and learning for educators' and Action 7 'Common guidelines for teachers and educational staff to foster digital literacy and tackle disinformation through education and training' of the Digital Education Action Plan.[212]

Key challenges facing EU Member States

The main challenges facing EU Member States in relation to achieving the two overarching priorities of the DEAP and digital inclusion relate, firstly, from an 'access' point of view, to ensuring the necessary **digital infrastructure** is in place at all levels of education to 'make digital education possible' and to support disadvantaged learners – through assistive technology – to access and fully participate in the school learning environment.[213] Secondly, from a 'teaching and learning' point of view, Member States need to make sure **teachers** are well-equipped and confident to use digital technology in their daily teaching practice – including for social inclusion – by embedding digital skills and pedagogy in initial teacher education (ITE) and continuing professional development (CPD) plans, thereby strengthening teacher agency and support for digital education. Thirdly, from an 'equity' point of view, not only teachers but also all students need to be equipped with the right level of **digital skills** to both access and fully participate in (further) education and society more broadly.

The extent to which different EU Member States prioritise or allocate resources to digital infrastructure, teacher or student digital skills development, or a combination of these, is highly dependent on their starting point and the main challenges their systems are facing in relation to digital education and social inclusion (and on the interpretation of inclusion and inclusive practice). The focus on digital inclusion also greatly varies depending on the challenges facing different education levels.

In the following sections, we will review the main challenges EU Member States are facing in relation to digital technology and social inclusion at different levels of

[211] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan/european-digital-education-hub_en
[212] https://www.pubaffairsbruxelles.eu/education-commission-launches-expert-group-to-develop-ethical-guidelines-on-artificial-intelligence-and-data-for-educators-eu-commission-press/
[213] Conrads, J., Rasmussen, M., Winters, N., Geniet, A., & Langer, L. (2017). *Digital education policies in Europe and beyond: Key design principles for more effective policies* (No. JRC109311). Joint Research Centre (Seville site).

education, based on national strategies and plans for education, and EU level comparative data. Sections 3.4 and 3.5 expand on the main solutions (policies/measures/initiatives) Member States are taking to improve access to education through digital technology (e.g., improving digital infrastructure at different levels of education or widening access through digital tools) and to improve the quality and inclusiveness of teaching and learning practices, as well as student digital skills, through digital technology.

3. Key challenges in ECEC (ISCED 0)

Availability of digital education infrastructure

Although there are no centrally comparable data on the levels of digital equipment in ECEC across the EU27, our desk research reveals that there is **great variety both between and within Member States in terms of the levels of digital equipment in ECEC schools**. In **Malta**, for example, almost all kindergarten classrooms (i.e., state, church and independent schools) are equipped with an interactive whiteboard and laptop, which are connected to the internet.[214] As will be discussed further down in this section, **Denmark** also has one of the most highly equipped preschools in the EU.[215] In **Sweden**, many pre-schools also have high levels of digital equipment, but this varies considerably by region. For instance, while pre-schools in the Bjuv municipality in Skåne have been working to integrate digital technology into their activities for several years now,[216] most of Sweden's Waldorf schools remain screen-free.[217]

In contrast, in many other Member States, the extent of digital equipment remains limited, and governments have put in place specific support programmes to encourage preschools to invest in digital education infrastructure. In **Germany**, for instance, a 2019 survey revealed that while most pre-schools have basic digital equipment in place in a central location (*e.g.*, a computer with internet access in the director's office), only 10% of groups rooms had their own digital tools.[218] In **Bulgaria**, pre-primary education institutions can apply for funding to purchase interactive multimedia equipment or innovative hardware under the National Programme 'Information and Communication Technologies in pre-school and school education'. [219] It is worth noting that funding for pre-schools to modernise their (digital) education infrastructure is often quite limited, however, as evidenced from **Lithuania**, where the Action Plan for the Inclusion of Children and Holistic Education (2017-2022) shows that funding will be made available for around 50 ISCED 0 schools to modernise their education infrastructure – this only represents 6.7% of ECEC schools in the country. [220,221]

[214] Camilleri R. (2018). Investigating and role/impact of the interactive whiteboard on Teaching practices in Maltese Kindergarten Classrooms through an Activity Theory Approach, Unpublished PhD, University of Lancaster, UK.
[215] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/
[216] https://www.aftonbladet.se/nyheter/a/opllwa/har-programmerar-barnen-i-forskolan
[217] ibid
[218] Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien. Helen Knauf (2019). BIELEFELD WORKING PAPER 3. https://www.pedocs.de/volltexte/2019/17999/pdf/Knauf_2019_Digitalisierung_in_Kindertageseinrichtungen.pdf
[219] National programme "Information and communication technologies (ICT) in the system of pre-school and school education" https://www.mon.bg/bg/100821
[220] Statistics Lithuania (2021). Official Statistics Portal. Available at: https://osp.stat.gov.lt/web/guest/pradinis
[221] Data from the official Lithuanian statistics department for the 2019 data (latest). Note that these pre-school institutions aren't necessarily focused only on ISCED 0, the number can include schools that combine pre-school and primary education (at least in Lithuania it is not uncommon to have the same building used for ISCED 0 – 1 levels).

Readiness of teachers

Another key challenge to digital inclusion in ECEC is that **many stakeholders, including a significant number of teachers and parents, believe that the use of digital tools should remain limited**. A survey among 190 day care centres in **Germany**, for example, showed that many respondents believed children should be protected from digital devices at this level.[222] A number of respondents noted that they believed it would be harmful to young children's early development to be exposed to digital tools in ECEC, especially since many already engage with it so much outside of ECEC settings.[223] Moreover, a fear that digital tools will make the children too passive in day care instead of active participants in physical and mentally challenging play was cited as another key concern among ECEC stakeholders.

It is important to note here that our findings, outlined in section 3.5 on enhancing teaching and learning, suggest that this is not necessarily the case when digital tools are integrated effectively, and that digital tools can actually promote both creativity and physically challenging play (see in particular sub-section 3.5.2). While reservations regarding the role of digital tools in ECEC is widespread and the related debate polarised, it is also worth noting that a majority of ECEC institutions appear to view at least a limited role for digital tools in ECEC. For example, an online survey of 248 parents and 172 educators carried out in 2015 by Early Childhood **Ireland**, reported that while 34% of ECEC settings do not provide ICT, 64% would like to incorporate some elements of ICT in their learning practices.[224]

As a result of reservations regarding the use of digital tools in ECEC, **teachers' use of digital technologies in ECEC is typically very controlled and limited**. In **Denmark**, for example, which has one of the highest levels of digital media and technology use by teachers in ECEC – a recent survey shows that 79% of Danish day care centres use digital tools with their children, and that half of the country's institutions use them daily[225], the latest version of the Pedagogical Curriculum (*Pædagogiske læreplan*)[226] dropped the idea of introducing digital literacy as one of its six overarching priorities, due to pressure from key stakeholder groups. As a result, children's screen time in day care centres remains limited to around ten minutes per day (in 70.8% of surveyed institutions), while it is between 30 minutes and one hour in only 0.9% of institutions.[227]

At the same time, despite the widespread *access* to digital technologies in families, childcare facilities and schools in Denmark, from an inclusion perspective, recent studies have uncovered an *unequal use of* digital technologies at ECEC and compulsory education levels based on gender[228]. In particular, the studies suggest that boys tend to engage in more diverse uses of technology already at ECEC level, and that they more

[222] Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien. Helen Knauf (2019). BIELEFELD WORKING PAPER 3. https://www.pedocs.de/volltexte/2019/17999/pdf/Knauf_2019_Digitalisierung_in_Kindertageseinrichtungen.pdf
[223] It should be noted that found that the majority of respondents felt that as digital media are part of children's daily lives, day care centres should teach children to effectively and safely work with digital devices.
[224] https://www.earlychildhoodireland.ie/wp-content/uploads/2015/12/OMEP-presentation-MHB-v2-20-04-2015.pdf
[225] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/
[226] https://emu.dk/sites/default/files/2020-01/Den%20styrkede%20p%C3%A6dagogiske%20l%C3%A6replan_engelsk.pdf
[227] Ibid.
[228] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/

frequently use technology in a 'behind-the-scenes'-way, e.g. reporting having experimented with controlling a robot.

In **Estonia**, the national curriculum does not emphasise digital skills development among pre-school children. Yet almost 60% of kindergartens do teach ICT skills through the ProgreTiger programme, aimed at supporting ICT education.[229] In **Germany** as well, a teacher survey shows that computers are still rare in the group rooms of day care centres, and two thirds of respondents (67%) said day care centres had insufficient digital equipment. In 59% of the facilities, computers are also not made accessible to children, and only used for targeted practice of specific skills (e.g., language learning, age-appropriate games, or research on the internet).[230] In **Hungary**, a 2016 survey shows that only around 3% of pre-school teachers use the internet for educational purposes. As a result, children receive few or sporadic opportunities for digital skills development.[231]

In **Cyprus**, the Ministry of Education and Culture (MOEC) went so far as to ban the use of WiFi in nurseries in 2017 to minimise the electromagnetic field exposure of children, and recommended that in other public schools, WiFi is only available in the director's office, the secretary's office and in the staff office for admin purposes.[232]

Readiness of children

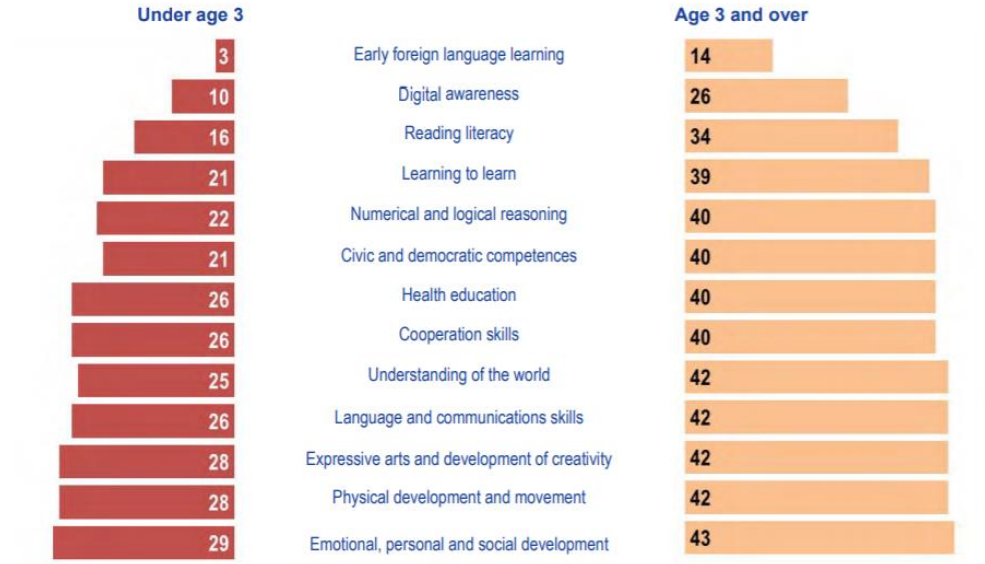
While their exposure to digital tools in ECEC remains limited in several Member States, evidence shows that **young children's engagement with digital tools, as well as their digital skills, are high in many EU Member States**, especially outside school. This suggests that there is great untapped potential to use digital tools to with young children to support inclusive and quality education. In **Austria**, for example, a national survey from November 2019 shows that small children aged 0-6 years old regularly use digital devices such as tablets, laptops and smartphones. 72% of parents indicated that their children were (already) using digital devices, with 25% reporting they used digital tools on a daily basis. For 10%, watching videos were an indispensable ritual for going to sleep.[233] Another study from **Poland** on the use of mobile devices by small children revealed that 25% of 3-4-year-olds own their own mobile devices. This figure goes up to 39% in the case of 5-6-year-old children. The share of children using mobile devices at home is even higher: 62% and 84% in respective age groups. Around a quarter of children use mobile devices daily. The most popular activities are watching films (79%), playing games (62%), but many children (63%) also use mobile devices with no particular goal.[234]

The limited focus on developing children's digital skills in ECEC is confirmed in a recent report by Eurydice presenting key data on early childhood education and care in Europe. Figure 3-2 shows that, after early foreign language learning, **digital awareness is a**

[229] https://www.hitsa.ee/it-education/educational-programmes/progetiger
[230] Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien. Helen Knauf (2019). BIELEFELD WORKING PAPER 3. https://www.pedocs.de/volltexte/2019/17999/pdf/Knauf_2019_Digitalisierung_in_Kindertageseinrichtungen.pdf
[231] Fáyné Dombi, A., Hódi, Á. and Kiss, R. (2016) *IKT az óvodában: kihívások és lehetőségek* [ICT in pre-schools. Challenges and opportunities]. In: *Magyar Pedagógia* [Hungarian Pedagogy] Vol. 116, No. 1. 91–117. (2016) DOI: 10.17670/MPed.2016.1.91
[232] https://ehtrust.org/wp-content/uploads/Egkyklios-Jan-17.pdf
[233] Neue Studie: 72 Prozent der 0- bis 6-Jährigen im Internet, https://www.saferinternet.at/news-detail/neue-studie-72-prozent-der-0-bis-6-jaehrigen-im-internet/
[234] Bąk, A. (2015). *Korzystanie z urządzeń mobilnych przez małe dzieci w Polsce*. Warszawa.

low priority area for learning and development in ECEC settings. They are the two least-mentioned focus areas in top-level educational guidelines for ECEC.

Figure 3-2 Areas of learning and development in ECEC settings (2018/19)



Source: EC/EACEA/Eurydice (2019)[235].

4. Key challenges in primary and secondary education (ISCED 1-3)

Availability of digital education infrastructure

Evidence from the 2nd European Survey of Schools shows that **'digital connectivity'[236] in primary education (ISCED 1) also remains limited**, with large differences between Member States (see Figure 3-3). In 2019, 42% of primary schools in 25 Member States surveyed[237] were 'highly digitally connected and equipped', with only nine Member States having more than 50% of their schools being highly digitally equipped (FI, DK, SE, EE, MT, NL, LS, SI and PT). The figures reach 90% and above in Finland, Denmark and Sweden. On the other side of the spectrum, we find Cyprus and Greece, where only a handful of primary schools are 'highly digitally connected and equipped' (2%). The majority of schools are also only 'partially digitally equipped and connected' in DE (91%), AT (89%), RO (86%), FR (86%), SK (83%) HU (82%) and HR

[235] Source: EC/EACEA/Eurydice (2019). Key data on Early Childhood Education and Care in Europe. 2019 Edition. Luxembourg: Publications Office of the European Union, p. pp. Available at: https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/ec0319375enn_0.pdf

[233] Bąk, A. (2015). Korzystanie z urządzeń mobilnych przez małe dzieci w Polsce. Warszawa.

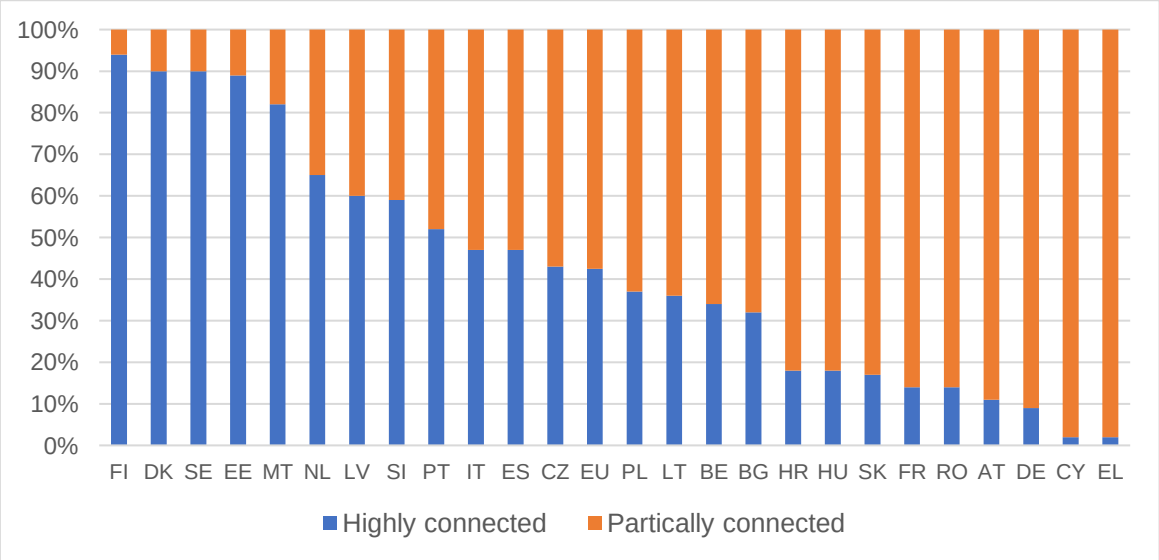
Number of computers, digital cameras laptops, tablets and interactive whiteboards per 100 students; (2) internet access and speed; (3) the amount of working digital equipment in schools; and (4) 'access to digital content', including school websites, student/teacher emails, management information systems, digital communication systems, e-learning platforms and wireless connectivity. Using cluster analysis, the researchers were then able to pinpoint the extent to which each of these countries was either "partially" or "highly" digitally connected.

[237] The survey does not include data for LU and IE.

(82%). **Bulgaria**, for instance, lags behind with one of the lowest rates (22nd) for the availability of digital devices in class and their use in classroom teaching. In the Bulgarian educational system, the number of students per computer is 14 in primary and 19 in secondary education, while the EU average is, respectively, 7 and 8.[238] Additionally, in Bulgaria fewer than 40% of schools are equipped with sufficient devices purchased in the past five years[239]. Conversely, schools in **Estonia** stand out as having high-speed internet and high access rates to wireless internet. More than half of Estonian students (ISCED 1-3) study in schools with internet speed above 100 mbps, whereas on average in the EU, this is the case for a small minority of students. Schools' wireless connection rates show 78-91% of Estonian ISCED 1-3 students attending schools with wireless connection. Estonia thus stands out with one of the highest rates of wireless connectivity of schools in the EU, where the average rate for students in ISCED 1, 2 and 3 is 46%, 52% and 67% respectively.[240]

Since the 2nd European Survey of Schools was published in 2019, no updated studies have been published. Therefore, we are aware that the situation concerning the digital connectivity of schools is likely change, or has in fact already changed, as a result of the COVID-19 pandemic.

Figure 3-3 The extent to which ISCED 1 (primary) schools are digitally equipped and connected



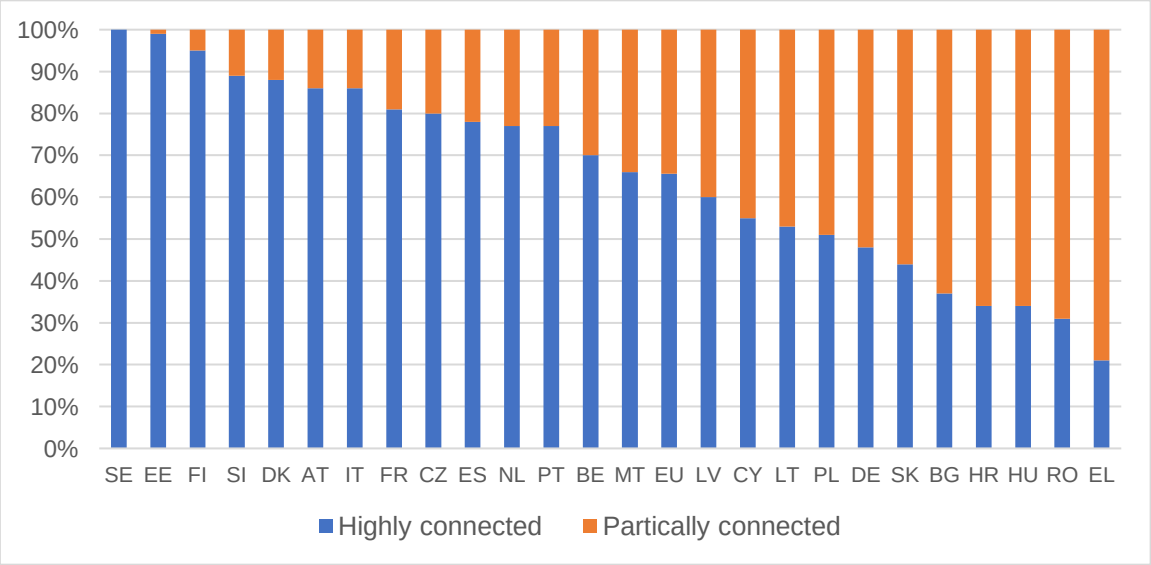
Source: 2nd survey of Schools ICT in education, 2019.

The levels of **digital equipment and connectivity in secondary education are higher than in primary education**. At ISCED level 2 (lower secondary education), 66% of schools in 25 Member States surveyed[241] were 'highly digitally connected and equipped', with 18 Member States having more than 50% of schools with high levels of digital equipment and connectivity. SE, EE and FI come out as top performers, having connectivity levels of above 90% (see Figure 3-4). They are closely followed by DK, AT, IT, FR and CZ, where connectivity levels are 80% or above. The percentage of lower

[238] Second study of ICT in schools, p. 29.
[239] National Programme ICT in school education 2020.
[240] Ibid.
[241] The survey does not include data for LU and IE.

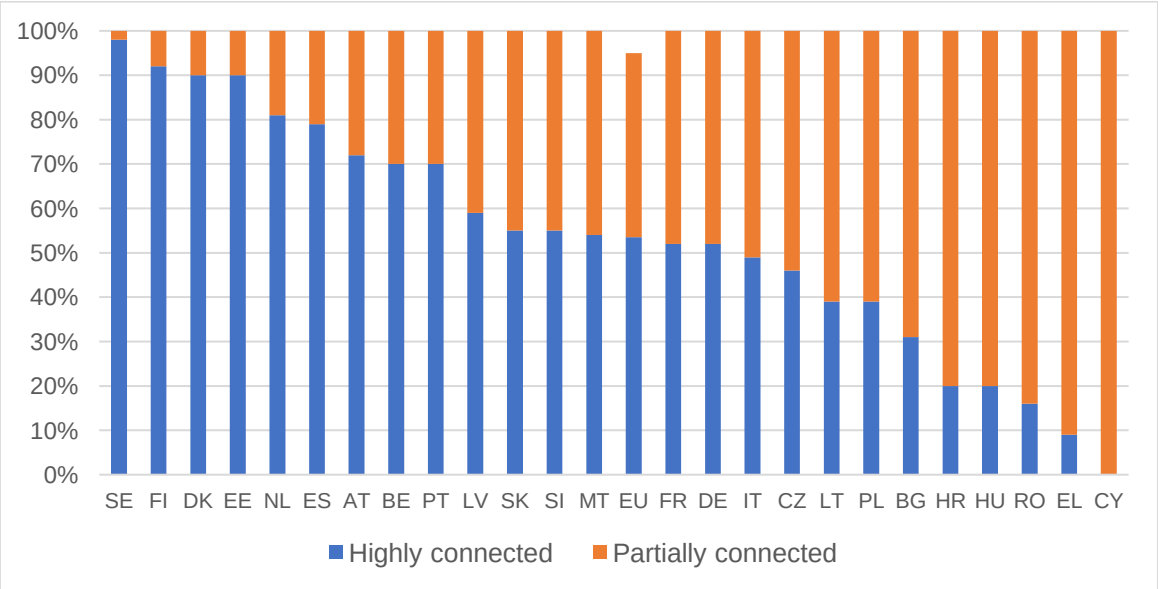
secondary schools where high digital equipment and connectivity levels are lowest in EL (21%), RO (31%), HU (34%), HR (34%) and (37%). At ISCED level 3 (upper-secondary education), slightly fewer (54%) schools were labelled as being 'highly digitally connected or equipped', with 15 Member States having more than 50% of schools having a high level of digital equipment and connectivity (see Figure 3-5). SE, FI, DK and EE are top performers (connectivity levels above 90%), followed by the NL (81%). The results show that in Cyprus, not a single school could be labelled as 'highly connected' (100% of schools are partially connected), and in Greece this was only 9%.

Figure 3-4 The extent to which ISCED 2 (lower-secondary) schools are digitally equipped and connected



Source: 2nd survey of Schools ICT in education, 2019.

Figure 3-5 The extent to which ISCED 3 (upper-secondary) schools are digitally equipped and connected



Source: 2nd survey of Schools ICT in education, 2019.

National level evidence confirms the EU level data above, suggesting that secondary schools have better ICT equipment than primary schools, although this is not the case in all Member States. In **Malta**, for example, primary schools have better IT equipment than secondary schools – the reason for this being higher numbers of tables and better internet availability.[242] **Several Member States have made investing in IT infrastructure a key priority for the coming years**. In **Belgium (French Community)**, for instance, the 2018 Digital Barometer report shows that in 2017, there were 7.0 digital devices per 100 students in primary schools compared with 15.9 per 100 students in secondary schools. Although this represents an improvement compared with 2009, the French Community lags significantly behind Flanders, where in 2012 there were already 17.5 digital devices per 100 students in primary schools and 56.5 per 100 students in secondary schools.[243] In **Cyprus**, as part of a series of reforms initiated in 2019, and outlined in the Strategic Plan of the Ministry of Education and Culture (2018-2020),[244] there will be a strong focus on strengthening IT infrastructure as part of the curriculum, teacher education and special needs education reforms. In 2020, **Ireland** received a country specific recommendation from the Council of the EU to address the risk of the digital divide including the education sector. This digital divide has been present in Irish education for many years. Prior to the pandemic the disparity and uneven ICT readiness in schools became apparent. Some 39% of primary school principals reported on the existence of a digital divide.[245]

Since several Member States are still working to improve/strengthen their educational infrastructures, there is **only a limited focus on equipping schools with digital tools to support social inclusion *specifically***. As part of the desk research for this study, only a limited number of Member State examples were identified where this is explicitly the case –and in many cases the initiatives were local and isolated in nature. In **Czechia**, for example, schools can directly request any equipment they may need to support students with special needs (e.g., special textbooks, digital tools, special teaching or compensatory aids, etc.) – this is enshrined in the Decree of 2016 on the education of pupils with special educational needs.[246] In **Sweden**, due to the very decentralised nature of the education system, municipalities differ significantly in their approaches to integrating digital tools in teaching and learning to support inclusion. The municipality of Nyköping, for instance, offers all students from year 4 their own digital unit for schoolwork, a so-called *"one-to-one" initiative.* The municipality does this to give all students the same conditions to use modern digital technology as a tool in their learning. The rationale is that this will enhance each student's digital competence in turn ensuring that all students are better prepared to meet the requirements that exist in the labour market, despite the ICT resources – or lack thereof- in their households.[247]

[242] European Commission, (2019b). 2nd Survey of Schools: ICT in education. Brussels: DG CNECT https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education
[243] https://www.digitalwallonia.be/fr/publications/education2018
[244] http://www.moec.gov.cy/download/monada_politikis_stratigikou_schediasmou/moec_strategicplan_2018_2020.pdf
[245] Eivers, E. (2019). Left to their own devices: Trends in ICT at primary school level. URL: https://issuu.com/ippn/docs/left_to_their_own_devices_final
[246] Ministry of Education, decree No. 27/2016, On the education of pupils with special educational needs and gifted pupils https://www.msmt.cz/dokumenty-3/vyhlaska-c-27-2016-sb-o-vzdelavani-zaku-se-specialnimi-2
[247] https://nykoping.se/barn-och-utbildning/grundskola/digitala-verktyg-i-skolan

Especially during COVID-19, this situation meant that many countries had challenges in putting in place the necessary measures to continue offering education. The fact that not all schools have the digital infrastructure in place for digital education, poses significant barriers to access for certain disadvantaged groups (as discussed in section 3.3.3 below), and it also made it very challenging for Member States to continue offering education during the crisis. In response to pandemic, countries have attempted to implement policies to mitigate the issues related to ICT infrastructure. For example, the Flemish Ministry in **Belgium** adopted Digi Jump (*Digisprong*) in December 2020, a new action through which a record amount of 375 million EUR will be invested in the quality digitalisation of all schools, teachers and pupils.[248]

Readiness of teachers

When it comes to teachers, one of the biggest challenges remains the **limited use of digital tools in teaching and learning**. In line with the findings for the level of digital infrastructure described above, the usage also increases with education level. Evidence from the 2nd European survey of schools suggests that 19% (ISCED 1), 15% (ISCED 2) and 30% (ISCED 3) of European students have teachers who use ICT in more than 75% of their lessons (see Figures 3-6, 3-7 and 3-8), with big differences between the Member States.

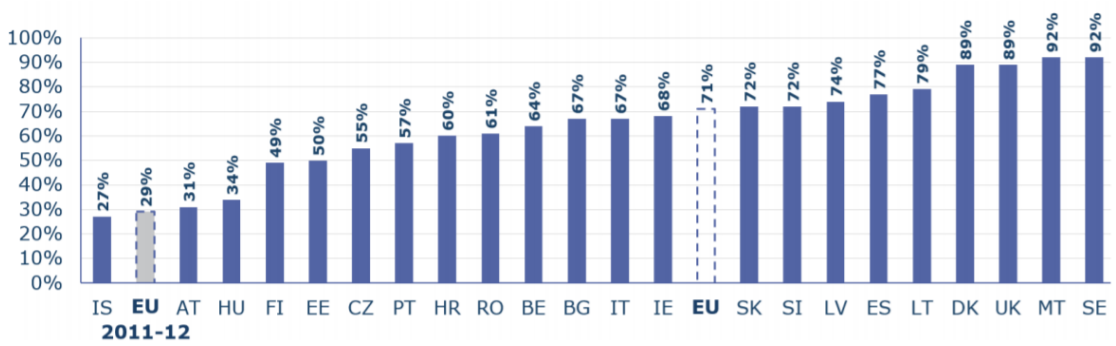
These findings are confirmed by national level data. The Flemish Community's 2018 ICT Monitor in Education (**Belgium**),[249] for instance, shows that in primary education only just over 5% of primary school teachers and just over 15% of secondary school teachers use digital tools several times per week during their classes. At both levels, fewer than 5% report using digital tools during their lessons on a daily basis. In **Austria**, in 2016 90% of federal schools (mainly upper secondary schools) engaged in e-learning, compared to 42% of lower secondary compulsory schools, and only 25% of primary schools.[250] In line with the findings for ECEC, when digital tools are used, this is mainly for purposes of demonstration or the simulation of practical tasks rather than specifically using them to promote inclusion or strengthen students' digital skills. Survey data from **Bulgaria**, shows that 83-87% of teachers use digital tools for demonstration or simulation purposes, rather than *actively* using them for observation or group work.[251] Teachers in **Estonian** basic schools (ISCED 1-2) are slightly less confident about their digital competence than teachers on average in the EU. At the same time, Estonian upper-secondary school teachers (ISCED 3) show confidence in their digital competences above the EU average.[252]

As regards the digital literacy and practices of teachers in **France**, the results of the national PROFETIC survey (2019),[253] which is conducted on a bi-annual rotating basis

[248] See https://onderwijs.vlaanderen.be/nl/digisprong
[249] https://onderwijs.vlaanderen.be/nl/monitor-voor-ict-integratie-in-het-vlaams-onderwijs-mictivo-2018
[250] Education and training Monitor 2020 – Austria https://op.europa.eu/en/publication-detail/-/publication/b6837464-2494-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171314305
[251] Questionnaire survey conducted by the Department of Communication systems and services, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, 2016-2018 http://css.iict.bas.bg
[252] Deloitte and Ipsos MORI (2019). 2nd Survey of Schools: ICT in Education. Objective 1: Benchmark progress in ICT in schools. https://data.europa.eu/euodp/data/storage/f/2019-03-19T084831/FinalreportObjective1-BenchmarkprogressinICTinschools.pdf
[253] To find out more about the PROFETIC surveys, please visit: https://eduscol.education.fr/1059/l-enquete-profetic-sur-les-pratiques-numeriques-des-enseignants

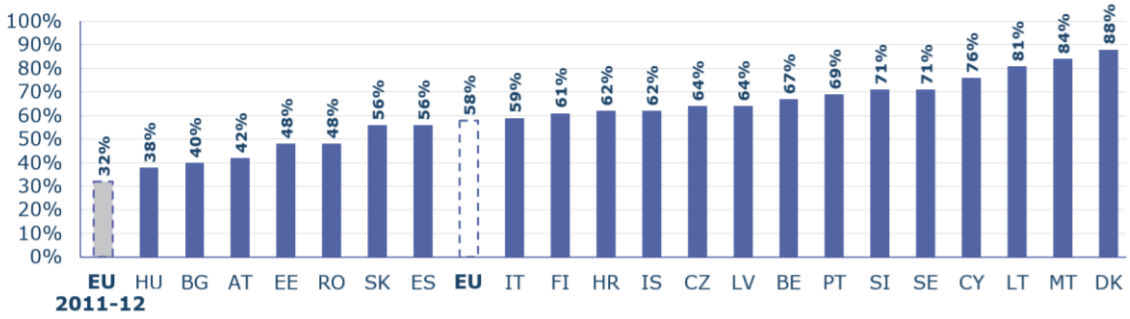
for primary and secondary education, show that while 64% of primary school teachers use digital tools in the classroom for basic functions, only 11% use IT tools to develop interactions with students and only 2% fully integrate them in their pedagogical practices.[254] At secondary level, 55% of teachers use digital tools in the classroom only for basic functions, however the active use of IT tools is more developed than at primary level, with a third of teachers using digital tools to interact with students in the context of pedagogical activities.[255] Every month, 57% of teachers organise activities involving IT tools and a similar share (62%) report that it is easy for them to access computers for student use.[256] Based on these figures, it can be said that whilst not systematic, the use of digital tools to support pedagogical activities is relatively frequent at secondary level in France.

Figure 3-6 Teachers' use of ICT in more than 25% of lessons (ISCED 1, % of students, by country and EU level. 2011-2012 and 2017-2018)



Source: 2nd Survey of Schools, p. 47

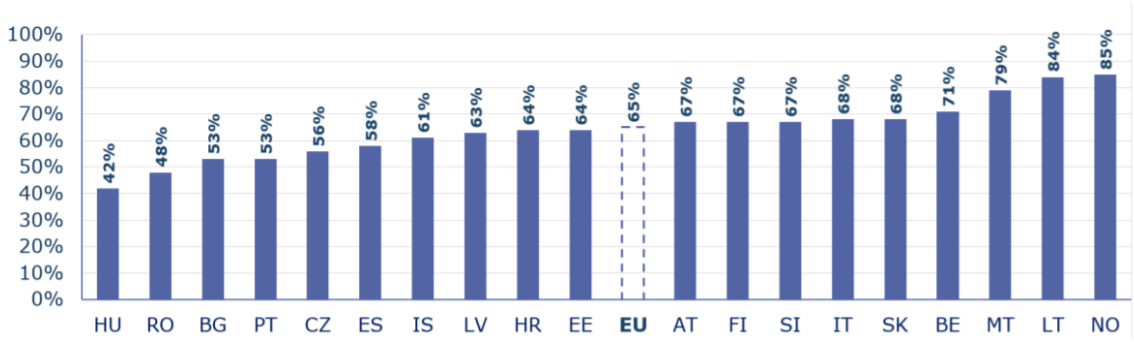
Figure 3-7 Teachers' use of ICT in more than 25% of lessons (ISCED 2, % of students, by country and EU level. 2011-2012 and 2017-2018)



Source: 2nd Survey of Schools, p. 47

[254] Enquête PROFETIC (2019). Available at : https://eduscol.education.fr/media/4303/download
[255] Enquête PROFETIC (2018). Available at : https://cache.media.eduscol.education.fr/file/ETIC_et_PROFETIC/65/7/Rapport_PROFETIC_2018_Synthese_1098657.pdf
[256] Enquête PROFETIC (2018). Available at : https://cache.media.eduscol.education.fr/file/ETIC_et_PROFETIC/65/7/Rapport_PROFETIC_2018_Synthese_1098657.pdf

Figure 3-8 Teachers' use of ICT in more than 25% of lessons (ISCED 3, % of students, by country and EU level. 2011-2012 and 2017-2018)



Source: 2nd Survey of Schools, p. 47

One of the most important reasons why teachers are not using digital tools as much as they could (or should) is firstly related to insufficient provision of digital devices (as discussed under the education infrastructure paragraph above). Another important reason is **negative attitudes or perceptions related to using digital tools for teaching and learning**. Data from the 2nd Survey of Schools shows that two of the main obstacles to using ICT in teaching and learning are a lack of interest and resistance of teachers to using digital tools. Parents ('resistance of parents') and commitment of school leadership ('ICT use not being a goal in the school'), on the other hand, are perceived as being weaker obstacles, which shows that there is a strong need to change teachers' attitudes and motivation to using digital tools in the classroom (see Figure 3-9). Negative attitudes of teachers towards using digital tools in teaching and learning vary depending on the Member State, though.

While in **Austria**, a recent study found that a large majority of teachers (83.19%) would like to continue using digital media learning platforms,[257] in several other countries negative attitudes persist. In **Hungary**, for example, evidence shows that there is still a strong belief that the overuse of new ICT tools is detrimental to young people's cognitive development and social relations. It is also believed that the presence of ICT tools in schools would distract students from teaching and learning, and that schools should therefore forbid students from using their personal digital devices at school (especially in the classroom), with parents supporting this approach.[258] There are also concerns that, as a result of digitalisation, the use of printed materials decreases, which would impact on reading motivation and skills. [259] This is why a mobile phone ban has

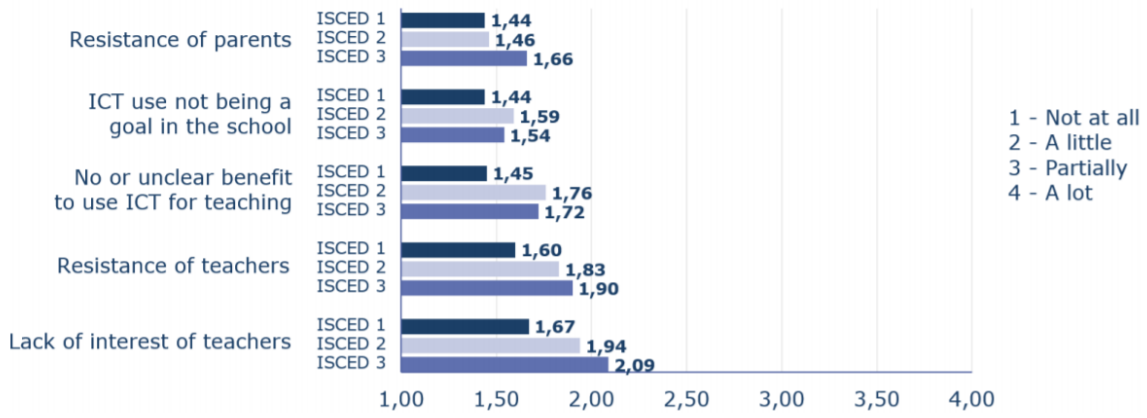
[257] Tengler, K., Schrammel, N., & Brandhofer, G. (2020). Lernen trotz Corona. Chancen und Herausforderungen des distance learning an österreichischen Schulen. *Medienimpulse*, *58*(02), 37-Seiten. https://journals.univie.ac.at/index.php/mp/article/view/3637/3513

[258] MHC (2020) *az Európai Unió számára készített köznevelési stratégia 2021-2030* (sic! with lowercase initial, without author, publisher and date) (Public education strategy prepared for the European Union 2021-2030) Budapest, Emberi Erőforrások Minisztérium (Ministry of Human Capacities) https://www.kormany.hu/download/d/2e/d1000/K%C3%B6znevel%C3%A9si%20strat%C3%A9gia.pdf#!DocumentBrowse

[259] Delgado, P., et al., (2018). Don't throw away your printed books: A meta-analysis on the effects of reading media on reading comprehension. Educational Research Review 25: 23-38.

been introduced in **Sweden**.[260] Moreover, a 2013 study from **Belgium (Flanders)** explains these negative attitudes of teachers as follows: after a wave of 'exaggerated enthusiasm' in the nineties for digital technology, we are currently going through a period of 'disillusion' with regards to the effectiveness of ICT in education among teachers and school leaders, which may be one of the reasons why ICT has not had such a drastic impact on education (in Belgium) thus far.[261]

Figure 3-9 Teachers' perception of attitude-related obstacles to the use of ICT in teaching and learning (2017-2018)



Source: 2nd EU Survey of Schools p. 50

These negative attitudes are, in turn, related to a **lack of teacher confidence and support to effectively use digital tools in teaching and learning**. Cluster analysis carried out as part of the 2nd Survey of Schools[262] shows that only half of all teachers feel highly confident about technology and consider themselves to be highly digitally active (see Figure 3-10).[263] While the data present a mixed picture across the EU and education levels, **Finland** and **Latvia**, where teachers feel highly confident and supported across all levels of education are of particular note. They are closely followed by **Estonia** and **Denmark**, where this is also largely the case across all levels of education. The extent to which teachers feel prepared to deliver digitally inclusive education is also strongly linked to the extent to which they feel supported at national, regional and/or school level to effectively use ICT in their daily teaching practice. The results from the 2nd European Survey of Schools show that school level policies to support teachers to effectively use ICT in teaching and learning are mostly in place at the level of upper-secondary education (ISCED 3), but this is only the case in 12 Member States, where more than half of all schools have strong policies and support structures in place to support teachers with ICT (see Figure 3-10). This figure drops to six Member States (DK, EE, FI, LT, LV, NL) and five Member States (DK, EE, FI, LT, LV) respectively for lower secondary and primary education respectively.

[260] https://www.regeringen.se/debattartiklar/2019/02/mer-trygghet-och-studiero/

[261] https://onderwijs.vlaanderen.be/sites/default/files/atoms/files/Literatuurstudie%20De%20school%20een%20aantrekkelijke%20plek%20voor%20leren%20en%20werken%20in%202030.pdf

[262] Ipsos Mori. (2019). 2nd survey of Schools ICT in education. European Commission: Brussels.

[263] This covers a myriad of variables, including training of teachers, teachers own use of and access to technology, and their digital skills.

Moreover, the desk research conducted for this study reveals that **only a limited number of Member States provide teacher support or training on using digital tools to support social inclusion *specifically***. An example is the government-funded i-Learn programme in **Belgium (Flanders)**, launched in September 2019, which aims to encourage teachers to individualise and tailor learning to pupils' needs through effective use of digital tools in the classroom. The objective is that by September 2022, at least 10% of all primary and secondary school students will have benefited from the programme. At EU level, as part of European SchoolNet's **MENTEP programme**, a teacher self-assessment tool was developed to support teacher professional development to work with digital technology in teaching.[264]

Figure 3-10 To what extent are teachers supported and confident about technology?

Member State	Over half of teachers feel highly digitally active and confident?			Over half of schools with strong policies and support for ICT use in teaching and learning?		
	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3
AT		✓	✓			
BE	✓					
BG						✓
CZ	✓	✓				✓
CY						
DE						
DK	✓	✓		✓	✓	✓
EE	✓		✓	✓	✓	✓
EL						
ES	✓	✓	✓			
FI	✓	✓	✓	✓	✓	✓
FR						
HR	✓	✓	✓			
HU						
IE	✓					
IT						✓
LT	✓			✓	✓	✓
LU						
LV	✓	✓	✓	✓	✓	✓
MT	✓	✓	✓			
NL					✓	
PL						✓
PT			✓			✓
RO		✓	✓			
SE	✓	✓				✓
SI	✓					
SK	✓	✓	✓			

[264] http://mentep.eun.org/tet-sat;jsessionid=2C99BB86A26383FDC17B415D488F873C

Source: Ipsos Mori. (2019). 2nd survey of Schools ICT in education. European Commission: Brussels.

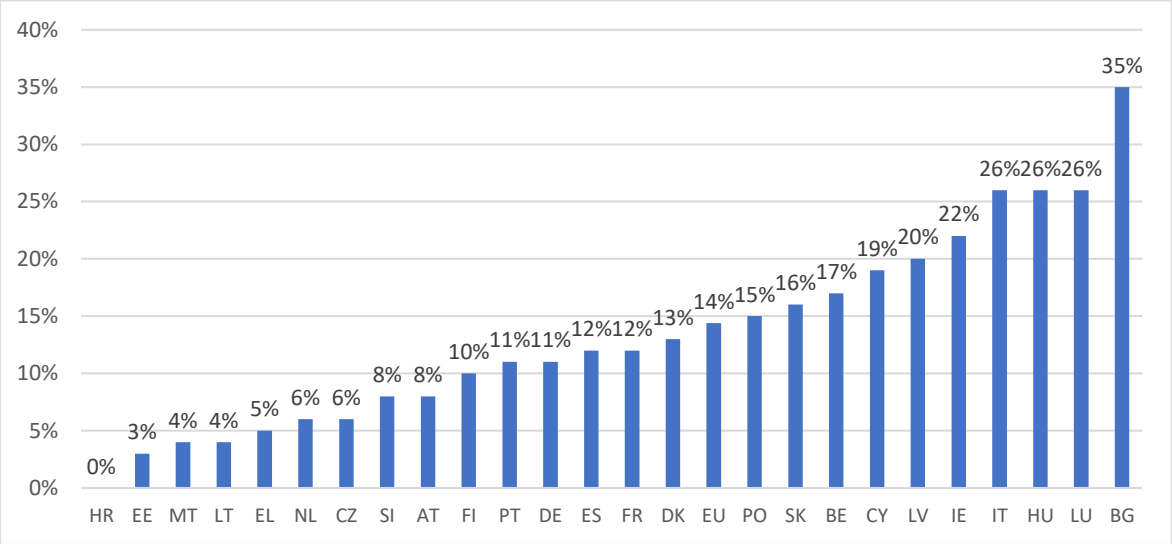
Readiness of students

Similar to the figures presented for ECEC, the 2020 EU Kids Online survey shows that **the majority of children in 19 European countries surveyed report using their smartphones daily or all the time**.[265] A study by the **Polish** Research and Academic Computer Network (NASK), for instance, showed that 79.7% of teenagers constantly (daily or several times a week) use the web to do homework. Most often they use it to expand useful knowledge in school (64.8%) and to prepare for tests (45.7%). The Internet is also a tool for teenagers to broaden their knowledge and interests - 41.8% of respondents use the web for this purpose every day, and 73.9% on a weekly basis. Only 6.3% declare that they do not use the Internet for this purpose.[266] A 2019 survey from **Finland**, looking into the digital skills of teachers and students, included 4,513 teachers, 4,135 2nd grade and 4,992 5th grade students. The survey found that 11% of fifth-graders have their own tablet and 74% of them were able to use a shared tablet or smartphone. The number of personal tablets had increased by as much as 5% compared with the previous year.[267]

The increased use of digital technology means that young people across the EU27 are more likely to have digital skills compared to their older counterparts.[268] Figure 3-11 shows that **at EU level in 2019, only 14% of pupils have low or no digital skills**. Only three Member States (IE, IT and PT) reported having 16-24-year-olds with no digital skills, although in each of these countries this represents only 1% of the population. Interestingly, Croatia reported having no young people with low/no digital skills. The highest levels of low achievers in digital skills can be found in BG (35%), which is more than twice the EU average. BG is followed by LU, HU, IT, IE and LV, where 20% or more of the overall population have low digital skills levels. As will be discussed in section 3.3.3 below, despite overall strong levels of digital skills among young people, there are big differences *between* different types of pupils. There are high levels of underperformance on basic digital skills among pupils with a migrant, low socio-economic, rural and Roma background. This has a big impact on their ability to access and fully participate in education, especially during the ongoing COVID-19 pandemic, where distance learning has become the norm rather than the exception in many Member States.

[265] https://www.lse.ac.uk/media-and-communications/assets/documents/research/eu-kids-online/reports/EU-Kids-Online-2020-10Feb2020.pdf
[266] NASK. (2016). Nastolatki 3.0. Wybrane wyniki ogólnopolskiego badania uczniów w szkolach [Teenagers 3.0. Selected results of the national student survey].
[267] Tanhua-Piiroinen, E. Kaarakainen, S.-S. Kaarakainen, M.-T., Viteli, J., Syvänen, A. & Kivinen, A. (2019) Digiajan peruskoulu [Primary and Secondary level school at the Digital era]. Valtioneuvoston selvitys- ja
[268] Eurostat. (2020). Digital economy and society database. Eurostat: Brussels.

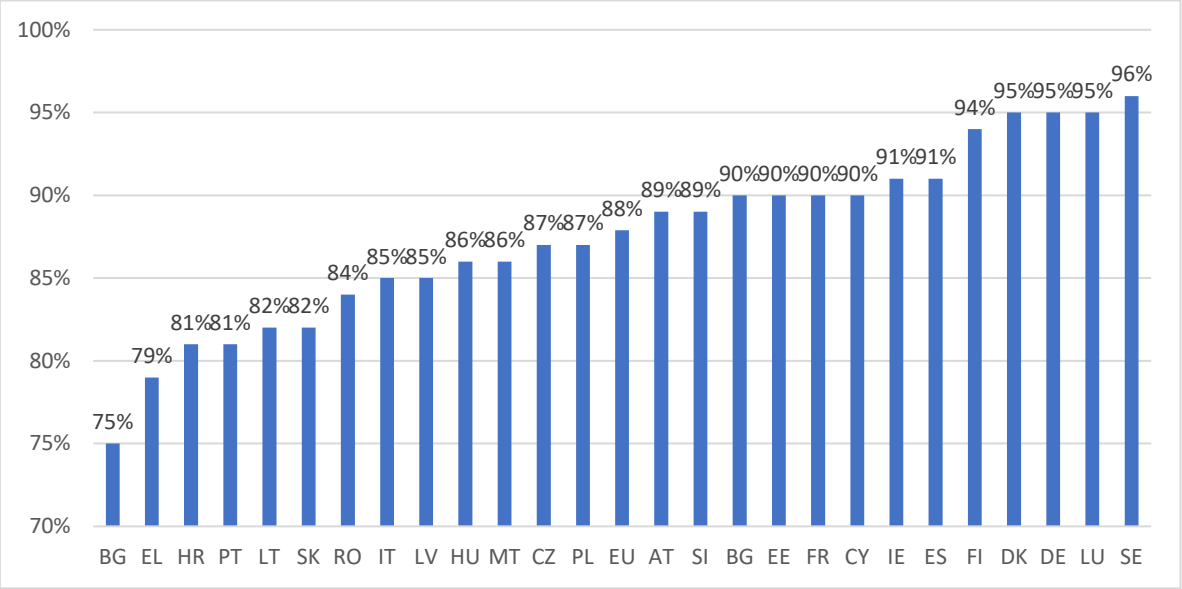
Figure 3-11 The proportion of young people with low or no digital skills (% of all students, by country and EU level, 2019)



Source: Eurostat, 2019.

Another requirement for being able to fully participate in distance learning and digital education more broadly (e.g., for completing or submitting assignments at home, or to keep in contact with teachers for one-to-one support or guidance) is access to digital tools and connectivity at home. Eurostat data show that, in 2019, **88% of households in the EU had internet access**, with access levels reaching 90% and above in no fewer than eleven Member States (BG, CY, DE, DK, EE, ES, FI, FR, IE, LU, SE), closely followed by SI (89%) and AT (89%). BG (75%) and EL (79%) are the only two Member States where household internet access does not reach 80%, which seems to suggest that across the EU internet access is relatively good, with only moderate differences between the Member States. As will be discussed in section 3.3.3 below, though, there are important differences *within* Member States depending on the region (urban/rural) and family background of pupils (e.g., migrant background, socio-economic status, etc.).

Figure 3-12 Household internet access in the EU (% of all households, by country and EU level, 2019)



Source: Eurostat, 2019.

5. Key challenges in vocational education and training (VET)

In the 1st European Survey of Schools on ICT in education, a differentiation was made between general and vocational education in upper secondary education. According to the survey findings, compared with general upper secondary education (55%), **slightly fewer (50%) grade 11 vocational students are attending highly digitally equipped schools**.[269] In the latest report produced by the European Commission's ET 2020 Working Group on Vocational Education and Training (VET), it is estimated that *"the speed of digitalisation in education is up to five times slower [in VET] than in other sectors"*.[270] The report continues by saying that the reason for this is likely to be poorly distributed knowledge and weak connectivity among teachers, school managers, governing bodies and policy makers. The VET sector is therefore likely to benefit from 'intermediary bodies' who can help these different actors to better understand the costs and benefits of investing in and using digital technology for teaching and learning.

The lack of digital infrastructure in VET is confirmed by national level data. For instance, data collected by the **Slovak** Centre of Scientific and Technical Information (SCSTI) show that in 2019 there were 73,381 devices with internet connection (WIFI + LAN) in VET schools and conservatories, 5,317 specialised classrooms equipped with digital technologies, but only 4,773 connected to the internet. Out of all 71,008 devices (PCs, tablet computers and laptops), only 50,934 (72%) have sufficient performance and parameters to use them for teaching purposes. There are on average 110 devices per school with parameters needed for use in classrooms and 2.5 students per such device.

[269] http://www.eun.org/documents/411753/817341/Survey+of+Schools-ICT+in+Education_summary2013/3e8082fc-7aaf-4e00-955f-dca445c9b53b
[270] https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8365&furtherPubs=yes p. 92

There are 3.7 such devices per full-time or part-time teacher. All schools are connected to the Internet, but accurate national administrative data on the quality of the connection is not available. These data indicate the limits of making use the digital education to support inclusion of learners when access is restricted.[271]

A 2020 report by Cedefop, looking at the extent to which the key competences of literacy, multilingual and digital are included in upper-secondary initial VET in the EU27, Iceland, Norway and the UK, shows that **67% of the 64 iVET policies identified have the explicit objective of strengthening digital competences in iVET**. Almost half (44%) of the 64 policies refer to EU or international initiatives, such as the DEAP, DigCompOrg or Council Recommendation on key competences for lifelong learning. This is important, as evidence shows that a growing number of VET professions require digital skills, and the digital skills of VET students are less developed than those of students in general secondary education. In **Finland**, for instance, standardised testing has shown that the digital skills of VET students are slightly lower than students in general education.[272] In **Portugal**, for example, digitalisation has been an important priority for VET as recent data shows that two of the three most chosen VET options by students are related to digitalisation (i.e., Electronics and Automation; Computer Sciences and Audiovisual and Media Production). In **Cyprus** also, the strategic plan for technical and vocational education and training 2015-2020 stresses the importance of strengthening students' (digital) skills and competences for the labour market in VET.[273] Therefore, an introductory ICT course (two 45-minute lessons per week) has been introduced in the first year of upper secondary VET; and in the second and third years of VET, ICT courses are optional for all specialisations.[274]

Specific challenges facing groups at risk of marginalisation

As described in section 3.3.2 above, EU education and training systems face important challenges to equipping schools with the necessary digital infrastructure, as well as equipping teachers and students with the necessary digital skills to make digital inclusion a reality. There are also a number of additional **challenges facing specific groups at risk of marginalisation to access and fully participate in (digital) education**. These will be described in turn for the following six groups: (1) Roma pupils and pupils from other ethnic minority backgrounds, (2) pupils with disabilities and mental health disorders, (3) students living in rural areas, (4) students with migrant and refugee backgrounds, (5) children with low socio-economic background, (6) students from difficult familial and personal circumstances, (7) pupils suffering from screen addition, (8) young male pupils, (9) LGBTQI+ learners, and (10) other groups with specific learning needs (e.g. gifted children). In the following section of the report, we will present the issues of inclusion in the EU27 by presenting country specific

[271] www.cvtisr.sk
[272] Foundation Innove, (2019). Digipädevuste tasemetöö 2019. Tulemuste analüüs. Digital literacy standard-determining test 2019. Analysis of results https://www.innove.ee/wp-content/uploads/2019/09/2019-Digip%C3%A4devuse-tasemet%C3%B6%C3%B6-tulemuste-anal%C3%BC%C3%BCs.pdf
[273] Υπουργειο Παιδειας Και Πολιτισμου, 2015, Στρατηγικος Σχεδιασμος Τεχνικης Και Επαγγελματικης Εκπαιδευσης. Available at: http://www.refernet.org.cy/images/media/assetfile/%CE%A3%CF%84%CF%81%CE%B1%CF%84%CE%B7%CE%B3%CE%B9%CE%BA%CF%8C%CF%82%20%CE%A3%CF%87%CE%B5%CE%B4%CE%B9%CE%B1%CF%83%CE%BC%CF%8C%CF%82%20%CE%94%CE%9C%CE%A4%CE%95%CE%95.pdf%20f
[274] Theocharous, A (2020). Vocational education and training for the future of work: Cyprus. Cedefop ReferNet thematic perspectives series. Available at: http://libserver.cedefop.europa.eu/vetelib/2020/vocational_education_training_future_work_Cyprus_Cedefop_ReferNet.pdf

examples, focusing specifically on the groups known to be at risk of marginalisation or underachievement mentioned above. In line with the analytical framework for our study, we will focus on the aspect of inclusion from three angles: **issues related to access, issues related to teaching and learning, and issues related to equity.**

6. Challenges facing students with a Roma background, as well as learners with other ethnic minority backgrounds

According to the Council of Europe, the term "Roma" refers to Roma, Sinti, Kale and related groups in Europe, including Travellers and the Eastern groups (Dom and Lom), and covers the wide diversity of the groups concerned, including persons who identify themselves as Gypsies.

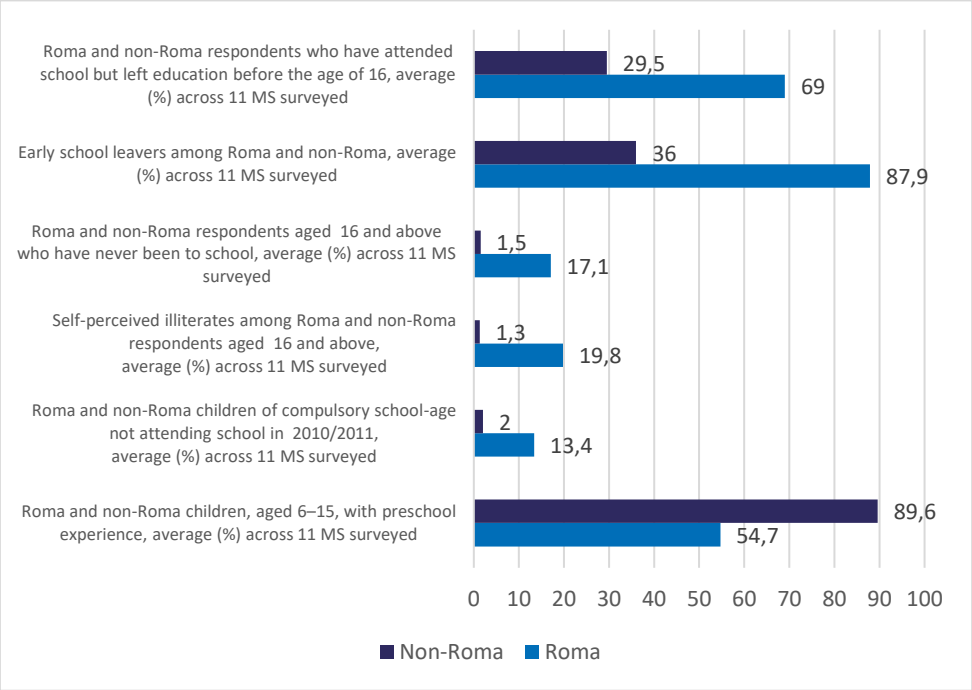
Evidence suggests that the marginalisation of Roma is exacerbated by their systematic exclusion from education, with underlying factors such as family poverty, poor parental education and perceived discrimination in schools contributing further to their limited opportunities. Despite decades of campaigning for Roma rights and fair treatment, a recent study reports ongoing segregation practices of Roma children across Europe, through refused enrolment, overrepresentation in special schools and poor-quality schooling.[275] UNESCO identified that Roma young people in Europe have not received the support they need to integrate effectively due to "cultural attitudes and negative stereotyping".[276]

In **Slovakia,** for instance, children living in marginalised Roma communities (MRC), often with low living standards, have limited access to kindergartens. Roma children are overrepresented in schools designed for mentally challenged children despite the strict prohibition and anti-discrimination measures. Roma children are frequently included in such schools based on a misdiagnosis due to social or cultural disadvantage.

According to a European Agency for Fundamental Rights (FRA) report,[277] which presents the results of the 2011 Roma survey on education in 11 EU member states, considerable gaps between Roma and non-Roma children persist at all levels of education, from preschool to secondary education. **Early school leaving rates for Roma children are also amongst the highest of any specific group in Europe**.[278] In fact, according to the FRA survey, on average only 12 % of the Roma aged 18 to 24 have completed upper-secondary general or vocational education. [279] Since 2011, when the FRA report was published, in 2019 another smaller FRA survey was conducted in five Member States (Belgium, France, Ireland, the Netherlands, Sweden and the United Kingdom).[280] The 2019 survey echoes the findings from the 2011 survey and finds that the share of Roma aged 18 to 24 who have attained at most lower secondary education and who do not continue in education or training ranges between 30% in Sweden and 91% in the United Kingdom (Figure 3-13).

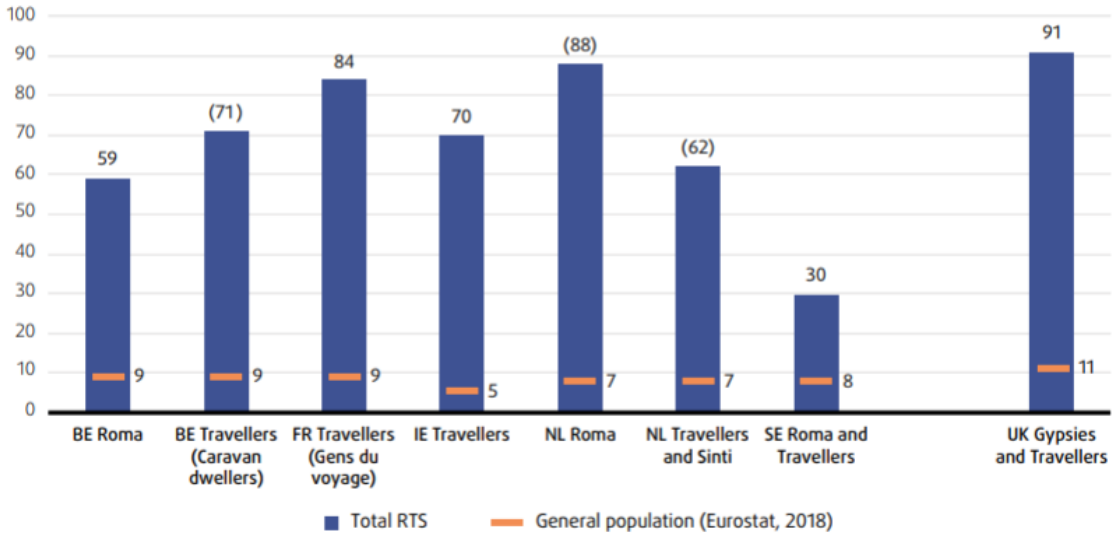
[275] Sime, D., Fassetta, G., & McClung, M. (2018). 'It's good enough that our children are accepted': Roma mothers' views of children's education post migration. British Journal of Sociology of Education, 39(3), 316-332.
[276] United Nations Educational, Scientific and Cultural Organization (UNESCO). (2010). Education for all global monitoring report 2010–Reaching the marginalized.
[277] European Union Agency for Fundamental Rights (2016). Education: the situation of Roma in 11 EU Member States. Roma survey – Data in focus. Luxembourg: Publications Office of the European Union
[278] Ferkovics, R. Addressing early school leaving amongst the Roma. Roma Education Fund. Brussels: European Economic and Social Committee.
[279] European Union Agency for Fundamental Rights, *op. cit.*
[280] European Union Agency for Fundamental Rights (2020). Roma and Travellers in six countries. Available at https://fra.europa.eu/en/publication/2020/roma-travellers-survey

Figure 3-13 Data sourced from FRA survey comparing Roma and non-Roma pupils (% across 11 MS, 2016)



Source: *European Union Agency for Fundamental Rights (2016). Education: the situation of Roma in 11 EU Member States. Roma survey – Data in focus. Luxembourg: Publications Office of the European Union*

Figure 3-14 Data sourced from FRA survey comparing Roma and non-Roma pupils (% across 11 MS, 2016)



Source: *European Union Agency for Fundamental Rights (2019), RTS 2019; Eurostat, Labour Force Survey (LFS) 2018*

Roma pupils are more likely to leave school early compared to the general population in **Austria,** where recent PISA data from 2018[281] show that Roma pupils are less likely to attend kindergarten and represent a higher proportion of early school leavers compared to the rest of the population. It is interesting to note that there have been some positive steps taken towards the educational inclusion of Roma students in the country, in fact, Roma pupils are achieving a higher level of formal education than previously and the proportion of Roma students graduating from secondary school is also increasing. Additionally, among autochthonous Roma, there has been an overall increase in the levels of education and the proportion of Roma with vocational training and qualified degrees is steadily increasing.

Similarly, in **Finland,** participation in integrated special education or learning in a special class and ESL among Roma children is much more common than among the whole population. Reasons for this are related to absence from school, low school readiness and low achievements. Additionally, according to the Finnish Roma Forum, Roma pupils may also feel uncomfortable with young people in the majority population attending school alongside them.[282]

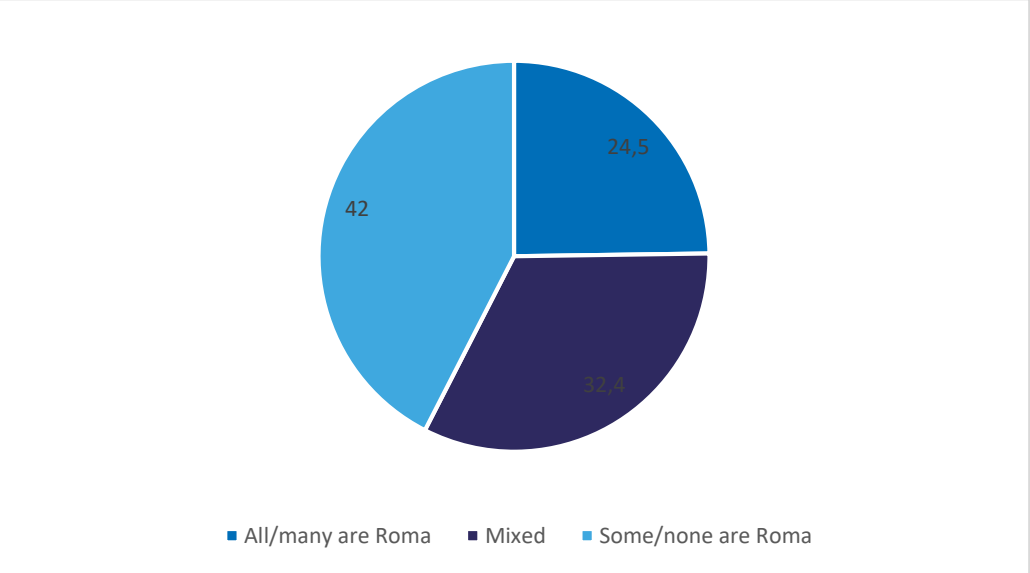
Additionally, **Roma learners also often find themselves in segregated schools or classes in mainstream education** as demonstrated in the figure 3-14 below. This is true in **Hungary**, where Roma students living in disadvantaged areas increasingly only have access to segregated schools. The proportion of primary schools with a Roma population of 50% or higher increased from 10% in 2008 to 15% in 2017, partly reflecting the demography of the locality in which the school is located. Since the compulsory school age was decreased from 18 to 16 years, the proportion of 17-year-olds who are not in employment, education or training has increased from 3% to 5-6% and reaches 40% among 17–year-old Roma boys.[283]

Segregation occurs in other member states as well. In **Bulgaria**, for instance, children and students from the Roma ethnic minority are the main group at risk of exclusion and marginalisation in education. Due to the regional distribution of the Roma groups, most of the schools attended by Roma children and students are segregated to a considerable degree, which creates issues with provision of quality of education due to overall lower access to high-quality teachers, learning resources, and a less balanced mix between higher- and lower-achieving classmates. There is a significant rate of ESL after primary education among these children, and the rate of Roma students graduating from secondary education is rather low. Access to education for disadvantaged children, especially Roma, is an ongoing challenge. The parameters of this challenge are demonstrated in the very slow rate of changing the level of enrolment of children from ethnic minorities and from poor families in the educational system at all levels and in particular in compulsory pre-primary education; the difficulties in keeping children in school above the primary level of education; the poor average performance of pupils; and, the difficulties in creating a supportive environment of real socialisation of these

[281] PISA (2018). Country Note Austria. Available at https://www.oecd.org/pisa/publications/PISA2018_CN_AUT.pdf
[282] Suomen romaanifoorumi (2020). Koulunkäynnin ongelmat [Challenges in education]. Suomen romaanifoorumi [The National Roma Forum of Finland]. https://www.romanifoorumi.fi/romanit-suomessa/romanien-yhteiskunnallinen-asema/koulunkaynnin-ongelmat/
[283] Köllő, J., Sebők, A. (2019a) *Mivel foglalkoznak azok a 17 évesek, akik nem járnak iskolába?* (What do 17-year-olds who don't go to school do?) In: *Munkaerőpiaci Tükör 2018*, MTA-KRTK. https://www.mtakti.hu/wpcontent/uploads/2020/01/mt_2018_hun.pdf

children in classes and schools. The enrolment rate of children from vulnerable social groups and in particular Roma children is very low compared to all other minority groups. Statistical data show that around 1.29% of the school age group say that "they have never been to school".[284] The percentage of children of compulsory school age (from 7 to 15 years old) who do not attend school remains high among Roma children (23,2%), as compared for example for children from Turkish origin (11,9%) and ethnic Bulgarian children (5,6%). There is a negative trend of dropping out among girls from this group due to various factors, including teenage pregnancy, difficult family conditions, and financial hardships.[285]

Figure 3-15 Ethnic composition of school classes attended by Roma children (% across 11 MS, 2016)



Source: *European Union Agency for Fundamental Rights (2016). Education: the situation of Roma in 11 EU Member States. Roma survey – Data in focus. Luxembourg: Publications Office of the European Union*

One of the structural barriers to Roma children accessing education is language. In fact, in **Bulgaria,** children with a poor level of Bulgarian as the language of schooling, are predominantly from ethnic minorities. The competence in the language of schooling is a major challenge for educational integration and it is an issue which has not been resolved even for those children who continue in secondary education. This leads to the risk of low performance and, effectively, to low access to quality education. The failure to ensure a good level of language competences in pre-school and primary school results in a low entry level to the educational system. Consequently, low performance is registered in international surveys (e.g. PISA) concerning literacy levels and performance in mathematics and science. Completion of secondary education for

[284] 2011 Census. Volume 1 Population, Book 2 Demographic and social characteristics, Sofia 2012, p. 241.
[285] Strategy for reducing the share of early school leavers 2013-2020, p. 9, https://www.mon.bg/upload/6565/strategy_napusnali_obr_sistema_2013_2020.pdf

Roma children is still an exception, which substantially limits their prospects of employability.

The 2019 FRA survey asked Roma respondents the main reasons for leaving school early. According to the survey results, 25% said it was because they were looking for work or needed to work; 14% stopped education because of marriage, pregnancy or childbirth; 14% mentioned changing their place of living during the year.[286] According to the report, this last reason is the most frequently mentioned (30%) for children aged 6 to 15 years for not going to school.

A School Education Gateway report which specifically focuses on Traveller communities, such as Roma or circus communities[287] suggests that **children who are part of Roma travelling communities often lack regular or sustained access to education because they do not reside in the same place for an extended amount of time**. The article[288] goes on to give examples of successful Traveller education programmes, which include projects such as Head in the Clouds,[289] implemented in **Kosovo, Slovakia and Romania**, which provides open education resources in the domains of digital competence, including computer programming, English, environmental awareness, video making and other daily life skills for children and young people ages 6 to 16; and Good Start for All[290] which aims to support teachers, social workers and parents to provide care for ECEC aged children through training programmes, useful reports and material, an online conference, and a good practice guide.[291]

Later in this report, we discuss the challenges faced by children with migrant and refugee backgrounds, who can also have Black, Asian and minority ethnic backgrounds (BAME). According to the stakeholders interviewed for the purpose of this research **BAME students often face challenges in accessing education**. There is a rich body of literature which discusses the challenges students face when accessing education, although this is mainly focussed on higher education rather than compulsory education.[292] According to a report published by the European Students Union, the challenges that BAME students face in accessing education (at all levels) are often due to discrimination.[293] The report identifies five types of discrimination which affect the access of BAME students to compulsory and higher education. These are: segregation

[286] European Union Agency for Fundamental Rights (2020). Roma and Travellers in six countries. Available at https://fra.europa.eu/en/publication/2020/roma-travellers-survey
[287] School Education Gateway, (2021), Overcoming the challenges of Traveller education for inclusion, available at https://www.schooleducationgateway.eu/en/pub/latest/practices/challenges-traveller-education.htm
[288] School Education Gateway, (2021), Overcoming the challenges of Traveller education for inclusion, available at https://www.schooleducationgateway.eu/en/pub/latest/practices/challenges-traveller-education.htm
[289] See https://brainsintheclouds.eu/
[290] See http://www.scholaempirica.org/projekt/gsa-dobry-zacatek-pro-vsechny-deti-rozvoj-inkluzivnich-vzdelavacich-metod-pro-deti-predskolniho-veku-ze-socialne-znevyhodneneho-nebo-kulturne-odlisneho-prostredi/
[291] See https://ec.europa.eu/programmes/erasmus-plus/project-result-content/e85d003e-5424-47d2-b0d1-2ece69907028/GSA_new_evidence_EN_web_2.pdf
[292] Broeke, S., & Nicholls, T. (2007). Ethnicity and degree attainment. Retrieved from http://mpra.ub.uni-muenchen.de/35284/.; Murtagh, S., Ridley, A., Frings, D., & Kerr-Pertic, S. (2016). First-year undergraduate induction: Who attends and how important is induction for first year attainment? *Journal of Further and Higher Education*. https://doi.org/10.1080/0309877X.2016.1159288; Richardson, J. T. (2008). The attainment of ethnic minority students in UK higher education. *Studies in Higher Education,33,* 33–48. https://doi.org/10.1080/03075070701794783.; Richardson, J. T. E. (2012). The attainment of White and ethnic minority students in distance education. *Assessment & Evaluation in Higher Education,37,* 393–408. https://doi.org/10.1080/02602938.2010.534767.; Schnell, P., & Azzolini, D. (2015). The academic achievements of immigrant youths in new destination countries: Evidence from southern Europe. *Migration Studies,3*(2), 217–240.; etc.
[293] European Students' Union, (2016), Students with a Migrant or Ethnic Minority Background. Available at: https://files.eric.ed.gov/fulltext/ED572768.pdf

in school classes; assignment to special education for reasons other than disability; exclusion from schools for cultural and religious reasons (such as excluding Muslim female students wearing the headscarf at schools in France),[294] BAME students are often less represented in more prestigious or private institutions, and absence of or low quality of compensatory or support programmes (especially in regard to languages).[295] Stakeholders participating in the study's Delphi consultation further cited **specific national ethnic minorities within their own countries more at risk of exclusion from education compared to national ethnic majorities**. These included, for instance, Sami learners in Scandinavia and Serb learners in Croatia.[296]

7. Challenges facing students with disabilities and mental health difficulties

Those with special needs and disabilities often need extra learning support and resources to access traditional education. Young people with special educational needs are more likely to be at risk of early school leaving than other student groups.[297] According to the European Commission, those with special needs are also often "placed in segregated institutions and those in mainstream educational settings often receive inadequate support".[298] According to Eurostat data from 2018[299]:

- Disabled people leave education and training earlier.
- In the EU-28, young people with disabilities are twice as likely to be in the NEET category as their peers who do not have disabilities (neither in employment nor in education and training);
- 15% of individuals with disabilities complete the first and second stage of tertiary education level as compared to 25% of individuals not having a disability.
- Tertiary education completion: countries are from the objective of 40% completion at this level, in fact, "About 36% of people aged 30-34 without disabilities attained this educational level in 2011, against fewer than 24% for persons having basic activity difficulty and about 22% for those having limitation in work caused by a standing health problem and/or a basic activity difficulty".
- Lifelong learning: Fewer than 10% of individuals with disabilities have participated in lifelong learning education and training as compared to 21% of individuals not having a disability.

[294] BBC news, (2004), French Girls expelled over veils. Available at http://news.bbc.co.uk/1/hi/world/europe/3761490.stm; The Guardian, (2004), School expels girls for wearing headscarves available at https://www.theguardian.com/world/2004/oct/20/schools.france
[295] Five types of discrimination sourced from: Luciak, M. (2004). Migrants, minorities and education: Documenting discrimination and integration in 15 member states of the European Union. Retrieved 27 May 2016 from https://fra.europa.eu/sites/default/files/fra_uploads/186-CS-Education-en.pdf
[296] Mercator, (2020), The Sámi language in education in Sweden. Available at https://www.mercator-research.eu/fileadmin/mercator/documents/regional_dossiers/sami_in_sweden_2nd_ed.pdf
Unesco, (2021), Pandemic Has Worsened Minorities' Schooling in Balkans, Central Europe. Available at https://balkaninsight.com/2021/02/12/unesco-pandemic-has-worsened-minorities-schooling-in-balkans-central-europe/
[297] Squires, G., & Dyson, D. (2017). Early school leaving and learners with disabilities and/or special educational needs: To what extent is research reflected in European Union policies? European Agency: Brussels.
[298] European Commission. (2012). Special needs children and disabled adults still getting a raw deal from education, says report. European Commission: Brussels.
[299] Eurostat, Disability statistics - access to education and training, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Disability_statistics_-_access_to_education_and_training&oldid=196899

Across many Member States, **educational inclusion of students with disabilities has become an important priority for policy makers**. In **Finland**, for example, educational equality and equity have been important values in Finnish education since the 1970s at all levels. As a consequence, there are no private schools. Instead, all children and adolescents attend the nearby common compulsory school. Finnish special needs education aims to integrate learners with learning difficulties, such as dyslexia or other barriers to engaging in learning, into inclusive classrooms with tailored support. ECEC institutions, schools, teachers, and families aim to recognise challenges in learning as early as possible. There are three levels of support for children and adolescents, including: general support for all learners or with minor difficulties' intensified support for those that need it (such as individual learning plans); and specialised support for SEN students.[300]

Providing digital tools for children with SEN to access education more effectively has also become an important priority. In fact, in **Greece**, all existing secondary education textbooks are available in Braille writing code and in various fonts for partially sighted learners. Furthermore, several schoolbooks have been adapted into accessible digital and easy to read formats for deaf learners, learners with autism and learners with intellectual disabilities. The Ministry of Education and Religious Affairs also provides technical aids to learners free of charge, including PCs and laptops with adequate software, Braille technology, assistive technology. A study on ICT in special education showed that specially designed software for students with learning difficulties is hard to find, as Greek software is rare, and most are not for free.[301]

However, **the COVID-19 pandemic has meant that some students with disabilities have not had access to the digital tools they need in order to access education**. In **Italy**, for instance, the COVID-19 pandemic has revealed important shortcomings in the integration of disabled pupils in the mainstream education system. In fact, 2020 ISTAT data show that 1 out of 4 schools are lacking computer stations for pupils with disabilities; 23% of pupils with disabilities did not participate in distance learning between April and June 2020; and there are over 60,000 pupils with other special educational needs, who represent 11% of students enrolled in secondary school and 6.5% in primary school in need of tailored efforts.[302]

In **Poland,** the support of the use of ICT in teaching is provided in two ways. Firstly, through the Education Development Centre, teachers and schools have access to guidance and materials (*i.e.* tools, exemplary lessons) that show how to use ICT in teaching students with special needs.[303] Secondly, students with disabilities can apply for the funding for equipment with assistive technologies from the programme "Active local government" of the State Fund for Rehabilitation of Disabled People.

In regard to issues/ barriers to equity (e.g. low digital skills/ competences), as mentioned above, although the inclusion of SEN students into the education system is an important priority across the European Union Member States, there are still structural

[300] FNAE (2020). Oppimisen ja koulunkäynnin tuki [Support for learning] https://www.oph.fi/fi/koulutus-ja-tutkinnot/oppimisen-ja-koulunkaynnin-tuki.
FNAE (2016). The National Core Curriculum for Pre-Primary Education. Helsinki: FNBE National Board of Education. http://www.oph.fi/ops2016.
[301] Nikoleta Anagnostou (2015) How do Greek teachers use computer technology in the education for students with reading and writing difficulties in primary school, University of Oslo. Available at: https://core.ac.uk/download/pdf/30832568.pdf
[302] ISTAT (2020), L'INCLUSIONE SCOLASTICA DEGLI ALUNNI CON DISABILITÀ - A.S. 2019-2020 Available at https://www.istat.it/it/files/2020/12/Report-alunni-con-disabilit%C3%A0.pdf
[303] Dobrowolska, M. (2018). Wykorzystnaie TIK w nauczaniu i uczeniu się uczniów ze specjalnymi potrzebami edukacyjnymi. Warsaw: Ośrodek Rozwoju Edukacji.

impediments in many countries. In **Bulgaria**, for instance, despite the work of the regional centres for support for the personal development of children and institutions in the field of inclusive education, there are still issues related to physical access, a need for a high level of support to parents and accompanying activities to include children with special educational needs and disabilities in the education system. The measures for provision of special assistive technologies are still not sufficiently effective.

In countries where access to digital infrastructure and tools is widely ensured, other challenges for learners with disabilities have been observed. For instance, while assistive technologies can be a great tool to promote access to education for SEN learners, several interviewees based in **Denmark** stressed that navigating online can present novel challenges with adverse socio-emotional effects for this diverse learner group. For example, a recent report suggests that young people with physical, mental or behavioural disabilities experience twice as many threats, aggressive behaviour and bullying on social media[304]. Learners with cognitive disabilities may also be particularly susceptible to being taken advantage of online[305]. In this sense, many SEN learners may be particularly vulnerable online, especially without tailored efforts in schools to ensure this learner group develop the necessary digital literacy skills to navigate safely.

Stakeholders consulted through the study's policy Delphi also stressed that mental health and emotional disorders may affect classroom learning for children and young people. According to the OECD, mental disorders account for one of the largest and fastest growing diseases[306] and mental health problems have been increasingly recognised as one of the most significant health concerns for children and adolescents in developed countries.[307] The impact of mental health issues can be severe, with poor mental health being shown to exacerbate social exclusion[308], and suicide being one of the leading causes of death amongst 10 to 19-year-olds in Europe.[309]

European countries are therefore setting mental health provisions high on their policy agendas and the Conclusions of the Vilnius Conference (October 2013) recommended to address mental health as a priority of EU-education policy activities on early child education and care and on school education.[310] Mental health can affect children and young people in a variety of ways and varying degrees in the classroom and they can often have 'good days' or 'bad days', which renders treatment and support difficult to. One review carried out by 9 European countries (Croatia, England, Estonia, Finland, Italy, Iceland, Malta, Norway, Slovak Republic)[311] finds that children with mental health difficulties need a variety of types of support in school. The report goes on to state that "in line with the need for a more holistic approach to the issue of mental health and

[304] Statens medieråd, 2017. Ungar & medier. https://www.statensmedierad.se/rapporter-och-analyser/material-rapporter-och-analyser/ungar--medier-2017
[305] https://www.osonline.dk/
[306] http://www.oecd.org/els/health-systems/mental-health-systems.htm
[307] Ravens-Sieberer, U. and V. Ottová-Jordan. 2016. 'Children's Mental Health in Europe: The Current Situation and Its Implications.' In Improving the Quality of Childhood in Europe (Alliance for Childhood European Network Foundation).
[308] Gardner, A., K. Filia, E. Killackey & S. Cotton. 2019. 'The social inclusion of young people with serious mental illness: A narrative review of the literature and suggested future directions.' Aust N Z J Psychiatry 53(1):15–26. DOI: 10.1177/0004867418804065.
[309] WHO. 2020. 'Child and Adolescent Mental Health.' http://www.euro.who.int/en/healthtopics/noncommunicable-diseases/mental-health/areas-of-work/child-and-adolescent-mental-health.
[310] https://ec.europa.eu/health/sites/default/files/mental_health/docs/ev_20131010_mi_en.pdf
[311] Rampazzo L. et al, (2017), Joint Action on Mental Health and Well-being. Available at https://ec.europa.eu/health/sites/default/files/mental_health/docs/2017_mh_schools_en.pdf

well-being among children and adolescents, inter-sectoral collaboration[312] has been recognised as being key to the success of promotion and prevention initiatives".[313]

However, as mentioned in a report published by the European Commission,[314] although mental health issues are preventable and treatable, there are important barriers. In fact, services to tackle mental health issues may not always be readily available, due for instance to long waiting lists, and structural and logistical hurdles may render access to provision difficult (such as transportation problems). Another important barrier is related to the perception around mental health problems, such as the stigma related to accessing services. [315] Because of these barriers, only an estimated quarter of young people suffering with such disorders receive the support they need.[316] Children and young people suffering from mental health problems therefore risk being excluded from education as they are unable to access the support needed to treat their disorders.

8. Challenges facing students living in rural areas

In addition to student achievement, there are also differences in individuals' educational outcomes across OECD countries between rural and urban regions. This is important as lower levels of skills supply in the labour force can hinder regions' productivity and innovation potential. Rural schools are usually smaller and have lower student-teacher ratios than urban schools. They are also more likely to have a less socio-economically advantaged student body, to experience staff shortages and have a lower proportion of qualified teachers. Early school experiences provide a foundation for subsequent learning. However, enrolment in pre-primary education is generally lower in rural than in urban areas across PISA participating countries.[317] **Therefore, students living in rural areas may face difficulties accessing education in certain member states**. This is the case for instance in **Croatia,** where there is a significant urban-rural divide when it comes to ECEC participation.[318]

According to the latest Eurostat data, in 2019 the level of internet access was lower for households in rural than in urban areas, as shown in table 3-3. Similarly, Eurostat data sourced from 2017 show that on average across the EU MSs, rural households have a lower level of computer use compared to urban households.

[312] Inter-sectoral collaboration has been defined as "A recognized relationship between part or parts of different sectors of society which has been formed to take action on an issue to achieve health outcomes or intermediate health outcomes in a way which is more effective, efficient or sustainable than might be achieved by the health sector acting alone" (modified from WHO, Geneva, 1997).
[313] Rampazzo L. et al, (2017), Joint Action on Mental Health and Well-being. Available at https://ec.europa.eu/health/sites/default/files/mental_health/docs/2017_mh_schools_en.pdf p.21
[314] European Commission, (2020), Children and Menal Health: Preventive Approaches to Anxiety and Depression. Available at https://ec.europa.eu/social/BlobServlet?docId=23575&langId=en
[315] Owens, P.L., K. Hoagwood, S.M. Horwitz, P. Leaf, J. Poduska, S. Kellam & S. Ialongo. 2002. 'Barriers to Children's Mental Health Services.' Journal of the American Academy of Child & Adolescent Psychiatry 41(6), 731–738.
[316] Centre for Mental Health. 2016. 'Missed Opportunities, A Review of Recent Evidence into Children and Young People's Mental Health.' See also Edbrooke-Childs, J.H. & P. Patalay, 2019. 'Ethnic Differences in Referral Routes to Youth Mental Health Services.' Journal of the American Academy of Child & Adolescent Psychiatry 58 (3).
[317] OECD. Trends Shaping Education Spotlight 9, Country Roads: Education and Rural Life. Paris: OECD.
[318] UNICEF, 2018

Table 3—1 Level of internet access (rural/urban split), 2019

Households located in cities	Households located in towns and suburbs	Households located in rural areas
92%	89%	86%

Source: Eurostat. Households - level of internet access[319]

Table 3—2 Level of computer use (rural/urban split), 2017

Households located in cities	Households located in towns and suburbs	Households located in rural areas
84%	79%	75%

Source: Eurostat. Individuals - computer use[320]

However, in **Belgium,** rural background is not a determining factor for access to digital tools. There are in fact no significant differences between pupils from rural/urban areas in terms of their frequency of internet access. In 2010 there was still a small difference (75% and 74% for pupils living in urban and towns and suburban areas vs. 68% of pupils living in rural areas), but data for all the subsequent years show no significant difference (e.g. in 2019: 87% and 90% of pupils living in cities and towns and suburban areas vs. 89% of pupils living in rural areas). This is also the case for internet access in general: in 2010 the difference between cities (72%) and rural areas (64%) was 8%, in 2019 we see that rural areas (90%) are even slightly overtaking urban areas (88%) in terms of household internet access.

Similarly, in **Slovenia,** no particular issues regarding access or quality of education for children from rural areas are reported. At primary school level (ISCED 1-2), all children either have a school in their vicinity or have organised access to a school-by-school bus. The OECD Education Policy Outlook report for Slovennia, based on the PISA 2015 results, shows an above average influence of school location (urban vs. rural) on student performance (after accounting for differences in socio-economic status, students from urban areas outperformed those in rural areas by 74 score points, compared to the OECD average of 18 points), but no indication is given as to contributing factors.[321] As with Belgium and Slovenia, the comparison between rural and urban households in **Estonia** does not reveal a significant digital divide. The share of urban households with internet access was 91% in 2020 (EU average 93%), and the share among rural households was 89% (88% EU average; Eurostat 2020).[322]

[319] Eurostat. Households - level of internet access, available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H__custom_134664/default/table?lang=en
[320] Eurostat. Individuals - computer use, available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_CFP_CU__custom_134959/default/table?lang=en
[321] OECD (2016). Education Policy Outlook Slovenia. http://www.oecd.org/slovenia/Education-Policy-Outlook-Country-Profile-Slovenia.pdf
322 https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H__custom_1005188/default/table?lang=en

In **Italy,** the differences in access to digital tools for pupils are more pronounced in some regions as compared to others, and these do not follow the typical rural and urban area divide. In fact, in the south of Italy, 41.6% of families have no computer at home (compared to an average of about 30% in the other areas of the country) and only 14.1% have at least one computer for each member of the household. This is also the case in **Belgium,** where digital technology is unequal across regions: while Flanders is almost entirely urbanised, in Wallonia there are still many "white zones" or areas with no connectivity at all. Similarly, in **Bulgaria** one in two children is at risk of exclusion and poverty in the northwestern region of the country while the ratio is 1 to 4 in the southwest.[323] This directly correlates to the availability of ICTs, whereby the highest proportion of households with internet access is in the southwestern region (85.9%) and the lowest in the northwestern region (66.2%).[324]

Early school leaving (ESL) rates, are also tied to the rural/urban location of the learner data from 2019 show that learners who live in towns and suburbs, as well as rural areas, are more likely to be at risk of early school leaving (ESL), as demonstrated in the table.

[323] www.nsi.bg
[324] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Digital_economy_and_society_statistics_-_households_and_individuals#Internet_access

Table 3—3 Early leavers from education and training by degree of urbanisation, 2019

Cities	Towns and suburbs	Rural areas
9.1%	11.2%	10.7%

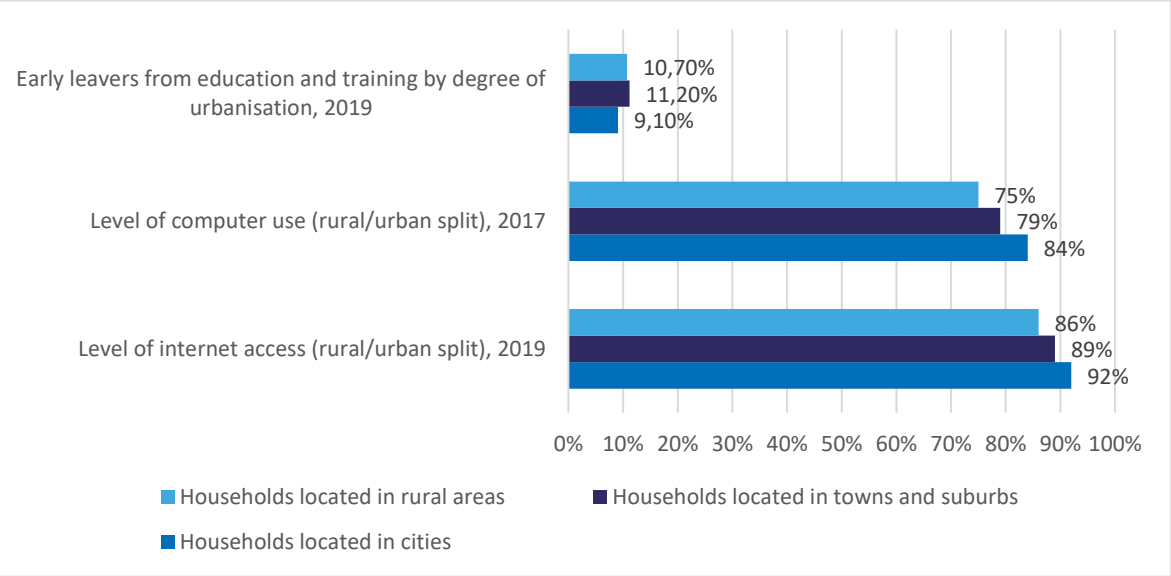
Source: Eurostat. Early leavers from education and training by sex and degree of urbanisation.[325]

In **Italy**, territorial imbalances in ESL remain strong, with Sicily, Campania, Sardinia above the national average.[326] However, in other MS, such as **Sweden,** early school leaving rates are slightly higher in rural areas than in urban areas and suburbs, although this is not a very significant gap. Rather, the key issue of school segregation relates to large inequalities between ESL and performance rates for learners in affluent and disadvantaged areas within urban districts of Sweden. The impact of (ethnic and socio-economic) school segregation in Sweden has been a subject of debate in recent years.[327]

The informational mentioned above concerning computer use and internet access across the EU Member States is also summarised in the figure below:

[325] Eurostat. Early leavers from education and training by sex and degree of urbanisation. Available at https://ec.europa.eu/eurostat/databrowser/view/edat_lfse_30/default/table?lang=en
[326] ISTAT (2020) https://www.istat.it/it/archivio/240949
[327] Eurostat, (2020). Early leavers from education and training, Available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Early_leavers_from_education_and_training

Figure 3-16 ESL, computer use, and internet access (rural/urban split), (% of households across MS, 2017 and 2019)



Source: *Eurostat. Households - level of internet access*[328], *Eurostat. Individuals - computer use*[329], *Eurostat. Early leavers from education and training by sex and degree of urbanisation.*[330]

9. Challenges facing students with migrant and refugee backgrounds

Foreign-born students lag in achievement, with 30% at age 15 not having basic reading skills, and only 9% being top achievers as defined by PISA.[331] However students born to immigrant parents (first generation) tend to do as well at school as the children of native parents.[332]

According to a UN report published in 2019,[333] **refugee children** are entitled to access education under the same conditions as nationals and children of EU born migrants. However they are not automatically entitled to associated benefits, which can restrict their ability to access education fully. Additionally, asylum-seeking children are also legally entitled to access the host State's education system through temporary accommodation centres which often do not offer the full curriculum as national schools nor meet the teaching standards of local schools.

Migrant children in irregular situations (*i.e.* those who have not applied for asylum and do not reside in a host country legally) are, according to the UN, most at risk of being excluded from formal education. In fact, three Member States (Hungary, Latvia, and Lithuania) explicitly exclude or limit the right to schooling to this category of learners; whereas only seven Member States explicitly recognise undocumented migrant

[328] Eurostat. Households - level of internet access, available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H__custom_134664/default/table?lang=en
[329] Eurostat. Individuals - computer use, available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_CFP_CU__custom_134959/default/table?lang=en
[330] Eurostat. Early leavers from education and training by sex and degree of urbanisation. Available at https://ec.europa.eu/eurostat/databrowser/view/edat_lfse_30/default/table?lang=en
[331] OECD. (2015). Indicators of immigrant integration 2015: Settling in. OECD Publishing.
[332] Some countries do significantly diverge from this tendency of second-generation learners performing at the same rate as native-born students, this is the case of Denmark for instance.
[333] UNHCR, UNICEF, IOM, (2019), Access to education for refugee and migrant children in Europe. Available at https://www.unhcr.org/neu/wp-content/uploads/sites/15/2019/09/Access-to-education-europe-19.pdf

children's entitlement to education (Belgium, Bulgaria, Finland, Italy, the Netherlands, Spain and Sweden). The UN report lists a series of challenges refugee and asylum-seeking children face in accessing education, which were also mentioned by stakeholders during the primary research stage of our study. These include:

a) legal barriers (such as lack of clarity on the entitlement of education);

b) administrative challenges (e.g. inflexible registration deadlines and high administrative burden for what concerns providing documentation);

c) insufficient human and financial resources of education authorities (such as lack of catch-up classes for pupils that join school later);

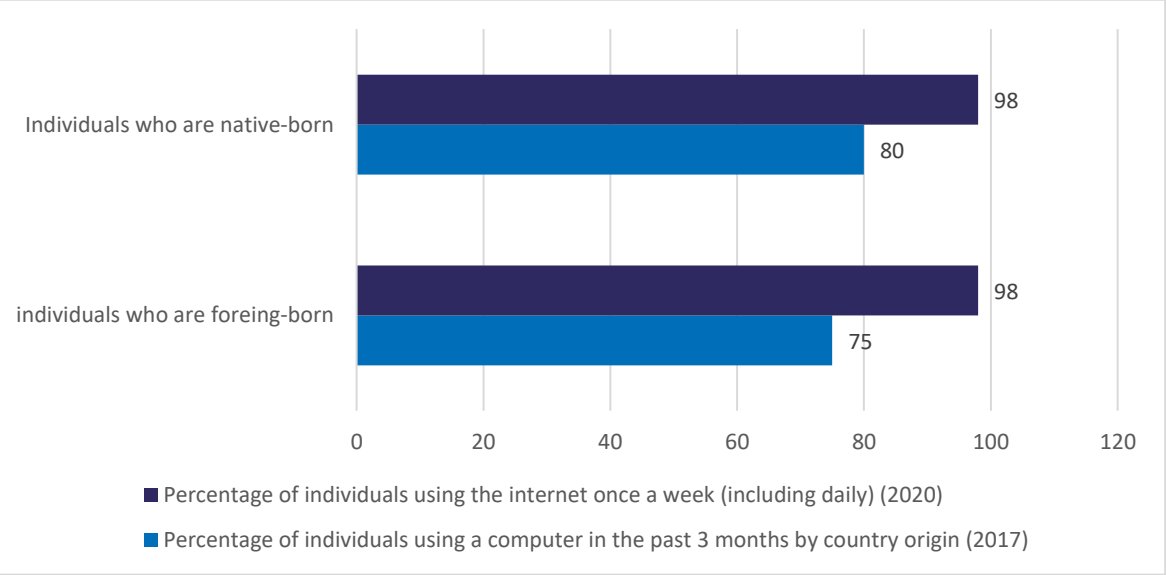
d) lack of psychosocial support in schools which may be necessary in the cases where children have suffered trauma and stress; language barriers; negative stereotypes;

e) limited opportunities for adolescents (15 to 17 year olds) who find it harder to integrate in the national education systems; and,

f) unaccompanied children who turn 18 and lose support from the national child protection system.[334]

According to Eurostat data sourced from 2017 and 2020, there is a difference between individuals' level of computer use depending on whether or not they were born outside of the EU, but there does not seem to be an important difference between native-born and foreign-born students' internet use.

Figure 3-17 Percentage of individuals using computers or internet (% of individuals across MS, 2017 and 2020)



[334] UNHCR, UNICEF, IOM, (2019), Access to education for refugee and migrant children in Europe. Available at https://www.unhcr.org/neu/wp-content/uploads/sites/15/2019/09/Access-to-education-europe-19.pdf

Source: Eurostat, Internet use statistics – individuals[335]

In regard to issues and barriers to accessing education and digital tools, **foreign born children are often over-represented in ESL data across EU MS.** This is the case for **Sweden,** where Eurostat data show that when comparing early leavers (18-24) from education and training by country of birth, a higher percentage of foreign-born learners are likely to drop out (13%) than their native-born peers (4,6%).[336] Since 2010, the rates seem to have slightly improved for native-born learners, while having slightly worsened for foreign-born learners.[337] Pupils who moved to Sweden after the typical school starting age of 7, as well as those from disadvantaged socio-economic backgrounds, perform particularly poorly according to a recent study by the Swedish Ministry of Finance's Expert Group on Public Economics (ESO).[338]

In some Member States, there appears to be a correlation between lower access to ICT tools and foreign background. This is the case for **Lithuania,** where foreign born individuals have lower access to the internet with access at least once a week once (71% for foreign born vs. 82% for native) as well as accessing a computer within last 3 months (70% for foreign born vs. 76% for native). While students from immigrant families constitute a small number of the overall student population (in 2018 children, age 0-15, from immigrant families accounted for 3,7% of the children aged 0-15), the Ministry of Education, Science and Sport notes that this percentage has been increasing. In fact, the number of immigrant children increased roughly 4 times between 2010 and 2020 (from 523 to 2255 for children whose parents are Lithuanian and from 107 to 471 for immigrant children whose parents are of other nationalities).[339] Similarly, in **France,** a migrant background correlates with less frequent computer use and internet access.[340] In fact, for native-born pupils, the last computer use within the last 3 months in 2019 was 83%, whereas for foreign-born it was 70%. Similarly, in regard to the frequency of internet access once a week or daily, 87% of native-born pupils accessed the internet, compared to 82% of foreign-born pupils.

This is not however the case for all EU Member States. In fact, in **Belgium, migrant background is not a determining factor for access to digital tools, but it does determine education outcomes.** PISA data show that pupils with a migrant background in **Belgium** perform worse than native pupils. In 2018, for example, the average PISA reading score for native students was about 506, for second-generation migrant pupils the average score was about 458 (an almost 50- point difference), and for first-generation migrant pupils the average score was about 427 (i.*e.* almost 80-point difference).

Good language skills are important for access to the curriculum, and some pupils with a migrant background may benefit from language support (*e.g.* through CALL, i.e. computer-assisted language learning). In **Denmark**, according to 2018 PISA results, the average difference in reading performance between immigrant and non-immigrant

[335] Eurostat, Internet use statistics – individuals, available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Internet_use_statistics_-_individuals
[336] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_lfse_02&lang=en
[337] Ibid
[338] https://www.thelocal.se/20170529/performance-gap-between-immigrant-pupils-and-native-swedes-growing-report
[339] Ministry of Education, Science and Sport. (2020). Migrantų integravimas bendrojo ugdymo mokyklose. Available at: https://www.nsa.smm.lt/wp-content/uploads/2020/12/Migrantu-integravimas.pdf
[340] (Eurostat 2017, 2019)

students was as high as 65 score points in favour of non-immigrant students. According to the case study research conducted for the purpose of this assignment, this could be linked to the estimated 76% foreign-born and 44% second-generation students who do not speak the language of instruction at home, which is a higher rate than in other OECD countries[341]. Therefore, whilst it is undoubtably important to support mother tongue linguistic development, this might lead to a greater need for linguistic support in schools to ensure that host-language development of learners of migrant background does not lag behind that of native peers. If we look at frequency of internet access in Denmark, there does not seem to have been a big difference in 2019: 89% of native background vs. 84% of migrant background students say they frequently access the internet, suggesting that internet access is not really an issue here (in 2010 already, the difference was only 6%: 73% vs. 79%). As we saw above, having a migrant background is an important determining factor for ELET.

In regard to issues and barriers to teaching and learning, teacher shortages in **the Netherlands** are more acute in schools where the majority of the student body is of a non-western background: in 2017/2018, 13% of schools with 0-25% students from a migrant background were looking for teachers through job sites, compared with 48% of schools with 75-100% of pupils from a migrant background.[342]

Interestingly, stakeholders based in **Belgium** mentioned that there are important differences in terms of the way in which different groups are connected to the internet. People from low income or migrant backgrounds, for example, are most often connected to the internet through a smartphone, while people from higher-income families can access the internet through multiple devices, which has an important influence on the amount and type of activity carried out online.

It is worth noting that **when looking specifically at digital competences in Nordic compulsory education, where access is near universal, the picture regarding which learner groups are particularly at-risk changes**. For example, **performance differences in digital skills due to migrant backgrounds are less pronounced in Denmark** than in other EU and OECD countries.[343] This is striking when noting that the performance gap for learners with a migrant background in Denmark far exceeds the EU/OECD averages in other subjects. For instance, the Danish gap stands at twice the EU average in reading. Overall, this is an important finding, as it likely speaks to the near universal access to digital tools for all learners having a significant impact on bridging the digital skills gap for this learner group[344]. This same pattern of considerably levelling the playing field in digital skills as a result of widespread access to digital tools can also be observed for learners with low socio-economic status in the Nordic countries, a learner group that will be further covered below.

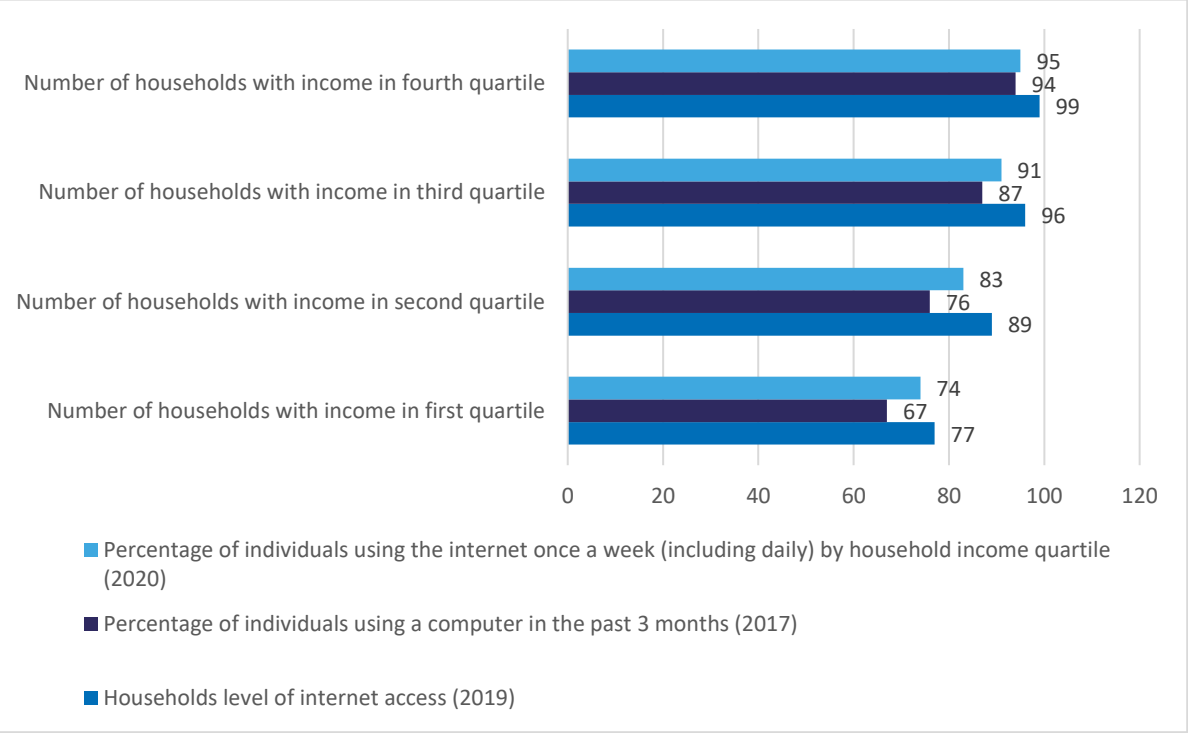
10. Challenges facing students with low socio-economic status

[341] https://www.oecd.org/education/policy-outlook/country-profile-Denmark-2020.pdf
[342] Source: European Commission (2020) Education and Training Monitor 2020 – Country analysis. November 2020. See: https://ec.europa.eu/education/policies/et-monitor-2020-country-reports_en
[343] https://op.europa.eu/en/publication-detail/-/publication/3fe7eba2-2496-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316210
[344] Ibid.

It is also important to note that **low socioeconomic status** plays an important role in students' access to education. According to Eurostat Data,[345] there is a strong link between leaving education and training early, social disadvantage and a low level of parental education. Many studies confirm that low socio-economic status is one of the key factors that can increase the risk of early leaving. In general, early leavers are much more likely to come from families with a low socioeconomic status, *i.e.* unemployed parents, low household income, and low levels of parental education.[346]

Eurostat[347] data demonstrate that there is an important correlation between income quartile and the access to internet and computers. The most recent data are presented in the figure below and show that households with income in the first quartile are less likely to have access to the internet once a week, have used a computer in the last 3 months, and have lower levels of internet access.

Figure 3-18 Access and use of internet and computers per income quartile (% of households across MS, 2017, 2019 and 2020)



[345] Young Fail. Early School Leaving Fact Sheet. European Commission: Brussels.
[346] Ibid.
[347] Eurostat. Households - level of internet access available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H__custom_185979/default/table?lang=en
Eurostat. Individuals - computer use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_CFP_CU__custom_186022/default/table?lang=en
Eurostat. Individuals - frequency of internet use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IFP_FU__custom_612556/default/table?lang=en

Source: Eurostat. Households - level of internet access, Eurostat. Individuals - computer use, Eurostat. Individuals - frequency of internet use[348]

In **Belgium,** for instance, according to a *Teach for Belgium* (a non-profit association that forms honorary teachers and coaches in vulnerable schools) survey conducted during the first wave of the pandemic of 1,000 pupils in its partner schools of secondary education, 35% of (predominantly underprivileged) pupils did not have a computer at home, or have less than 2 hours access to it a day. For 80% of them it is not possible to focus on school tasks for more than 4 hours a day at home.[349]

The situation is similar in **France.** Whilst French students typically enjoy better home settings for online learning than do their OECD counterparts on average, a sizeable share of French students do not enjoy such adequate conditions.[350] In fact, 91% of students reported having a computer they could use for schoolwork, but this percentage fell to 79% for students from the bottom quartile of the socio-economic distribution. Both these numbers may have fallen during the COVID-19 pandemic as a result of having to share access to a computer with other family members. Additionally, 94% of students reported having a quiet place to study at home, but this percentage fell to 87% for students from the bottom quartile of the socio-economic distribution. Access to a quiet place may also have deteriorated as a result of the lockdown measures.[351]

According to a study conducted in 2020 in the United Kingdom**, single-parent families at greater risk of "digital vulnerability"**, which the authors define as not having access to internet or computer in the home.[352] Digital vulnerability could be due to living in a single-income household and is therefore related to economic marginalisation. This is an important issue across the European Union, as according to Eurostat data dating back to 2020, approximately 14% of households with children (7.8 million households) consist of single parents, accounting for 4% of total households.[353] Disaggregate level data on the digital capacity of households (single-parent or not) is not easily accessible, so it is therefore difficult to make an EU-level assessment on the number of single-parent households that are "digitally vulnerable". However, several stakeholders interviewed for the purpose of this assignment stated that single-parent households are an important group at risk of digital exclusion. In **Belgium,** for example, stakeholders mentioned that 22% of single-parent households do not have internet access at home

[348] Eurostat. Households - level of internet access available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H__custom_185979/default/table?lang=en
Eurostat. Individuals - computer use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_CFP_CU__custom_186022/default/table?lang=en
Eurostat. Individuals - frequency of internet use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IFP_FU__custom_612556/default/table?lang=en
[349] Teach for Belgium (2020). *Thuis leren in tijden van corona: leerlingbevraging april 2020* [Studying at home in times of corona: survey of pupils April 2020]. Available at https://stories.teachforbelgium.org/2020/04/01/thuis-leren-in-tijden-van-corona-leerlingbevraging/
[350] OECD (2020). Country note – France: School education during COVID-19. Were teachers and students ready?, p.5. Available at: http://www.oecd.org/education/France-coronavirus-education-country-note.pdf
[351] Eurostat. Individuals - computer use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_CFP_CU__custom_186022/default/table?lang=en
Eurostat. Individuals - frequency of internet use available at https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IFP_FU__custom_612556/default/table?lang=en
[352] Mikolai, J., K. Keenan, and H. Kulu, 'Intersecting Household Level Health and Socio-Economic Vulnerabilities and the COVID-19 Crisis: An Analysis from the UK', SSM -Population Health, July 2020, p. 100628.
[353] Eurostat, (2021), How many single-parent households are there in the EU? Available at https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20210601-2

(compared with 9% of couples without children), and 30% of single women in Wallonia do not have internet access at home.[354]

11. Challenges facing students from difficult familial and personal circumstances

Students with tumultuous or difficult home lives are also at risk of exclusion from education. According to a study conducted in the United Kingdom,[355] many children face harsh challenges in their home lives which can include parental ill health and disability, unemployment, poverty and poor housing. An article dating back to 2009 found that "wider life circumstances had reinforced difficulties in school, including early parenthood, frequent house moves, challenging family circumstances and living in a community with long-term unemployment and a poor infrastructure": a difficult familial context can therefore impact behaviour at school, which can in turn affect children's educational achievement.[356] The challenging familial background can be linked to socio-economic status.

As relates to personal circumstances, policy Delphi consultation stakeholders also stressed that **children in Detention and Care are another specific group at risk of exclusion from education**. These barriers are often associated with their unique personal circumstances which include aspects such as trauma, relationships with families or carers, education provision within the care environment, the impact of the adverse childhood experiences on their educational provision and their disposition to learn.[357]

12. Challenges facing students suffering from screen addiction

Stakeholders participating in the study's Delphi consultation mentioned that students suffering from screen addiction (such as gaming) are often suffering from exhaustion in class, which disconnects them from the social environment for learning. They are often struggling with continuity in learning with 'good days' and 'bad days', which makes it a challenge for teachers and school staff to provide effective support. Research in fact demonstrates that video gaming addiction can negatively impact memory, attention and learning skills; a recent report concluded that "higher addiction to video gaming salience was significantly associated with worse episodic memory, problem solving, basic reading skills and written expression. Higher addiction to video gaming was significantly associated with poor novel problem solving and poor attention. Higher addiction to video gaming and withdrawal were significantly associated with poor attention, factual memory, attention, processing speed, visual spatial

[354] Refer to Belgium Case Study prepared for the purpose of this study.
[355] Department for Education (England), (2019), School exclusion: a literature review on the continued disproportionate exclusion of certain children. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800028/Timpson_review_of_school_exclusion_literature_review.pdf
[356] Evans J, Meyer D, Pinney A, Robinson B (2009) Second chances: Re-engaging young people in education and training. Barkingside: Barnardo's. http://www.barnardos.org.uk/2nd_chances_report.pdf
[357] The Inspectorate, Department of Education and Skills, (2017), EDUCATION OF CHILDREN IN DETENTION AND CARE: Schools at High Support Units, Special Care Units and Children Detention Centres. Available at https://assets.gov.ie/25247/286c2569a3e34b2aacb32f32a4b69d0b.pdf

organization, sustained sequential processing, working memory, novel problem solving and poor written expression skills".[358]

13. Challenges facing boys compared to girls

Ecorys has recently conducted research on gender behaviour and its impact on education outcomes, with a special focus on the performance of boys and young men in education.[359] The study found that there are gender differences between boys and girls of compulsory school age, **with boys' participation generally falling behind that of girls. Eurostat data show that boys are more likely to be early school leavers compared to girls**, with 11.8% of males aged 18 to 24 being early leavers from education and training in 2019 in the EU, as compared to 8.4% of girls.[360] Boys were also found to be more likely to repeat a grade.[361] In regard to attainment rates in compulsory education, in every MS, girls score higher than boys in reading – in 2018, the average PISA gap between girls and boys across the EU in reading was thirty points – which is equivalent to one year of schooling.[362] In regard to science, data demonstrate that girls outperform boys in later compulsory education.[363] There are a number of reasons why boys underperform compared to girls and the literature explaining this gender gap is rich and varied, addressing: gender norms (what is traditionally feminine or masculine); societal norms; school; family; and, individual attitudes and behaviours. It's also important to note that there is a higher prevalence of SEN among boys than girls which has implication for access to education, as mentioned above. It's interesting to note that boys' and girls' use of digital tools also varies. As previously mentioned in this report, studies suggest that boys tend to engage in more diverse uses of technology already at ECEC level, and that they more frequently use technology in a 'behind-the-scenes'-way (such as experimenting with controlling a robot).

14. Challenges facing LGBTQI+ learners

Stakeholders participating in the study's Delphi consultation mentioned that LGBTQI+ (lesbian, gay, bisexual, transgender, queer and intersex) students can face a series of additional challenges when accessing education. According to OECD these include domestic violence, stronger levels of depression and anxiety, and higher rates of suicide attempts, ideation and completions.[364] Additionally, LGBTQI+ pupils may also face bullying at school and discrimination and lack of visibility.[365] These challenges can impact LGBTQI+ students' school attendance and school performance. The International Lesbian, Gay, Bisexual, Trans and Intersex Association (ILGA Europe)

[358] Farchakh Y. et all, (2020), Video gaming addiction and its association with memory, attention and learning skills in Lebanese children. Available at https://capmh.biomedcentral.com/articles/10.1186/s13034-020-00353-3
[359] Staring, F., Donlevy, V., Day, L., Georgallis, M., and Broughton, A. (2021) Study on Gender Behaviour and its impact on Education Outcomes (with a special focus on the performance of boys and young men in education) - Final Report. Luxembourg: Publications Office of the European Union. Online: https://op.europa.eu/en/publication-detail/-/publication/414f506c-df95-11eb-895a-01aa75ed71a1/language-en/format-PDF/source-search [Accessed: 03.09.21]
[360] Eurostat (2020). Early leavers from education and training by sex and labour status. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_lfse_14&lang=en
[361] OECD (2015). *The ABC of Gender Equality in Education. Aptitude, Behaviour, Confidence*. PISA, OECD publishing. Available at: https://www.oecd-ilibrary.org/docserver/9789264229945-en.pdf?expires=1610634769&id=id&accname=guest&checksum=66B1763A84CB2A7C21B3829FBC7B8E3B
[362] OECD (2018). *Programme for International Student Assessment (PISA) 2018 Results: What Pupils Know and Can Do*. Available at: https://www.oecd-ilibrary.org/docserver/35665b60-en.pdf?expires=1610022523&id=id&accname=guest&checksum=B6ED8635FD5E7D65934BF526B99E6EC0
[363] PISA data available here: http://www.oecd.org/pisa/data/.
[364] OECD, (2021), Strength through diversity, available at https://www.oecd.org/education/strength-through-diversity/
[365] ILGA Europe, available at https://www.ilga-europe.org/what-we-do/our-advocacy-work/education

states that there are a series of initiatives on education with a focus on LGBTQI+ issues being carried out at local and national levels in Europe, these include: "*governmental action plans to fight bullying in Ireland; the introduction of comprehensive anti-discrimination legislation in Sweden and UK, which covers LGBTI-phobic bullying and the use of pedagogical inspectors monitoring bullying in United Kingdom*."[366] From a European perspective, the institutions have implemented multiple tools to fight discrimination of LGBTWI+ people at all levels, from education to employment.[367]

Notably, the Council of Europe Recommendation from 2010 explicitly called on measures to fight discrimination on the grounds of sexual orientation and gender identity in education.[368] Recently, the European Commission also published a Communication on the LBTQI Equality Strategy 2020-2025,[369] which outlines the tools and initiatives already in place and which will be implemented by the Commission to combat inequality in education based on sexual orientation.

15. Challenges facing other groups with specific learning needs

Finally, it is important to state that **both low and high achievers in school can face issues with regards to not receiving sufficient support**. As stated in an OECD report, in 2012, one quarter of 15-year-old students in OECD countries had not achieved a baseline level of proficiency in at least one of the three core subjects PISA assesses: reading, mathematics and science. Poor performance in school has long-term consequences for both students and countries. The OECD report outlines policy and practice that can help students overcome these obstacles and the policy agenda needs to include "multiple dimensions, such as: creating demanding and supportive learning environments; involving parents and local communities; inspiring students to make the most of available education opportunities; identifying low performers and providing targeted support for students, schools and families; offering special programmes for immigrant, minority-language and rural students; tackling gender stereotypes; and reducing inequalities in access to early education and limiting the use of student sorting*".*[370]

As evident from the mapping exercise conducted across the EU27 for the purpose of this study, the reasons for students' educational underachievement are varied, and may include income disparity, migrant background, SEN, etc. For instance, in **Cyprus,** underachievement is often due to low socio-economic background. In fact, 52% of students at the lowest ESCS quartile are underachievers in math compared to 22% of students at the highest quartile. A similar disparity exists in reading (59% vs 30% - EU average 36.4%) and science (55% vs 24%). In the top socio-economic quartile, 29.7% are low achievers, the highest share in the EU (where the average is 9.5%). Low

[366] Ibid.
[367] A list of the Legal aspects of LGBTIQ equality in Europe can be found at https://ec.europa.eu/info/policies/justice-and-fundamental-rights/combatting-discrimination/lesbian-gay-bi-trans-and-intersex-equality/legal-aspects-lgbtiq-equality_en
[368] Council of Europe, (2010), Recommendation CM/Rec(2010)5 of the Committee of Ministers to member states on measures to combat discrimination on grounds of sexual orientation or gender identity. Available at https://www.coe.int/en/web/sogi/rec-2010-5
[369] European Commission, (2020), LGBTIW Equality Strategy 2020-2025. Available at https://ec.europa.eu/info/sites/default/files/lgbtiq_strategy_2020-2025_en.pdf
[370] OECD (2016), PISA Low-Performing Students WHY THEY FALL BEHIND AND HOW TO HELP THEM SUCCEED, available at https://www.oecd-ilibrary.org/docserver/9789264250246-en.pdf?expires=1615288417&id=id&accname=guest&checksum=6B462C0A533E5A37F21E98BB355DDCE0

achievers are much more exposed to frequent bullying than high achievers (54.6% vs 21.1%).[371]

Conversely, gifted students may also face issues in accessing relevant educational support. Gifted education varies considerably from country to country. According to academics Eva Reid and Heiner Boettger, gifted children require special attention, and their article provides an overview of various school systems, definitions, supporting organisations of gifted education in ten European countries.[372] In **Estonia,** gifted students' issues with regards to access to education that takes their special needs into consideration has been better addressed since 2010. In 2010, in fact, gifted students' needs have been defined in different versions of the Basic and Upper Secondary Schools Act as a possible special educational need.[373] The current Act states that gifted students should be provided necessary individual learning curricula and/or additional guidance by specialists in the school or from other institutions. In practice, the most common ways of identifying and developing gifted students are subject-specific olympiads.[374] However, olympiads are relevant for only certain ways of being gifted; guidance for students who participate in olympiads is underfunded and often seen as teachers' voluntary work, and students who demonstrate good results at the olympiads are found in certain types of schools: large, urban and schools focused on specific fields of study.[375] In **Slovenia,** similarly to Estonia, there are provisions in place to support gifted pupils. In fact, gifted students can attend additional classes (these are open to all interested students, not only those who were recognised as gifted/talented) and they can receive other forms of individual or group support. Guidelines for discovering and working with gifted/talented students are available for primary[376] and secondary[377] schools. These guidelines present the basis for work with gifted/talented students.

A final observation

It is crucial to note that while the above sections provide useful insights into the specific barriers that groups most at risk of marginalisation and underachievement may face, thinking about inclusion in education through the lens of individual demographic or contextual factors undermines the complexity of this picture. **No young person presents with a single characteristic which is likely to make them marginalised or afford them better educational opportunities**. Instead, the **issue is highly intersectional**, with young people presenting a myriad of characteristics and traits which may simultaneously improve and impede their ability to receive an equitable and inclusive education. For instance, even for a young person who presents with characteristics statistically favourable to high attainment and progress, other factors, such as parental attitude to learning, teacher quality, cognitive ability, health, support of learner agency, wellbeing, interpersonal factors, and life experiences can play an

[371] http://www.moec.gov.cy/archeia/psifiaki_ekpaidefsi/04-commissioner-eiriniloizidou.pdf
[372] Reid e. and Boettger H., (2015), GIFTED EDUCATION IN VARIOUS COUNTRIES OF EUROPE Available at https://www.researchgate.net/publication/282133674_GIFTED_EDUCATION_IN_VARIOUS_COUNTRIES_OF_EUROPE
[373] Basic Schools and Upper Secondary Schools Act. Division 3 § 37. Supporting development of students. Riigi Teataja I 2010, 41, 240 (entry into force 01.09.2010) https://www.riigiteataja.ee/en/eli/501022018002/consolide
[374] erbak. K. (2019). Andekad Eesti hariduses. Tartu: Haridus- jaTeadusministeerium https://www.hm.ee/sites/default/files/andekad_eesti_hariduses_kadi_serbak.pdf
[375] Serbak. K. (2019). Andekad Eesti hariduses. Tartu: Haridus- jaTeadusministeerium. https://www.hm.ee/sites/default/files/andekad_eesti_hariduses_kadi_serbak.pdf
[376] Žagar, D. et al. (1999). Koncept odkrivanja in dela z nadarjenimi učenci v devetletni osnovni šoli (Concept of Discovering and Working with Gifted Pupils in the Nine Year Primary School). https://www.zrss.si/zrss/wp-content/uploads/koncept-dela-z-nadarjenimi-ucenci.pdf
[377] Žagar, D. et al. (2007). Koncept vzgojno-izobraževalnega dela z nadarjenimi dijaki v srednjem izobraževanju (Concept of Educational Work with Gifted Students in Secondary Education). https://www.zrss.si/zrss/wp-content/uploads/koncept-dela-z-nadarjenimi-ucenci.pdf

important part in determining the extent to which they become marginalised within the education system. At the same time, a heightened risk of marginalisation does not automatically constitute educational underachievement.

4.0 Technology, Education and Access in Member States

Box 4 Key Messages: technology, education and access in member states

Key messages

Technology and access to education prior to the COVID-19 pandemic

- **Member States had frequently reformed digital education under the umbrella of a wider digital strategy, with the aim of modernising public services** and supporting local economic development**.** Such programmes tended to be infrastructure-oriented, with an emphasis on digitally equipping and connecting schools and communities. They often integrated national and EU funds.
- **Looking across digitalisation approaches adopted by EU Member States, common enabling factors can be identified.** These include policy and funding stability and continuity; blended investment; infrastructural and pedagogical development; empowerment of schools and municipalities; and scaling for impact. These elements are found in combination in some Member States.
- **The research also provided insights to the circumstances where digital programmes failed**. Some causes were self-evident, including major fiscal adjustments affecting educational expenditure or policy abandonment. However, programmes designed to stimulate innovation had sometimes unintentionally widened the equity gap, e.g. by favouring learning institutions with higher access to digital infrastructure, showing the importance of monitoring and evaluation in order to ensure a level playing field.
- **There were quite stark regional differences in the availability of digital tools, and the integration of digital pedagogies within school curricula**. At ECEC level, digital tools were generally most widely used in Scandinavian countries for administration, home-school communication, and teaching and learning. At primary and secondary education levels, the availability of technology within schools generally increases, but infrastructural measures can hide gaps in how digital tools are applied within teaching and learning.
- **At the micro level, Member States have increasingly looked towards mobile technologies as a tool to facilitate access**, in order to overcome the challenges of the digital divide. There were some signs of promise, where micro-technology was coupled with personalisation and self-study. However, providing access to devices rarely proved successful in isolation from pedagogical measures.
- **Overall, the use of digital tools within education followed a principle of universalism (i.e. directed at all learners) within the EU before the COVID-19 pandemic.** While there were widespread examples of digital projects and programmes targeted at learners facing disadvantages, these varied considerably in their scope. Inclusive education measures did not always include an explicit

'digital' dimension, while equity and inclusion objectives were often implicit within digital strategies.

- **Member States had included a more or less explicit focus on digitalisation in widening access to education for learners with SEN** This most commonly involved the use of assistive technology to meet legal obligations for access, and the conversion of educational content into digital formats. It less often positioned SEN learners and their families as co-creators.
- **Other measures, including those for linguistic and minority ethnic learners and those from a low socio-economic status (SES) were commonly addressed through pilot projects, supported by EU funds**. Actions with a digital dimension often included spatial dimension, with an emphasis on improving home internet access, and making educational or therapeutic services, information, or guidance available online.

Policy and practice responses to secure access to education during and beyond the crisis

- **System leadership was a common enabling factor in managing the transition to remote learning**. Where this was lacking, Member States encountered challenges relating to the uneven distribution of resources; a lack of coherence in the pedagogical approaches taken by schools, and confusion regarding public information about access to resources and training.
- **The shift to remote learning raised important questions about geographical scale and scope**. Some actions were necessary at a national level, putting education ministries and public bodies tasked with digital education centre stage, but regional and municipal level actors were also pivotal in widening access to education through networks and distributing resources.
- **Common factors were present where countries experienced greater success in maintaining educational access**, some of which related to the strategy and measures that were adopted (implementation) and some of which reflected the underlying status and characteristics of digital education (structural). However, the crisis exposed a far from level playing field.
- **Cross-sectoral partnerships created during the crisis were beneficial in leveraging expertise that was not previously available** to public authorities. NGOs had a specific role to play through their networks within disadvantaged communities, where public authorities had more limited access. They also bolstered expertise with regard to child rights, welfare and safeguarding.
- **Teachers, school leaders and other child and youth professionals were active in mobilising to secure access to education for young people and their families**. They did so by creating online professional networks and co-creating and brokering access to specialist content for learners with additional needs. There was also evidence that non-formal learning through digital youth work, civic and social participation, was an important aspect of continued access,
- The use of **monitoring, feedback and evaluation** was critical during the crisis. Most countries set in place monitoring mechanisms of some kind to estimate numbers of households and learners without access to Wi-Fi or devices. They

undertook monitoring and gathered feedback from teachers and school leaders, families and learners on their needs and experiences of distance learning. These data were instrumental to how governments and schools responded.

- The country analysis highlights a number of **negative impacts** of social distancing restrictions and disrupted education during the pandemic. There is concerning evidence that the COVID-19 crisis:
  - **Compounded inequalities and resulted in more inequity**, evident from the poor outcomes for low SES and SEN learners and their families and despite best efforts of Member States to mitigate against these outcomes.
  - **Raised concerns** about the mental health and wellbeing of teachers and students; the security and child protection issues arising from a rapid shift online, and quality assurance, governance and ethical considerations arising from partnerships forged at pace. This indicates a need for further research.
- The country analysis also highlights a number of more **positive impacts** for education systems across the EU27, as ministries plan ahead for recovery. There is promising evidence that the COVID-19 crisis:
  - **Gave fresh impetus to policy and legislation** regulating the use of digital technologies within education, pushing digitalisation higher on the policy agenda.
  - **Prompted action on inclusion**, in response to the stark disparities in educational access highlighted during the crisis for disadvantaged learners.
  - **Created conditions for greater school and municipal autonomy** with regard to digital tools and pedagogies in some Member States.
  - **Demonstrated the sustainable use of digital tools and practices** developed during the COVID-19 pandemic, and the potential of teacher professional networks and open channels of home-school communication.

4.1 Introduction

This section addresses the question of access within digital education. Drawing on evidence from the country mapping and wider literature, it examines how EU Member States have used digital technologies to ensure that all learners have access to education, and to remove barriers for learners with additional needs. It also considers the steps taken by Member States to widen access to *digital* education and to provide learners with opportunities to acquire digital competences at ISCED levels 0-3.

The section is broadly divided into two time periods, while recognising the continuities and discontinuities between them. In the first part, we examine the historical arrangements within Member States before the watershed of the COVID-19 pandemic, considering measures taken regarding access to education at the macro-, meso- and micro-levels within national education systems and the main lessons learned.

In the second part, we examine how key stakeholders across Europe have responded to the challenges presented by the COVID-19 crisis with regard to access. We start by examining the types of measures that were put in place during the pandemic, and the

governance arrangements that formed to ensure continued access for all learners and for vulnerable groups. We then go on to consider the main positive and negative impacts of the crisis on access to education.

4.2 Technology and access to education prior to the COVID-19 pandemic

Historically, the place of digital tools in **Early Childhood Education and Care (ECEC)** has been varied considerably across Europe, although this subject has increasingly come to the fore with growing numbers of EU Member States legislating to introduce compulsory ECEC provision and taking steps to raise levels of participation[378].

Before the introduction of emergency measures during the COVID-19 crisis, fewer than half of EU Member States made widespread use of digital tools in pre-school settings (AT, BG, CY, DE, DK, EE, FI, IE, LT, MT, SE). Among these, the arrangements are generally the most comprehensive in Scandinavian countries, where digital tools are used for administration, home-school communication, and teaching and learning. In **Sweden** and Denmark, digital awareness has been integral to pre-school curricula for many years, albeit with differences in implementation at municipal levels arising from a decentralised system. Similarly in **Denmark**, digital technologies are well-established and complement the delivery of the pedagogical curriculum[379]. It is perhaps unsurprising, therefore, that 79% of Danish day care centres use digital tools with children, half of them on a daily basis.[380] **Malta** also stands out for its substantial digital transformation programme, with interactive whiteboards and Kindergarten Educators available in all pre-school settings[381].

In other countries, children's familiarisation with digital technology is stipulated in ECEC curricula, but this has not been fully implemented or has only appeared more recently or. **Lithuania** introduced a policy of pre-school digital literacy in the 2017-2020 Action Plan, but rollout has reached only an estimated 6,7% of pre-school institutions[382]. In **Cyprus,** the Ministry banned the use of Wi-Fi in nursery schools, to minimise the exposure of children to electromagnetic fields.[383] Other Member States have principally used digital technologies in a management or administrative capacity, such as **Austria** and **Germany** (in the latter case, 59% of children in pre-school settings are unable to access digital tools directly[384]), and / or their educational use has been confined to special pilot projects in selected pre-school settings only (BE, PT, RO, and HR).

At **primary** and **secondary** education levels, the availability of technology within schools generally increases, along with the availability of comparable data measuring

[378] European Commission (2019) *Key Data on Early Childhood Education and Care in Europe – 2019 Edition*. Luxembourg: European Commission. Available online: https://eacea.ec.europa.eu/national-policies/eurydice/content/key-data-early-childhood-education-and-care-europe-%E2%80%93-2019-edition_en
[379] https://emu.dk/sites/default/files/2020-01/Den%20styrkede%20p%C3%A6dagogiske%20l%C3%A6replan_engelsk.pdf
[380] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/
[381] https://digitalmalta.org.mt/en/
[382] Data from the official Lithuanian statistics department for the 2019 data (latest). Note that these pre-school institutions aren't necessarily focused only on ISCED 0, the number can include schools that combine pre-school and primary education (at least in Lithuania it is not uncommon to have the same building used for ISCED 0 – 1 levels).
[383] https://ehtrust.org/wp-content/uploads/Egkyklios-Jan-17.pdf
[384] Allensbach survey (2014): Digital education begins in primary school. https://www.telekom-stiftung.de/presse/allensbach-umfrage-digitale-bildung-beginnt-der-grundschule

their use. Surveys indicate that use of digital tools by teachers is greater on average at ISCED levels 1-3 than at pre-school stage. As with ECEC, however, teacher access does not always translate directly into the application of digital technologies within teaching and learning. In **Estonia**, the use of digital tools within teaching practice is as high as 90%, but this drops-off to 39% regarding the use of computer-based tools for assessment.[385] In **Bulgaria**, the use of digital tools by teachers is estimated at between 83 and 87%, but this principally relates to "*demonstration, simulations and practical tasks*", and to a lesser extent to "*observation, exploration of virtual reality and working in small groups".*[386]

There are also observable differences between Member States regarding modes of access for students. A general distinction can be drawn between national programmes using fixed infrastructure such as lab-based technology for informatics (Bulgaria, Czechia, Greece and Romania), and countries where a 'Bring Your Own Device[387]' (BOYD) policy has been developed to equip students with mobile devices such as tablets or laptops (CY, EE, FI, MT). In **Cyprus**, subsidised portable devices have been issued at lower secondary stage since 2008 to encourage independent learning[388], while students in **Malta** obtain devices in the fourth grade. The rationale for doing so is to ensure that students are able to use apps that have been developed specifically in line with the national curriculum; to provide learning at home and school; and, to ensure more equitable access to ICTs.[389]

The positioning of **digital education within curricula** also warrants consideration. In **Lithuania**, digital competences are integrated from ISCED levels 1-3,[390] while they feature at ISCED levels 0-3 in **Sweden** and **Malta**, and the **Spanish** primary curriculum includes a requirement for schools to secure "*early initiation experiences in ICT*[391]. In Malta, pedagogical continuity is assisted through the co-location of pre-schools and primaries.

Although digital education is taught as a stand-alone subject in some countries, such as the discipline of 'Technology Comprehension' in **Denmark** since 2018[392]', others have adopted a transversal approach to widen access (CY, EE, FI, PL, and SE). In **Italy**, the curriculum at upper secondary stage where 3D printing, and elements of digital design are cross-curricular and even appear within classical disciplines. In **Sweden**, digital competence is a nationwide learning outcome for primary and secondary school, encompassing digital skills, media literacy and the ability to appraise online content. In

[385] Ministry of Education and Research, (2019). *Haridus- ja Teadusministeeriumi valdkondade 2018. a arengukavade täitmise analüüs.* Analysis of the implementation of 2018 development plans of the Ministry of Education and Research. Tartu: HTM *Macro* https://www.hm.ee/sites/default/files/tulemusvaldkonnad_2018_koond_loplik.pdf
[386] Questionnaire survey conducted by the Department of Communication systems and services, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, 2016-2018 http://css.iict.bas.bg
[387] Ministry of Education and Research, (2019). op. cit. https://www.hm.ee/sites/default/files/tulemusvaldkonnad_2018_koond_loplik.pdf
[388] European School Net, 2011, Country Report on ICT in Education L Cyprus. Available at http://cms.eun.org/shared/data/pdf/cyprus_cr_2011_final.docx.pdf
[389] Ministry for Education and Employment. (2019). Ministry for Education and Employment Annual Report: 2018. Malta: Permanent Secretary Office, Ministry for Education and Employment.
[390] Ministry of Education, Science and Sport (2016). Dėl Mokymo nuotoliniu ugdymo proceso organizavimo būdu kriterijų aprašo patvirtinimo. Available at: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/905730a0e4a811e5b18181b790158f61?jfwid=-wd7z8ryey
[391] European Literacy Network (2017) Digital Literacy in Education, Spanish Country Report. See: https://www.eln.eu/en/working-groups/working-group-2/digital-literacy/
[392] https://xn--tekforsget-6cb.dk/

Bulgaria, school curricula for all school grades[393] refer to developing digital skills as a key competence field and the use of digital tools in four ICT related subjects starting from primary education. The use of digital tools and ICT is a reference point for the majority of school subjects. Other countries too have emphasised the social and ethical dimensions of technology, including the role of digital tools in fostering self-expression and citizenship (**Finland**), responsibility online (**Poland**), and 'critical thinking for a new digital culture' (**France**)[394].

Barriers and enablers to access

Macro level

At a **macro level**, the role of digital technologies in education has been shaped by wider arrangements concerning inclusion and digitalisation within EU Member States. Based on country data, this has often involved a combination of the following:

1. policies and legislation concerning the role of ICT within schools, and explicitly within core subject teaching and curricula during compulsory education
2. equivalent legislation concerning educational access and entitlements of learners with Special Educational Needs and Disabilities (SEN), and the role of assistive technologies within this provision
3. special programmes with the objective of school modernisation and digitalisation, through investment in ICT infrastructure, and teacher education programmes
4. special programmes on educational inclusion for vulnerable or disadvantaged learners, within which a digital component is more or less explicit; and,
5. local and regional economic development and spatial strategies, including where education is one of a number of strands within a wider 'digital strategy', which may also include the modernisation of wider public services and e-government.

In several countries, we can see a move towards integrating students with special educational needs and disadvantages (SEN) into mainstream education, sometimes coupled with specific stipulations for schools around using assistive technologies and making reasonable adjustments for this group of students. In **Denmark**, for instance, as the result of a 2012 regulation to promote integration[395], many learners who previously went to specialised SEN schools and were taught by specialised SEN teachers, now attend mainstream education. Similarly, in **Belgium (Flanders)**, the M-Decree of 2014 encourages schools to include SEN pupils in mainstream education, and to make reasonable adjustments (including assistive technologies) to support these learners.[396]

[393] www.mon.bg/bg/28
[394] European Schoolnet (2018), *op.cit*. p.4.
[395] https://viden.sl.dk/media/8704/inklusion-i-folkeskolen.pdf
[396] See https://onderwijs.vlaanderen.be/nl/grote-lijnen-van-het-m-decreet

Moreover, Member States have often reformed digital education under the umbrella of a **national strategy** – either specifically focussed on education, and / or as a component of a wider digital strategy. This has often been a way to unlock additional funding, including ESF for social programmes or ERDF for larger infrastructure projects.

In **Denmark**, the National Digitalisation Strategy[397] provided substantial funding to promote the use of digital tools in Danish primary schools. This was a factor in municipalities purchasing digital tools and solutions and provided a stimulus to the EdTech market – both domestically, and through exporting digital solutions to other countries[398][399]. An independent evaluation concluded that the efforts of the Ministry of Education and the Danish Digitization Agency had achieved a step change in the use of digital resources in Danish primary and lower secondary schools in 2018.[400]

Looking across the range of digitalisation approaches adopted by EU Member States, the following elements appear to have played an enabling role:

a) policy and funding stability and continuity

b) resources secured from multiple sources, including private sector investment

c) a multi-dimensional approach, with attention to both infrastructural and pedagogical development rather than one or the other

d) active involvement and empowerment of schools and municipalities; and,

e) appropriate scaling for impact

These different elements are found in combination in some Member States, In **Finland**, there have been six official national level digital education or ICT strategies, and hundreds of development projects during the past 35 years. Since 2015, these strategies have been combined, integrated and embedded.[401] In **Sweden**, digitalisation has taken place through high levels of leadership and autonomy from municipalities operating within a clear national curriculum framework and guidelines. **Denmark** owes its high level of digital infrastructure and competences to a long-standing tradition of investing in digital infrastructure, online resources and teacher digital skills since roughly 2011, when an investment of DDK 45 million (approx. 6 million EUR) was made.[402] Additional investments followed in 2015 and 2016.

In **Estonia**, also, the high levels of school connectivity and teacher digital skills are the result of programmes which started as early as the 1990s. In 1997, Tiger Leap was initiated, which aimed at providing all schools with internet access, computers and basic ICT courses for teachers. ProgeTiger followed in 2012 and aimed at improving students' digital skills[403]. In **Flanders (Belgium)**, the integration of ICT in primary and secondary

[397] https://op.europa.eu/en/publication-detail/-/publication/3fe7eba2-2496-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316210
[398] https://area9lyceum.com/
[399] https://www.clio.me/dk/forskningsbaseret-laeringsteknologi/
[400] https://www.kl.dk/media/15401/samlet-evaluering-af-indsatsen-for-it-i-folkeskolen.pdf
[401] Mahlamäki-Kultanen, S., Lauriala, A. Karjalainen, A. Rautiainen, M. Räkköläinen, M. Helin, E., Pohjonen, P. & Nyyssölä K. (2014). Opettajankoulutuksen tilannekatsaus: Tilannekatsaus marraskuu 2014 [Analysis of current status of teacher education]. Opetushallitus: Muistiot 2014:4.
[402] https://www.uvm.dk/folkeskolen/laering-og-laeringsmiljoe/it-i-undervisningen
403 see more https://www.educationestonia.org/tiger-leap/

education has also, been a priority for more than 20 years now. Already in 2009, the Flemish Pact for 2020 (*Pact 2020: Een nieuw toekomstplan voor Vlaanderen*), which includes a list of 20 goals for 2020, stated that one of the priorities for teacher education and school management was to ensure *"organising them in order to ensure they are able to deal with important changes such as diverse student populations, inclusive education or changing technologies and competences"*.[404] In **Italy**, a series of related policies and programmes have had complementary effects (see highlight box 5).

Box 5 Spotlight on widening access - policy coherence and continuity (Italy)

SPOTLIGHT BOX: Widening access - policy coherence and continuity (Italy)

Italy has seen continuity in policy developments on digital skills and digital infrastructure in the education system, covering primary, secondary and VET. The national context for digitalisation is characterised by sustained investment, measures combining infrastructure development alongside behavioural change, and acclimatisation within digital environments[405]. Each step has seen substantial public and private investment, including the utilisation of EU funds.

- 2007: Piano Nazionale Scuola Digitale (PNSD) – introduced to initiate a shift away from the segregation of ICT subjects and equipment, iincluding a cross-curricular approach towards the use of EdTech within classrooms.
- 2008 – 2012: LIM, a multimedia interactive whiteboard, was introduced in classrooms at scale.
- 2009: Classes 2.0 launched – building on multimedia investments to create workshops, to offer students innovative learning environments.
- 2010: "Action for school digital publishing" - digital content pilots in schools.
- 2014-15: 'Programme il Futuro' (Program the Future) project for primary school children launched, with the aim of providing schools with accessible tools to train students in the basic concepts of computer science. The project was recognised as a European initiative of excellence for digital education in the context of the European Digital Skills Awards 2016.[406]. It was subsequently expanded, introducing the use of educational robotics, unplugged paths, block and card coding, drones and 3D printers in multidisciplinary educational paths.

Italian broadcasters have supported this evolving digital agenda through national TV programming, such as through the 'Digital Generation' episodes.

It is also important to examine the circumstances where national programmes have not proven to be sustainable. To some extent, these represent the converse of the elements

[404] See p. 13 https://www.vlaanderen.be/publicaties/pact-2020-een-nieuw-toekomstpact-voor-vlaanderen-20-doelstellingen
[405] http://www.oecd.org/education/ceri/Innovation%20Strategy%20Working%20Paper%2090.pdf
[406] https://programmailfuturo.it/progetto/descrizione-del-progetto

outlined above. In **Spain**, for example, the *Escuela 2.0*[407] programme suffered from a sharp change in policy direction and in fiscal circumstances regarding educational expenditure. Supported with EUR 200m funding, it aimed to incorporate state-of-the-art infrastructure and connectivity to the third cycle of primary education. It continued until 2012, but a change in national government combined with cuts to educational expenditure to address the public deficit signalled the end of the initiative.[408]

Elsewhere, programmes designed to stimulate innovation have sometimes encountered unintended negative consequences, highlighting the **importance of monitoring and evaluation**. The 'Digital School' programme in **Poland** was a major government initiative with the aim of integrating ICTs in primary education, through a package of new equipment, digital resources, and teacher education (a model of "e-trainers" within schools). A competitive element was introduced, to incentivise schools to take ownership. An independent evaluation concluded that there had been mixed results, with fewer digitally equipped and experienced schools experiencing difficulties in accessing the programme and with subsequent implementation[409]. The evaluators concluded that the qualifying criteria, which included minimum levels of Wi-Fi connectivity, evidence of ICTs in subject teaching and a funding contribution by the local authority, may have had an adverse effect on equity by excluding schools from disadvantaged communities.

Finally, in some cases the **fragmentation of funding for specific initiatives or measures** has led to varying degrees of school and teacher competences to integrate digital education. In **Estonia**, for instance, which has a general policy that supports school and teacher autonomy, where state funding is split across multiple measures to allow for flexibility use and implementation of funding by stakeholders, this often leads to inadequate or insufficient funding for individual measures, and as a result also a lack of sustainability of these initiatives.

Supporting good practices at school level

At the **school level**, some Member States have put an emphasis on mobile technologies as a tool to facilitate access, while addressing the challenges presented by different levels of access to technology within the home environment. This has largely mirrored efforts to use digital technologies to achieve greater personalisation and independent study.

Since January 2019, the National Centre for Distance Learning (CNED) in **France** has issued a digital assistant, *Jules,*[410] to all lower secondary students in French public education. This provides instant access to methodological support, with the aim of giving students greater autonomy with home learning.[411] Although at pilot stage, and accessed

[407] La Moncloa (2009) Online. See: https://www.lamoncloa.gob.es/Paginas/archivo/040409-enlace20.aspx#:~:text=El%20programa%20Escuela%202.0%20impulsa,la%20pizarra%20o%20la%20tiza.&text=A%20partir%20de%20ahora%20van,proceso%20de%20ense%C3%B1anza%20y%20aprendizaje.
[408] See: https://www.businessinsider.es/utiliza-tecnologia-aulas-espana-252440
[409] Białek, A., Fila, J., Penszko, P., Rybińska, A., Sijko, K., & Zielonka, P. (2013). IBE - raport, Ewaluacja ex-post rządowego programu rozwijania kompetencji uczniów i nauczycieli w zakresie stosowania technologii „ Cyfrowa szkoła ", 200. Retrieved from eduentuzjasci.pl/images/stories/publikacje/ibe-raport-cyfrowa-szkola.pdf
[410] CNED 2019 activity report: http://modules.cned.fr/flipbookRA/2019/common/data/catalogue.pdf
[411] https://www.cned.fr/le-cned/services-aux-etablissements-scolaires/avatar-jules-devoirs-faits

by 44,443 students, the CNED has a view to national rollout to reach a potential 3.4 million. Similarly in **Sweden**, the municipality of Nyköping offers all students in year 4 a digital unit for schoolwork. This *"one-to-one"* initiative is project-based and learner-centred. The aim is to give all students the same conditions to use modern digital technology as a tool in their learning, irrespective of device ownership and household ICT resources.[412] In Belgium (Flanders), the move towards greater personalisation and digital education go hand in hand and is driven by the government-funded Smart Education Programme (see box below).

[412] https://nykoping.se/barn-och-utbildning/grundskola/digitala-verktyg-i-skolan

Box 6 Spotlight on smart education programme (Belgium, Flanders)

SPOTLIGHT BOX: Smart Education Programme (Belgium, Flanders)

The Smart Education Programme is run by imec, an independent research centre founded in 1984 with the aim of developing innovative technological solutions to support the digital transition in six sectors: education, health, cities, industries, mobility and energy.[413] The organisation brings together academic expertise in the field of ICT across all major universities in Flanders and supports collaboration with businesses and other local actors.

In the field of education, itec (imec research group at KU Leuven) takes the lead in collaboration with SMIT (from the Free University of Brussels), MICT and IDLab (from Ghent University) in carrying out four major types of activities:

(1) **Strategic research**:[414] imec develops smart technologies and carries out research on educational technology that can support personalised learning, complex learning, distance learning and collaborative learning.

(2) **Research on technology use in practice**:[415] through its imec.icon-programme, imec funds consortia of companies and universities to develop educational applications. In the context of imec smart education, these imec.icon projects are carried out in close collaboration with schools. The end product of these projects is a fully finalised and ready-to-use prototype, informed by (educational) practice.

(3) **Bottom-up implementation projects in schools**:[416] through its Smart Education@Schools programme, imec organises an annual call for proposals – funded by the Flemish government – to fund one-year projects led by teachers from Early Childhood Education and Care (ECEC), primary, secondary, and adult education (max. project funding of 75,000 EUR). Through these projects, teachers and schools can develop and implement smart technological solutions in close collaboration with educational technology companies.

(4) **Roll-out and implementation in Flanders**:[417] in order to improve the quality and inclusiveness of education in Flanders the i-Learn project was set-up. i-Learn is an online platform for primary and secondary schools that facilitates personalised learning by making use of (existing) technologies.

As with other forms of digital technology, however, access to equipment alone does not guarantee participation, with a number of case study interviewees highlighting that digital empowerment, competences and strategic leadership among teachers, school leaders, pupils and parents are key to ensure effective implementation. The following examples are illustrative:

[413] See https://www.imec.be/nl/sectoren
[414] See https://www.imec.be/nl/sectoren/smart-education/smart-education-schools/strategisch-basisonderzoek
[415] See https://www.imec.be/nl/sectoren/smart-education/smart-education-schools/technologisch-gebruikersonderzoek-in-de-praktijk
[416] See https://www.imec.be/nl/sectoren/smart-education/smart-education-schools/bottom-up-implementatieprojecten-in-scholen
[417] See https://www.imec.be/nl/sectoren/smart-education/smart-education-schools/uitrol-en-implementatie-vlaanderen

- In **Greece**, the Ministry of Education distributed personal laptops to all lower secondary students from 2009 with the aim of widening access, but found that their usage decreased year by year. An independent study concluded that this was due to a combination of factors, including the absence of a pedagogical framework, an insufficient range of engaging digital content for students, and poor Wi-Fi quality in many schools.[418] On balance, students were insufficiently motivated or supported to realise the intended benefits of the scheme.

- In **Germany**, the government adopted a special €500 million support programme that allows schools to provide pupils in need with laptops.[419]

- In **Malta**, in 2018, 11,400 personal tablets were distributed among students and teachers in the final three years of primary education in State, Church and Independent schools with the aim of facilitating access to apps developed specifically in line with the curriculum[420]. The stated aim was to provide 20 minutes of digital access per day in an educational context. However, an evaluation concluded that fewer than one in five students were using electronic tablets as part of a lesson on a daily basis in schools[421].

- Stakeholders interviewed as part of the case studies conducted in **Belgium**, **Bulgaria** and **Denmark** said that while there have been significant investments in the number and quality of digital tools across various education levels, teachers' skills and confidence in using these tools remains low (and also in the perceived effectiveness of digital methodologies to reach education outcomes). Teachers often limit themselves to using PowerPoint or showing videos and are not trained to use the full potential of digital tools for educational inclusion and personalisation.

- In addition to strengthening teachers' competences, stakeholders highlighted that successful participation also depends on students' and parents' digital competences to effectively use digital tools for educational purposes. Interviewees from **Belgium**, for example, highlighted that while it was positive that attention is being paid to developing advanced coding and programming skills as part of the Flemish and French Community's digital education strategies, not enough attention is being paid to develop students' *basic* digital skills and media literacy.

The question of how to make digital materials and supporting guidance accessible to teachers and schools at scale is a further challenge facing Member States. The *Informatics for Primary Education* project in **Lithuania** provides one example of this, collating past and present examples of digital education delivered in Lithuanian schools

[418] Angelopoulos, P and Vagelatos, A (2017) Evaluating the Use of Laptop Computers in Secondary Education in Greece: Findings from a National Survey of Teachers. Available at: https://www.researchgate.net/publication/308125124_Evaluating_the_Use_of_Laptop_Computers_in_Secondary_Education_in_Greece_Findings_from_a_National_Survey_of_Teachers

[419] See https://www.bmbf.de/de/karliczek-bundesmittel-fuer-lehrerlaptops-koennen-fliessen-13636.html

[420] Ministry for Education and Employment. (2019). Ministry for Education and Employment Annual Report: 2018. Malta: Permanent Secretary Office, Ministry for Education and Employment

[421] Times of Malta. (2020). School tablets used more in pandemic than last four years combined €12 million project had previously been criticised for lack of take up. 25 May, https://timesofmalta.com/articles/view/school-tablets-used-more-in-pandemic-than-last-four-years-combined.794333

within a single portal, along with detailed instructions for teachers. The project includes only piloted materials that are presented to assist with replication, including technical specifications for the tools used; instructions on deployment and classroom strategies.[422] The *KlasCement* digital platform run by teachers for teachers in **Belgium (FL)** is a further example of making digital content accessible and navigable.[423] In **Denmark**, interviewees pointed to the high potential of teacher peer-learning and support through teacher networks and communities of practice.

Access for disadvantaged learners

The majority of measures described so far are universal in scope and have been deployed with all learners in mind. However, it is also important to consider the role of digital tools in **removing barriers to education for learners experiencing specific forms of disadvantage**. A number of interviewees pointed to the potential of digital tools to foster differentiation and cater to individual learner needs within and across different groups of vulnerable learners as the primary benefit for inclusion. The main target groups represented among the policy and practice examples from the EU27 country mapping include those listed below.

- Learners with Special Educational Needs and Disabilities (SEN)
- Learners experiencing poverty and / or low socio-economic status (SES)
- Ethnic and linguistic minorities, and migrant children
- Rural isolation, and other territorial inequalities
- Children with long-term illnesses

Overall, there is clearest evidence of action on inclusion in relation to SEN , where all Member States have set obligations for access to education in law. Arrangements typically point towards the need for digital technologies to meet such obligations and have provided a legislative driver for the adoption of Assistive Technologies (ATs) within schools and pre-school settings. Alongside individual access, many countries have devised policies to ensure that families and schools can access specialist pedagogical and therapeutic support alongside digital tools. Arrangements range from in-school support, to accessing expertise and equipment via specialist education centres at a locality or municipal level. The adaptation and co-creation of digital resources tailored to the needs of SEN learners is also a characteristic of EU-funded programmes.

On balance, however, many of the measures designed to widen access for disadvantaged groups have suffered from being project-based and of small scale relative to levels of need. In **Romania**, the national programme "*Euro 200*" was the principal offering to secondary level students with a disadvantaged background, comprising of financial aid of EUR 200 to purchase a personal computer. Given the proportionately limited budget and the corresponding difficult qualifying criteria, the scheme only

[422] Informatics in Primary Education (2020). Gerosios patirtys. Available at: https://informatika.ugdome.lt/lt/biblioteka/gerosios-patirtys/
[423] https://www.klascement.net/ict/thema/ict-eindtermen-voor-lager-en-secundair-onderwijs/

benefited 5,000 students annually from a population of 2.8 million prior to the COVID-19 pandemic.[424]

The following table illustrates some of the more specific approaches taken to widen access to education using digital technologies, for learners with additional needs. All of the examples that are shown pre-date the COVID-19 crisis, which we consider shortly.

Table 4—1 Examples of digital solutions to widen access to education for disadvantaged learners

Status	Description
Learners with Special Educational Needs and Disabilities (SEN)	• **Lithuania -** The Action Plan for the Inclusion of Children in Learning and Multidisciplinary Education 2017–2022 was launched with an aspiration to update the entire education infrastructure (ISCED 0-3) with the needs of vulnerable children and families including those with SEN , children living in rural areas and minority ethnic children at the forefront. It included a heavy emphasis on digitalisation, encompassing actions to digitise existing educational content, and funding for the acquisition and introduction of technologies (virtual platforms and software). Supported with ESF, an important aspect of the programme was the establishment of learning communities of teachers, parents and carers, alongside widened access to adapted content. [425]
Learners experiencing poverty and / or low socio-economic status (SES)	• **Denmark –** the Inkludigi[426] platform has produced a substantial volume of educational materials and been a key stakeholder in promoting inclusive digital education practices both within and between Danish municipalities. The project has highlighted specific practices that have reportedly worked well in certain schools or municipalities. For example, in the 3rd grade at Maglegårdsskolen in Gentofte, virtual reality helps to promote social inclusion by ensuring that all students can go on virtual cabin trips together[427], widening access to non-formal educational opportunities for learners from lower income families.[428]
Ethnic and linguistic minorities, and migrant children	• **Sweden** - Umeå's municipal preschools have purchased a municipal licence to the app Polyglutt, a digital picture book service for working with language development and literature in preschools.[429] The app has an inclusive focus and has been designed to provide multilingual children and SEN children a means of communicating by way of Augmentative and Alternative

[424] Ministry of Education and Research (2020). Order 5545/2020 from 10th of September on approving the framework methodology on teaching activities through technology and internet, as well as for personal data processing. Available at: https://www.edu.ro/sites/default/files/_fi%C8%99iere/Legislatie/2020/OMEC%205545.pdf
[425] Ministry of Education, Science and Sport (2020). The Action Plan for the Inclusion of Children and Holistic Education 2017-2022. Available at: https://www.e-tar.lt/portal/lt/legalAct/deca98f05bbf11e79198ffdb108a3753
[426] https://inkludigi.dk/
[427] https://www.youtube.com/watch?v=Lx5NHtQ4K1U&feature=emb_title
[428] https://www.denoffentlige.dk/her-er-tre-konkrete-eksempler-digitale-loesninger-giver-bedre-skolegang
[429] https://sites.google.com/edu.umea.se/eduit/app-best%C3%A4llning/appar/polyglutt

Status	Description
	Communication (ACC) while developing their language skills in both the Swedish language and their mother tongue, and to strengthen the children's cultural identity. For this purpose, Polyglutt has more than 1900 books in Swedish, in up to 56 languages. The idea is that preschool learning should also lay the foundation for a strongly developed mother tongue. In Umeå municipality, experts in digital pedagogy have been given the task of facilitating the use of the app with schools.[430]
Rural isolation, and other territorial inequalities	• **Spain** – the Ministry of Education (MoE) launched a dedicated project in 2015: School Connectivity[431], to provide Internet access using ultrafast broadband networks (100Mb) to primary and secondary schools, paying particular attention to rural areas. Thirteen regions have participated**.** The project was funded by the Ministry of Education and Culture, Economy, Competitivity and Industry, Energy and Tourism with €330m and supports more than 16 500 schools.[432] The project, promoted by the Digital Agenda in Spain aims to level the playing field with regard to digitalisation through more equal internet connectivity[433]. • **France** – Since 2019, the primary classes of the 'réseau d'éducation prioritaire' (Priority Education Zones) have been a focal point for the use of new digital tools for basic learning and new evaluation methods Through this approach, public authorities have ensured that new and more experimental methods which aim to support digital inclusion are developed with the disadvantaged communities which are also the end beneficiaries.
Children with long-term illness	• **Belgium (Flanders)** – in April 2018, the Flemish Ministry adopted the Decree on student support in primary education, secondary education, and student guidance centres (*Decreet betreffende de leerlingenbegeleiding in het basisonderwijs, het secundair onderwijs en de centra voor leerlingenbegeleiding*)[434], introducing the right to synchronous internet education as a key principle in Flemish education law. BedNet[435], the organisation officially appointed by the Ministry to offer synchronous internet education, now receives structural support to support hundreds of schools each year to organise synchronous internet education for children with long-term illness.

[430] https://www.regeringen.se/4ad046/contentassets/73de9759ac8a41548fe7a7a7e3641b73/forskola-for-alla-barn--for-battre-sprakutveckling-i-svenska-sou-202067
[431] European Schoolnet (2018) Spain Country Report on ICT in Education, p.5, See: http://www.eun.org/documents/411753/839549/Country+Report_Spain_2018.pdf/b38b02b0-4b4c-4925-bccd-3b0cf28ad669
[432] Gobierno de España (2015). See: https://www.lamoncloa.gob.es/presidente/actividades/Paginas/2015/300315escuelasconectadas.aspx
[433] Ibid.
[434] See https://data-onderwijs.vlaanderen.be/edulex/document.aspx?docid=15236
[435] See https://www.bednet.be/

In summary, it would be fair to say that the use of digital tools within education was conducted with a spirit of universalism before the COVID-19 pandemic. While there were widespread examples of digital projects and programmes targeted at learners facing disadvantages, these varied considerably in their scope. Inclusive education measures did not always have an explicit 'digital' dimension, while equity and inclusion objectives were often implicit within digital strategies. Similarly, while many EU Member States used digital tools to support education management and administration, the use of synchronous distance learning within school education was far from widespread.

The country mapping conducted for this study also illustrated the extent to which the scale and pace of digitalisation has varied across the EU. The evolution of national digital strategies is a complex one, involving decisions within the remit of education policy, while also linking with economic development and spatial strategies within Member States. Moreover, the organisation of curricula, continuity between levels of education, autonomy afforded to municipalities and schools, and public and professional attitudes towards the use of ICTs within education have all had a bearing on the implementation of digital programmes. It is this landscape that provides a backdrop to the COVID-19 crisis.

4.3 Policy and practice responses to secure access to education during and beyond the crisis

The COVID-19 crisis presented unprecedented challenges to education systems across Europe and worldwide, following widespread school closures from March 2020 and a rapid shift to distance learning. In this section, we consider the implications for access and continuity in education and compare and contrast the measures taken by Member States. We conclude by examining the positive and negative impacts of the COVID-19 pandemic on education, and steps taken to widen access during the recovery.

Overview of key responses during and beyond the crisis

A number of key features can be distinguished in the way in which the EU Member States responded to the COVID-19 crisis, put in place distance learning, and provided support to disadvantaged learners, including:

- Strengthening ICT infrastructure
- Legislative responses and coordination
- Involvement of regional and municipal actors
- Emergence of cross-sectoral partnerships
- Proliferation of national portals and digital platforms
- Emergence of smaller-scale projects and experimentation
- Monitoring, feedback and evaluation

Strengthening ICT infrastructure

The first and perhaps one of the most important first responses we saw during the pandemic is that several EU Member States increased investments in their existing ICT

infrastructure to strengthen their systems' overall readiness for distance learning. This was especially the case in countries which did not have a strong pre-existing digital infrastructure in place before the pandemic.

Our case study research shows that in **Denmark**, **Estonia, Flanders (Belgium)** and **Sweden**, the long history and policy continuity of investing in ICT infrastructure and digital skills paid off in terms of ensuring a smooth transition from physical to online learning. More specifically, an Estonian academic noted that the digital education discourse if often dominated by discussions about software and skill needs, yet inequalities start from the lack of or poor hardware and connectivity. The latter is particularly problematic for students living in remote areas. By contrast in regions such as Wallonia **(Belgium**), **Italy** or **Spain**, where there are strong regional differences and a high level of so-called "white zones" (i.*e.* areas with no internet connectivity at all), the existing ICT infrastructure and access to digital tools for all teachers and learners needed to be strengthened before implementing distance education.

Legislative response and coordination

One of the first actions at the onset of the crisis was to set in place guidelines for schools to ensure continuity in access to education. A **legislative response** was initiated at an early stage, where reforms were needed to re-centralise controls over educational planning (**Finland**[436]); to allow the Government to temporarily close schools if that proved necessary (**Sweden**[437]); or to ease restrictions on municipal budgets, thus releasing them for the emergency effort (**Greece**[438]). This included the acquisition of laptops and other ICT infrastructure on behalf of schools. Member States used varying methods to secure an emergency budget, typically offsetting ministerial funds with external assistance.

Alongside more general capacity-building for digital access and internet connectivity, a number of Member States took an early decision to scale up investment within the context of a wider national digitalisation programme. This had the advantage of providing a more strategic basis for responding with a view to growing digital education beyond the immediate crisis period. In April 2020, for example, the **German** federal government approved an additional €500 million[439] for the *DigitalPakt Schule* (Digital Pact for Schools) to widen access to laptops for disadvantaged pupils and to digitally equip vocational schools[440]. Funds provided within the framework stimulus package supplemented national funds to recruit and train IT administrators for the education sector.[441] These measures formed part of a wider nationwide infrastructure project.

[436] This took place on March 2020, line with the Emergency Powers Act. https://www.finlex.fi/fi/laki/kaannokset/1991/en19911080_20030696.pdf
[437] https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/forordning-2020115-om-utbildning-pa_sfs-2020-115
[438] Emergency legislation passed in April 2020 to enable municipalities to use money saved on operational costs during school closures to procure ICT equipment for students in need: Cedefop, 2020. Estonia: Responses to the COVID-19 outbreak.
[439] Karliczek: 500 Millionen für Schülerlaptops können fließen (2020). Ministry of Education and Research. https://www.bmbf.de/de/karliczek-500-millionen-fuer-schuelerlaptops-koennen-fliessen-12016.html
[440] In particular broadband school building cabling, WLAN coverage, digital interaction and devices, and other pedagogical equipment.
[441] Education and training Monitor 2020 – Germany

Member States commonly made extensive use of EU funds and other forms of external assistance (such as from the UN Agencies) to ensure that their response to the crisis was scalable. This was particularly apparent in Eastern Europe. The **Lithuanian** Government allocated €14 million from the state budget to match ESIF funds targeting the digitalisation of schools within the auspice of the *DNA of Lithuania's future economy* action plan.[442] In **Bulgaria**, the ministry was able to build on two complementary ESIF funded programmes to make them more ambitious -- moving to cloud-based technology and giving a boost to teacher education. These included the *National Programme ICT in pre-school and school education*, and *Project Education for the Future* (2019-22), which aims to provide a safe educational environment in schools and kindergartens[443].

Other **national level agencies also played an important role** within the response. In particular, *national education inspectorates and other public bodies* tasked with digital transformation provided additional technological and pedagogical expertise, often at arm's length from government. France, Germany and the Netherlands each stood out as having benefited from the active involvement of a national pedagogical institute with a remit for digital education:

- In the **Netherlands**, education sectoral councils and the ministry endorsed Kennisnet,[444] the Dutch public organisation dedicated to ICT-innovation for primary and secondary education and vocational training, as the official provider of materials and support tools in relation to distance learning for school leaders, teachers and parents. The agency took a lead on quality assuring educational content and set-up and hosted an online advisory and support service.

- In **France**, the National Centre for Distance Learning (Centre National d'Enseignement à distance – CNED) had recently become a Digital Academy after signing its new performance contract with the Ministries of Education and Research (April 2019) prior to the crisis. This was a fortuitous development, as it meant that a variety of pedagogical services were already available to all students, including CNED's 'My classroom at home' platform which provides pedagogical support and virtual classes from ECEC to upper secondary education. This proved invaluable in the context of French schools having a high degree of autonomy in how they organised online learning during the pandemic.

- In **Germany**, the agency responsible for education, science, and culture (KMK) provided a key oversight role to maintain coherence of the shift to remote learning in the context of a large and federalised country. This included a mapping exercise, and provision of centralised information regarding the digital teaching support offers and entitlements across each of the 16 Länder.[445]

Involvement of regional municipal actors

Regional and municipal level actors also played a central role in widening access to education across Europe during the pandemic. First, there was a more fundamental

https://op.europa.eu/en/publication-detail/-/publication/0b2b1170-2499-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316678

[442] Ministry of Finance of the Republic of Lithuania (2020). Ateities ekonomikos DNR planas. Available at: https://finmin.lrv.lt/lt/aktualus-valstybes-finansu-duomenys/ateities-ekonomikos-dnr/vyriausybes-patvirtintas-planas

[443] https://www.mon.bg/bg/100725

[444] https://www.kennisnet.nl/

[445] KMK (2020b). Lernen von zuhause – digitale Lehrangebote https://www.kmk.org/themen/bildung-in-der-digitalen-welt/lernen-von-zu-hause-digitale-lernangebote.html

question of supply and demand for ICT infrastructure and resources, and how best to utilise the municipal/local level of the education system in the distribution process. Countries managed this in different ways. Within **Lithuania**, funds for ICT equipment were distributed to municipalities on the basis of pupil numbers, which were then tasked with coordinating with schools to ensure that funds were administered proportionately in order to reach low-income families. In contrast, other countries (e.g. **Austria** and **Ireland**) used schools-based criteria or formulae to determine the allocation of national resources. In **Belgium (Flanders)**, a mixed approach was chosen. The Flemish Ministry tasked DigitalForYouth to distribute 15,000 laptops to schools from March 2020 onwards on the basis of socio-economic profiles of schools' student population. The laptops were then distributed by the schools to the pupils who most needed them[446].

Beyond funding administration, there was a growing recognition of the importance of the municipal tier within the recovery from the crisis, as the extent and complexity of digital divide issues became apparent. In **Poland**, the first wave of the "Distant School' (Zdalna Szkoła) initiative involved direct allocations of resources to schools. By the second lockdown, however, local authorities mobilised to administer funding to teachers, allowing for greater differentiation according to their ICT support and training needs upon more widespread recognition of the scale and complexity of access issues[447]. In **Spain**, there was significant cooperation between the autonomous regions; in **Hungary** the municipal coordinators took the initiative, while within **Sweden**, the COVID-19 crisis was reported to have consolidated the relationship with the Swedish Association of Local Authorities and Regions (SKR) to address disparities in educational access at a municipal level[448]. This example is further detailed in the box that follows.

Box 7 Spotlight on a new role for municipalities (Sweden)

SPOTLIGHT BOX: A new role for municipalities, post-COVID (Sweden)

In **Sweden**, the pandemic catalysed a new Government agreement with the Swedish Association of Local Authorities and Regions (SKR) on "*The possibilities of digitalisation to promote knowledge development and equality in the school system*" (2020-2022). This agreement aims to provide a blueprint for collaboration post-COVID and to address disparities in the response at a municipal level. The overall aim is to ensure that local schools do not develop digital solutions in isolation. Rather, new approaches should be developed in a coordinated manner across Sweden despite the decentralised nature of the education system.

The intention is that the SKR will support municipalities to ensure that digital solutions are outcomes-oriented, user-friendly and adjusted to school systems and learners in diverse circumstances. One key factor identified in the agreement of successful digitisation is equal access to and use of digital tools. The agreement between the government and SKR means, among other things, that SKR will work to support principals, schools, and other education providers in the school system to obtain e-credentials and to nurture appropriate digital ecosystems.

[446] See https://www.digitalforyouth.be/
[447] https://www.gov.pl/web/cyfryzacja/zdalna-szkola---kolejne-180-milionow-na-zakup-sprzetu-dla-uczniow
[448] https://www.regeringen.se/4abeae/contentassets/9a5edaa4192f42a6ada595d75eb98dcf/digitaliseringens-mojligheter-for-att-framja-kunskapsutveckling-och-likvardighet-i-skolvasendet.

SKR will also assist in strengthening the principals and teachers' competences in developing their capacity to ensure user-centred services and accessibility, aimed at all principals, schools, and other education providers within the school system.

Emergence of cross-sectoral partnerships

The emergency context facilitated cross-sectoral partnerships across the EU27. This took different forms, with **tech companies, philanthropists, broadcasters, educational publishers and NGOs** making up a varied patchwork of financial and other support across Europe. The situation required multiple stakeholder accountability[449] on an unprecedented scale, with the crisis providing added incentives for public and private sectors and NGOs to work towards a common vision and shared outcomes. The nature of support varied considerably between individual Member States, from the provision of subsidised ICT equipment for schools, to Wi-Fi access through broadband installation or upgrades by telecommunications companies, and license-free availability of educational resources.

National TV broadcasters were involved in streaming educational content via terrestrial and digital channels, including YouTube. This was often part of a wider strategy to secure access to educational content for families without adequate home internet connectivity or devices, often in conjunction with more targeted measures to support low-income families and learners facing additional challenges such SEN and disabilities. Some countries moved quickly to ensure that educational broadcasting was available from an early stage in the crisis. For example, **Bulgarian** National Television (BNT) and the Ministry of Education partnered with a publishing house to schedule a comprehensive daily schedule of programming for learners of all ages. This comprised of 30-minute classes for students in grades 1 to 7 starting from 09:15 in the morning to 16:00 in the afternoon on two dedicated channels[450]. In **Ireland**, the national broadcaster, RTÉ, collaborated with educationalists, to introduce a cross-platform teaching initiative for primary school children[451]. On the digital media player RTÉ2, the children were able to engage with project work, and fun activities that linked with the curriculum.

Not only during, but also beyond the pandemic, these cross-sectoral partnerships seem to be sustained in some cases, with important impacts on the education sector. In **Latvia**, for example, the Ministry of Education and Science (MoES) including a variety of academic and private sector partners (i.e. Riga Technical University, the Latvian Association of Local and Regional Governments, Latvian State Radio and Television Centre and a number of prominent business companies) signed a memorandum "Powerful internet for every Latvian school"[452]. The goal of the partners is *"to introduce within the shortest possible time such technological solutions for every Latvian school that will ensure full value distance learning process and will allow the use of modern digital learning content and methods in the educational process".*[453] As a result of the memorandum a project "Powerful internet for every Latvian school" was launched and currently involves 563 out of 616 Latvian schools and 6 communication operators.[454]

[449] Levin, H. M. (1974) A conceptual framework for accountability in education. *The School Review*. (82/3), p. 363-391.
[450] Prosveta is the major publishing house of textbooks and learning materials in the country. Its educational platform e-prosveta has 32956 educational resources, which were given open access under the National Emergency situation. (https://www.e-prosveta.bg/).
[451] https://www.rte.ie/learn/2018/0116/933703-about-rte-learn/
[452] MoES (2021). IZM un partneri vienojas par sadarbību interneta jaudas palielināšanai skolām (MoES and partners agree on cooperation to increase the capacity of the Internet for schools) https://www.izm.gov.lv/lv/jaunums/izm-un-partneri-vienojas-par-sadarbibu-interneta-jaudas-palielinasanai-skolam
[453] MoES (2021). Sadarbības memorands: Jaudīgs internets ikvienai Latvijas skolai (Memorandum of Cooperation: Powerful internet for every Latvian schooL) https://www.izm.gov.lv/lv/media/6807/download
[454] Jaudīgs internets ikvienai Latvijas skolai (Powerful internet for every Latvian school) https://skoluinternets.lv/

The proliferation of hardware, software and digital content and rapid agreement on licensing matters and public-private partnerships raised a number of challenges for governments, schools, parents and learners alike. These included the following:

- **Quality assurance of digital content** – the educational value of materials was not always assured, with such a rapid influx of new content being created or adapted for digital learning environments by educationalists, publishers and TV broadcasters. Public authorities often found themselves in the position of being curators of digital content, especially where materials were curriculum oriented. The exponential growth in digital content made this challenging, with teachers and families expected to make informed judgements about quality. Online professional networks and parent associations played a role in this regard (see also below). Moreover, some countries developed a kite-marking or validation process of sorts[455]. Nevertheless, the absence of quality assurance mechanisms, or even basic analytics, was problematic in some countries where there were little or no data on how and by whom digital materials were being used.

- **Quality assurance of technical solutions** – in addition to quality assuring the digital content developed by private actors and NGOs, there has been an additional challenge of carefully assessing whether the digital tools and applications developed are fit-for-purpose and actually benefit students. Some stakeholders interviewed as part of the case studies (*e.g.* **Belgium**, **Sweden**) highlighted that while public-private-academic partnerships are key to ensure the latest cutting-edge technologies are considered, not every technological solution can be so easily adapted or tailored to meet needs in educational settings. This is why it is important to involve educational practitioners and learners in the development and piloting of inclusive digital tools.

- **Governance and ethical considerations** – public-private partnerships were a characteristic of educational governance during the crisis, and in many countries across Europe this was an essential feature of the national response. Looking beyond the immediate crisis, however, some actors at a Member State level expressed reservations about the ethical dimensions of a perceived 'privatisation' of public education over and above a Corporate Social Responsibility rationale. A need was identified to redraw lines for sustaining these collaborations in future, with attention not only to data rights and responsibilities (as discussed separately below) but also the place of global corporations within the education landscape.

- **Data protection and privacy** – concerns about the sufficiency of cybersecurity measures, privacy and data rights were omnipresent during the crisis. National surveys showed that teachers sometimes had to use their own devices for distance learning[456] and were not always adequately equipped within their home environment. According to research carried out within upper secondary/VET schools in Romania, there was some evidence that teachers had avoided synchronous activities due to concerns that their classroom activity would be

[455] In Portugal, for example, the Ministry of Education supports the 'Learning Labs' project, which was established to support the dissemination of methodologies for the integration of ICTs in school curriculum that have been validated in European pilot projects. Further information is available at: https://erte.dge.mec.pt/la-acoes-de-formacao
[456] Centrum Cyfryzacji (2020) Edukacja zdalna w czasie pandemii. Raport z badań.

disclosed to actors outside school or recorded without their consent[457]. Parents and students pointed to schools as responsible for online risks, privacy and cybersecurity, and school leaders had to concede that there were gaps.[458] In response to the first lockdown, student representative bodies across the EU raised issues of privacy, data security and digital rights as priority areas of concern.

- **Language diversity** - the scarcity of multilingual materials was a commonly reported issue across Europe, with digital content often either restricted to the language of instruction, or to English language content that was made available license-free by publishers. This meant that translation has had an important role to play in widening access in the short-term, alongside measures to support the co-creation of new content by teachers, parents and learners from linguistic minorities. During the crisis these issues have been particularly apparent for migrant and refugee children in Europe, who also face a host of other challenges relating to housing conditions and income. In **Greece**, UNICEF and UNHCR provided equipment such as solar lamps for refugee and asylum-seeking children living in camps and translated the guidelines for distance education into 11 languages and dialects in collaboration with the MofERA[459].

The cross-sectoral nature of educational partnerships created during the crisis was particularly beneficial in leveraging expertise that was not previously available to public authorities. NGOs had a specific role to play through their networks within disadvantaged communities, with which public authorities had more limited access. They also bolstered expertise with regard to children's' rights, welfare and safeguarding within Member States' efforts to keep education open. In **Romania**, for example, the Step-By-Step Association collaborated with the Ministry to produce online safety awareness content for schools and students.

Active citizenship was also a feature of stakeholder engagement and cooperation during the crisis, whether facilitated by officialdom or occurring from the bottom-up through direct social action. In the **Netherlands**, a significant public response helped to ensure the feasibility of running autumn learning recovery programmes for disadvantaged students, while summer camps in **Austria**[460] and **Germany**[461] benefited from a substantial volunteer base. Social media platforms played a facilitating role in this respect. In **Czechia**, the city of Prague used the online collaboration app, *Slack,* to establish a programme of support for students with SEN or disabilities and their families -- matching volunteers with individual families with support ranging from assistance with shopping or buying medicine, to providing online tutoring for children. There was

[457] UCE (2020). Scoala la distanta in perioada pandemiei COVID- 2019. [Distance school during COVID- 2019 pandemics]. Available at: http://www.ise.ro/ancheta-privind-invatarea-la-distanta-pe-perioada-suspendarii-cursurilor
[458] Carretero Gomez, S., Napierala, J., Bessios, A., Mägi, E., Pugacewicz, A., Ranieri, M., Triquet, K., Lombaerts, K., Robledo Bottcher, N., Montanari,M. and Gonzalez Vazquez, I., (2021). What did we learn from schooling practices during the COVID-19 lockdown, EUR 30559 EN, Publications Office of the European Union, Luxembourg. ISBN 978-92-76-28418-5, doi:10.2760/135208, JRC123654.
[459] OECD (2020) Education Policy Outlook Greece. Available at: https://www.oecd.org/education/policy-outlook/country-profile-Greece-2020.pdf
[460] Education and training Monitor 2020 – Austria https://op.europa.eu/en/publication-detail/-/publication/b6837464-2494-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171314305
[461] For example, the authorities in Rhineland-Palatinate launched a call to student teachers, teaching staff, educational staff and high school students to register as summer school volunteer tutors. This resulted in 4,500 volunteers.

also evidence that non-formal learning through youth work, civic and social participation activities played an important aspect of continued access to education during lockdown.

Teachers, school leaders and other child and youth professionals were similarly active in mobilising to ensure access to education for young people and their families. In **Greece** and **Estonia**, more formalised professional networks provided access to peer support for teachers during the pandemic. The "*Distance Education*" network in Greece claimed a membership of 35,000 on Facebook as of November 2020[462]. In the **Netherlands**, the Primary Education Partnership brokered access to a range of specialist content, including for children with SEN.[463] The partnership was established before the crisis and had spotted a gap in the available online provision for vulnerable learners, including those with dyslexia, ADHD, behavioural issues, language difficulties, gifted and talented, and newly arrived migrant children.[464] The project 'Zapojme vsechny'[465] (**Czechia**) was set-up to boost access to psychological support for students or parents of children with SEN . As well as providing access to a database of counselling centres, it aims to recruit university students studying special needs education as volunteers, thus widening access to support to online counselling while providing students with practical supervised experience.

Proliferation of national portals and digital platforms

National portals and digital platforms provided one of the channels for **centralising information and support for digital learning** while face-to-face teaching was suspended or limited. This typically involved the creation of digital libraries, which pooled learning materials and resources. In many countries, this had the advantage of widening access to a greater volume and range of materials than were available previously.

Member States often found that the most effective route to establishing portals of this kind was to **repurpose or scale up infrastructure that had been set in place before the COVID-19 pandemic**. In **Hungary**, the shift online provided the impetus to modernise several reportedly unpopular learning portals and to complete the transition to a Learning Management System (LMS) for schools.[466] Similarly, in **Romania**, the digital.educred.ro platform was adapted from serving an administrative function, to become a central access point for digital resources. In **Ireland**, the education ministry had fortuitously launched an official portal for online education some years previously, meaning that 20,000 digital resources were at schools' disposal from an early stage of the pandemic[467]. In **Denmark**, the Ministry website Emu, operating as an electronic meeting place for the teaching world also prior to the crisis, made guidance available for teachers at a national level[468]. Teachers were also able to access a number of centralised ICT resources through key communication platforms such as Aula (which is used in all public schools), Lectio and Ludus, to send teaching plans, lesson plans and

[462] Carretero Gomez, et. al. (2021). Op. cit.
[463] Comprising of an association of 14 school boards and 95 primary schools.
[464] Passend onderwijs thuis (2021) Tips en tools voor het primair onderwijs. Online: https://www.passendonderwijsthuis.nl/po/
[465] http://www.zapojmevsechny.cz/doucovani/
[466] *Nemzeti Köznevelési Portál* (National Public Education Portal) https://www.nkp.hu/
[467] https://www.scoilnet.ie/scoilnet/about-us/
[468] https://emu.dk/

information on homework to students and parents. Through these universally employed communication platforms parents were also kept up to date on their expected roles in supporting the remote lessons. In **Sweden**, the website School Home (*Skola Hemma*) provided support and guidance to schools and teachers on how to deal with the consequences of the COVID-19 pandemic.[469]

These online portals and platforms were important as various sources were available in one central repository (thereby avoiding "information overload" for parents, teachers and students). They were, however, not just static repositories of online content. They also provided **an important vehicle for communication** between ministries and schools, learners, parents and carers, as well as for **guidance** on changing educational regulations throughout the crisis. Ministries were also able to reinforce core educational policy priorities via portals. In a number of cases, they also provided a single point of access for **teacher education** and wider professional development relating to psychological or counselling services. Specific examples included the following:

- In **Croatia**, the national platform was in place two weeks before schools closed, offering guidelines on how to organise distance learning, pedagogical advice on assessment and grading in virtual environments[470], and materials for students to prepare for the Matura examination. Importantly, there was a good level of synchrony between different media, so that short video lessons on national TV complemented online learning for upper primary and secondary students. Just one week after the move to distance education, psychological help teams were created to support pupils, parents, and teachers either on the phone or online[471].
- In **Czechia**, the *Ucime online / We are teaching online* digital space was established by the *Cesko.Digital* collaborative, which involves representatives from government, software developers and NGOs. The collaborative provided support ranging from advice and guidance on VLE set-up, to master classes for teachers, and equipment distribution to parents of children from disadvantaged backgrounds. As of autumn 2020, there were over 600 schools engaged in this project, 630 volunteers supporting the schools, and 1,517 families receiving IT equipment[472].
- In **Belgium (FL)**, the KlasCement[473] digital library is funded and hosted by the ministry and provides guidelines on how to implement the final objectives (*eindtermen*) for digital competence, while also being based on content created, moderated and peer reviewed by teachers living and working within Flanders. While having been established for some years prior to the pandemic, the platform reportedly thrived during the shift to online education, with a net expansion of its membership, and the library of user-generated content taking on a new significance.

[469] See: https://www.skolahemma.se/om-skolahemma-se/
[470] Ministarstvo znanosti I obrazovanja, 2020c
[471] European Commission. Education and training monitor 2020 - MS Report 2020 https://op.europa.eu/en/publication-detail/-/publication/c951e121-2497-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171315948
[472] https://www.ucimeonline.cz/
[473] https://www.klascement.net/ict/thema/ict-eindtermen-voor-lager-en-secundair-onderwijs/

Following the initial emergency response, many countries saw the emergence of a wider range of **independent sources of online information and guidance**, including websites established by NGOs, teacher networks and parents, and a diverse set of voices on digital education, foregrounding young people's views on their digital education futures. This trend was mirrored at an EU level. In June 2020, the European Youth Forum launched their Blueprint to Recovery, which included long-term goals based on strengthening youth participation in civic and democratic life, investment in citizenship education to prepare young people for a post-COVID world and addressing the "*impact of digitalisation in decision making processes".*[474] Similarly, OBESSU[475] published a response to the impact of COVID-19 on secondary education and VET based on consultation with its membership base of students from across Europe.[476] This paper highlighted the priority for clearer guidelines from ministries of education regarding educational rights during the crisis, and for greater accountability by schools. It also highlighted concerns with educational inequality and ethical and privacy issues.

While the proliferation of digital platforms was crucial to centralise information and guidance on digital and distance learning solutions, thereby avoiding fragmentation and "information overload" and facilitating peer learning, the exchange of good practice and the building of a collaborative and supportive community among teachers, our research also found some challenges in some of these platforms. In particular, the following challenges were highlighted by key stakeholders consulted throughout the primary research stage of our study:

- **Quality assurance** – While these online platforms allowed for teachers to discover and experiment with new digital solutions, some stakeholders flagged the absence of quality assurance for these digital tools. Moreover, they mentioned that well-established, high-quality and "well-known" digital tools (both hardware and software), were important not only to improve the overall quality of online education but also to foster trust among all stakeholders using these tools (*i.e.* parents, students, teachers and administrative staff). As mentioned before, trust remains one of the main barriers to an effective implementation of digital education.

- **Lack of guidance** –The proliferation of independent sources of online information and guidance, even within platforms, and the lack of a clear link on how to use them to support intended learning outcomes was another key challenge mentioned by some of the stakeholders interviewed as part of the case study research.

To respond to some of the main challenges underpinning online platforms and their content (in particular their quality and effective use), in September 2019 the Flemish government launched a new online platform (i-Learn), to teachers to follow and/or create different learning paths. Learning paths are being developed for each year of primary and secondary education, and these will be linked with specific learning

[474] European Youth Forum (2020). *The European Youth Blueprint to Recovery.* Online: https://www.youthforum.org/sites/default/files/publication-pdfs/blueprint.pdf P.16
[475] The Organising Bureau of European School Student Unions (OBESSU)
[476] OBESSU, *op. cit.* p.2.

outcomes and/or subjects, combining different digital tools in a suggested sequential order and including assessments. These learning paths are all fully optional and, using any of the digital tools included in the platform, teachers can adapt them to make sure they are relevant to their own (and their learners') teaching and learning needs[477].

Emergence of smaller-scale projects and experimentation

Countries benefited from initiatives that has been developed for **transfer or replication**. Member States that had run smaller scale pilots before the crisis often saw their investments bear fruit during school closures. In **Lithuania**, the pandemic provided the opportunity to re-imagine the 2018 Informatics in Primary Education Programme as a blueprint for teacher education, extending the tools and framework from a limited number of pilot schools to a universal offer for all ISCED 2 teachers in a bold and ambitious move to embrace digital education[478]. **Croatia** undertook a similar decision to scale-up several initiatives (see table below). A call for pilot projects was launched in **Germany** to incentivise creative and evidence-based approaches to distance learning with a view towards rapid rollout. This was managed by the Federal Education Ministry, which published a new funding guideline for the *Innovation Competition INVITE* (Digital Platform for Continuing Education and Training), encouraging digitally0driven systems for information, advice, and guidance.[479]

Box 8 Spotlight on building on an established digital infrastructure (Croatia)

SPOTLIGHT BOX: Building on an established digital infrastructure (Croatia)

In **Croatia**, the shift to distance learning was facilitated by two large EU-funded projects: e-Schools and curriculum reform, covering both primary and secondary general and VET schools. The project e-Schools was launched in 2015 with ERDF support and was extended from 2019-22 with support from the ESF.

The pre-COVID-19 goal was to modernise and strengthen both the IT infrastructure and skills of teachers and other school professionals, but these efforts were intensified with the school closures. This provided a platform for response to the COVID-19 situation:

1) Digital skills training was provided to over 40,000 school personnel in 2020-21 under the curriculum reform and e-Schools. This was offered to school leaders, teachers, and expert associates, as well as to administrative staff. The rollout started with the pilot schools and then expanded.[480]

[477] See https://www.i-learn.vlaanderen/en/
[478] Informatics in Primary Education (2020). Available at: https://informatika.ugdome.lt/lt/biblioteka/gerosios-patirtys/
[479] Education and training Monitor 2020 – Germany https://op.europa.eu/en/publication-detail/-/publication/0b2b1170-2499-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316678
[480] European Commission. Education and training monitor 2020 - MS Report 2020 https://op.europa.eu/en/publication-detail/-/publication/c951e121-2497-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171315948

SPOTLIGHT BOX: Building on an established digital infrastructure (Croatia)

2) A new Strategic Framework for Digital Maturation of the School and the School System was launched in March 2020[481], modelled on the project framework and with four elements: 1) a digitally mature environment; 2) digitally mature and confident teachers; 3) ICT as support to teaching and learning; and, 4) digital leadership.

3) Guidelines on the integration of digital technologies to learning and school processes were scaled up during the pandemic, again based on the e-Schools framework. This informed the Action plan for distance education and Models and recommendations for schools in COVID-19 conditions.[482]

Monitoring, feedback and evaluation

The use of monitoring, feedback and evaluation was of central importance to all key stakeholders during the crisis, given the unprecedented scale and pace of the shift to online education and the associated uncertainties. Most countries set in place **monitoring mechanisms to estimate numbers of households and learners without access to Wi-Fi or devices** and recalibrated their remote learning approaches as data became available. In **Bulgaria**, the first lockdown exposed specific geographical disparities in access to devices and connectivity, resulting in a more targeted approach prior to the second wave of school closures. The Ministry stepped-up its laptop loan scheme with support from NGO partners and ESIF and worked with two telecommunications companies to establish 11 new Wi-Fi zones in localities with poor internet connectivity and the highest concentration of students not participating in online learning.[483]

In **Belgium (Flanders)**, for instance, the King Baudouin Foundation has been tasked to conduct an annual survey of ICT use by families and individuals between the ages of 16 and 74 years old since 2020. This 'Digital Barometer E-Inclusion' maps the digital divide across three dimensions: access levels to digital technology; levels of digital skills; and use of essential online services.[484]

Beyond quantification of the digital divide, however, countries also undertook monitoring and gathered **feedback from teachers and school leaders, families and learners** on their needs and experiences of distance learning. These exercises varied in their scale, methods used, and the degree of independence with which the work was carried out. Internal and external evaluations sometimes provided conflicting accounts of the success of national educational management efforts during the COVID-19 emergency. Consultation and dialogue with professional networks and associations of teachers and school leaders was widespread, while some countries also conducted

[481] https://mzo.gov.hr/UserDocsImages/dokumenti/PristupInformacijama/Strateski-digitalno2030/Strateski%20okvir%20za%20digitalno%20sazrijevanje%20skola%20i%20skolskog%20sustava%20u%20Republici%20Hrvatskoj%20-%202030.pdf
[482] https://mzo.gov.hr/vijesti/modeli-i-preporuke-za-rad-u-uvjetima-povezanima-s-bolesti-covid-19-u-pedagoskoj-skolskoj-godini-2020-2021/3916
[483] https://dnes.dir.bg/obshtestvo/mon-kupuva-pone-80-000-ustroystva-za-elektronno-obuchenie 25.05.2020
[484] See https://e-inclusie.be/onderzoeken/2020-barometer-digitale-inclusie

household or learner surveys, and gathered feedback from school inspectorates. These data (qualitative and quantitative) were instrumental to government and school responsiveness.

- In **Estoni**a, for example, the ministry remained in close contact with schools and families throughout the crisis and tailored the support provided online accordingly.[485] It quickly became apparent that there was a latent demand for digital education resources and corresponding teacher education measures, and the ministry was able to respond by providing webinars, Frequently Asked Questions (FAQ) sheets and inventories through the national education porta.

- Similarly, in Austria a national survey of 3,500 teachers identified specific skills gaps during remote teaching.[486] These data informed the development of a MOOC for Distance Education with support from virtual teacher education institutions, which was attended by around 10,000 teachers. The four-week online course aimed to provide support for the integration of didactic methods of distance learning in teaching practices countrywide.

In each instance, there was a visible connection between feedback and action at a policy level. At the same time, a number of countries had moved rapidly to deliver large-scale educational programmes without attention to take-up, reach, or any kind of mechanism for evaluating the educational benefits. This was the case for educational content provided by some TV broadcasters, for example.

Key themes emerging from the first lockdown

Two themes emerged quite strongly following the first lockdown. They related to:

- The extent of additional support and intervention required for learners with additional needs during remote learning; and

- The mental health and wellbeing needs within school communities.

Additional support and intervention for disadvantaged learners

In **Ireland**, the ESRI published a detailed report on the impact of COVID-19 on school communities in June 2020, based on feedback from school leaders across the system. This report highlighted that there had been insufficient focus on SEN learners during the initial school closures. Following the report and a wider consultation, the particular needs of disadvantaged learners was covered more closely in the media, as the schools prepared to reopen in September 2020, and the ministry and schools redoubled their efforts in this regard[487]. In another example, a study on the implementation of distance education in schools in **Cyprus** (ISCED 1-3) made proposals for a psychological framework for distance learning and funding for school counsellors to help maximise teachers' and students' success online.[488]

[485] Carretero Gomez, et. Al. (2021). Op. cit.
[486] Besic, E., & Holzinger, A. (2020). Fernunterricht für Schüler* innen mit Behinderungen: Perspektiven von Lehrpersonen. Zeitschrift für Inklusion.https://www.inklusion-online.net/index.php/inklusion-online/article/view/580/418
[487] https://www.esri.ie/system/files/publications/SUSTAT92_3.pdf
[488] European commission (2020) Education and Training Monitor, Cyprus.

The geographical dimension and the status of particular marginalised groups of learners were often country-specific. and following first wave of COVID-19, supported a more targeted and nuanced approach towards access and the scope and composition of cross-sectoral partnerships. In **Greece**, the municipal education and counselling centres provided a focal point for assimilating resources and pedagogical support for SEN learners. Additional targeted funding was provided for psychological support and counselling (**Romania**, **Estonia**), the provision of home access equipment, mobile data allocations and SIM cards for digitally excluded students accessing learning from mobile phones[489] (**Spain**) and reading recovery schemes for low SES and migrant learners who had fallen further behind academically[490] (**Netherlands**).

Mental health and wellbeing needs

In Section 2, we already discussed extensively the rise in mental health disorders on young people, especially among young people with special educational needs. While, according to several interviewees, some young people managed to "thrive" during distance learning (as it provided them with more flexibility, autonomy and self-pacing), evidence shows that for the majority of children distance learning was coupled with a rise in mental health disorders. A recent paper which provides a review of child and adolescent anxiety, depression and traumatic stress experienced during the COVID-19 pandemic, for instance, shows that while there currently are only a small number of studies examining the prevalence of mental illness in children and adolescents during COVID-19, *"the existing literature, findings do point to an increase in depressive and anxiety symptoms in children and adolescents".*[491] Evidence of this also emerged in our case study research. A representative from BedNet[492] (i.e. the organisation in Flanders, Belgium, providing synchronous internet education to sick children), for instance, mentioned that there had been a rise in children who were absent from school for long terms due to mental illness.

More specifically, the various government and independent studies and evaluations carried out within Member States provide an overview of the barriers and enablers to distance learning as reported at regional/municipal and school levels. These include infrastructural, pedagogical, psychological and practical dimensions. The table below provides a distillation of the key points, insofar as these can be generalised from the data.

Table 4—2 Factors moderating access to education remotely during COVID-19

Infrastructural	Pedagogical
• Access to a suitable digital device	• Availability of pedagogical guidelines

[489] European Commission – Directorate-General for Education, Youth, Sport and Culture (2020) Education and Monitoring Training 2020. Spain. p.9, See: fhttps://op.europa.eu/en/publication-detail/-/publication/c9527d62-2497-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316235

[490] OCW (2020b): Ministry of Education, Culture and Science: Subsidieregeling inhaal- en ondersteuningsprogramma's gepubliceerd. https://www.nieuwsbrievenminocw.nl/actueel/nieuws/2020/05/26/subsidieregeling-inhaal--enondersteuningsprogramma%E2%80%99s-gepubliceerd

[491] See Racine, N., Cooke, J. E., Eirich, R., Korczak, D. J., McArthur, B., & Madigan, S. (2020). Child and adolescent mental illness during COVID-19: A rapid review. Psychiatry research, 292, 113307. https://doi.org/10.1016/j.psychres.2020.113307

[492] See https://www.bednet.be/

Infrastructural	Pedagogical
• Reliable Wi-Fi, sufficient bandwidth • Top-up data for prepaid phones • Cyber-security measures for schools • Assistive Technologies (SEN)	• Access to high quality digital materials • Consistency in pedagogies deployed by schools and individual teachers • Formative assessment and feedback
Psychological	**Practical**
• Teacher, learner, parental motivation • Access to psychological support • Emotional wellbeing of teachers, students and their parents / guardians • Home-school communication • Student-teacher-parent relationships	• Sufficient time to prepare / adapt education content and curricula • Access to information and guidance • Appropriate home learning environment (light, noise levels) • Parental moderation, screen time

Factors affecting the effectiveness of the response

The country mapping exercise provided an opportunity to explore what factors may have helped or hindered efforts to maintain access to education during the crisis. The timing of the research (autumn 2020 – spring 2021) and the emphasis on secondary data means that this is very much an early view. Indeed, one of the challenges relates to standard definitions of how an effective response might be defined and measured in the absence of longitudinal educational performance data, which are not yet forthcoming. Key dimensions emerging at this stage include:

a) levels of access and reach with regard to distance learning
b) levels of participation in (high-quality) education
c) equality and equity considerations, relating to the access and inclusion of disadvantaged groups
d) confidence in professional leadership, responsiveness and accountability to children, schools and families during the crisis
e) perceived sufficiency of arrangements to secure educational access, pedagogical support and continuity, and personal safety, wellbeing and citizenship.

It was apparent that certain common factors were present where countries experienced greater success in maintaining educational access, some of which related to the strategy and measures that were adopted (implementation factors) and some of which reflected the underlying status and characteristics of digital education, and levels of infrastructure and resources within the system (structural factors). It was clear that at all levels (macro, regional and school), the crisis had exposed a far from level playing field and that countries were responding from varied baselines.

Table 4—3 Factors affecting the effectiveness of country-level access measures

Intervention factors	Structural factors
• Coherence of system leadership & strategy	• Prior digital infrastructure • Workforce readiness

Intervention factors	Structural factors
• Stakeholder engagement and mobilisation • Utilisation of existing digital resources and infrastructure • Use of monitoring, evaluation and feedback	• Parent, carer and learner readiness • Scale and scope of equity challenges • Resources within the system

Irrespective of whether education systems are centralised or decentralised, **clear system leadership** was a common enabling factor in managing the transition to remote learning. Key stakeholders (from learners and carers to teachers) appear to have generally felt more confident in their remote schooling roles in Member States where a pro-active and ambitious approach towards addressing the challenges presented by the crisis, beyond an initial "emergency" response were made available. Such proactiveness was typically reflected in inclusive and broad-reaching governance arrangements and multi-dimensional action plans combining infrastructural, informational and pedagogical measures supported by a longer-term digital plan and budgets. They further utilised data and feedback to adapt, target and (re)prioritise resources where they were needed to address exclusion, based on consensus-building and public dialogue.

Where this leadership was perceived to be lacking, Member States had generally encountered challenges related to the uneven distribution of resources; a lack of coherence in the pedagogical approaches taken by individual schools; and confusion regarding public information about digital education and access to resources and training. These factors also tended to perpetuate existing structural inequalities, with better digitally equipped schools and teachers more able to take action to shift online. This question was separate to school autonomy – some countries with high levels of school autonomy had taken steps to ensure pedagogical continuity, and had done so within a clear policy framework. Distributed leadership and access to professional networks were also important. Moreover, some had used incentives to nudge schools towards greater consistency, such as the requirement in Austria for schools to demonstrate "engagement" and to create a digitalisation plan as a condition for receiving subsidised devices.[493]

Above all, however, the research underlines **the importance of know-how surrounding activating digital tools to achieve specific pedagogical aims**. A number of Member States struggled to adapt to distance learning arrangements during the COVID-19 pandemic, despite performing well above average on the key measures relating to digitally equipped schools and teacher digital skills**. A consistent theme in the feedback from schools and teachers was the lack of readiness for distance learning,** perhaps suggesting an over-emphasis on infrastructure (hardware, software) relative to the embeddedness of educational technology within homes and classrooms:

- In **Malta**, the COVID-19 crisis revealed a surprising gap between expected and actual levels of digital preparedness. Malta ranks first among EU Member States

[493] BMBWF webpage „8-Punkte-Plan für den digitalen Unterricht" https://www.bmbwf.gv.at/Themen/schule/zrp/dibi.html

at ISCED 1 and 2, with regard to the use of ICT in teaching, while over 70% of students at ISCED 2 report using the internet and computer for learning[494]. Before the crisis, however, ICT was principally integrated in classroom-based teaching. This meant that teachers and students had comparatively little experience of online learning outside school and were not ready for this adjustment when schools closed. Although participation in education was not systematically monitored during this period, an independent study[495] found that very few students (about 5%) had experienced online teaching prior to COVID-19, and only around 35% of the teachers reported that they had already received training. The study also found that students with learning difficulties were disproportionately affected.

- Similarly, the picture was rather mixed in **Sweden**. Overall, the shift to distance learning was publicly considered a success. Most Swedish schools were already utilising digital platforms and tools prior to the COVID-19 crisis, and their efforts to maintain continuity in access were applauded[496]. A recent study found that this position may have been exaggerated, however, and that many teachers lacked confidence in the pedagogical strategies needed for online teaching[497]. Teachers, students and school leaders were not fully able to benefit from the technology due to gaps in knowledge and experience.

Parent, carer and learner readiness was another key theme emerging from the Delphi research. Stakeholders interviewed in **Belgium**, for instance, underlined the importance of strengthening parents' digital skills, especially for children from disadvantaged backgrounds, to empower them to be more closely engaged with the education of their children, their teachers, the school and the local community.

A number of **promising examples** have emerged, most (but not all) of which are from northern European countries with a history of investment in digital education, and a strong track record for educational inclusion. These are further described and explained within the case study box below.

Box 9 Spotlight on country level responses to maintain access

SPOTLIGHT BOX: Country level responses to maintain access - promising examples

- **Denmark -** the education sector was comparatively well prepared for school closures, having a well-developed ICT infrastructure and teacher and student digital competences well above EU averages. The ministry moved quickly to consolidate a central communication platform, a variety of digital platforms, and digital strategies in schools. Perhaps one of the most telling indicators of success,

[494] European Commission, (2019). 2nd Survey of Schools: ICT in education. Brussels : DG CNECT https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education
[495] Busuttil, L., & Farrugia, R. C. (2020). Teachers' response to the sudden shift to online learning during COVID-19 pandemic : implications for policy and practice. *Malta Review of Educational Research*, 14(2), 211-241.
[496] https://www.cedefop.europa.eu/en/news-and-press/news/swedish-actions-education-response-corona-pandemic
[497] https://www.researchgate.net/publication/343738011_COVID-19_and_crisis-prompted_distance_education_in_Sweden

SPOTLIGHT BOX: Country level responses to maintain access - promising examples

however, is that teachers largely maintained the engagement of students within a virtual learning environment.[498] According to a survey by Aarhus University of over 10,000 students in third and ninth grades and their parents, over three quarters (80%) of learners knew what teachers wanted them to do and felt part of a learning community.[499] Nine in ten students considered that they were supported at home. There was also clear trail of accountability. In response to concerns raised about the situation of vulnerable students, the ministry increased levels of educational outreach. In response to emerging signs of loss of motivation among upper secondary students, additional funds were committed to widen access to pastoral support with a focus on increased one-to-one teacher time.[500]

- **Estonia** - in general, all of the necessary conditions were present for smooth management of the lockdown. These included: a solid baseline of digital skills and infrastructure; an emergent national strategy; brokerage of access to resources and cross-sectoral expertise; and local action by schools. Although the growth of digital platforms was overwhelming during the initial stages of the crisis, and timetables proved to be ambitious, research indicates that **teachers** and learners considered that their digital competences stood up to the test, and that Estonia's national response was characterised by "*…good governance, cooperation, partnership and information-sharing between stakeholders*".[501] Teacher and school leader professional networks took on a new dimension, helping to provide a clearer distinction between teachers' needs for peer support, and for online instructional practices. Moreover, it was not uncommon for teachers to report having used the lockdown period to familiarise themselves with more advanced digital equipment in a teaching and learning context, such as the use of document cameras.[502]

- **Bulgaria** – an ambitious and forward-looking educational action plan which combined multiple resources, alternative modes of digital learning, and license-free access to textbooks and online learning materials was implemented. With regard to structural considerations, Bulgaria entered the crisis with relatively high levels of ownership of digital devices even among households of low Socio-Economic Status (SES), and widespread adoption of digital tools in classroom teaching[503]. This was further enabled by wide-ranging public support for the integration of digital tools in compulsory education. Partly as a result of this, around 90% of schools have organised and tried online education since the first wave of the pandemic.[504]

[498] Gymnasieskolen (2020) Digitalisering må ikke overlades til den enkelte. [Online]. https://gymnasieskolen.dk/digitalisering-maa-ikke-overlades-til-den-enkelte
[499] https://op.europa.eu/en/publication-detail/-/publication/3fe7eba2-2496-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316210
[500] op. cit.
[501] Cedefop, 2020. Estonia: Responses to the COVID-19 outbreak. https://www.cedefop.europa.eu/sl/news-and-press/news/estonia-responses-covid-19-outbreak
[502] Carretero Gomez, S., et. al. (2021) op. cit.
[503] https://obr.education/doklad-distancionno-obr/
[504] op. cit.

Positive and negative impacts of distance education on learning

In this section, we have thus far considered how Member States widened access to education during the pandemic, and the strengths and drawbacks of the methods that were adopted. In this final sub-section, we consider the positive and negative impacts of the COVID-19 pandemic, and the corresponding shift to distance learning, on education within the EU27. This sets the context for the recovery period.

Negative impacts

The negative impacts might be grouped into the following categories:

- Equality and equity implications
- Mental health and wellbeing implications
- Cyber security and privacy implications
- Safeguarding implications

Equality and equity implications

The consensus was that the pandemic has **compounded existing inequalities** and resulted in **more inequity**, despite best efforts of EU Member States to mitigate against these outcomes. This overall scenario emerges from a combination of indicators and data sources, including evidence of unequal *access* to education (digital divide issues), and unequal *participation* in educational provision even where access was secured. Furthermore, there was evidence that socio-economic status (SES) had implications for student motivation and attainment, parental engagement in education, and the quality of home learning environments. In short, as one study interviewee from Belgium working with vulnerable young people phrased it: *"the pandemic did not create new inequalities, it merely enlarged existing inequalities"*.

Taking the digital divide issue first, Member States reported gaps in access to devices and internet connectivity despite large scale programmes of emergency funding and distribution of devices. These gaps invariably correlated strongly with household income and SES. In Spain, for example, education authorities estimated that around 10% of the 8.2 million students from socio-economically disadvantaged backgrounds did not have digital devices or internet access at home during lockdown.[505] A separate study by Save the Children estimated that among families with monthly incomes of less than EUR €900, 42% did not have a computer at home and 22% did not have internet access.[506]

These disparities often also had a strong territorial dimension, mapping onto localities or regions with higher levels of socio-economic disadvantage or rurality. In **Romania**, schools in more affluent localities managed better and received support from local authorities, companies and parents at the expense of those in socio-economically disadvantaged areas. As a consequence, many students were excluded, with figures

[505] European Commission – Directorate-General for Education, Youth, Sport and Culture (2020) Education and Monitoring Training 2020. Spain. p.9, See: fhttps://op.europa.eu/en/publication-detail/-/publication/c9527d62-2497-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316235
[506] European Commission (2020) op. cit.

varying from 5% to 15% of the overall student population.[507] A national teacher's survey in **France** showed that there was widespread concern regarding widening educational inequalities in the Priority Education Zones during the pandemic, although these were difficult to quantify in the shorter term. In **Ireland**, schools in areas with lower availability of high-speed broadband, schools included in the Delivering Equality of Opportunity in Schools (DEIS) initiative and schools in areas of lower household income were more negatively impacted.[508]

Serious underlying infrastructural problems were too entrenched and multi-faceted for Member States to address with emergency budgets, and this was especially the case in countries with higher levels of socio-economic inequality and structural disadvantages prior to the crisis. In **Hungary**, for example, 70% in villages without broadband were cut off from education resulting in widespread learning loss and lost communication with schools according to research conducted with parents by NGOs. [509]

Even in **Finland**, which showed many positive features within the national response to the pandemic, an evaluation report by the Finnish Education Evaluation Center Karvi [FEEC] concluded that the distance learning period had weakened the learner equity and the conditions for learning.[510] The report highlighted priorities to strengthen methods for assessment of students' needs, personalisation of learning, and stronger co-operation between home and school, to mitigate against a further widening of the attainment gap.

[507] IRES (2020a). Accesul copiilor școlari din România la educația online [Romanian students access to online education]. Available at: https://ires.ro/articol/394/accesul-copiilor--colari-din-romania-la-educa%C8%9Bie-online
[508] Mohan, et al. (2020). Learning for all? Second-level education in Ireland during COVID-19. *Economic and Social Research Institute (ESRI) Research Series*.
[509] https://docs.google.com/document/d/e/2PACX-1vSihd04xyu6HXWzZiwrwqjLYZQ9-Q_OMGRLahg7AEzaqm1Kn31ZXNsb55UrckRGnrblAC5uoDutAHud/pub?fbclid=IwAR1Qeq7xHNaqVuSofGFENcd6yy6VW2aA6zWIGjSbQfwcqiR6LrJIpA1jWdg&urp=gmail_link
[510] Karvi [FEEC] (2020). The Korona era has challenged schools and colleges to develop new good practices. Kansallinen arviointikeskus, Karvi [Finnish Education Evaluation Center, FEEC]] https://karvi.fi/2020/11/17/korona-aika-on-haastanut-kouluja-ja-oppilaitoksia-kehittamaan-uusia-hyvia-kaytanteita/

There was also more specific evidence of negative outcomes according to particular student and family characteristics. The main findings were as follows:

- **Low socio-economic status (SES)** - issues of challenging living conditions at home, including overcrowding and lack of access to study space were common challenges for students from lower income families. In **Germany**, research indicated that one in ten (10%) of children from the bottom quartile of SES may not have had a quiet place to study at home,[511] and that the home access situation may have worsened for households with multiple school age children, due to competition for devices within the family. In **Poland**, one third (33.9%) of students from households from the lowest decile income group did not have access to a computer or were required to share with siblings.[512] Lower average levels of parental literacy and digital skills also had an influence on educational progress, along with challenges arising from prior (de)motivation in learning[513]. Indeed, country reports suggest a disproportionate impact of reduced teacher contact on low SES students, and a greater propensity to replace instruction with "passive" use of the internet in the absence of home learning routines[514].

- **Ethnic and linguistic minority students -** disruption to education was particularly detrimental for families where the language of instruction is not spoken at home. In **Denmark**, language experts expressed concerns about missed time in kindergartens and schools for children of a migrant background. Foreign born children were already between one and two years behind their peers in Danish language development, so the lack of language stimulus and support was predicted to have negative consequences for their future schooling[515]. This also presented challenges for home-school communication during the crisis. One study in **Belgium** raised concerns about non-Dutch speaking students becoming absent and falling behind during this period.[516] In **Croatia**, one estimate put the participation of Roma families in distance learning as low as 30%.[517] The report authors cited a number of economic, social and cultural factors, but with particular attention to home literacy practices and parental engagement.

- **Special educational needs and disabilities (SEN)** – the pandemic presented widespread disruption to the availability of specialist support for SEN students, from speech therapy and tutoring to psychological help. In **Italy**, 2020 ISTAT data indicated that almost one quarter (23%) of students with disabilities did not

[511] Education and training Monitor 2020 – Germany https://op.europa.eu/en/publication-detail/-/publication/0b2b1170-2499-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316678
[512] Myck, M., Oczkowska, M., & Trzciński, K. (2020). Zamknięte szkoły : warunki uczniów do nauki zdalnej w okresie pandemii COVID-19.
[513] Αναστασιάδης, Π. (2020). Η Σχολική Εξ Αποστάσεως Εκπαίδευση στην εποχή του Κορωνοϊού COVID-19: το παράδειγμα της Ελλάδας και η πρόκληση της μετάβασης στο «Ανοιχτό Σχολείο της Διερευνητικής Μάθησης, της Συνεργατικής Δημιουργικότητας και της Κοινωνικής Αλληλεγγύης».. Ανοικτή Εκπαίδευση: το περιοδικό για την Ανοικτή και εξ Αποστάσεως Εκπαίδευση και την Εκπαιδευτική Τεχνολογία, 16(2), 20-48. doi: Available at: https://doi.org/10.12681/jode.25506
[514] Coronakrise halbierte bei Kindern die Zeit für die Schule. ifo Institut: 2020.
[515] https://www.sdu.dk/da/nyheder/forskningsnyheder/ekstra-sproghjaelp-under-covid19
[516] Baten e.a. (2020). Thuisonderwijs tijdens de COVID-19 pandemie: de eerste resultaten [Teaching at home during the COVID-19 pandemic: First results]. UGent: Onderzoeksgroep Ontwikkelingsstoornissen, April 2020. Available at https://www.ugent.be/nl/actueel/thuis-onderwijs-covid19.htm
[517] https://infogram.com/ukljucenost-ucenika-romske-nacionalne-manjine-u-nastavu-na-daljinu-1hmr6gvrl57z6nl?live&fbclid=IwAR0A2un5vpfc4Lqzdd0x1BM0uOuH6xDKBQnYGOLFKvh7vaDdqNBl7jF8EwQ

participate in distance learning between April and June 2020.[518] In **Ireland**, therapeutic services usually provided to SEN students by the Health Service Executive halted in March 2020 with the lockdown.[519] In **Malta**, fewer than 40% of teachers taking part in a national survey reported that their Learning Support Educator (LSE) joined them in their online teaching of students with SEN.[520] This statistic is an indicator of how many students went without specialist support. Home schooling presented additional challenges. A study by the Education Inspectorate in **Belgium (Flanders)** found that parents of children with SEN reported significantly greater problems adjusting to distance learning, and especially in secondary education[521].

- **Other student and family characteristics** – students living in single-parent households are another significant group at risk of disadvantage. In **Belgium**, for example, the 2020 Digital Barometer highlighted that 22% of this group do not have internet access at home (compared with 9% of couples without children), and 30% of single women in Wallonia do not have any internet access at home.[522]

Despite various measures to secure access to devices and the internet, pedagogical tools and specialist support, therefore, the COVID-19 crisis showed that distance learning put some learners at a significant disadvantage. Schools were required to plan for a combination of blended learning, educational outreach, and special access permission for on-site teaching to avoid a widening gap in educational achievement during the crisis.

Mental health and well-being implications

The country data also highlighted the potential impacts of the pandemic and distance learning on the **mental health and wellbeing** of teachers and students. Although the sources and time periods differed, there were recurring themes across the EU27. First, with regard to teachers the uncertainty of the pandemic situation, unfamiliarity with distance learning pedagogies, and increased workload combined to create higher levels of anxiety among the school workforce in some countries. Two thirds (66%) of teachers responding to a national study in **Austria** reported increased stress during lockdown,[523] while an independent report on COVID-19 education in **Cyprus** noted problems with "mental exhaustion" of teachers during remote learning.[524] These challenges were compounded to a greater or lesser extent by administrative burdens placed on schools. In **Hungary**, schools put in place strict measures to monitor compliance with nationally recommended hours of online teaching. This was found to have created an administrative burden as well creating pressure for teachers and students, so the president of the national school agency (the Klebelsberg Centre) intervened to urge a

[518] https://www.istat.it/it/files/2020/12/Report-alunni-con-disabilit%C3%A0.pdf
[519] Mohan, et al. (2020). Learning for all? Second-level education in Ireland during COVID-19. *Economic and Social Research Institute (ESRI) Research Series*.
[520] Busuttil & Farrugia, (2020), op. cit.
[521] Vlaamse Onderwijsinspectie (2020). *Tussentijdse resultaten belronde* [in-between results of interview rounds with schools]. 24 April 2020. Available at https://www.onderwijsinspectie.be/sites/default/files/atoms/files/200424%20RAPPORT%20BELRONDE%20GBAO.pdf
[522] See
[523] Goldan, J., Geist, S., & Lütje-Klose, B. (2020). Schüler* innen mit sonderpädagogischem Förderbedarf während der Corona-Pandemie. Herausforderungen und Möglichkeiten der Förderung–das Beispiel der Laborschule Bielefeld. //www. pedocs. de/frontdoor. php? source_opus= 20226, 189-201.
[524] https://politis.com.cy/politis-news/kypros/vasikos-pylonas-i-ex-apostaseos-ekpaideysi/

new, more flexible approach which thus far has been deemed to work better according to key stakeholders.[525]

For students the pressures of educational uncertainty during lockdown took their toll. In **Croatia**, feedback from students showed that there was substantial anxiety about learning new content in isolation, preparing for the Matura, and enrolling in higher education.[526] The ministry responded by launching an online platform with access to questions from previous examinations, alongside guidelines for teachers on task preparation and evaluation procedures[527]. Unrealistic expectations of online learning also placed pressures on students in some Member States and schools, while anxieties surrounding the pandemic, reduced physical contact with peers and family, and isolation all affecting wellbeing. Students with SEN were particularly at risk of poor wellbeing, often having been isolated by school closures.[528]

The extent to which these negative outcomes will fade over time is unknown while Europe still contends with the pandemic. Nonetheless, many countries were taking steps to boost capacity for counselling and psychological support during the recovery period, with widespread concerns about the potential longer-term effects of the pandemic on the mental health on their student populations. Indeed, the World Health Organisation has noted the risk of increased levels of *"…loneliness, depression, harmful alcohol and drug use, and self-harm or suicidal behaviour"*,[529] and has issued guidance for parents and carers to safeguard children's wellbeing and mental health during the crisis.[530]

Cyber security and privacy implications

Another set of more negative impacts from the shift to online during the pandemic related to the **cyber security and privacy** implications of distance learning. The lag in securing access to laptops and equipment following the onset of the pandemic meant that there was a substantial reliance on teachers and families having their own devices and software. A heightened level of risk of loss of personal data arose from a combination of factors, which included: varying levels of teacher and student digital competences; gaps in knowledge and awareness of data protection and security obligations under the GDPR; varying standards of cyber-security within the home environment; and, shared use of devices between adult and child family members with varying levels of encryption.

Surveys of teachers carried out in EU Member States commonly flagged concerns around a lack of privacy where lessons or individual pastoral interactions were at risk of being overheard or recorded without their consent for uses that were beyond their control. In some instances, they also revealed teachers' anxieties about being duped online by

[525] https://kk.gov.hu/download/e/83/92000/T%C3%A1j%C3%A9koztat%C3%A1s%20digit%C3%A1lis%20munkarend%20adminisztr%C3%A1l%C3%A1s%C3%A1r%C3%B3l.pdf
[526] Ristic Dedić, 2020. Available at https://www.pef.uni-lj.si/fileadmin/Datoteke/CRSN/slike_glavna/Risti%C4%87_Dedi%C4%87__Z.__2020_-_preliminarna_z_gimnazijci_-_koronavirus.pdf
[527] European Commission. Education and training monitor 2020 - MS Report 2020: https://op.europa.eu/en/publication-detail/-/publication/c951e121-2497-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171315948
[528]https://www.researchgate.net/publication/343738011_COVID-19_and_crisis-prompted_distance_education_in_Sweden
[529] https://www.euro.who.int/en/health-topics/noncommunicable-diseases/mental-health/data-and-resources/mental-health-and-covid-19
[530] https://www.who.int/docs/default-source/coronaviruse/helping-children-cope-with-stress-print.pdf?sfvrsn=f3a063ff_2

digitally more competent students during the period of distance learning.[531] Moreover, parents and students held schools accountable for privacy and cyber security, and school leaders conceded that schools' efforts had not always been sufficient.[532]

[531] UCE (2020) op. cit.
[532] Carretero, et. al. (2021). op. cit.

Safeguarding and child protection implications

There was also evidence of increased family conflict arising within a distance learning situation, due to pressures on students and parents or carers during lockdown. A national survey of parents in **Germany** showed that 38% of parents reported increased levels of stress during home schooling, while 28% reported having argued with their children more frequently as a consequence.[533] Indeed, academic research has suggested a heightened risk of more serious family conflict and violence during the lockdown situation, where vulnerable children are confined to their homes and cut off from networks and support.

This relates also to child protection issues presented by online grooming and circulation of child abuse material. Europol have reported increased levels of online activity by those seeking child exploitation material during the pandemic, and an increased prevalence in sexual coercion and extortion, facilitated by the greater amounts of time spent by children on social media, online gaming, and using the internet for study.[534] The public health risks posed by the shift online during the pandemic have not been met with appropriate measures to evaluate and mitigate against these child welfare risks[535], and it has been argued that more emphasis is needed on 'social technologies'[536] alongside educational ones.

Our case study research highlighted that **safeguarding and child protection issues** during the pandemic may be particularly present among children who had already been living in difficult home situations. A **Belgian** stakeholder interviewed for the study who works for an organisation for vulnerable young people explained that, for these children, in addition to a lack of digital infrastructure and skills to participate in online education, the fact of not physically being able to go to school was particularly challenging for this group, as school for them is an important outlet and "escape" from very difficult home situations.

Positive impacts

The country analysis shows that the shift to online learning during the pandemic also had a number of more **positive impacts** for education systems across the EU27. These might be grouped into the following categories:

- Leverage for digital education policy and funding reforms
- Improved understanding of needs
- New cross-sectoral partnerships and alliances
- Increased school and municipal autonomy
- Sustainable use of digital tools and practices
- Changes in attitudes and behaviours

[533] Coronakrise halbierte bei Kindern die Zeit für die Schule. ifo Institut: 2020.
[534] Europol (2020). Exploiting isolation: Offenders and victims of online child sexual abuse during the COVID-19 pandemic. Available online: https://www.europol.europa.eu/publications-documents/exploiting-isolation-offenders-and-victims-of-online-child-sexual-abuse-during-covid-19-pandemic [Accessed: 14.03.21]
[535] Pereda, N.., Díaz-Faes, D.A. Family violence against children in the wake of COVID-19 pandemic: a review of current perspectives and risk factors. *Child Adolesc Psychiatry Ment Health* 14, 40 (2020). https://doi.org/10.1186/s13034-020-00347-1
[536] https://www.coe.int/en/web/portal/covid-19-one-in-five-children-suffers-one-or-another-form-of-sexual-abuse-or-victimisation-during-their-childhood

Leverage for digital education policy and funding reforms

Across Europe, the pandemic gave **new impetus to policy and legislation regulating the use of digital technologies within education**. While reforms were already planned or underway in many Member States, the crisis pushed digitalisation up the policy agenda. The emergency measures meant that governments and schools rapidly acquired new knowledge of barriers and enablers to the use of digital tools within education, and practical experience from implementation. This created a public and political appetite for reform that was rarely present before the crisis, even in Member States where there was already a longstanding commitment to digital education.

A number of Member States have used this momentum to design flagship digitalisation programmes, or to scale up existing programmes. Perhaps tellingly, the objectives of many of these reforms go beyond the massification of ICTs, per se. Instead, they place a stronger emphasis on the social and behavioural aspects of integrating digital tools to learning environments, and the need to align education, welfare, and economic objectives. The COVID-19 experience seems to have been a key factor.

- In **Estonia**, the Ministry has launched the Digital Focus Programme to achieve the goals of the Lifelong Learning Strategy 2020[537]. In doing so, it aims to draw on lessons learned from the pandemic to ensure that prerequisites to nurture a new 'digital culture' within schools are in place, including for teachers' digital competences, e-assessment, and support for innovative activities for the integration of digital solutions into learning and curricula.[538] Looking further ahead, the Ministry has started the preparation of the Education Strategy 2035 with "innovation in education" as a cross-cutting theme, and an emphasis on the use of relevant educational data in decision-making processes.

- In **Portugal**, the experiences of distance learning during the pandemic have helped to accelerate educational policy reforms. In October 2020, digitalisation was the main issue highlighted for educational within the resilience and recovery plan approved by the government. Accordingly, the first reform to be included in the digital transition strategy relates to school education. An estimated €538 millon has been allocated for infrastructure development, coupled with measures to develop digital competences among teachers and school leaders.[539]

- In **Belgium (Flanders)**, the ministry adopted a new digital education action plan in December 2020 called 'Digi Jump' (*Digisprong*),[540] which will invest a record amount of €375 million in ICT infrastructure, ICT education and ICT coordinators. A Ministry representative interviewed as part of the case study research confirmed that the COVID-19 crisis pushed Flanders to fully embrace digital education, to which this strategy is a direct response. The strategy was also conceived from a highly inclusive perspective, seeking to address some of

[537] Ministry of Education and Research, (2014). Lifelong Learning Strategy 2020. https://www.hm.ee/sites/default/files/estonian_lifelong_strategy.pdf
[538] Ministry of Education and Research, (2019). *Digipöörde programm 2019-2022.* The Digital Focus Program 2019-2022 *https*://www.hm.ee/sites/default/files/2_digiprogr_2019_22.pdf
[539] https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=%3d%3dBQAAAB%2bLCAAAAAAABAAzNDAzNgMAAfd%2fsQUAAAA%3d
[540] See https://onderwijs.vlaanderen.be/nl/digisprong

the main digital divides exposed during the and second waves of the COVID-19 pandemic.

Better understanding of needs

A **stronger emphasis on inclusion** was apparent in policy measures influenced by the COVID-19 experience. The stark disparities in educational access during the crisis, especially for vulnerable learners with lower SES or ethnic minority backgrounds and those with SEN , were instrumental in a shift from universalism (universal application) towards a more 'progressive universalist'[541] approach for meeting learners' specific needs within digital environments.

- In **Bulgaria**, an amendment to the Pre-school and School Education Act allowed for the application of distance learning to a wide range of emergency situations that might result in the disruption of face-to-face education[542]. It also legitimised distance learning as an option for individual students, at the request of parents and upon meeting specific criteria (including special needs, health reasons or other barriers to learning). It is anticipated that the limit of up to 30 days of remote learning will provide flexibility for disadvantaged learners in future.

- In **Spain**, the government has launched the digital transformation programme "Educa en Digital". Alongside a raft of other measures intended to modernise public services, the programme will provide half a million devices and expanded connectivity to educational centres country-wide in order to improve their accessibility for students with SEN and other vulnerabilities. This forms part of a €260 million investment, which is to be co-financed by Red.es, the CCAA and ERDF[543].

- In **Finland**, there was a high degree of public and political consensus surrounding the need to better support students with SEN or at risk of marginalisation in the wake of the pandemic. The incoming government has stated a commitment to the fulfilment of policies to improve equality and equity initiated under the previous administration. These include the investments made through the Government Programme[544] and Right to Learn project[545]. This step has been welcomed by schools, regional authorities and teacher unions.

[541] Progressive universalism can be defined as: "…a determination to ensure that people who are poor gain at least as much as those who are better off at every step of the way toward universal coverage, rather than having to wait and catch up as that goal is eventually approached". Source: Grwatkin, D. (2014) Health 2015: A conversation with Davidson Gwatkin on progressive universalism. Available online: https://r4d.org/blog/health-2015-conversation-davidson-gwatkin-progressive-universalism/.
[542] The Pre-School and School Education Act 2015 https://www.mon.bg/upload/23949/zkn_PedUchObrazovanie-izm092020.pdf
[543] Ministerio de Educacion y Formacion Profesiona (2020) El Gobierno lanza el programa Educa en Digital para impulsar la transformación tecnológica de la Educación en España. Online See: http://www.educacionyfp.gob.es/prensa/actualidad/2020/06/20200616-educaendigital.html
[544] Programme of Prime Minister Antti Rinne's Government (2019). Programme of Prime Minister Antti Rinne's Government: INCLUSIVE ANDCOMPETENT FINLAND. –a socially, economically and ecologically sustainable society. Publications of the Finnish Government 2019:25. https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161664/Inclusive%20and%20competent%20Finland_2019.pdf?sequence=9&isAllowed=y
[545] MEC (2020b). The Right to Learn. Ministry of Education and Culture. http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161950/Comphrehensive%20school%20education%20programme%20-%20Brochure.pdf

New cross-sectoral partnerships and alliances

The crisis also established **new cross-sectoral partnerships and alliances**. There are questions to be answered regarding the sustainability of partnerships that were initiated across Europe in the context of a public health emergency, and whether the social responsibility ethos (*e.g.* waiving of licenses, subsidisation and donations) will persist beyond the crisis. Nonetheless, there are signs of sustainability. In **Sweden**, where public-private initiatives in education were generally limited in scope before the crisis, larger and more sustainable coalitions have been forming around common educational goals between municipalities and the private EdTech sector. These have centred on migrant education, and the digitalisation of SEN provision.[546] In **Ireland**, the abundance of digital resources made available without cost to students and teachers by a coalition including publishers and the Irish Writers Union has been much celebrated[547]. The PDST[548] and other Irish agencies were also proactive in offering training to teachers on how they could harness available technology and provide exemplars of good practice to support teachers. This looks likely to continue.[549]

Increased school and municipal autonomy

A further positive impact of distance learning during the pandemic was that in some Member States it created the conditions for **greater school and municipal autonomy** with regard to digital tools and pedagogies. Schools and local authorities were part of the national effort to mobilise and distribute ICT equipment and to facilitate continued access to education. In many instances they needed to become more self-sufficient during the crisis while national guidance and resources were set in place. In **Greece**, the ministry has acknowledged the continuing importance of digital school leadership post-COVID, while in **Hungary** many schools developed their own digital teaching guidelines for organising the teaching and learning; selected a single learning platform; and, issued a guide for teachers on best practices. Having set these measures in place, a "*no turning back*" ethos has persisted. In **Cyprus**, a major €27.8 million ERDF co-financed project to equip public schools with a new e-government system was announced. The aim is to mainstream the use of tools allowing parents, students, teachers and other professionals to access services linked to the operation of schools, and to support school leaders to develop thriving school communities at a local level[550].

Sustainable use of digital tools and practices

There are positive indicators regarding the sustainable use of digital tools and practices developed during the COVID-19 pandemic across Europe. At an immediate level, this is apparent from **longer-term plans for infrastructure** that were developed to facilitate distance learning during the crisis. The government owned *Eduthek* online education platform that provided schools with access to teaching materials in **Austria**, is to be updated and harmonised with national curricula to ensure its continued relevance.[551]

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[546] https://www.hhs.se/en/research/sweden-through-the-crisis/future-digitalization-of-education-after-covid-19/
[547] https://www.irishhumanities.com/blog/covid-19-and-digital-learning/
[548] Professional Development Service for Teachers
[549] https://www.pdsttechnologyineducation.ie/en/Good-Practice/
[550] https://www.reporter.com.cy/local-news/article/741707/
[551] Education and training Monitor 2020 – Austria
https://op.europa.eu/en/publication-detail/-/publication/b6837464-2494-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171314305

Similarly in **Romania**, the Ministry of Education has encouraged new schools to join the *Clasa viitorului* initiative of EduApps,[552] providing access to open education resources. The membership has increased from 300 to 4,000 schools, post-crisis. The virtual school established in **Malta** to ensure access to education for vulnerable students is set to continue for students with health conditions preventing them from attending mainstream school,[553] while the Teacher-Tutor Programme set-up in **Finland** to provide in-classroom teacher support by professionals with expertise in digital pedagogy has been expanded. This follows a commitment by the Ministry to train and support a further 2,500 specialist tutors, to be based in the municipalities.[554]

In **Romania**, the 'School in a Suitcase' initiative emerged from the crisis as one of a number of innovative solutions for embedding digital education in rural schools. Importantly, the model aspires to be replicable and scalable, as explained below.

Box 10 Spotlight on the 'School in a Suitcase' (Romania)

SPOTLIGHT BOX: The 'School in a Suitcase' (Romania)

The project is funded by the World Vision Romania Foundation and Vodafone Foundation aims to address the threefold challenge facing rural schools: access to appropriate ICTs, teacher digital know-how, and support to embed high quality digital learning materials[555]. In doing so, it combines three main components:

1) **Free hardware and software**: a suitcase containing a laptop for the teacher, 25 tablets for students, a mobile server, a video projector, an audio system, a built-in equipment charging solution, a Wi-Fi router and a 4G modem.
2) **Training for teachers** to use free digital resources provided through the project, such as virtual lessons and online educational materials.
3) **A dedicated platform** (scoaladinvaliza.ro), including access to a bank of free high quality educational resources, and access to pedagogical support.

The project is covers ISCED levels 1-3 and is currently operational in schools from 11 municipalities within Romania, reaching over 6,000 students and teachers.

The platform took on a life of its own during the pandemic. According to monitoring undertaken by the project, teachers have created over 5,000 digital lessons on the platform and 4,000 lessons have been accessed by students. The large majority of students in supported schools actively participated to online classes and asynchronous activities while schools were closed. In comparison, up to 40% of the students in rural schools of a similar profile faced significant difficulties in accessing online education.

[552] https://www.clasaviitorului.ro/
[553] Times of Malta. (2020b). 600 students to be enrolled in a virtual primary school: School expected to be up and running in the coming days. 4th November 2020. https://timesofmalta.com/articles/view/600-students-to-be-enrolled-in-a-virtual-primary-school.829516
[554] http://www.oph.fi/rahoitus/valtionavustukset
[555] https://worldvision.ro/implica-te/proiecte-in-derulare/educatie/scoala-din-valiza/

Further to the sustainable use of digital tools and practices *beyond* the crisis, it is increasingly evident that some technology also holds the potential to mitigate the negative effects of human activity on the environment by replacing harmful materials, processes, or products with digital solutions that do not disrupt or deplete natural resources (i.e. 'green tech')[556]. Within this context, one of the efforts that can be put forth through education is introducing green technology from an early age to increase green awareness and ethos among learners. For instance, Gedved School[557] in Horsens, Denmark, gets 75% of its power from solar energy, saving the school an estimated €30, 000 annually. These funds are now redirected towards other education priorities at school-level. Furthermore, the school reports that switching to solar power has not only cut CO_2 emissions by 90 tonnes a year but is also providing an important opportunity to introduce pupils about the importance of environmental sustainability. Further to this aim, the school has produced an app aimed at educating pupils about climate change[558].

Changes to attitudes and behaviours

Alongside specific initiatives and measures, the various surveys carried out during the crisis provide an indication of changes to attitudes and behaviours that are attributable to experiences of remote education during the pandemic.

While **students' experiences** varied considerably, feedback indicated that flexibility, the ability to study at their own pace, and to balance work-life-home routines were commonly valued aspects of distance learning[559]. Although many **parents and carers** struggled to balance work and home-schooling responsibilities, the say benefits in having greater insights to their child's education[560], and more open and regular channels of communication with teachers and were keen not to lose these completely[561].

Despite the inevitable wide spectrum of views and experiences, **teachers** reported a number of positive aspects of remote learning. There was evidence that, for some, reliance on digital platforms had demystified the technology, made them less risk averse,[562] given them a more realistic sense of their competences, and demonstrated the potential for online methods to co-exist with face-to-face instruction. There was a corresponding acknowledgement of the social aspects of technology, extending beyond technical and pedagogical skills to include the need for *"…flexibility, adaptability, social empathy and responsibility"*[563]. A national survey conducted in **Poland** showed that a fair proportion of teachers still intended to use digital tools and methods to some extent

[556] Anissa Lestari Kadiyono et al (2019). J. Phys.: Conf. Ser. 1175 012170. Available at: https://iopscience.iop.org/article/10.1088/1742-6596/1175/1/012170/meta
[557] Gedved Skole, (2021). Website available at: https://gedved-skole.aula.dk/
[558] For more, please see "A school with the latest green technologies (Denmark)" via EUClimateAction on Youtube. Available here: https://www.youtube.com/watch?v=V-VnNByUVj0
[559] Haag, P. (2020). Confinement et éducation à distance. Le regard des élèves, *EHESS*. Available at : https://www.ehess.fr/fr/carnet/coronavirus/confinement-et-%C3%A9ducation-distance-regard-%C3%A9l%C3%A8ves
[560] UCE (2020). Scoala la distanta in perioada pandemiei COVID- 2019. [Distance school during COVID- 2019 pandemics]. Available at: http://www.ise.ro/ancheta-privind-invatarea-la-distanta-pe-perioada-suspendarii-cursurilor
[561] i CSI 2020, Distance learning: Experience of students and teachers of primary schools https://www.csicr.cz/cz/Aktuality/Tematicka-zprava-Zkusenosti-zaku-a-ucitelu-ZS-s-di
[562] http://www.oecd.org/education/Portugal-coronavirus-education-country-note.pdf
[563] Cedefop, 2020, Digital gap during COVID-19 for VET learners at risk in Europe. Available at: https://www.cedefop.europa.eu/files/digital_gap_during_covid-19.pdf

after the pandemic, including for project-based learning (66%) as a tool for student voice and participation (50%) and to some extent within teaching practices (50%).[564]

It was often **the collaborative and collegiate potential of digital technologies** that appealed to teachers the most, however. This included the opportunity to establish more open channels of home-school communication during home schooling, and the closer partnerships with parents in relation to student welfare and academic progress. Teachers have highlighted a stronger wellbeing dimension than under pre-COVID circumstances and attention to issues such as poverty and living conditions, which changed the nature of teacher-parent relationships and fostered trust and openness. In **Hungary**, nurseries first sought to organise communication with parents online through social media channels such as Messenger and Facebook and then through nursery websites. One survey found that the proportion of nurseries interacting with parents online increased from an initial 42% to 90% by the end of the first lockdown.[565] This collegiate ethos was also valued in relation to teacher professional networks,[566,567] which expanded considerably during the crisis and provided sources of moral, psychological, and pedagogical support.

4.4 Concluding thoughts

Overall, we only have early information on the impacts of the COVID-19 pandemic. The crisis has shown deeply concerning indicators of widening inequalities and learning losses. There are also causes for optimism in the raised profile for digital education across Europe. The shift to online learning has led to the emergence of new cross-sectoral partnerships, bringing together public and private sectors with NGOs beyond the traditional domain of "education", and has helped to ensure a place for educational inclusion within digital strategies and within local and regional development plans.

The pandemic has also shone a spotlight on the importance of monitoring and evaluation arrangements at a country level, and in some instances, it has prompted Member States to rethink their digital strategies and the data that is needed to inform them. Although international comparative assessments and surveys have provided important benchmarks for digital infrastructure and the integration of ICTs within schools, the crisis has shown the need for a wide range of sources to inform policy decision making. In numerous instances, countries that performed well based on ICILS[568] and PISA nonetheless encountered substantial challenges in the shift to distance learning.

Often there were quite contrasting accounts of the success of Member States and schools in managing the shift to distance education at scale, with official evaluations tempered by a more critical appraisal from school leaders. Similarly, Member States took widely differing approaches to quantifying educational success during distance

[564] Centrum Cyfryzacji. (2020). Edukacja zdalna w czasie pandemii. Raport z badań.
[565] E.g. Fodor, É., Gregor, A., Koltai, J. & Kováts, E. (2020) *Az egyenlőtlenségek alakulása a koronajárvány idején Magyarországon* [Inequalities in Hungary during the coronavirus pandemic].
[566] CSI 2020, Distance learning: Experience of students and teachers of primary schools https://www.csicr.cz/cz/Aktuality/Tematicka-zprava-Zkusenosti-zaku-a-ucitelu-ZS-s-di
[567] See Cedefop article, available at: https://www.cedefop.europa.eu/en/news-and-press/news/cyprus-responses-covid-19-outbreak
[568] ICILS measures international differences in students' computer and information literacy, referring to their ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in the community. In addition to student achievement, the study collects a rich array of contextual data on students' home and school environments. For more, please see: https://www.iea.nl/data-tools/repository/icils

learning, and national monitoring efforts varied considerably in their scale, scope and methods.

A key conclusion to be drawn is that greater attention is required to sustained monitoring and evaluation of digital access and inclusion in planning for recovery, drawing on quantitative and qualitative data sources to gain a more complete understanding of how and for whom educational benefits have ensued from the COVID-19 pandemic. The research showed the importance of stakeholder engagement and consultation, and as such, any national monitoring and evaluation strategy arguably requires robust and nationally representative methods to seek feedback from school leaders, teachers, parents and carers and students to triangulate the results.

5.0 Technology to enhance the quality of learning and teaching in Member States

Box 11 Key Messages: technology to enhance the quality of learning and teaching in member states

Key messages

- Despite significant concern among many ECEC practitioners and parents that the use of technologies in early childhood can restrict children's imagination and make them passive, **our findings suggest that digital tools have been successfully integrated in a number of ECEC institutions across the EU as a tool to**:
  a) encourage movement and creativity
  b) develop early basic skills and key competences
  c) enrich audio-visual experiences
  d) serve as a cultural mediator for children of different backgrounds
  e) provide as a way to entertain young children; and
  f) provide a documentation and inclusive communication tool.
- Similarly, digital tools can play an eminent role in primary and secondary school learners' **cognitive development, understanding and higher order thinking skills** when implemented effectively (*e.g.* through gamification that relies on experiential learning, exploration, and experimentation, which help in understanding mathematical concepts, relationships, strategies, and norms).
- Digital tools can also enhance learning outcomes by **creating frameworks for a learning-oriented peer culture**, which some research findings suggest help boys perform at the same level as girls in subject where they traditionally underperform (e*.g.* reading). Research also shows that digital collaborative platforms can constitute important pedagogical tools by facilitating knowledge-sharing as well as

learner creativity and innovation. They can also constitute useful platforms for formative feedback, from teachers and peers, as well as self-assessment.

- Digital tools such as game-based learning and artificial intelligence have been widely reported to **affect students' behaviour, engagement, and motivation**, with benefits for their learning. In this sense, digital tools hold a special potential to re-engage learners struggling with traditional pedagogies. Evidence from Member States further suggests a special potential for SEN learners, *e.g.* with gamification allowing them to focus on specific tasks for longer periods of time.
- Digital tools can also **support more learner-centred approaches by detecting learner specific difficulties (*e.g.* through AI) and presenting highly personalised solutions.** This can be particularly valuable for high- and low-achieving learners, as such use of digital tools in the classroom can help to make learning both more challenging for learners who are performing exceedingly well, and at the same time, provide more targeted support to those who need it the most. Still, such tools should not be used to replace, but rather to support and enrich traditional measures, as the limitations of AI and other tools are evident.
- Moreover, digital tools and approaches can **deepen summative and formative assessment practices within and beyond the classroom**, for example, when integrated in personalised learning platforms, e-portfolios/ digital diaries, social media (blogs, wikis, etc.), digital storytelling, e-textbooks, mobile learning, classroom polling, dashboards and monitoring tools and digital games. Formative assessment can be particularly important for lower-achieving learners.
- While scalable costs are still a significant concern for application in education, **VAR has real potential for VET as well as for classes requiring practical application of complex problem-solving competences** (e.g. science experiments). For example, VAR can allow students to rehearse risky or expensive processes in safe and controlled conditions that otherwise would not be possible. Similarly, research evidence suggest that **gamification is highly suitable for developing transversal skills as well as occupational competences.**
- Mobile learning can help to **connect different places of learning** (*e.g.* work based-learning and classroom-based learning in the case of VET) and also provide unique opportunities to engage with peers and/or to receive feedback from teachers and trainers, which can support better learning outcomes.
- The research points to **the prime factor in the pedagogical use of digital technologies to be teacher competence.** However, a recent Eurydice report shows that **the definition of what constitutes digital competence for a teacher varies greatly across the EU**. Where teacher-specific digital competences are recognised in competence frameworks, for example, these definitions range from very broad descriptions, to detailed description of skills.
- Findings from across the EU27 further suggest that **active teacher engagement in professional learning communities**, rooted in aspects like teacher collaboration, involvement in decision-making and joint responsibility for teaching outcomes, is found to be increasingly effective. For example, evidence suggests that more and more countries (*e.g*. AT, FR, HR, SL) had set up teacher networks specifically dedicated to digital education, even before the COVID-19 crisis.

- Despite the importance of parental support and engagement, **our findings suggest that very few education systems have national measures or frameworks in place to involve and support parents in digital education**, although this appears to be changing somewhat as a result of the COVID-19 crisis.

5.1 Introduction

Based on evidence collected from across the EU27, this chapter first outlines the potential of digital tools to enhance learning in ECEC, primary and secondary education (including VET). The chapter then presents examples of how key digital tools have been used to enhance learning for all learners, as well as for specific groups at risk of poor learning outcomes. Next, it provides a snapshot of the prevalence of national digital strategies and frameworks to enhance learning as well as frameworks for digital competences across the EU27. Finally, it explores the role of teacher education and training, as well as parents and the whole-school community.

5.2 The potential of digital tools in ECEC: evidence from across the EU27

Across the EU27 two key objectives for introducing digital education in ECEC can be observed: first, the use of digital technologies to support and enhance learning and second, the development of basic digital competences prior to entering compulsory education. These are different, but complementary objectives.[569]

For instance, in some Member States (*e.g.* BG[570], DK[571], ES[572], CY[573] and SE[574]) national ECEC educational guidelines emphasise the pedagogical use of digital technologies to support the learning process (the first objective above). The recommended activities encourage, for instance, reading digital books, exploring nature and science through the support of digital devices such as webcams and GPS, experiencing and producing art using digital forms of expression, or playing games on computers. However, they do not stipulate which specific digital competences (the second objective above) are to be developed.

In other education systems, however, national guidelines specifically detail the digital competences that children should start developing already at ECEC level, in line with the most basic competences outlined in the DigComp 2.0 Framework.[575] Here, Member States typically focus on one or more global competences within the Framework (*e.g.* communication, digital content creation, information and data literacy, safety and problem solving). In **France**, for example, the communication competence is incorporated in the national curricula for pre-primary school by recommending that

[569] European Commission/EACEA/Eurydice (2019). Key Data on Early Childhood Education and Care in Europe – 2019 Edition. Eurydice Report. Luxembourg: Publications Office of the European Union. Available at: https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/kd_ecec_2019_report_en.pdf
[570] Ministry of Education and Science, Bulgaria (2016). Ordinance No 5/ 3.06.2016 on preschool education. Available at: https://www.mon.bg/upload/24770/nrdb5-2016_PreducilisnotoObr_izm112020.pdf
[571] Denmark's 'Pædagogiske læreplan'. En: Pedagogical curriculum (2020). Available at: https://emu.dk/sites/default/files/2020-01/Den%20styrkede%20p%C3%A6dagogiske%20l%C3%A6replan_engelsk.pdf
[572] The Spanish Ministry of Education and Vocational Training (2008). Order ECI / 3960/2007, of December 19, which establishes the curriculum and regulates the organization of early childhood education. Available at: https://www.boe.es/buscar/act.php?id=BOE-A-2008-222
[573] Web portal of the Republic of Cyprus (2020). Information for pre-elementary education. Available at: http://www.cyprus.gov.cy/portal/portal.nsf/gwp.getGroup?OpenForm&access=0&SectionId=citizen&CategoryId=Education&SelectionId=Pre-school%20Education&print=0&lang=en
[574] Skolverket (2018). Ordinance (SKOLFS 2018:50) on the curriculum for the preschool. Available at: https://www.skolverket.se/download/18.6bfaca41169863e6a65d897/1553968298535/pdf4049.pdf2019
[575] Carretero, S., Vuorikari, R. and Punie, Y. (2017). DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use. Luxembourg: Publications Office of the European Union. http://dx.doi.org/10.2760/38842 [Accessed 29 June 2018].

children contact each other using digital tools.[576] Moreover, information and data literacy are referred to in the national guidelines for pre-school in **Lithuania**, which recommend "children using ICT-based educational material to collect and assess information".[577]

Some countries also aim to introduce coding at ECEC level. For example, just before the first cases of COVID-19 were reported, the Ministry of Education in **Luxembourg** announced a new strategy for digital education on 6 February 2020, named "einfach digital – Zukunftskompetenze fir stark Kanner" (Simply digital – future competences for strong children; MENJE, 2020).[578] At pre-primary level, the Government intends to implement the digital strategy in formal and non-formal ECEC institutions in line with young children's development. The plan is to gradually introduce coding through various subjects in Cycles 1 (children aged 3/4-5 years), 2 (6–7-year-olds) and 3 (8-9 year olds), starting from the 2021/22 school year. In **Poland**, a Coding Masters Junior programme under the nationwide program Mistrzowie Kodowania was also launched in pre-schools in 2017.[579]

It is important to highlight that digital technologies are also addressed in some national ECEC educational guidelines across the EU27 as a necessary component for the development of children's understanding of the world and as an acknowledgment of the importance of these technologies in their daily lives, and in society more broadly. For instance, in **Latvia**, as stated in the "Regulations on the National Guidelines for Pre-primary Education and Templates of Pre-primary Education Programs", one of the objectives of the pre-school curriculum centres on helping children learn how to distinguish between the virtual and real worlds, understand the importance of digital technologies and using them safely.[580] Accordingly, the approved "Pre-school learning programme" specifies that children should be using both printed materials and digital technologies for various topics.[581]

Although many countries provide a national framework for digitalisation in ECEC, the use of digital tools can still be seen to vary greatly between institutions within Member States. For instance, despite digitalisation constituting a formal part of the national pre-school curriculum in **Sweden** as of 1 July 2019 (Lpfö 18), the decentralised nature of the Swedish education system has led to a range of different approaches to digitalisation across municipalities, as well as from preschool to preschool. For instance, some preschools, including most of Sweden's Waldorf schools, still remain largely screen-free despite the formalised curriculum requirements[582]. On the other hand, in **Italy**, prior to COVID-19, despite the absence of a national framework for ECEC, there were a number of cases where kindergartens across the country had attempted to become more innovative and increase their digital capacity. This is, for example, the case for

[576] French government, Arrêté du 18 février 2015 relatif au programme d'enseignement de l'école maternelle. Available at: https://cache.media.education.gouv.fr/file/MEN_SPE_2/84/6/2015_BO_SPE_2_404846.pdf
[577] Ministry of Education, Science and Sport (2020). The Action Plan for the Inclusion of Children and Holistic Education 2017-2022. Available at: https://www.e-tar.lt/portal/lt/legalAct/deca98f05bbf11e79198ffdb108a3753
[578] Ministry of Education, Luxembourg (2020). einfach digital – Zukunftskompetenze fir stark Kanner. Available at : https://men.public.lu/fr/publications/dossiers-presse/2019-2020/einfach-digital.html
[579] Buchner, A., Kisilowska, M., & Wierzbicka, M. (2016). Mistrzowie kodowania Junior. Raport z badań, 1–124.
[580] Legislation of the Republic of Latvia (2018). Regulations regarding the State Guidelines for Pre-school Education and the Model Pre-school Education Programmes. https://likumi.lv/ta/id/303371-noteikumi-par-valsts-pirmsskolas-izglitibas-vadlinijam-un-pirmsskolas-izglitibas-programmu-paraugiem
[581] Primary school curriculum. https://mape.skola2030.lv/resources/10
[582] https://www.aftonbladet.se/nyheter/a/opllwa/har-programmerar-barnen-i-forskolan

kindergartens in Sennori, where European Union funding has been channelled to support the acquisition and use of digital tools.[583]

Key stakeholder attitudes on the integration of digital tools in preschool to enhance learning

As illustrated by the diverse examples above, there are ongoing public and professional debates as to whether and how digital tools should be integrated in ECEC institutions.[584]

One concern raised relates to the place of digital technologies in traditionally valued forms of play-based learning. Research has indicated that there is a strong concern among educators that the use of technologies in early childhood, as either "play with technologies" or "learning technologies through play", could ultimately restrict children's imagination and make them passive.[585] Another reason for restricting access to technology in EC centres involves parental concerns about their children's use of digital technology. In a study examining young children and their families' experiences with digital technologies in seven European countries, parents could not always see the benefits of children using digital technologies as compared to the risks of being exposed to inappropriate or unwanted content. They had also received conflicting messages about how much screen time is appropriate for children[586]. Given the conflicting information about the best uses of digital tools as well as parental pressures, the study thus highlighted the difficult task early childhood educators are faced with as they attempt to ensure the best learning and wellbeing outcomes for children in their institutions.

Echoing these findings, a 2019 survey[587] regarding digitalisation in German 190 day-care centres captured the contentious debate, finding that both educators and parents were largely divided into two opposing camps. In the larger camp, digital tools were seen as an integral part of the child's learning environment and therefore also in day-care centres. However, in the other camp, day-care centres were seen as a place where children should be protected from digital devices.

In several Member States this tense debate has also directly impacted policy level views to digitalisation in ECEC. For instance, in **Denmark**, digital literacy was reportedly originally intended to be one of the overarching principles of the national ECEC pedagogical plan, but due to predominantly negative views in public debates as to their use in ECEC, this focus was eventually downplayed in the final document, and is now only mentioned twice in relation to the overarching curriculum themes 5 (nature, outdoor life and natural phenomena) and 6 (culture, aesthetic and community).[588] Along

[583] https://www.repubblica.it/dossier/esteri/fondi-strutturali-europei-progetti-italia/2019/08/02/news/a_sennori_nasce_l_asilo_nido_del_futuro_con_quasi_mezzo_milione_di_fondi_regionali-232591303/
[584] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/
[585] Bird, J., & Edwards, S. (2015). Children learning to use technologies through play: A Digital Play Framework. British Journal of Educational Technology, 46(6), 1149-1160.
[586] Chaudron, S. (2015). Young children (0-8) and digital technology: JRC Science and Policy Reports. (Report No. EUR 27052 EN). Retrieved from http://publications.jrc.ec.europa.eu
Computer Science Unplugged (2015). Available at: https://csunplugged.org
[587] Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien. Helen Knauf (2019). BIELEFELD WORKING PAPER 3. https://www.pedocs.de/volltexte/2019/17999/pdf/Knauf_2019_Digitalisierung_in_Kindertageseinrichtungen.pdf
[588] For more on the contentious debate regarding the use of digital tools in Danish ECEC please see article by Stine Liv Johansen, Associate Professor at Aarhus University and Head of the Danish Media Council for Children and Young People.

similar lines, in **Cyprus**, the MOEC banned the use of WiFi in nursery schools in 2017 so as to minimise the exposure of children to electromagnetic fields, and recommended that in other public schools WiFi only be available in the director's office, the secretary's office and in the staff office for administrative purposes.[589]

Recent academic literature suggests that hesitations and uncertainty around the (appropriate) use of digital tools in ECEC could likely be mediated through the sharing of targeted good practices and research evidence around children's digital play to the whole-school community. The dissemination of such evidence could support educators in identifying and implementing children's activities with technologies in a play-based way that complements traditional playtime activities, while also reassuring parents that potential risks are mitigated (e.g. through controlled and limited exposure).[590] Policy makers and experts in early years educational settings could thus play an important role in inspiring and advising whole-school communities regarding the appropriate introduction of digital technologies, in ways that strengthen children's competences and curiosity, as well as their critical sense towards them.

A 2020 study from Aarhus university, for example, encourages practitioners to remain open when starting a dialogue with parents, and to continuously inform them and discuss the digital pedagogical possibilities with them in order avoid misunderstandings, and remaining responsive to parents' concerns and questions. The study stresses that parents are essential players in their children's digital education.[591]

How digital technologies can enhance learning in ECEC

A number of reports across the EU27 have already documented the potential of digital tools to enhance learning in ECEC.[592] Among these, a 2015 study aimed to identify the ways in which information and communication technologies (ICT) are integrated in three preschools in southwestern **Sweden**. The case study involved observations of and interviews with preschool teachers. It is worth noting that the study was carried out in an area with a high immigrant population. For instance, in one of the preschools, nearly 50% of the children were estimated to be from immigrant backgrounds. The study found that ICT can enhance preschool practices by providing a variety of complementary opportunities to enrich and transform existing curricula. In particular, the study outlined that digital programmes had been successfully integrated: as an object to enrich existing practices; as a cultural mediator for children of different ethnic and cultural

Available here: https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/
Note: Curriculum theme 5 – Nature, outdoor life and natural phenomena: " Furthermore, children can find out about different technological tools such as GPS, digital scales, webcams, etc., allowing them to develop a creative, productive and critical approach to the use of such technologies." and 6 – Culture, aesthetics and community: "…children should be met with a differentiated pedagogical approach to allow everyone, including vulnerable children, to gain experience with realising their potential and navigating in society. As part of this, children could be allowed to use IT in an experimental community. Children should be supported in developing skills that make them creative and productive and enable them to navigate in society in ethically responsible ways."

[589] https://ehtrust.org/wp-content/uploads/Egkyklios-Jan-17.pdf

[590] Edwards, S. (2013). Digital play in the early years: a contextual response to the problem of integrating digital technologies and play based learning in the early childhood curriculum.
European Early Childhood Education Research Journal, 21(2), 199-212.

[591] https://ebooks.au.dk/aul/catalog/view/385/259/1336-3

[592] See for example Rafal Wajszczyk (2014), A study of the impact of technology
in early education. Available at: https://www.diva-portal.org/smash/get/diva2:737018/FULLTEXT01.pdf or the National Children's Resource Centre, Ireland (2006). Children and Technology: A Tool for Child Development. Available at: https://www.barnardos.ie/media/1496/chidlren-and-technology.pdf.

backgrounds; as a way to entertain young children; and, as a communication and documentation tool.[593]

Similarly, the State Institute for Early Childhood Education in Germany recently noted that the use of digital tools has shown considerable potential for addressing the growing heterogeneity and diversity in day-care, offering chances to create additional access to education for children, but also for further differentiating the educational processes and thereby eroding barriers to learning, strengthening independence and to better developing individual potential.[594]

Based on data collected from across the EU27 during the country mapping, the below overview presents a clustering of the main ways in which digital tools were reported to enhance learning in ECEC:

Encouraging movement. As seen in previous sections (e.g. p. 117), a key concern among ECEC stakeholders relates to the idea that digital tools make children passive as opposed to active participants in physical and mentally challenging play. However, insight from some EU countries suggest that digital tools can play a complementary role in engaging young children in physical activity. For example, a comprehensive Danish mapping -- which encompassed telephone surveys among 746 day-care institutions, combined with extensive observational studies and in-depth pedagogical work in three different Danish day care institutions -- found that digital tools can create motivating, versatile and challenging movement activities for children.[595] The report highlighted the importance of keeping in mind that digital tools are not limited to just iPads and other screens, but also include robots and small and simple digital remedies that can encourage targeted physical activity.[596]

Some research suggest that digital tools can also play a role in enhancing young children's fine motor skills. For instance, an Irish report issued by the Barnardo's charity described improved eye/hand co-ordination in children using ICT such as iPads, stemming from the children's experience with manipulating content on screens with their fingers.[597]

Audio-visual stimulation. Additionally, the research suggests that tablets and other similar digital tools hold the potential to bring abstract concepts to life and introduce young children to physical representations that may not be readily available in person, such as historic events, or people, geography, or extinct animals- ultimately increasing engagement as well as understanding. For instance, a Swedish study showed that

[593] Masoumi, D., (2015). 'Preschool teachers' use of ICTs: Towards a typology of practice', Contemporary Issues in Early Childhood 16(1), 5–17. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers%27_use_of_ICTs_Towards_a_typology_of_practice

[594] Kita digital - KTK-Bundesverband (2018). https://www.ktk-bundesverband.de/cms/contents/ktk-bundesverband.de/medien/dokumente/kita-digital-2017-ha1/kita_digital_didacta_2017_reichert-garschhammer_handout_fuer_veroeffentlichung_end-2.pdf

[595] DPU, Aarhus Universitet (2020). Hvem Sidder Dér Bag Skærmen... og hvem hjælper? [en: who's sitting behind the screen… and who's helping?]. Available at: https://ebooks.au.dk/aul/catalog/view/385/259/1336-3

[596] Ibid

[597] The National Children's Resource Centre, Ireland (2006). Children and Technology: A Tool for Child Development. Available at: https://www.barnardos.ie/media/1496/chidlren-and-technology.pdf.

integrating iPad YouTube videos and other audio-visual content to explain concepts related to geography appeared to aid the children's comprehension.[598]

Audio-visual tools can also allow young children to observe themselves by way of video recordings, which can stimulate participation, curiosity and self-awareness. For instance, in **Flanders**, **Belgium,** a research project carried out by UC Leuven-Limburg suggested that the use of a chat box in which the young children could see themselves talking increased engagement, while encouraging less proficient children to also speak[599].

Early basic skills and key competences development. Early studies have also found that digital tools can introduce children to abstract concepts that were previously considered too advanced for their age group, such as concepts related to mathematics, dynamic systems, and communication competences[600]. For example, in **Greece**, Fessakis, et al. conducted an exploratory case study addressing problem solving by preschool children in free Logo-like programming environments. The study concluded that computer-programming significantly enhanced the children's basic mathematical, communication and collaboration skills, as well as their problem-solving abilities.[601]

Similarly, in **Spain**, a 2019 research study examined pedagogical approaches to properly integrate robotics, coding and computational thinking concepts into pre-school classrooms. The study was conducted with pre-school children aged 3 to 5 years old (N=172) from three early childhood centres with different socio-demographic profiles, and teachers of 16 classes across these three centres. Results suggested that it is possible to start teaching digital literacy very early (at 3 years old), and that these approaches promoted communication, collaboration and creativity among the young learners.[602]

In line with such promising study results, evidence from across the EU27 shows that some preschools, particularly in north-western Europe, are already integrating digital tools to support preschool children's language development and their comprehension of quantities (*e.g.* DE[603], LT[604], SE[605], PL[606]). In **Sweden**, for instance, digital tools have been observed to offer rich environments for pre-school children's language development. A 2015 report concluded that the integration of digital tools mediated

[598] Masoumi, D (2015). Preschool teachers' use of ICTs: Towards a typology of practice. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers'_use_of_ICTs_Towards_a_typology_of_practice
[599] Wauters R., Van Hulle J., 2008, Audiovisual education: turning the switch, CANON Cultuurcel and BAM institute for visual, audiovisual and media art.
[600] Resnick, M., Martin, F., Berg, R., Borovoy, R., Colella, V., Kramer, K., & Silverman, B. (1998). Digital manipulatives: New toys to think with. Proceedings of CHI 98, ACM Press
[601] https://www.researchgate.net/publication/257171388_Problem_solving_by_5-6_years_old_kindergarten_children_in_a_computer_programming_environment_A_case_study
[602] Bers, M. U., González-González, C., & Armas–Torres, M. B. (2019). Coding as a playground: Promoting positive learning experiences in childhood classrooms. Computers & Education, 138, 130-145. https://doi.org/10.1016/j.compedu.2019.04.013
(1) (PDF) Coding as a Playground: Promoting Positive Learning Experiences in Childhood Classrooms. Available from: https://www.researchgate.net/publication/332550604_Coding_as_a_Playground_Promoting_Positive_Learning_Experiences_in_Childhood_Classrooms [accessed Mar 09 2021].
[603]Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien. Helen Knauf (2019). BIELEFELD WORKING PAPER 3. Available at: https://www.pedocs.de/volltexte/2019/17999/pdf/Knauf_2019_Digitalisierung_in_Kindertageseinrichtungen.pdf
[604] Happy Kids, Latvia (2020). Project on creating digital tools for kindergartens is proceeding successfully. Available at: https://happykids.lv/en/article/project-on-creating-digital-tools-for-kindergartens-is-proceeding-successfully
[605] Masoumi, D (2015). Preschool teachers' use of ICTs: Towards a typology of practice. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers'_use_of_ICTs_Towards_a_typology_of_practice
[606] Buchner, A., Kisilowska, M., & Wierzbicka, M. (2016). Mistrzowie kodowania Junior. Raport z badań, 1–124.

and encouraged longer, more complex talk among the children. The report went on to note that the strategic use of iPads to create digital stories and picture presentations was considered particularly effective in enhancing young immigrant children's language fluency[607]. The digital tools were observed as providing the children with new and exciting avenues to express themselves, to develop their talents, and to communicate.

Preschool technology tools may also promote an early foundation for digital literacy — in which children learn appropriate ways of using technology for constructive learning activities.[608] For instance, in **Estonian** preschools, teachers have integrated numerous developmentally appropriate digital technologies for children to explore, such as LEGO WeDo, Kodu Game Lab, tablets (apps) and programmes to create animations through the ProgeTiger Programme.[609]

[607] Masoumi, D (2015). Preschool teachers' use of ICTs: Towards a typology of practice. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers'_use_of_ICTs_Towards_a_typology_of_practice
[608] https://littlesunshine.com/technology-in-preschool-enhances-interactive-learning-at-little-sunshines-playhouse/
[609] https://www.hitsa.ee/it-education/educational-programmes/progetiger

Cultural awareness and open-mindedness. In line with the broad competence developments observed above, the potential of digital tools to enhance children's cultural literacy has also been emphasised. Most significantly, a 2015 research study from southwestern Sweden concluded that ICT could play a key role in promoting cultural and ethnic open-mindedness by offering young children a glimpse of the lives of children in other cultures and allowing them to draw upon multimedia resources from across the world to enhance their cultural literacy[610]. Practices observed in Swedish preschools included the use of interactive whiteboards to search for relevant maps, pictures and clips to familiarise children with other children's lives, cultures and their peers' countries of origin. Such practices were deemed particularly successful in preschools where many of the children were from immigrant backgrounds. The study concluded that digital tools empowered teachers to explore new opportunities to present other ways of living, writing, and talking. Apart from enhancing children's cultural awareness, the study noted that digital tools could also help highlight cultural similarities. In this sense, the study concluded that digital tools could be used as a cultural mediator to enhance young children's understanding and appreciation of cultural and ethnic diversity.[611]

Administration and inclusive communication. Even when kids are not exposed to the digital tools, ICT can significantly reduce administrative burdens in preschools. For instance, an evaluation from lower **Austria** predicted that equipping preschools with laptops beginning in Autumn 2020 would likely reduce the administrative burden by up to 20 per cent.[612] In **Ireland**, tools such as *Childpaths* have been deemed instrumental in enabling stakeholders to communicate, reduce paperwork and support early childcare centres to facilitate inspections.[613]

Similarly, ICT enabling more effective communication among pre-school staff and parents is well documented across the EU27. In a number of Member States, teachers use digital portfolios that include photographs as well as audio and video recordings to document, archive, and share a child's accomplishments and developmental progression with families in face-to-face conferences or through communication and social media tools (e.g. MT[614], FI[615], DE,[616]IE[617]). As a consequence, technology can help ensure parents feel more connected to their children's learning and empower them to take an active role. By developing a strong relationship with parents online, educators can further reassure reluctant parents that technology is enhancing their child's early education.

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[610] Masoumi, D (2015). Preschool teachers' use of ICTs: Towards a typology of practice. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers'_use_of_ICTs_Towards_a_typology_of_practice
[611] Thurston A (2004). Promoting multicultural education in the primary classroom: Broadband videoconferencing facilities and digital video. Computers & Education 43(1–2): 165–177.
[612] ORF, (2019). Kindergärten werden digitalisiert. Die Digitalisierung hält nun auch in den mehr als 1.000 Kindergärten des Landes Einzug. Die Kindergartenverwaltung soll digitalisiert und dadurch vereinfacht werden. So sollen die Pädagoginnen und Pädagogen mehr Zeit für die Betreuung der Kinder haben. https://noe.orf.at/stories/3026589/
[613] https://childpaths.ie/
[614] https://www.um.edu.mt/__data/assets/pdf_file/0012/314400/YoungChildrenandDigitalTechnology-TheNationalReportforMalta.pdf
[615] https://www.oph.fi/fi/funding/innovatiivisten-oppimisymparistojen-edistaminen-varhaiskasvatuksessa-2019
[616] Kita digital - KTK-Bundesverband (2018). The potential of digitization in the day care education system. Available at : https://www.ktk-bundesverband.de/cms/contents/ktk-bundesverband.de/medien/dokumente/kita-digital-2017-ha1/kita_digital_didacta_2017_reichert-garschhammer_handout_fuer_veroeffentlichung_end-2.pdf
[617] https://www.littlevista.ie/family.html?gclid=Cj0KCQiA-OeBBhDiARIsADyBcE4Y1AkbfUz5LwWhbCl5D5aBsg-Pmie99d0jW0jG52eLVqjF__iPvbgaAp_TEALw_wcB

For instance, in **Ireland**, the use of software such as Little Vista[618] and ChildDiary.net[619] allows parents to access a detailed visual snapshot of what their child is doing in the childcare setting (e.g. real time updates, artwork and photos). The literature cautions, however, that such transparency into the daily functions of the kindergarten should still be kept within certain limits in order to shield the day-care workers from excessive scrutiny and ensure that pedagogical value is not overshadowed by performative activities primarily put in place to impress parents. It has also been stressed that excessive surveillance could lead to a spiral of paranoid parenting in which many parents feel more anxious in relation to their children's activities than before.[620]

Lastly, recent German research suggests that digital tools hold particular potential when communicating with parents and families whose mother tongue is not German.[621] This is because texts and voice messages that are received with a smartphone, for example, can be easily translated using translation tools in the same digital device. The growing importance of photos and videos similarly supports mutual understanding while bridging language barriers. As such, communication via digital channels can offer migrant parents the opportunity to communicate on a more equal footing.[622]

Box 12 Spotlight on Knowledge base of successful digital methodologies in ECEC, Hungary

SPOTLIGHT BOX: Knowledge base of successful digital methodologies in ECEC, Hungary[623]

A repository of open access digital methodologies and good practices has been published by the Hungarian Erasmus National Agency (Tempus Public Foundation). Here, preschool staff can choose from more than 1000 exercises available in the knowledge base to enrich their lessons with new exercises, methods and interactive digital elements. Teachers can also upload new ideas and share their experiences with different pedagogical approaches. Good practice examples encompass a range of approaches aiming to develop thinking, learning, logic and speaking skills in children. This includes digital music pedagogies using interactive whiteboards to support gifted children, game-based learning approaches to support language development in children from vulnerable backgrounds, as well as ROBOT TURTLE and ROBOT MOUSE to teach children the basics of coding.

[618] https://www.littlevista.ie/family.html?gclid=Cj0KCQiA-OeBBhDiARIsADyBcE4Y1AkbfUz5LwWhbCl5D5aBsg-Pmie99d0jW0jG52eLVqjF__iPvbgaAp_TEALw_wcB
[619] https://childdiary.net/
[620] Frank Furedi, Culture of Fear Revisited, London 2006; ders., Paranoid Parenting, London 2001.
[621] Kita 2.0. Potenziale und Risiken von Digitalisierung in Kindertageseinrichtungen (2019). BPB. https://www.bpb.de/apuz/293130/potenziale-und-risiken-von-digitalisierung-in-kindertageseinrichtungen
[622] Ibid
[623]https://tka.hu/index.php?page=tudastar_kereso&temakor=&celcsoport=10&eszkozok=&kompetencia=&idotartam=&munkaforma=&str=

5.3 The potential of digital tools in compulsory education: evidence from across the EU27

As seen in section 3.2, a running theme throughout the literature on the use of digital tools in compulsory education is that having access to the latest digital tools and technology alone makes little difference in improving learning. Instead, it is how practitioners use this technology and how they integrate it within their pedagogies and curriculum delivery, which will have the biggest impact on learner outcomes.[624,625,626] Against this backdrop, a 2016 research review by Islam and Grönlund[627] stressed that practice and future research should focus on pedagogical, organisational and leadership aspects and "their contribution to improving and disseminating good pedagogy" (p. 216). Similarly, the Commission Staff Working Document of the new Digital Education Action Plan 2021-2027 notes that effective use and integration of digital technologies in teaching and learning ''require careful planning for pedagogical, technological and organisational change'' (p.30).[628]

As such, there is no easy or straightforward relationship between ICT and student performance, firstly because the tools need to be successfully situated within individual school contexts by digitally empowered teachers and school leaders, but also because the translation of findings from controlled studies into actual practices can sometimes be challenging. For the latter, further action research (with practitioners directly involved) would be instructive. Nonetheless, a number of key areas in which digital tools have been reported to hold particular potential to enhance learning outcomes in recent years have been identified below.

Digital tools can promote cognitive development, understanding and higher order thinking skills

As seen in the ECEC section, digital tools can play an eminent role in learners' cognitive development when implemented effectively. European research projects examining the effects of digital tools on cognitive development date back over a decade, with early interventions providing a solid foundation for subsequent more complex and effective initiatives.

For instance, as early as 2009, Kronreif developed two robot systems aimed at improving the learning outcomes of cognitively and physically impaired children in Germany. The first system facilitated autonomous play with LEGO bricks (PlayROB) for children with disabilities, whereas the second system aimed to facilitate interactive play, either solitarily or collaboratively, on a robot platform with multiple user-centred

[624] McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of research on technology in education*, *48*(3), 194-211.
[625] Agelii Genlott, A., & Grönlund, Å. (2013). Improving literacy skills through learning reading by writing: the iWTR method presented and tested. € Computers & Education, 67, 8e104. http://dx.doi.org/10.1080/17439884.2012.756518.
[626] OECD. (2010). Joint research centre- european commission. In F. Sheuermann, & F. Pedro (Eds.), Assessing the effects of ICT in education indicators, criteria and
benchmarks for international Comparisons: Indicators, criteria and benchmarks for international comparisons. Centre for educational research and innovation, 2010 pp. 21e38). OECD Publishing. ISBN: 9264079785, 9789264079786.
[627] Islam, M. Sirajul and Grönlund, Åke (2016). Journal of Educational Change, v17 n2 p191-222. Available at: https://eric.ed.gov/?id=EJ1100195
[628] https://ec.europa.eu/education/sites/default/files/document-library-docs/deap-swd-sept2020_en.pdf

scenarios depending on the specific disabilities of different children (IROMEC). Evaluation results showed positive results in children's endurance, concentration, and spatial perception.[629] In the same year, Solomonidou presented two representative constructivist, student-centred educational software applications, which were designed, implemented and evaluated in Greece. Evaluations of each software programme pointed to students' overall knowledge improvement.[630]

More recently, focusing on the potential of digital tools to enhance literacy, researchers at GAIPS Lab (University of Lisbon) in Portugal have developed an autonomous system to assist primary school children in improving their handwriting skills. The system they created[631], entails the use of a social robot in one-to-one learning sessions with children. More specifically, the CoWriter Project and its active follow-up iReCHeCk explore how a robot can help children with the development of handwriting skills, by having the children act as teachers who can help the robot to write better. This paradigm, known as learning by teaching, has been observed to have several powerful effects including boosting the children's self-esteem (which is especially important for children with handwriting difficulties), getting them to practice handwriting without noticing, and also stimulating a "Protégé effect" in which the children instinctively feel accountable for the robot's success in improving its writing skills. The research suggested that this increasing sense of ownership over the process was largely successful in motivating the children to go the extra mile to figure out what was difficult for the robot, ultimately developing their own metacognitive skills and reflecting on their own errors.[632]

Beyond literacy, as relates to mathematics, a number of digital games can be seen to be basically, drill and practice applications for the acquisition of very basic mathematical skills, such as automaticity in operation skills.[633] On the other hand, there are games that rely on experiential learning, exploration, and experimentation, which help in understanding mathematical concepts, relationships, strategies, and norms[634]. For example, puzzle games seem to have a positive impact on computing skills, accuracy, and speed of carrying out arithmetic operations.[635] Role-play games, along with well-designed activities, allow students to create links between abstract mathematical concepts and real-life situations.[636] The potential for digital tools to enhance learning outcomes by creating the framework for a learning-oriented peer culture is further illustrated below.

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[629] Kronreif, G, (2009). "Robot systems for play in education and therapy of disabled children". In I.J. Rudas et al. (Eds), "Towards Intelligent Engineering & Information Tech", Springer-Verlag Berlin Heidel-berg, pp. 221-234, (2009). http://dx.doi.org/10.1007/978-3-642-03737-5_16
(1) (PDF) Learning Tools and Applications for Cognitive Improvement. Available from: https://www.researchgate.net/publication/263301529_Learning_Tools_and_Applications_for_Cognitive_Improvement.
[630] Solomonidou, C. (2009). "Constructivist design and evaluation of interactive educational software: a research-b ased approach and examples", The Journal for Open and Distance Education and Educational Technology, vol. 5, number 1, (2009).
(1) (PDF) Learning Tools and Applications for Cognitive Improvement. Available from: https://www.researchgate.net/publication/263301529_Learning_Tools_and_Applications_for_Cognitive_Improvement [accessed Mar 03 2021].
[631] https://link.springer.com/article/10.1007/s12369-019-00589-w
[632] https://www.epfl.ch/labs/chili/index-html/research/cowriter/
[633] Miller, D.J, Robertson, D.P, (2011). Educational benefits of using game consoles in a primary classroom: A randomised controlled trial. Available at: https://bera-journals.onlinelibrary.wiley.com/doi/full/10.1111/j.1467-8535.2010.01114.x
[634] Kebritchi, M., Hirumi, A. and Bai, H. (2010). 'The effects of modern mathematics computer games on mathematics achievement and class motivation', Computers and Education, 55, 2, 427–443.
[635] Miller, D. J. & Robertson, D. P. (2009). Using a games-console in the primary classroom: effects of 'Brain Training' programme on computation and self-esteem. British Journal of Educational Technology, 41, 2, 242–255. (in press) available on Early View at: http://www3.interscience.wiley.com/cgi-bin/fulltext/122213368/PDFSTART.
[636] Shauffer, D.W. (2009). How Computer Games Help Children Learn

Box 13 Spotlight on effective use of the Write-to-Learn method, a lesson from Sweden

SPOTLIGHT BOX: Effective use of the Write-to-Learn method, a lesson from Sweden

A recent Swedish study measured the effects of the Write-to-Learn (WTL) method for 502 primary school students who had consistently been exposed to different teaching methods over a period of three years (from grade 1-3). In other words, in this controlled study, each group of learners was consistently exposed to one specific method over these three years (i.e. either the WTL method or one of two control group approaches outlined below).

WTL lets children from 1st grade use several ICT tools to write texts and subsequently discuss and refine them with classmates and teachers using digital real-time formative feedback and assessment. The central learning factor addressed, in mathematics as well as in literacy, is the written communication allowing the learners to interact with peers and teachers. WTL draws on methods from socio-cultural theory, including continuous social interaction and written real-time formative feedback among peers, using shared electronic forums for collaboration. The study used quantitative methods and two control groups, one using traditional methods (no ICT) and one using technology individually without integrated social interaction and formative feedback (ITU), to compare results from the 502 students in grade 3 national tests in mathematics and literacy.

The findings showed that WTL yielded by far the best results; this included higher average scores both in literacy and mathematics, but remarkably also a smaller gender gap, and significantly better results for the under-achievers. The ITU method performs worst, which shows that ICT use must be well integrated into the pedagogy to be useful.[637]

With regards to inclusive learning, it is worth highlighting here that the WTL method also scored the best by far in reducing the gender gap in performance. The gender gaps in both literacy and mathematics were much smaller in the WTL group than in the control groups. The most conspicuous result on this point was that in mathematics boys and girls performed equally well. In accordance with previous research on ICT use in various processes, this shows that a structured method integrating social interaction is beneficial for both boys and girls, and in both literacy and mathematics. The gain was the biggest and the most important for boys' literacy, the subject in which they traditionally performed worse than girls. This supports the argument of Legewie and DiPrete that in particular, boys benefit from school resources that "create a learning-oriented peer culture".[638] The results also unambiguously show that method development in conjunction with ICT use is imperative.

[637] A.A. Genlott and Å. Gronlund (2016). Computers & Education 99, p.68-80. Available here: https://www.researchgate.net/publication/301269936_Closing_the_gaps_-_Improving_literacy_and_mathematics_by_ict-enhanced_collaboration

[638] Legewie, J., & DiPrete, T. (2012). School context and the gender gap in educational achievement. American Sociological Review 2012, 77(463). http://dx.doi.org/10.1177/0003122412440802. originally published online 4 April 2012.

Digital tools can facilitate collaboration

In line with the observed potential for digital tools to enhance learning-oriented peer cultures, digital tools are transforming learning communities across Europe. They are also supporting communication between students and teachers, and parents and school leaders.

For instance, platforms for web-based discussion threads and creation of course or class wikis change how students can get involved in project-based writing assignments. A piece of student writing can develop breadth and depth when it is the basis for a step-by-step exchange of ideas and questions among teachers, peers, authors and mentors. Moreover, digital communication offers clear benefits in VET and work-based learning where the key parties (learners, school-based teachers and company-based trainers or mentors) are not always in the same place at the same time, as the below examples show.

Box 14 Spotlight on digital tools as a means of connecting VET places of learning

SPOTLIGHT BOX: Digital tools as a means of connecting VET places of learning

The Trialog mobile app – daily mobile internship feedback for learners[639]

The Trialog mobile app is an easy-to-use tool that permits teachers from schools, tutors from companies, and learners to better cooperate in a work-based context. The app was created through a strategic project partnership under the Erasmus+ programme to bridge the gap between educational standards, training programmes and real-world challenges. The approach is built on short feedback cycles, in which the learner receives daily feedback for demonstrated competences, including soft skills, during the work-based internship. More specifically, through the Trialog mobile app, the learner is able to:

1. register himself/herself in an internship already defined by the teacher and tutor;
2. visualise the elements of the internship, including relevant competences and the daily task for each single day (visible to both the learner and teacher);
3. easily inform the tutor if he/she will not attend the planned activities;
4. upload their own self-assessment, concerning the concrete tasks accomplished at the end of each day, and;
5. receive feedback from the tutor, in real time, for the demonstrated/validated technical skills and the list of soft-skills relevant for the tasks of the day (this daily feedback will provide the final competence profile of the students).

In this sense, the Trialog app aims to ensure the effective communication in real time between the three interested parts of the teaching-training-learning process in VET, namely the learners, educators and company-based tutors.

[639] Trialog, 2018. About the Trialog Project. http://criovest.ro/trialog/.

SPOTLIGHT BOX: Digital tools as a means of connecting VET places of learning

LOL: Gamified Online Learning Environment linking students and entrepreneurs, Finland

A learning resource developed and now offered for general use by Omnia in Finland is a business development game called LOL (the acronym of the game's Finnish name, Lievästi Outoa Liiketoimintaa) that combines real-life interaction between students and entrepreneurs with working on an online board game. The upper-secondary students and entrepreneurs form an online community within which the entrepreneurs present their business challenges, and the students suggest creative solutions. The game enables the students to work on authentic business problems in an entertaining and engaging manner, while the entrepreneurs gain new insights and ideas and contribute their knowledge and skills to the learning process. Moreover, the teachers are able to observe first-hand how business ideas are put to the test, bringing the teaching closer to the realities of the labour market.[640]

Digital tools can increase students' engagement and incentivise ownership of learning

Some studies illustrate that digital tools benefit student learning because they enhance motivation (Fleischer, 2012[641]; Peterson et al., 2018[642]). Similarly, according to John Dewey[643], the types of activities that stimulate real motivation give students "something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; from which learning naturally results." Within this context, digital tools can be used to promote the art of doing, empowering learners to take ownership of their own learning.

For instance, game-based learning has been widely reported to affects students' behaviour, engagement, and motivation, which can lead to the improvement of their knowledge and skills[644]. The aims are to integrate more fun into education while providing positive feedback, which increases student interest and motivation, and stimulates them to learn[645]. In this sense, digital tools such as gamification can be seen to have particular potential to re-engage learners who are risk of poor outcomes or drop out due to lack of motivation (and low engagement with the content)[646]. This also includes learners encountering difficulty in grasping the relevance of theory in their studies[647]. Gamification allows players to restart or play again, meaning that their mistakes are recoverable. This freedom to fail allows students to experiment without

[640] Vainio, L. ; Oksanen-Ylikoski, E. & Ylikoski, T. (2017) Finland: VET and Omnia. In (Colin Latchem, Editor) Using ICTs and Blended Learning in Transforming TVET. UNESCO and COMMONWEALTH OF LEARNING, 131-141. http://oasis.col.org/bitstream/handle/11599/2718/2017_Latchem_Using-ICTs-and-Blended-Learning.pdf
[641] Fleischer, H. (2012), "What Is Our Current Understanding of One-to-one Computer Projects: A Systematic Narrative Research Review", http://dx.doi.org/10.1016/j.edurev.2011.11.004.
[642] Peterson, A. et al. (2018), "Understanding innovative pedagogies: Key themes to analyse new approaches to teaching and learning", OECD Education Working Papers, No. 172, OECD Publishing, Paris, https://doi.org/10.1787/9f843a6e-en
[643] https://books.google.be/books/about/Democracy_and_Education.html?id=8P0AAAAAYAAJ&redir_esc=y
[644] Hsin-Yuan & Soman, 2013
[645] Muntean, 2011
[646] Fan & Wolters, 2014
[647] McQuail, 2010

fear, ultimately increasing student engagement, particularly among low-performing learners.[648]

Similarly, the positive effects of AR, VR and AI on the efficiency of instruction vis-à-vis increased attention, motivation and participation of users have been highlighted in the literature, although Karasavvidis and Kollias call for more data and insights into students' perspectives regarding their experiences with AI in education[649].

Box 15 Spotlight on digital tools and engagement – EU27 examples

SPOTLIGHT BOX: Digital tools and engagement – EU27 examples

A Playful Mobile Digital Environment to Tackle School Burnout using Micro Learning, Persuasion & Gamification, Belgium[650]

A Belgian project recently responded to the issue of school burnout, which often precedes Early School Leaving (ESL), by created an engaging software environment that learners could access from their phones. The EUFEDER 2014-2020 project emerged from the observation that Belgium generally, and Brussels specifically, still had high rates of early leavers despite EU2020-related plans to reduce them. The project developed a playful digital environment called TICKLE. TICKLE allows secondary school students to collect digital cards by tackling challenges in their surroundings. The challenges are small activities intended to reactivate the disengaged learners' drive to learn.

Different pilot evaluations have already been performed to gain insights into the usability of the TICKLE environment, including the way it was perceived and used by the students and their supervisors. The evaluation reports indicated positive feedback from its target groups[651]. A longitudinal evaluation is also being prepared.

The Games platform – a gamification guide for Swedish mainstream and SEN schools[652]

The Games platform has developed innovative pedagogical practices and insights into the use of games as a pedagogical tool in compulsory education, with a particular focus on SEN students. Many of its practices focus on fostering engagement and ownership from the process of creation, and the benefits of "falling forward", where making mistakes is a natural part of learning. Teachers and experts are encouraged to share their specific approaches and insights on the platform.

One teacher shared his experiences with selecting the right games for students' needs, noting that for learners who struggle with language, imagery is an important element in a game. In practice, this meant that Kodu achieved better results than Scratch:

"More pupils, especially learners with learning difficulties, will respond better to Kodu over Scratch and I feel this is because Kodu is a visual based platform that allows

[648] Lee & Hammer, 2011
[649] Kamarainen, A. M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M. S. and Dede, C.: "EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips." Computers & Education 68 (2013): 545-556. Karasavvidis, I., & Kollias, V. (2017). Understanding Technology Integration Failures in Education: The Need for Zero-Order Barriers. In Reforms and Innovation in Education. (pp. 99-126). Springer.
[650] https://wise.vub.ac.be/tickle/
[651] https://wise.vub.ac.be/tickle/
[652] http://www.gamesforlearning.se/

SPOTLIGHT BOX: Digital tools and engagement – EU27 examples

pupils [with] literacy issues to easily design and create their own game. There is no complex language used and all choices are clear, bright and easy to read. I also believe that pupils will find Kodu more motivating as it is 3D".

Similarly, experiences shared from another SEN classroom suggested that student's engagement was higher than normal, with a significant improvement in SEN children's ability to stay on task for longer periods of time. Whereas normally children in this group would be able to sustain their engagement (in planning and writing) for no more than 15 minutes at a time, the children reportedly remained on task for more than 35 minutes.

The children were also reportedly able to better communicate their ideas and plans to peers, as well as to supportive adults, once they had completed their 3D planning. Children took advantage of the 'tracking/roaming tool' within the KODU programme and were able use it to identify a series of events that they would then describe in their writing. Once the children had completed their mapping, they were more confident and willing to begin their writing and showed greater levels of determination in completing their set task. As well as an increased level of productivity, the descriptive quality of the writing was noted to have improves as well.

Overall, the changes in the children's attitudes and work was summarised as follows:

- Increase in overall engagement in their writing;
- Increase in time spent on task;
- Increase in the volume of work produced;
- Reduction in the time it took to settle down to the writing task;
- Reduction in support required to help children form their work;
- Improvement in children's ability to link series of events and ideas chronologically, and;
- Improvement in the levels of description and atmosphere in children's writing.

More such stories are available on the project website[653] , including benefits and difficulties different teachers identified, as well as the software they used.

Digital tools can support more learner-centred learning

Equally, digital tools hold tremendous potential as a tool to enhance learner-centred approaches, including individualised and flexible learning that recognises and accommodates the needs of individual learners. More specifically, digital tools can support teachers' efforts to materialise individualised learning by detecting, mapping and presenting tailored solutions for the key conditions of learning, such as the motivation and well-being of the student, feelings of autonomy and agency, abilities and the relevance of the learning.[654]

In this sense, individualised learning frameworks, when implemented successfully, represent highly inclusive models capable of responding to the complex learning needs

[653] http://www.gamesforlearning.se/
[654] https://hundred.org/en/innovations/personalized-learning-paths#d5cc3916

of individual learners, including SEN and other potentially vulnerable groups of learners. This is because the approach does not view learners through the lens of a single demographic or contextual characteristic. Instead, individualised learning models recognise that young people present with a myriad of characteristics and traits that might affect their abilities and motivations. In this sense, individualised learning pathways can enable every student to learn what they need and to benefit from the right learning approach for them.

At present, across Europe the research shows a trend towards more individualised learning pathways, as observed in a number of structural developments, such as reforms to national qualifications frameworks and curriculum modularisation.

In **Finland**, for example, it is at the heart of current VET reforms, which aim to achieve an innovative lifelong learning VET system organised around personal study paths, broad-based competences and close cooperation with working life. Under the new system, Initial VET (I-VET) and Continued VET (C-VET) are merged and there are no fixed VET paths for anyone: rather, individual competence needs are addressed by offering learners flexibly opportunities to acquire qualifications by attending programmes in education institutions, in workplaces or in digital learning environments. National digital solutions are a central to supporting individualised learning, including Arvo, a digital education management information service, and e-hooks, an online service to support individual study paths.

At the school level, **France**, through a partnership with the private sector, the government aims to develop pedagogical resources using AI to support teachers with personalised and differentiated learning for both French and mathematics (grades 1-3 of primary education). In 2020, a voice assistant to learn English in primary education was also tested as part of the modern languages plan.[655]

In **Belgium**, through the government funded i-Learn Programme[656] launched in September 2019, the Ministry of Education also aims to encourage teachers to use more digital technologies in the classroom (in primary and secondary education) to better tailor learning to pupils' individual needs. The aim is for the use of digital tools in the classroom to make learning both challenging for students who are performing exceedingly well, and at the same time, ensure more tailored support to those who need it the most. As part of this initiative, an online portal will be developed. It is to include an interactive map of resources and applications teachers can access, as well as teacher training , to use all these applications effectively in the classroom, supported by the Flemish coaching institutes and guidance services. The aim for 2020 was to implement the pedagogical approaches propagated by the programme in at least 10% of all primary and secondary schools.

Beyond what is generally understood as individualised learning, it is vital to note that digital tools can also play a crucial role in promoting *flexible* learning, e.g. by supporting learners going through temporary transitions, such as disruptive illnesses. The below example sheds light on how this can be done.

[655] https://www.cned.fr/le-cned/services-aux-etablissements-scolaires/dcol-accompagnement-college
[656] https://www.i-learn.vlaanderen/en/

Box 16 Spotlight on Bednet, Belgium

SPOTLIGHT BOX: Bednet – Belgian Synchronous Online Education for learners in transition[657]

Synchronous Internet Education (SIE) has been developed to support Belgian children and other school staff who are ill long-term (or ill short-term during regular intervals) or suffered from a debilitating accident. It is also available for learners and school staff who are pregnant or are experiencing other life events that prevent them from full face-to-face participation. SIE is free for schools and learners, with anyone who is involved in the education of the child being able to submit a request online to get BedNet, including school leaders, teachers, the children themselves, their parents, their counsellors and Centres for Student Counselling. Once a request has been submitted the following steps are taken:

- **Step 1**: within 1 to 5 days, BedNet will get in touch with the parents of the child via phone in order to discuss whether their child is eligible for BedNet and to ensure they have parental consent.
- **Step 2**: a personal consultant will come and explain, at school and at home, to the parents and child, how BedNet works. The consultant coordinates with the school and internet provider, so that the parents do not have to worry about this.
- **Step 3**: BedNet makes sure that the student has access to internet.
- **Step 4**: BedNet delivers resources to the school and child (such as speakers, printer/scanner, computer with moveable camera, headphones).
- **Step 5**: a volunteer comes and install all the equipment at the school
- **Step 6**: BedNet provides a helpdesk to support schools and the child/parents in rolling out the online learning environment and provides support in case there are any (technical) issues.

The initiative has been evaluated, with various surveys conducted with relevant stakeholders and beneficiaries, and received overwhelmingly positive feedback.[658] More specifically, BedNet had an average rating of 8/10 (both by schools and families). Only 5% of respondents rate its services as "insufficient". The scores were slightly lower for secondary education than primary and pre-school education.

A particularly noteworthy observation was that, for pre-school and primary school, the main value of this blended/ virtual learning environment appears to have been the "social dimension" of going to school, while in secondary school the importance of supporting learners to keep up to date with content was amplified.

Top 5 benefits for pre-school reported:

[657] https://www.bednet.be/tevreden-over-bednet/voldoet-bednet-aan-de-verwachtingen#:~:text=Wat%20is%20de%20impact%20van,kinderen%20via%20Bednet%20bereikt%20hebben.&text=Gemiddeld%20scoort%20Bednet%20goed%20voor,(kleuter%2Den%20lager).
[658] https://www.bednet.be/tevreden-over-bednet/voldoet-bednet-aan-de-verwachtingen#:~:text=Wat%20is%20de%20impact%20van,kinderen%20via%20Bednet%20bereikt%20hebben.&text=Gemiddeld%20scoort%20Bednet%20goed%20voor,(kleuter%2Den%20lager)

SPOTLIGHT BOX: Bednet – Belgian Synchronous Online Education for learners in transition[657]

- Sense of belonging to the class;
- Keeping in contact with peers;
- Keeping in touch with the teacher;
- Being aware of what happens in class, and;
- The sense of being supported by classmates.

Top 5 benefits/results for primary school:

- Sense of belonging to the class;
- Keeping in contact with peers;
- Keeping in touch with the teacher;
- Being aware of what happens in class, and;
- Staying on top of learning content.

Top 5 benefits/results for secondary school:

- Staying on top of learning content;
- Making sure the student passes their year;
- Staying in the habit of going to class;
- Sense of belonging to the class, and;
- Keeping contact with the teacher.

There was also a small difference in priorities for each clinical picture, as the below overview demonstrates.

- Maternity rest: more explicit focus on 'limiting learning delay' and promoting a smooth return; social contacts and ties with school were deemed to be less important.
- Long-term illness: social contacts were deemed to be very important
- Chronically ill: connection with school was less often cited as being very important, likely because beneficiaries often still combined Bednet with going to school.

Digital tools may potentially enhance classroom-based formative and summative assessments

Formative assessment is sometimes referred to as assessment *for* learning (in contrast to assessment *of* learning, or summative assessment). Formative assessment is focused on improvement and can be particularly important for lower-achieving learners. Black

and William, in one of the most widely cited definitions in this field, emphasise that formative assessment is a process:

> *Those activities undertaken by the teacher, and by their students in assessing themselves (that is, students' assessment of their own work as well as their peers), which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. Such assessment becomes 'formative assessment' when the evidence is actually used to adapt the teaching work to meet the needs.*[659]

Teachers can draw upon a wide variety of digital tools and approaches to deepen formative assessment practices within and beyond the classroom, such as personalised learning platforms, e-portfolios/ digital diaries, social media (blogs, wikis, etc.), digital storytelling, e-textbooks, mobile learning, classroom polling, dashboards and monitoring tools and digital games.

Advantages of different digital formative assessment tools and approaches include:

- Rapid (real-time) feedback and scaffolding of learning to next steps in the learning process, at an appropriate level of difficulty (e.g. automated learning platforms).
- Immersive learning environments to support situated learning. This may include mobile tools to support assessment of learning in the field ('anytime, anywhere' learning), or serious games that set out complex ill- defined problems that challenge learners and support collective problem solving in small groups or in massive multi-player online platforms, VAR).
- Opportunities for self- and peer-assessment (e.g. digital portfolios, collaborative platforms).
- Collection (or 'mining') of educational data to better understand learning processes and contexts, and in turn, use these data to generate learning analytics to predict student progress and adapt learning.[660]

Importantly, Black and William emphasise that in classroom settings the same assessment tool may be used both formatively (to identify learning needs and next steps for learning) or summatively (for decisions on student status). Digital portfolios, for example, provide opportunities for self- peer- and teacher-assessment over time, and final grades may be based on the cumulative work and evidence of improvement. The primary distinction between formative and summative assessment, Black and William note, is in ensuring that interpretation of information from assessments is valid (*i.e.* the assessment is aligned with learning aims and the use of results is appropriate). This integrated approach to formative and summative assessment can help ensure different

[659] Black, P. and Wiliam, D. (2010). Inside the Black Box: Raising Standards Through Classroom Assessment, Kappan Magazine, Vol. 92, No. 1, pp. 81 – 90.
[660] Looney, J. (2019). Digital Formative Assessment: A review of the literature. European SchoolNet. Brussels. http://www.eun.org/documents/411753/817341/Assess%40Learning+Literature+Review/be02d527-8c2f-45e3-9f75-2c5cd596261d

assessments are aligned and that the primary focus is on learning (and not solely on test performance). [661]

The country mapping suggests that some initiatives to support classroom-based formative and summative assessment have already taken place at European level.

Among these, the **Cyprus** Pedagogical Institute has designed a variety of assessment approaches and tools on its website, including a formative self-assessment and scaffolding tool that can be used by upper primary (age 9-13) and lower primary (age 12-15) learners, in order to allow them to assess their own competences and skills. The competences and skills assessed encompass information literacy, autonomous learning, communication and collaboration, and creativity and innovation. The tool is flexible and can be adapted by the teacher, who selects the competences and skills which are applicable for the learning cycle so that the students can make their self-assessment more focused and targeted.[662] Another EU-initiative is featured below.

Box 17 Spotlight on assessment of Transversal Skills 2020 (ATS2020) Policy Experimentation

SPOTLIGHT BOX: Assessment of Transversal Skills 2020 (ATS2020) Policy Experimentation (2015 – 18)

The *Assessment of Transversal Skills 2020 (ATS2020)* project proposed a comprehensive learning model to enhance student transversal skills, using web 2.0 platforms to support formative and summative assessment of those skills. This EU-funded project included 17 partners from 11 EU countries.

The ATS2020 learning and assessment model included:

- Learning design for selected transversal skills development (Information Literacy, Collaboration and Communication, Autonomous Learning, Creativity and Innovation, Digital Literacy) within country curricula.
- Incorporation of digital technologies in the learning design process (e.g. ePortfolios (mainly Mahara, Office365 OneNote).
- Introduction of learner digital journals (My Learning Journal).
- Introduction of learner ePortfolios.
- Formative assessment (teacher assessment, peer-assessment, self-assessment) and scaffolding tools (to guide learners to appropriate next steps for learning).

The main research question for this policy experimentation was: "To what extent did the ATS2020 learning model promote the development and the assessment of the transversal skills defined for the purposes of the project?" The results of the quantitative evaluation showed a statistically significant difference of transversal skills in post-test in favour of the experimental classes in 4 out of the 10 implementing countries (Belgium, Croatia, Lithuania and

[661] Black and Wiliam (2018). Classroom assessment and pedagogy Assessment in Education: Principles, Policy & Practice, Vol. 25, No. 6, 551-575, DOI: 10.1080/0969594X.2018.1441807
[662] https://resources.ats2020.eu/resource-details/SCTS/assessment-student

SPOTLIGHT BOX: Assessment of Transversal Skills 2020 (ATS2020) Policy Experimentation (2015 – 18)

Finland). Qualitative evaluation results reinforced progress in development of learners' transversal skills following implementation of the learning model.

The ATS2020 partnership emphasised their belief that all countries would likely have shown similar results had the project lasted longer.

5.4 An overview of key digital tools

As seen in the section above, digital tools in and of themselves do not appear to enhance learning. Rather, the ways in which they are embedded within pedagogy and practice ultimately determine their success. In gathering examples of promising practices from across Europe, the below provides a snapshot of how key tools are currently used to enhance learning in Member States.

Virtual and augmented reality (VAR)

A recent Ecorys report noted that VAR is **becoming far more widescale with increasing scalability to education systems**[663]. O'Leary and colleagues note that while costs initially prohibited widespread use of virtual reality, there has been a revolution in availability of high-quality, usable and affordable applications.[664] While scalable costs are still a significant concern for application in education, VAR has real potential for vocational education and training (VET) as well as for classes requiring practical application of complex problem-solving competences (e.g. science experiments). For example, in VET, VAR can allow learners to step into virtual 'real life' work situations without having to physically relocate. In this sense, AR/VR which provides the ability to access learning opportunities outside the classroom can also help students contextualise and apply their learning in the real world. This can, in turn, help students struggling to grasp abstract concepts by creating practical learning scenarios. In this sense, the effectiveness of VAR in VET appears to depend on the extent to which it can support activities that target relevant cognitive skills (*e.g.* self-regulation, reflection and abstraction) without disconnecting these skills from the real-life professional context. In this sense, teachers and trainers need to remain critical of what professional skills can, and what skills likely cannot, be successfully mimicked through VAR and with what learning outcomes. They also need to ensure that VAR complements rather than replaces work0based learning where possible.

Nonetheless, when implemented successfully, it is evident that VAR can allow students to rehearse risky or expensive processes in safe and controlled conditions that otherwise would not be possible. Two examples from the European VET sector are featured below.

[663] Bezegová, E., Ledgard, M., Molemaker, R., Oberc, B., & Vigkos, A. (2016). Virtual Reality and its Potential for Europe. *Brussels: Ecorys*.
[664] O'Leary, M., Scully, D., Karakolidis, A. and Pitsia, V. (2018). The state-of-the-art in digital technology-based assessment. European Journal of Education, Vol. 53, No. 2, 160 - 175 DOI: 10.1111/ejed.12271

Box 18 Spotlight on VAR in VET

SPOTLIGHT BOX: VAR in VET

VRHOOGTE, Belgium – working safely in high places[665]

Funded by the **Flemish** government, the teacher-led project VRhoogte has developed a high-quality VR training module for secondary VET students to learn how to work safely in high places, such as high-voltage pylons or wind turbines. Through the VR training module students can work and train a number of basic skills in a safe, interactive and challenging environment in preparation for this particular work environment. The module itself deals with scaffolding installations and construction. Based on the project's success in improving the learning outcomes of trainees, the project consortium is developing a manual and training for schools and teachers so that the module can be transferred to other schools.

SPOTLIGHT BOX: VAR in VET

BloomyPro, the Netherlands - Florist training with virtual flowers[666]

The **Dutch** tool BloomyPro is a tool that allows trainees to create digital bouquets for virtual customers. By using the tool, the apprentice can explore the design of different flower arrangements. The Swizz Leading House DUAL-T research project concluded that apprentices using the tool experimented with more varieties of flower arrangements than with the virtual free-of-cost flowers.[667]

Digital games

Digital games engage students in immersive learning experiences in situated contexts. They have a variety of aims and formats and include simulations that play out a series of problems, with features that allow the learner to compare their own approach to that of experts. Virtual worlds engage players in problem-based quests that require the learner to draw on their knowledge of a specific subject area. These may feature complex, ill-defined problems to be addressed individually or collectively. Games which include a storyline and series of puzzles may allow learners to explore a new concept (e.g. mathematical thinking). Furthermore, commercial off-the-shelf (COTS) games may be adapted for instructional purposes (e.g. SimCity and Newton's Playground).[668]

[665] VRhoogte - Veilig werken op virtual hoogte, (2019). Available at: https://www.imec-int.com/drupal/sites/default/files/inline-files/VR_HOOGTE_V4_0.pdf https://www.imec-int.com/drupal/sites/default/files/inline-files/VR_HOOGTE_V4_0.pdf
[666] https://bloomypro.com/
[667] https://www.epfl.ch/labs/chili/dualt/
[668] Bhagat, K. K. and Spector, J. M. (2017). Formative Assessment in Complex Problem-Solving Domains: The Emerging Role of Assessment Technologies. Educational Technology & Society, Vol 20, No. 4, 312–317.

Similar to VAR, given its 'learning by doing' nature, gamification has also shown a distinct potential in supporting learning in training and one-off activities' in VET. This is underlined by the observation in 2014 that 50% of documented gaming for learning purposes took place in 'training or extracurricular activities rather than strictly academic courses' (only 10% took place in primary and secondary education).[669] Against this backdrop, research evidence suggests that gamification is highly suitable for developing transversal skills as well as occupational competences.[670] Moreover, the VET student pool frequently includes people with negative experiences of 'traditional' pedagogies used in schools and gaming can in many cases be seen as a tool to help to re-capture their interest. Also, VET students' engagement with key competences in terms of programme/qualification design has tended to vary and gaming may offer a cost-effective way of improving their incorporation into curricula. In this context, games focused on key competences could be 'sector-neutral', for example, and used across VET programmes.

Box 19 Spotlight on SOLAS (Ireland)

SPOTLIGHT BOX: SOLAS, Ireland – a game-based approach to delivering education and training

In Ireland, the Galway Roscommon Education and Training Board (GRETB) is currently leading an innovation project which aims to introduce a game-based approach to providing education and training in aquaculture. This will include delivering an aquafarm simulator and a range of game-based resources. The aim of the simulator is to use real-life occurrences to prompt applied problem solving and risk recognition. The game-based resources will encourage active problem solving accompanied by a point system to create a pathway to elevate learners to more complicated tasks reflecting the specialised theoretical content of units. These resources will inform the development of accredited on-the-job training and CPD opportunities within the industry, while also supporting teaching and learning leading to accredited aquaculture awards developed in conjunction with Bord Iascaigh Mhara, the agency responsible for developing the Irish seafood industry.[671]

Mobile applications

As seen in the section on access, mobile learning can be used to increase students' access to education, however it can also enhance teaching and learning both inside and outside traditional school settings. The most obvious way in which mobile learning can support learning includes allowing learning "anytime, anywhere", which provides opportunities for valuable situated learning. Examples are apps to support field work in natural sciences, such as bird or plant identification.[672] However, as seen in previous

Groff, J.S. (2018). The potentials of game-based environments for integrated, immersive learning data. European Journal of Education, Vol 53, No. 2, 108 – 201

[669] European Commission (2020). Innovation and Digitalisation in VET: A report by the ET2020 WG on VET. Available at: https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8365&furtherPubs=yes

[670] De Witt, C. (2013) New forms of learning for vocational education: mobile learning – social learning – game-based learning, BiBB BwP Special edition, p. 30, URL: https://www.bibb.de/veroeffentlichungen/de/publication/download/7056 .

[671] SOLAS, the Further Education and Training Authority, Ireland. http://www.solas.ie/

[672] Santos, P., Cook, J., & Hernández-Leo, D. (2015). M-AssIST: Interaction and Scaffolding Matters in Authentic Assessment. Educational Technology & Society, Vol. 18, No. 2, 33–45.

Shih, J-L. Chu, H-C., Hwang, G-J. and Kinshuk (2011). An investigation of attitudes of students and teachers about participating in a context-aware ubiquitous learning activity. British Journal of Educational Technology, Vol 42, No 3, 373–394. doi: 10.1111/j.1467-8535.2009.01020.x

examples including the Trialog Mobile App (p.147) and Micro Learning project (p. 128) mobile apps also provide unique opportunities to engage with peers and/or to receive feedback from teachers and trainers, which can support better learning outcomes.

Box 20 Spotlight on integrating mobile technologies into the classroom through MSchools (Spain)

SPOTLIGHT BOX : Integrating mobile technologies into the classroom through MSchools, Spain

MSchools is a multi-faceted education programme in Catalonia, Spain that empowers students and teachers to integrate mobile technologies into the classroom, and opens new approaches to teaching and learning, with the goal of enhancing learning outcomes and employability. The mSchools programme develops curricular materials, tools and methodologies which have been designed to empower teachers to effectively apply mobile learning, with a special focus on digital competences, STEM career paths and gender equality. mSchools is backed by a strong private-public partnership which has allowed individuals from the tech industry to provide mentorship and guidance. Over 130,000 children from ages 8 to 18 have benefited from the programme[673].

Artificial intelligence (AI)

As seen in section 2.1.3.4, data-based neural AI refers to tracking of learning behaviour (through images or voice) to spot patterns of behaviour and react accordingly, while logic/ knowledge-based AI allows computers to make inferences based on the information they have been given (*e.g.* through tracing student performance in the use of digital textbooks, games and mobile apps)[674]. As a consequence, AI is seen to hold great potential for the "hyper-personalisation" of teaching material for young people, the use of voice assistants to help students with basic and nonanalytical tasks and help teachers with administration and automatic grading.[675] Intelligent tutors can also provide automated feedback. These programmes verify if a student answer is correct, and if the answer is incorrect, explain why. The software, which employs machine learning, can detect patterns in written work, speech, and other actions, which then can be individually adapted to students' learning styles and needs.[676]

At the same time, as a general note of caution, the limits of Artificial Intelligence in its current state need to be kept in mind. Tuomi (2018) argues that the "…learning algorithms [used in in AI] are based on historical data, they can only see the world as a repetition of the past" (p. 4).[677] As previously mentioned, the limits of Artificial Intelligence in its current state need to be kept in mind, as Tumoi notes that "…supervised learning algorithms create unavoidable biases … from a more

[673] https://en.unesco.org/sites/default/files/best_practices_in_mobile_learning-case_studies-top-down-en.pdf
[674] Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. Research and Practice in Technology Enhanced Learning, 12(1), 22
[675] Schmelzer, R. AI Applications in Education. New York: Forbes Magazine.
[676] Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C. and Ananthanarayanan, V. (2017), "NMC horizon report: 2017 higher education edition", The New Media Consortium, Austin, TX, available at: http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf (accessed 05 March 2018).
[677] Tuomi, I. (2018). The impact of artificial intelligence on learning, teaching, and education. Luxembourg: Publications Office of the European Union).

fundamental ethical point of view, however, the expression of human agency requires capability to make authentic choices that do not only repeat the past. AI systems will have great difficulties in dealing with people who are creative, innovative, and not only average representations of vast collections of historical examples." (p. 4). Thus, while AI technologies allow for the "hyperpersonalisation" of learning content and intelligent tracking of student progress and attainment, teachers and policymakers need to also be aware of their limitations.

Exploring its potential and restrictions in practice, **Finnish** municipalities are making crucial first steps with artificial intelligence in education. For example, the city of Vantaa has begun to develop a new type of digital learning platform. The aim is to gather all school and teaching-related material, such as assignments, exams, assessments, and communications with parents in one place. The system is planned to use AI in the offering and assessment of assignments. One of the main goals of the project is to improve learning outcomes[678]. Here, the Finnish compulsory education sector can draw on experiences from Finnish universities which are more advanced than other universities. For example, Aalto University has already integrated artificial intelligence and learning analytics into its teaching practices[679]. The aim is to make teaching more efficient and to provide students with increasingly individualized teaching.

Examples suggesting early experimentation with AI can also be observed in other Nordic countries. In **Denmark**, for example, the Frederiksvaerk school uses SmartBooks. These are digital tutors that use AI to tailor individual learning paths. The individual pathways proposed are based on reading comprehension of an assignment.[680] In **Sweden**, more than 25 schools have tested Mr Albert – an AI math tutoring system that makes personalised lessons available to students.[681]

In **Belgium**, the Flemish Action Plan on Artificial Intelligence of 18 February 2019[682] notes that Flanders will also start experimenting with the use of AI in education. Current deliberations also centre on exploiting AI's potential to better tailor education to pupils' individual needs.[683] In **France**, the 2018 Strategy on Artificial Intelligence also notes in one of its four priorities that AI should be used to leverage lifelong learning through the anticipation of needs and individualisation of learning pathways. The Strategy notes that this should be done through funding for research projects and start-ups.

Increasingly, within such national support frameworks, EdTech providers across Europe, but in particular in the Nordic countries, may be found to be developing more

[678] YLE (1.8.2019). Tekoäly korjaa pian koulutehtävät – Vantaa kokoaa myös arvioinnin ja yhteydenpidon koteihin yhdelle digitaaliselle alustalle [Artificial intelligence will soon fix school tasks - Vantaa also gathers assessment and communication in homes on one digital platform]. YLE [Finnis broacasting company]. https://yle.fi/uutiset/3-10903966
[679] Aalto University (20.1.2020). Tekoäly tarjoaa opiskelijalle yksilöllisempää opetusta [Artificial intelligence provides students with more individualized instruction]. https://www.aalto.fi/fi/uutiset/tekoaly-tarjoaa-opiskelijalle-yksilollisempaa-opetusta
[680] Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C. and Ananthanarayanan, V. (2017), "NMC horizon report: 2017 higher education edition", The New Media Consortium, Austin, TX, available at: http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf (accessed 05 March 2018).
[681] https://www.hejalbert.se/
[682] https://www.ewi-vlaanderen.be/sites/default/files/quaternota_aan_de_vlaamse_regering_-_vlaams_beleidsplan_artificiele_intelligentie.pdf
[683] https://www.vleva.eu/nl/onderzoek-en-innovatie/events/artifici%C3%ABle-intelligentie-in-onderwijs

sophisticated AI tools which are capable of predicting student performance, *e.g.* by using eye-tracking data, as the below example illustrates.

Box 21 Spotlight on Using Artificial intelligence to detect reading difficulties (Sweden)

SPOTLIGHT BOX: Using Artificial Intelligence to detect reading difficulties, Sweden[684]

The digital tool Lexplore uses eye tracking AI to determine students' reading levels. This unique evidence-based technology is based on an extensive 30-year research project carried out at the Karolinska Institute in Sweden. Lexplore's machine learning algorithms recognise correlations and patterns in eye movement data.

More specifically, tools like Lexplore make their analysis by tracing how a reader's eyes follow words in sequential (or non-sequential) order to identify patterns. Readers at low risk for dyslexia tend to make more progressive movements—from left to right—as they scan words. Dyslexic readers on the other hand make more regressive movements—right to left movements—and do not make regular pauses (or fixations) during reading in the same way non-dyslexic readers do.

This unique high-tech process provides teachers with real-time data for intervention that directly correlates to a student's reading level (as well as detecting dyslexia). The methodology for this comprehensive research project entitled "the Dyslexia project", has since been evaluated and refined. Over two years, more than 3,000 students in grades 1-3 in Järfälla and Trosa municipalities were screened. The evaluation reported high overall accuracy with a good balance between sensitivity and specificity.

Digital learning management systems

Digital learning management systems allow for more sophisticated school-level monitoring of whole-school strategies to support inclusive learning environments, and of individual student progress and attainment[685]. They may also track indicators such as school absenteeism to identify students who are at-risk of drop-out or failure and who may benefit from intervention. This, in turn, can help to reduce ESL by allowing school stakeholders to intervene as early as possible to reverse the process of disengagement. Increased communication with parents has also been associated with reducing ESL. Such communication can also be enhanced through digital tools.

For instance, in **Croatia**, the Early Warning System practice is linked to the schools' responsibility to monitor the number of classes students miss. If the number increases, it is the responsibility of the school to make sure that teachers, management and other experts get involved, together with parents. In this context, the Ministry of Education

[684] https://www.lexplore.com/
[685] https://ec.europa.eu/assets/eac/education/experts-groups/2011-2013/esl/europe-warning-systems_en.pdf

has started a project called the 'e-register book' which aims to improve the communication between the school and parents. It ensures that parents have constant access to school data about their children. This is also linked to teacher training to help teachers to identify at-risk students.[686]

Similarly, most **Estonian** schools have joined the e-Kool system, which makes it possible for parents to obtain more accurate, timely information about their child's exam results, grades, attendance, homework and other notifications to ensure that parents are plugged into their children's school lives. The platform also hosts discussion forums for parents.[687]

Online personalised learning environments

Students may also use platforms to design e-portfolios with their own multi-modal projects (developed individually or with peers) or to keep track of their qualifications. E-coaches and other digital monitoring tools may help students to track their progress toward learning goals and provide automated feedback and/or scaffold activities for learning based on prior responses.

In Malta, for example, the use of blockchain technology for encrypting qualifications represents an important educational innovation. Malta is predicted to be the first country in the world where education certificates and credentials of all students will be on blockchain. This step is made possible through BlockCerts technology that facilitates an open standard for creating, issuing, viewing, and verifying blockchain-based certificates. As a result, through an online portal, learners can organise and store educational and professional certificates, enabling digital access to educational records accumulated over time. Benefits include users' increased autonomy over credentials and the ability to add certificates over time, as well as lowered administrative costs.[688]

Online repositories

Whether established by national ministries of education, pedagogical centres or non-state actors, online resource portals and platforms has been identified in virtually every Member State. These resource portals aim to establish and disseminate learning materials, tasks and logistical information to students, but also to distribute online resources to educate teachers and parents on topics related to high-quality, inclusive education. However, there is great variation in the target audiences (*e.g.* promotion of co-education between teachers and parents through interactive applications in CZ,[689] between municipalities in DK[690] or between teachers/schools in BE-FL[691]) and the scope (some focusing on specific issues, e.g. preventing ESL in SE[692]).

In **Bulgaria**, online portals providing open access resources have been considered to be a breakthrough in promoting new ways of learning. For instance, the Ucha portal offers more than 15,000 video lessons and tests, aligned with the official school

[686] https://www.carnet.hr/en/usluga/e-class-register-for-schools/
[687] https://www.ekool.eu/#/
[688] http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108255/jrc108255_blockchain_in_ education%281%29.pdf
[689] http://www.zapojmevsechny.cz/
[690] https://inkludigi.dk/
[691] https://www.klascement.net/ict/thema/ict-eindtermen-voor-lager-en-secundair-onderwijs/
[692] National Plug-In digital platform to prevent early school leaving. Available at: https://webbutik.skr.se/bilder/artiklar/pdf/5412.pdf

curricula.[693] Apart from providing lessons in all schools' subjects, including pre-school education, ucha.se also provides a special series of lessons in three ICT subjects at school (information technologies, informatics and computer modelling) as well as on programming. The portal has reportedly been very popular with schools, but also with parents, who are also seen to frequently access the portal to keep up with their childrens' lessons.[694]

5.5 The prevalence of digital strategies and frameworks to enhance learning

Despite its potential, the evidence in Europe and beyond suggests that more could be done to support the effective integration of digital tools at practitioner and policy levels.

At institution-level, the 2nd Survey of Schools on ICT in Education finds that only about one third of EU students in primary and secondary education attend schools that have written statements on the use of ICT for pedagogical purposes.[695] As such, perhaps unsurprisingly, the 2018 OECD TALIS noted that technology is not being effectively integrated into teaching practice across Europe.[696] Furthermore, one quarter of school leaders (25%) cited inadequate use of digital technology for teaching as a barrier to teaching quality.[697] These findings provide an indication of the potential under-utilisation of meaningful ICT use.

Findings from the country mapping further suggest that across the EU27 there is a tendency for wider and more intensive use of digital tools in STEM classes, science laboratories, interdisciplinary laboratories in physics, chemistry and biology and extracurricular activities (e.g. BG[698], ES[699], HR[700]), while little evidence could be found of deep pedagogical integration in other subjects. This is particularly significant considering the potential of digital tools, for example, when it comes to learning outcomes in literacy as seen consistently throughout previous sections. Lastly, the Commission's 2nd Survey of Schools revealed that as of 2019 a total of 79% of lower secondary school students and 76% of upper secondary school students had never or almost never engaged in coding or programming at school[701]. In light of these figures, activities to strengthen students' coding skills at EU, Member States and local levels need to be further developed.

At Member State level, a 2019 Eurydice report suggested that most countries, primarily in eastern and south-eastern Europe only address digital education within a broader strategy and that 14 EU Member State education systems[702] (mostly in western, central

[693] https://ucha.se/
[694] ibid
[695] https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education.
[696] OECD (2018). TALIS 2018 Insights and interpretations. Paris: OECD.
[697] Ibid.
[698] https://www.cedefop.europa.eu/da/news-and-press/news/bulgaria-ict-professionals-step-vet-classrooms
[699] https://en.unesco.org/sites/default/files/best_practices_in_mobile_learning-case_studies-top-down-en.pdf
[700] https://pilot.e-skole.hr/en/
[701] https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education.
[702] Bulgaria, Czech Republic, Denmark, Germany, Ireland, Spain, France, Italy, Luxembourg, Hungary, Austria, Slovenia, Slovakia and Sweden

and northern Europe) have a specific strategy in place.[703] However, our recent country-mapping suggest as of early 2021, this picture is already changing. For example, in **Romania**, a National Digital Strategy for Education (2021- 2027 SMART-EDU) is underway following a 2020 public consultation.[704] Similarly, in **Croatia**, a strategic framework for digital maturation of schools and the school system recently came into effect for the 2020-2030 period.[705] Strategic Area 3 of the latter framework focuses on teaching and learning support through the use of ICT and on monitoring students' performance, which could enhance the personalisation of the education experience.

It is worth noting, however, that while all education systems currently have strategies for digital education only a few undertake regular monitoring or evaluation of these policies (BE-FL, BG, CZ, EE, SE). Similarly, while policies to improve the development and availability of digital learning resources (including Open Educational Resources) are evident across virtually all Member States, in only 10 of these systems (CZ, EE, IE, EL, FR, HR, MT, AT, SL, SK) have top-level authorities taken practical steps to ensure the quality of digital resources. Moreover, in Czech Republic, Estonia, Croatia and Austria, top-level policies include the development of specific standards or qualitative requirements for digital learning resources (i.e. devices).[706]

Similarly, only 10 countries (CZ, EE, IE, ES, LV, LT, HU, MT, PL, RO) can be seen to include specific criteria related to digital education in their external school evaluation frameworks. In these education systems, inspectors are required to consider different aspects of digital education including how well digital technologies are incorporated into teaching and learning or school management processes, or the extent to which quality of digital infrastructure is up to the necessary standards.

Frameworks for digital competences: an EU27 snapshot

References to the development of digital competences are included in the curriculum in the vast majority of EU education systems and at all three levels of compulsory education. However, unlike other traditional school subjects, it is not only addressed as a topic in its own right, but as a transversal key competence (further bolstered by the DigComp framework).[707] In primary education, only four education systems (BE-FR/BE-DE, Croatia, Latvia, Luxembourg) did not explicitly address digital competences in their national curriculum in the reference year (2018-19), while in secondary education, this was only the case in the French and German-speaking Communities of Belgium. In primary education, the majority EU education systems include digital competence as a cross-curricular theme. In lower secondary education, however, over half of the countries teach digital competences as a separate compulsory separate, as in **Austria** (see below). The numbers slightly drop again for upper-secondary school, likely owing to the more specialisation-oriented nature at this education level.[708]

[703] https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/eurydice_brief_digital_education_n.pdf p.14
[704] https://www.edu.ro/sites/default/files/SMART.Edu%20-%20document%20consultare.pdf
[705] https://mzo.gov.hr/UserDocsImages/dokumenti/PristupInformacijama/Strateski-digitalno2030/Strateski%20okvir%20za%20digitalno%20sazrijevanje%20skola%20i%20skolskog%20sustava%20u%20Republici%20Hrvatskoj%20-%202030.pdf
[706] https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/eurydice_brief_digital_education_n.pdf
[707] Ibid
[708] Ibid

Box 22 Spotlight on digital skills in the Austrian curriculum

SPOTLIGHT BOX: Digital skills in the Austrian curriculum

The Austrian curriculum, introduced in 2015, includes the two subjects ''Design and Technologies'' and ''Digital Technologies'' from primary to secondary education. "Design and Technologies" focuses on the impact of technologies on society, whereas "Digital Technologies" covers the use of information technology. Both subjects are divided into the two blocks "Knowledge and Understanding" and "Processes and Production Skills". The "Processes and Production Skills" block includes collecting, managing and analysing data, and creating digital solutions by investigating and defining, generating and designing, producing and implementing, evaluating, collaborating and managing.[709]

Teacher Education and Training

Despite the public debate which frequently centres on the quality of specific digital tools and approaches, the research points to teacher competences as the prime factor in the pedagogical use of digital technologies. In addition to the digital competences needed for everyday life, teachers need specific digital competences to enable them to use technology effectively in the classroom and for their wider responsibilities in school, as also shown by the latest TALIS data on continuing professional development (CPD) needs of teachers.[710]

At European level, these competences have been captured in a competence framework for educators, the European Framework for the Digital Competence of Educators.[711] Teachers' digital competences and related teaching and learning practices are also addressed in the European Framework for Digitally Competent Educational Organisations (DigCompOrg). Moreover, SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies), is an online and free self-reflection tool for schools, based on DigCompOrg, that helps schools to identify strengths and weaknesses in their use of digital technologies for teaching and learning. Specifically targeted at teachers, the Erasmus+ funded TET-SAT self-assessment tool further aims to trigger teachers' self-reflection, identify learning needs, and initiate teachers actions to develop their competences[712].TET-SAT assesses four dimensions of digital pedagogical competence, namely: digital pedagogy, digital content use and production, digital communication and collaboration and digital citizenship. These three European frameworks (DigComp, DigCompEdu, DigCompOrg/SELFIE) alongside this EU-funded self-assessment tool for teachers aim to provide a common language and common ground for discussions and developments at national, regional, and local levels. Moreover, they offer a consistent set of self-reflection tools at European level addressing

[709] Micheuz, P., Pasterk, S., & Bollin, A. (2017, July). Basic Digital Education in Austria–One Step Further. In *IFIP World Conference on Computers in Education* (pp. 432-442). Springer, Cham. https://www.aau.at/wp-content/uploads/2018/05/2017-WCCE-Micheuz.pdf
[710] OECD (2019). TALIS 2018 results, Volume I. Available at: http://www.oecd.org/education/talis/talis-2018-results-volume-i-1d0bc92a-en.htm
[711] Redecker, C., (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union
[712] http://mentep.eun.org/fr/tet-sat

citizens and learners (DigComp), educators (DigCompEdu and TET-SAT) as well as schools (DigCompOrg/SELFIE).[713]

Ten EU27 national education systems[714] promote the use of self-assessment tools to help teachers evaluate their level of digital competence and thereby define their development needs. Six of these (CZ, CY, EE, ES, PT, SL) have adopted the European self-assessment tools, while the others have developed their own models.

A recent Eurydice report highlights that the definition of what constitutes digital competence for a teacher also varies across the EU. Where teacher-specific digital competences are recognised in competence frameworks, for example, these definitions range from very broad descriptions, to detailed descriptions of specific areas and skills. Some countries (e.g. AT, EE, ES, HR, LT) have gone so far as to develop a distinct digital teacher competence framework providing a complete mapping of the essential digital competences, including those related to the pedagogical use of technologies.

Focusing on the topic of teacher agency and empowerment, however, the cluster analysis in figure 3-10 (p. 65) based on findings from the *Second survey of schools: ICT in education* shows a mixed picture as to the extent to which teachers felt "active, confident and supported" in their use of digital technology. This covers a myriad of variables, including teacher training, teachers own use of and access to technology, and their digital skills.[715]

As already noted in the access section, the extent to which teachers feel prepared to deliver digital education has also been a key factor in the quality of provision offered during COVID-19. Based on emerging evidence from Ecorys and other sources, in those countries where teachers felt confident and supported in the move to online learning has been far easier to facilitate, whereas those without the necessary digital skills and competences, or the required support from senior leaders, have found the move to e-learning difficult and often faced increased stress and a lack of ability.

Our country mapping research shows that most Member States (e.*g.* AT, LT, PL, HR, PT, EL, LV, EE, SK, RO, BE-FL), have provided some level of guidance and resources for teachers to help them continue learning online albeit these are of varying quality. Some of these initiatives can also be seen to extend beyond the remote and blended learning context of 2020 and early 2021, suggesting that the current crisis has pushed countries to look beyond crisis responses in addressing the digital competence needs of teachers. For example, in response to the crisis revealing a deep-seated digital competence divide between teachers across the country, **Austria** launched an 8-point plan for digital learning[716]. In August of 2020, a MOOC for Distance Education was also set up by the virtual teacher education institutions attended by around 10,000 teachers. The four-week online course was intended to familiarise teachers with the basic innovative didactic methods for their lessons in the online remote learning environment. The MOOC, like the 8-point plan for digital teaching, looks beyond the crisis and sets out longer-term frameworks for teacher training.

[713] https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/eurydice_brief_digital_education_n.pdf
[714] Bulgaria, Czech Republic, Estonia, Spain, France, Cyprus, Austria, Portugal, Slovenia and Finland
[715] Ipsos Mori. (2019). 2nd survey of Schools ICT in education. European Commission: Brussels.
[716] https://www.bmbwf.gv.at/en/Topics/school/krp/8_p_p.html

Some countries (e.*g.* EE, DK, FI, LT, LV) have also pooled their solutions together and offered to support other countries' teachers during the COVID-19 crisis.[717] For example, the Estonian virtual teachers' room Clanbeat[718] has offering its services for free, and during the crisis has organised webinars to help schools develop strong virtual communities among their school staff.

Findings from across the EU27 further suggest that active teacher engagement in professional learning communities, rooted in aspects like teacher collaboration, involvement in decision-making and joint responsibility for teaching outcomes, has been found to be effective and is increasingly developed. For example, evidence suggests that more and more countries (e.g. AT, FR, HR, SL) had set up teacher networks specifically dedicated to digital education, even before the onset of the COVID-19 crisis.

Against this backdrop, the **Belgian** online portal KlasCement provides guidance for teachers on how to effectively implement digital tools in the classroom to enhance learning.[719] It is a platform *by* teachers and *for* teachers. Teachers are able to leave comments and rate pedagogical examples (e.g. give them a four- or five-star rating). The portal also provides specific guidance for teachers on assessing different digital competence areas in the classroom in line with the final objectives (*eindtermen*) for ICT-skills.[720] Similarly, in **Sweden**, the project Makerskola has reported success in designing distributed learning models, where teachers collaboratively learn about specific subject matters. In situations where a lot of new knowledge is needed, such as in the implementation of new curricula, this methodology for teacher training has been reported to be particularly valuable[721]. Currently in its third consecutive year, MakeDays is a **Swedish** conference and workshop series under Makerskola in which teachers and school managers learn about programming, games, maker culture and associated domains. The annual gathering aims to stimulate knowledge-sharing on common topics, build a virtual community of teachers, and promote active, empowered schools.

[717] https://www.hm.ee/en/news/estonia-offers-its-digital-education-solutions-free-support-other-countries
[718] Clanbeat.com
[719] https://www.klascement.net/ict/thema/ict-eindtermen-voor-lager-en-secundair-onderwijs/
[720] https://www.klascement.net/thema/icteindtermen-basisonderwijs/
[721] http://makerskola.se/about-our-project/

Box 23 Spotlight on INTEF (Spain)

SPOTLIGHT BOX: INTEF, Spain – MOOCs, NOOCs, SPOOCs, Edu Pills and Open Badge Backpacks[722]

Innovative teacher training offers that are accessible for all teachers to improve their skills are provided by the Spanish National Institute for New Technologies and Teacher Training (INTEF). These innovative offers include:

1. **Massive Open Online Courses (MOOCs)**, each with its own Facebook group and Twitter hashtag for teachers to connect and help each other. The hashtags and Facebook groups continue after the end to create communities of teachers.
2. **NANO Open Online Courses (NOOCs)**, which give participants the opportunity to explore, learn and be evaluated on a key element of a competence, a skill, or an area of knowledge in a period of time that may last from a minimum of 1 hour to a maximum of 20 hours of effort in total.
3. **Self-paced Open Online Courses (SPOOCs)**, in which courses can be undertaken by the learner at their own pace, without any time limits.
4. **EduPills**, a micro-learning app to acquire and/or develop digital abilities, skills and competences in a fast and simple way (3–8 minutes).
5. **Insignias INTEF Open Badge Backpack**, which stores, imports, downloads and shares digital badges on social media related to training in competences.

5.6 Parents and the whole-school community

Beyond teacher support, the research also shows that parental support can be highly effective in enhancing student learning[723]. For instance, according to recent OECD data from **Slovakia**, students who frequently use ICT and who received very high support from families scored on average 23 points higher than their peers who had less support from families.[724] At the same time, parents' own attitudes and abilities are important in determining whether they can provide effective support for the development of their children's digital competences.

Despite the importance of parental support and engagement, our findings suggest that very few education systems have national measures or frameworks in place to involve and support parents in digital education. For example, it is very rare for parental support feature in the main objectives of digital education strategies.[725] Nevertheless, in **Belgium**, an initiative called Click Safe[726] does aim to provide information to parents on how to safely and effectively navigate on the internet. The website provides

[722] The National Institute for New Technologies and Teacher Training (INTEF), (2019). The education meeting point. https://enlinea.intef.es/
[723] http://www.oecd.org/coronavirus/policy-responses/strengthening-online-learning-when-schools-are-closed-the-role-of-families-and-teachers-in-supporting-students-during-the-covid-19-crisis-c4ecba6c/
[724] http://www.oecd.org/coronavirus/policy-responses/strengthening-online-learning-when-schools-are-closed-the-role-of-families-and-teachers-in-supporting-students-during-the-covid-19-crisis-c4ecba6c/
[725] https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/eurydice_brief_digital_education_n.pdf
[726] https://www.childfocus.be/nl/preventie/clicksafe-veilig-internetten

information on such topics as optimal internet usage in the family, social media, and privacy. The programme also runs 'e-safety' trainings.[727] An additional example from **Latvia** is featured below.

Box 24 Spotlight on Uzdevumi (Latvia)

SPOTLIGHT BOX: Uzdevumi - Digital learning tool to support parents, Latvia[728]

The Latvian learning portal Uzdevumi recognises the importance of parental involvement to maximise the educational outcomes of their children, particularly in low-income families and families with low levels of educational attainment. Uzdevumi.lv thus supports parents in helping their children with their homework and tests (*i.e.* by helping them explain various subject-specific concepts), and also supports parents in keeping up with their children's achievements and progress in school subjects.

Despite a lack of attention to parental support in national education measures in previous years, this appears to have somewhat changed as a result of the COVID-19 crisis. For example, during school closures the Ministry of Education in **Ireland** provided numerous online resources directed at parents. These include several documents providing guidance on the continuity of schooling for parents of children in compulsory education. Documents specifically dedicated to parents of children at risk of educational disadvantage and of learners with SEN have also been provided.[729]

In **Portugal**, resources targeting families during COVID-19 were also published on the government-run website "Support for Schools", which provides all students, teachers, principals, parents and the rest of the school community with a comprehensive set of online resources.[730] "CRI goes home", for example, is a guide of strategies and activities encompassing practical guidelines related to psychology, psychomotricity, occupational therapy, physiotherapy and speech therapy.[731]

Moreover, various international and non-governmental organisations (NGOs) such as Save the Children in Spain, created and disseminated online resources to support parents during the crisis.[732] These materials range from mere recommendations and guidelines,[733] to short and condensed explanatory videos providing advice on how to help children manage their emotions, how to promote their participation at home and in society, or how to play creative games.

[727] https://www.childfocus.be/nl/preventie/veilig-internetten/professionelen/vorming-clicksafe
[728] https://www.uzdevumi.lv/
[729] https://www.education.ie/en/Schools-Colleges/Information/continuity-of-schooling/continuity-of-schooling.html
[730] https://apoioescolas.dge.mec.pt/
[731] https://www.dge.mec.pt/sites/default/files/cri_vai_a_casa.pdf
[732] https://www.savethechildren.es/consejos-para-madres-y-padres-en-tiempos-de-coronavirus
[733] https://www.unicef.org/es/coronavirus/seis-maneras-en-que-padres-y-madres-pueden-ayudar-sus-hijos-durante-coronavirus.

6.0 Conclusions

In this concluding chapter, we draw together and distil the findings from our various research strands in a series of conclusions, before presenting our recommendations for stakeholders at EU, national and practitioner levels.

6.1 Digital technologies promoting inclusion for all learners

The study has highlighted the range of different elements that must align in order to unlock the educational benefits of digital technologies for learners across Europe. As we have considered throughout the report, access to digital infrastructure and high-quality tools are pre-requisites for leveraging digitalisation for inclusive learning. Specifically:

- At a **macro level**, this requires that countries achieve an equitable distribution of resources among schools, working *horizontally* to secure collaboration between sectors and *vertically* to harness the capacities of municipalities and other intermediaries, while creating feedback loops to understand and respond to emerging needs.
- At a **micro level**, the challenge is one of utilising digital tools to ensure equitable access to high-quality learning opportunities to meet individual learner needs and characteristics, and of subsequent pedagogical application of these tools to achieve intended learning outcomes.

Reflecting on the overall findings, a number of themes stand-out, which we go on to discuss in further detail below.

Realising educational value for all

The study has underlined the central importance of *how* digital tools are activated to realise educational benefits. Despite the importance of ensuring that learners have access to digital technology, it is clear that access alone is not a guarantor of learning outcomes, and that **teachers and learners require specific pedagogically-oriented digital skills to integrate digital technologies into teaching and learning practice effectively**. The desk research and case studies illustrated how digital tools are the most effective where they are designed to enhance high-quality instruction, rather than to replace it. Similarly, research shows that an over-reliance on ICT without a pedagogical justification can be counterproductive.

The question of teacher competences warrants closer attention. While there is widespread recognition of the importance of up-skilling teachers to make effective use of technologies, the research found that teacher digital competences are often taken to mean different things when described within individual studies or practice examples. The most recent TALIS data on the CPD needs of teachers differentiates between the digital competences that teachers require for everyday life and those needed to apply

technologies within the classroom.[734] The EU frameworks and self-assessment tools go further to provide a common language and structure for citizens and learners (DigComp), educators (DigCompEdu and TET-SAT) and schools (DigCompOrg / SELFIE).[735] The widespread use of these tools and frameworks would seem beneficial to make training resources more transferable between schools and teachers across Europe – especially with greater openness to look beyond national boundaries to source professional resources following the COVID-19 crisis.

The literature provides a wealth of evidence regarding the **specific educational benefits of digital tools**, although these are not always routinely captured or reported upon within policy and practice. In particular, the distinction is not always made between the use of digital technologies to enhance *learner experiences,* and their role in the *acquisition of key competences*. These two types of outcomes are closely interlinked but one does not always result from the other. There is also a rather mixed evidence base regarding the efficacy of specific educational tools or methods, owing in part to the need for more controlled studies as well as systematic monitoring and evaluation, but also to inconsistencies in how learning goals are defined.

Nevertheless, a number of general conclusions can be drawn:

- First, there is strong evidence, backed by scientific research, regarding the potential benefits of digital tools for learners' **cognitive development**, and supporting the acquisition of higher-level thinking skills. These outcomes are particularly well documented for coding and programming-based tools, and for the 'gamification' of curriculum content.
- The appropriate use of digital tools can also equip learners with **transversal skills**, such as information literacy, communication, creativity and digital literacy, while VAR can offer safe spaces for learners to acquire **technical skills** in a simulated environment, where mistakes could otherwise prove expensive, impractical or potentially dangerous in a real-world context.
- Despite concerns about the use of digital tools in pre-school settings, studies also demonstrate benefits from utilising digital tools for learning in ECEC, **laying the early foundations for digital literacy** and supporting the pre-school to primary transition. Specifically, the appropriate uses of screen-based technologies for educator-child interactions and digital play have been shown to have benefits for movement, coordination and imagination in young children, the development of fine motor skills, and early language and literacy development. This is in sharp contrast with the view that early exposure to (especially screen-based) digital technologies within ECEC may inhibit creativity.

The social dimensions of education technologies in **enhancing collaboration and widening access to places beyond the classroom** are also reflected strongly in the research. The examples documented in the report range from the use of video content to assist with intercultural learning, by providing glimpses of other cultures and traditions; opening-up ECEC settings to parents for a more visible, real-time observation and participation in their child's learning; and, aiding teacher-learner interaction through the use of digital platforms for formative assessment with the enhanced opportunities

[734] OECD (2019) *op. cit.*
[735] https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

this brings for timely feedback and personalisation (whether one to one interacting through VLEs, with entire classes via online polling, online portfolios, and so on).

Alongside promising practices, the study has provided an opportunity to identify where there are **potential knowledge gaps, or unexploited opportunities**. We found that, while there has been deeper integration of digital technologies within STEM subjects, this is not always the case in the arts and humanities – a potential opportunity given the transversal application of digital technologies for key skills and literacy development noted in previous chapters. Survey data also show the potential for leveraging more systematic use of digital technologies in European schools, as underlined by the findings that three quarters of secondary school students reported having never or almost never engaged in coding or programming at school,[736] and one quarter of school leaders cited the inadequate use of digital technologies as a barrier to improving teaching quality.

From 'hearts and minds' to behavioural change

Putting this learning into practice, the subject of *agency* comes to the fore[737]. School leaders, teachers and learners require the opportunities to acquire key competencies needed for 21st Century learning, citizenship and future work, but **the recognition or acceptance of digital technologies is not guaranteed**. We have considered in the report how, for example, professional and public attitudes towards the digitalisation of pre-school settings have been somewhat polarised. Similarly, the willingness for teachers to embrace digital technologies is reflective of personal attitudes and beliefs and moderated by factors such as age, experience, and perceived relevance of digitalisation to teaching and learning. Furthermore, even methods that have been tested and validated under experimental conditions are subject to a degree of 'real world' uncertainty when applied within particular settings and mediated by the actions of particular school leaders, teachers, parents and learners.

To address these issues holistically, an important conclusion of this report is that a strategic approach is needed to integrate digital tools and approaches into classrooms and into home learning environments, requiring **strong and effective school leadership** and **whole school approaches** towards digitalisation incorporating strategy development, funding alignment, cooperation and distributed responsibilities. The literature review and numerous examples documented in the study attest to the importance of school leaders being knowledgeable and aware of the benefits of digital tools, setting a vision, and keeping open channels of communication with the whole school community to address their hopes and fears about technology.

The connection between school leadership and teacher agency is particularly apparent from the research. In previous chapters, we reported how international surveys show that teachers who perceive school leaders to be supportive of innovative practice are also more likely to hold a positive view about the role of digital technologies within teaching and learning.[738] This is supported by the wider body of research examined for the study, which underlines the importance of collaboration and empowerment to build

[736] https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education
[737] In the educational context, we understand agency to refer to a respectful and more empowered positioning of students to be active agents in their own learning lives. Student agency encompasses the power of possibility in learning contexts with personal desire and the will to act.
[738] Perrotta (2013) *op. cit.*

teachers' and parents' intrinsic motivation for the use of digital tools, rather than focusing on compliance alone.

A diverse but unequal EU digital ecosystem

The study aimed to establish how digital technologies in compulsory education can promote the inclusion of all learners. Having considered the levers for activating digital tools, it is necessary to reflect on actions that may be required at EU and national levels to establish technological, pedagogical and infrastructural conditions for ensuring inclusive digital education.

There is a clear message from the study that **the state of digital education across Europe is far from a level playing field**, both in terms of between-country and within-country comparisons. Surveys and research conducted in recent years reveal a varied picture regarding household connectivity and access to digital tools, the extent to which classrooms are "*digitally equipped*" for inclusive education, and levels of digital competences among teachers and learners. Similarly, the differences between levels of education are stark – characterised by a diminishing use of digital tools in educational settings moving downwards from secondary, to primary and ECEC stages respectively. The fact that digital technologies were integrated to teaching and learning at pre-school stage in fewer than half of EU Member States prior to the COVID-19 crisis is particularly revealing in this respect.[739] This would appear to run contrary to other areas of educational policy, where investment in ECEC has been a strategic priority to lay the foundations for the acquisition of key competences during compulsory schooling.

One of the implications is that a one-size-fits-all approach to digital education is unlikely to be successful, and that national policy responses by EU Member States must be contextualised in view of the differences in prior levels of digital infrastructure, educational expenditure and resource uses within the system; the relative degree of centralisation of national education systems; and the varying degrees of autonomy afforded to schools. While there are red threads to digital policies and strategies, policy learning may be best focussed on schools, municipalities or ministries who face similar challenges, rather than seeking to replicate the models that have proven effective within countries with very different structural conditions.

Lessons from a crisis – scalability and sustainability

The timing of the study allowed for a consideration of national responses to the COVID-19 pandemic, and the watershed that this represented in **how digital technologies have been utilised to maintain access to education before, during, and beyond the crisis**. As we have shown in the report, the pre-COVID-19 situation provides valuable insights to the historical development of digital technologies within education systems in Europe. We reported how Member States typically maintained digital education under the umbrella of a wider digital strategy and with a main focus on infrastructure. Many had leveraged national and EU funds to support education objectives in tandem with large-scale regional development or public sector reforms. Those with more embedded digital education arrangements had often benefited from relative policy stability and continuity, allowing time for initiatives to take root.

[739] Ecorys country mapping findings.

The COVID-19 crisis stress-tested these arrangements to a significant degree. At one level, the crisis has compounded existing inequalities, underlining the scale of Digital Divide issues within Member States and the inevitable disruption caused by a rapid shift to distance learning on an unprecedented scale. At the same time, however, the crisis gave new impetus to policy and legislation regulating the use of digital technologies within education. Where reforms were already planned or underway in many Member States, it pushed digitalisation up the policy agenda and leveraged additional resources, facilitated by emergency legislation that had allowed for a more radical movement of resources within systems. At a grassroots level, the crisis saw the emergence of new teacher professional networks, and collaborative forms of home-school communication.

The research carried out for the study suggests that common factors were present where countries experienced greater success in maintaining educational access. Some of these related to the actions that were taken (*intervention factors*), and some reflected the underlying status and characteristics of digital education and the infrastructure and resources within systems (*structural factors*). Most notably:

- **System leadership was a common enabling factor in managing the transition to remote learning**. Countries invariably secured a higher level of cross-sectoral support where there was a pro-active and ambitious approach towards addressing the challenges presented by the crisis. This was reflected within broad and inclusive governance arrangements and an action plan combining infrastructural, informational and pedagogical measures, and supported by a mixed funding portfolio. Such measures were not exclusive to centralised education systems, and some countries with high levels of autonomy had taken steps to secure pedagogical continuity but had done so within a clear policy framework, access to professional networks, and distributed leadership within schools.

  Where this leadership was perceived to be lacking, Member States generally encountered challenges relating to the uneven distribution of resources; a lack of coherence in the pedagogical approaches taken by individual schools and confusion regarding public information about digital education and access to resources and training. These scenarios also tended to perpetuate existing structural inequalities, with better digitally-equipped schools more likely to adapt.

- **The smart use of data and feedback** was a further characteristic of countries that responded quickly and effectively to ensure continuity following school closures. Member States were better equipped to (re)aim and (re)prioritise resources where this was data-led, based on monitoring and surveys and supported by consensus-building and public dialogue. In a number of instances, large-scale teacher and school leader surveys were pivotal in identifying training needs and informed the set-up of remote teacher education programmes delivered through MOOCs and OERs while schools were closed.

- **Pedagogical activation emerged as being critically important.** A number of Member States had used the emergency measures initiated during the crisis to design new flagship digitalisation programmes, or to scale up efforts that were already in train. Perhaps tellingly, the objectives of many of these reforms go beyond the massification of ICTs per se. Instead, they place a stronger emphasis on the social and behavioural aspects of integrating digital tools, and the need to align education, welfare and economic objectives.

Conversely, some Member States performing above average on key measures relating to schools' infrastructure and teacher digital skills encountered greater difficulties than anticipated in responding to the crisis, due to a lack of preparedness for distance learning. It was not so much a lack of availability of digital tools that was the problem, but rather that teachers, students and school leaders were not fully able to benefit due to gaps in their knowledge and experience within the context of distance learning.

The key test is whether the crisis is indeed a "*point of no return*[740]" for the use of digital tools in EU education systems as anticipated within the DEAP, or whether this momentum is lost. It falls beyond the timescales of the study to answer conclusively.

6.2 Digital technologies promoting inclusion for learners with different learning needs

Going digital; traditionally and newly excluded groups

As seen in chapter 2, countries across the EU27 have different understandings of the term 'vulnerable learners' and the conditions for different learner groups vary greatly across Member States, regions, and even schools. Nonetheless, a number of learner groups have been identified throughout this study as particularly susceptible to educational exclusion. These groups include:

- learners with special educational needs or disabilities;
- learners from low socio-economic backgrounds;
- migrant-learners generally and refugee learners in particular;
- high- and low-achievers;
- learners in rural/ isolated locations;
- learners with mental health and/or emotional problems;
- learners with tumultuous/difficult home lives;
- Learners in detention and care;
- LGBTQI+ learners;
- ethnic and religious minority learners generally, and Roma/ traveller community learners in particular;
- underachieving boys;
- learners with addictions (e.g. gaming/gambling addictions) and;
- learners with long-term illnesses.

At the same time, an important finding of this study, is that when looking specifically at digital skills in compulsory education, the picture regarding vulnerability changes somewhat. More specifically, **some learner groups traditionally at risk of educational underachievement and exclusion listed above, appear to fare considerably better overall in digital skills** than in other subjects, while other vulnerable learner-groups appear marginalised in novel ways.

For instance, while access does not always translate to skills, **the experience of a number of EU countries shows that when close to all students have easy**

[740] European Commission (2020) *op. cit.*

access to digital infrastructure, some traditionally marginalised learner groups are in fact able to significantly bridge the digital skills gap. For example, performance differences in digital skills due to migrant backgrounds is not very pronounced in the Nordic countries compared to EU/OECD averages. This is an important finding, when noting that the performance gap for learners with a migrant background in these countries far exceeds the EU/OECD averages in other subjects. For instance, the Danish gap stands at twice the EU average in reading.[741] This same pattern of considerably levelling the playing field in digital skills by way of near universal access can also be observed for learners with low socio-economic status in the Nordic countries.

On the other hand, while assistive technologies can be a great tool to promote access to education for **SEND-learners**, our findings show that navigating online can present novel challenges for this diverse learner group. In particular, **young people with physical, mental or behavioural disabilities are far more likely to experience threats, aggressive behaviour and bullying on social media.**[742] Learners with cognitive disabilities may also be particularly susceptible to being taken advantage of online, where everything from sending compromising pictures to sharing financial data can have grave socio-emotional or financial implications.[743] In this sense, many SEN-learners might find themselves at heightened risk, which should in turn be reflected in how schools equip learners with special needs with the tools to thrive, and connect with others online, in an increasingly digital world.

Moreover, the data show that even when all learners have steady access to the internet and sufficient skills, **socio-economic status and other key learner characteristics still appears to reproduce disparities in *how* students use technology outside of the classroom**. For instance, advantaged students appear more likely than disadvantaged students to search for information or read news online. Disadvantaged students, on the other hand, can be observed to use the internet to chat or play videogames at least as often as advantaged students do.[744] This divide is mirrored by adult users, with online services used much less frequently by people with a low-income and low-education level.[745] With education administration moving increasingly online, a caution should be made here about the importance of ensuring that low-income parents (and their children) are not at an increasing disadvantage for enrolment and staying up-to-date with information provided by the school as a result.

In addition, secondary data from across the EU27 has uncovered an unequal use of digital technologies at ECEC and compulsory education levels based on **gender**. In particular, findings from several EU27 countries suggest that boys tend to engage in more diverse uses of technology (already at ECEC level), and that they more frequently use technology in a 'behind-the-scenes'-way, e.g. reporting having experimented with controlling a robot.[746] This is an important finding, as getting a sense of how digital

[741] https://op.europa.eu/en/publication-detail/-/publication/3fe7eba2-2496-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316210
[742] Statens medieråd, 2017. Ungar & medier. https://www.statensmedierad.se/rapporter-och-analyser/material-rapporter-och-analyser/ungar--medier-2017
[743] https://www.osonline.dk/
[744] See, for example, https://www.oecd-ilibrary.org/docserver/5jlv8zq6hw43-en.pdf?expires=1629276562&id=id&accname=guest&checksum=40BA1AD5AC1F7852E8CC634F0593B16D
[745] See for example: Digital Dashboard. The digital barometer of the federal government. https://digitaldashboard.belgium.be/en
[746] https://media-and-learning.eu/type/featured-articles/early-years-education-and-digital-media-in-denmark/

technologies are designed and function (i.e. 'computational thinking') is an increasingly important part of digital literacy.

Targeted digital inclusion measures are not common

The research concludes that, prior to the shock of the COVID-19 crisis, EU Member States had mixed success with using digital tools to support inclusion. **On the one hand, digital education strategies have typically been designed with all learners in mind, without sufficient attention to the specific barriers faced by marginalised learners or groups. On the other hand, inclusive education measures have not always included a clear 'digital' dimension**.

Where the social and digital dimensions have been brought together to support vulnerable learner groups most strategically at system-level across the EU27, appears to be in the case of SEND-learners, largely driven by strategic initiatives to ensure that assistive technologies widen access to education generally, and in some Member States to ensure that digital tools are employed to support the transition of SEND-learners from special education schools into mainstream education specifically. Interconnectedly, there is also a much stronger evidence base regarding the potential of inclusion through digital tools for this learner group. On the other hand, **digital inclusion for other identified vulnerable learner groups has typically been in the form of piece-meal, bottom-up initiatives without a guiding framework at system level.**

Our findings indicate, however, that **this has somewhat changed with COVID-19, with many Member States putting in place targeted digital inclusion initiatives for vulnerable learner groups.** This has included providing access to ICT devices and internet for students in vulnerable regional zones, many of whom are SES-learners, learners from migrant and ethnic minority backgrounds and rural learners. Regional and national policy makers across the EU27 also appear to have paid close attention to participation rates in distance learning among vulnerable learners, as well as the take-up of digital learning resources among at-risk groups. Special efforts have also been made to support students with special education needs and disabilities during online learning, albeit with varying success. While many of these initiatives have been introduced as emergency responses, the crisis has prompted a stronger action on digital inclusion across the EU that is likely to linger after the crisis. As such, education systems have the opportunity to scale up effective responses implemented during COVID-19 to address challenges facing vulnerable learner groups and adapt them in the post COVID-19 settings to foster equity and inclusion for all students.

Moreover, while initial and continuing teacher education in many EU Member States has become increasingly attuned to the importance of supporting teachers' digital competence development, our findings suggest that **preparing teachers for multicultural or multilingual settings, as well as the inclusion of learners with special needs, is generally lagging**, which can also limit the ways in which digital learning tools and approaches are integrated into teaching and learning for inclusion purposes.[747] To this end, some of the initiatives to address the different needs of vulnerable students during the COVID-19 crisis, including differentiated instruction and

[747] https://op.europa.eu/en/publication-detail/-/publication/3fe7eba2-2496-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-171316210

strategies to identify and reach at risk learners, could also represent an important starting point beyond the pandemic to work towards *all teachers* being equipped with the skills and tools (digital or otherwise) to teach *all learners*.

Digital tools and inclusion for specific vulnerable learner groups

As a crucial disclaimer, it is important to acknowledge the vast diversity within each vulnerable learner group identified throughout this study. This will be further emphasised in section 6.2.4 below. Nonetheless, based on evidence collected from across the EU27, the below section will proceed to highlight some of the key identified opportunities for digital tools to enhance learning across ECEC, primary and secondary education (including VET) for specific groups at risk of marginalisation.

SEND-learners

SEND-learners with developmental and attention problems

In promoting the increased academic and social inclusion of learners with developmental and attention problems in compulsory education, our research suggests that digital tools could be incorporated for a number of purposes.

Firstly, technologies could be particularly useful in **shielding this learner group from distracting sound, light, sight and movements, making it easier to focus and maintain concentration**. For instance, research from the study Ididakt found that Danish schools have used several different IT-based interventions successfully to shield learners with attention difficulties from impressions and increase their focus on teaching activities. Some of the most valuable tools identified included hearing protection or quiet music via headsets, sound amplifications (e.g. comfort audio system) and virtual participation systems.[748]

Our research findings further suggest that digitally-supported interventions can contribute to **increased engagement, production and dissemination**, uncovering numerous examples where students with developmental and attention problems have used digital writing templates, multimodal production programmes and digital technologies for these purposes. For instance, insights from a Swedish gamification project aimed at mainstream and SEN schools suggested that this learner group's engagement was higher than normal when exposed to gamification, with a significant improvement in the children's ability to stay on task for longer periods of time[749]. Whereas typically children in this group would be able to sustain their engagement (in planning and writing) for no more than 15 minutes at a time, the children reportedly remained on task for more than 35 minutes. Increases in the overall volume of work produced were also observed. Lastly, the children were also reportedly able to better

[748] Ididakt (2016). Fokuselevers udfordringer i forhold til skærmning og focus: http://ididakt.dk/interventioner/skaermning-fokus/
[749] Games for learning (2020), available here: http://www.gamesforlearning.se/

communicate their ideas and plans to peers as well as to supporting adults, once they had completed tasks such as 3D planning.[750]

Recent studies identified through our desk research, also show that the use of digital tools could generally increase **learners with developmental and attention problems' ability to oversee and follow through on the school day's activities, self-monitor and complete tasks**.[751] Key digital tools identified to support structure and overview include visualisations (*e.g*. digital documents, pictograms, checkboxes, forms, lists), time-management tools (*e.g.* digital clock resources), templates (*e.g.* PowerPoints, Word, BookCreator, Google Apps), digital calendars (*e.g.* MobilizeMe, Planet), portfolios *(e.g*. Google Sites, Showbie), learning platforms (*e.g.* SkoleIntra, Meebook, Google Apps for Education), and other tools like alarm functions, notifications, videoclips and coping tools.

As such, digital interventions hold the potential to enable this learner group to increase their overall focus and production, control learning process and experience ownership, independence and self-mastery in conducting specific learning tasks.

SEN-learners with reading disabilities

Our study shows numerous benefits from the use of digital tools for learners with reading disabilities. The most obvious benefit refers to the use of **assistive technologies**, such as text-to-speech technology, supporting learners with access to written text. Some key tools highlighted throughout the study includes:

- Laptops with pre-installed reading and writing supportive software;
- C-pens that can read out single words and short sentences;
- hand-held scanners that convert text into sound, and;
- headphones with microphones.

A somewhat less evident finding, however, relate to the observation that digital tools are increasingly leveraged to **support the early identification of learners struggling to read**. For instance, AI is progressively used to recognise correlations and patterns in eye movement data in order to determine students' reading levels. More specifically, tools like Lexplore[752], identified through our case study research, make their analysis by tracing how a reader's eyes follow words in sequential (or non-sequential) order looking for patterns. Readers at low risk for dyslexia tend to make more progressive movements—from left to right—as they scan words. Dyslexic readers on the other hand make more regressive movements—right to left movements—and do not make regular pauses (or fixations) during reading in the same way non-dyslexic readers do. As such, this unique high-tech process can provide teachers with real-time data for intervention that directly correlates to a student's reading capability (as well as detecting dyslexia).

[750] Ibid
[751] See for example: Andersen, H. V., & Sorensen, E. K. (2016). Powerlessness or Omnipotence – the Impact of Structuring Technologies in Learning Processes for Children with Attention and Developmental Deficits. Presented at the 1st EAI International Conference on Design, Learning & Innovation, Esbjerg. See also: Ididakt (2016), structure on overlink: http://ididakt.dk/interventioner/struktur-og-overblik/
[752] https://www.lexplore.com/

SEN-learners with physical disabilities

As evidenced by the literature, digital tools can also help learners to **overcome physical impediments**, e.g. by way of hearing aids for learners with hearing difficulties, and audio tools/ braille readers for those who struggle with their vision; and tools for those with mobility issues, such as micro-switches (e.g. personal and accessible equipment controls)[753]. Going one step further, however, AR and VR digital tools are increasingly used to help learners with physical mobility issues access physical training activities through simulations.[754]

Learners with long-term illnesses

As evidenced by practices identified through this study, learners with long-term illnesses unable to physically attend learning environments with their peers can also significantly benefit from digital tools. These benefits can be organised into two overarching categories:

Firstly, digital tools can **support learning continuity** for learners experiencing extended school absenteeism, with digital tools ensuring that learners stay connected to what is happening in the classroom, *e.g*. through the use of interactive communication tools. This can facilitate comprehension by allowing learners to see and hear the teacher's explanations, as well as their classmates' questions, while also facilitating participation in academic discussions and group work in real-time.

Moreover, extended absenteeism in learners can lead to serious socio-emotional challenges.[755] For instance, upon return to school after cancer treatment, recent evidence suggests that around 50% of children and adolescents experience social, psychological or school-related problems resulting in 20% of affected learners repeating a grade.[756] Commonly cited reasons for challenges in returning to school include psychosocial problems, such as social exclusion, fear of peer rejection and bullying. Here, digital tools can play a key role in **supporting the socio-emotional well-being** of these learners. For instance, our research suggests that **the use of digital avatars, such as telepresence robots, can create meaningful social interactions between learners with long-term illnesses and their school environments.** In Denmark, AV1 robots have been reported as highly effective as a physical representation of sick learners in the classroom, even for young children (i.e. primary

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[753] Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using Assistive Technology in Teaching Children with Learning Disabilities in the 21st Century. Journal of Education and Practice, 6(24), 14-20; Akpan, J. P., & Beard, L. A. (2013). Overview of Assistive Technology Possibilities for Teachers to Enhance Academic Outcomes of All Students. *Universal Journal of Educational Research*, *1*(2), 113-118.

[754] See for instance COSMO (cognitive support in manufacturing operations), an imec.icon project, which was funded by the Agency for Innovation and Entrepreneurship of the Flemish Ministry. As part of this project, virtual reality (VR) and augmented reality (AR) experts, schools and companies collaborated to develop safe and effective work-based learning methods with VR and AR technology for SEN schools: https://www.imec.be/nl/research-portfolio/cosmo#about

[755] For example: Helms, A. S., Schmiegelow, K., Brok, J., Johansen, C., Thorsteinsson, T., Simovska, V., & Larsen, H. B. (2016). *Facilitation of school re-entry and peer acceptance of children with cancer: A review and meta-analysis of intervention studies*. European Journal of Cancer Care (Engl), 25(1), 170–179. https://doi.org/10.1111/ecc.12230 *or* Sandeberg, M., Johansson, E., Bjork, O., & Wettergren, L. (2008). *Healthrelated quality of life relates to school attendance in children on treatment for cancer*. Journal of Pediatric Oncology Nursing. 265–274. https://doi.org/10.1177/10434 54208 321119

756 See for example, Helms, A. S., Schmiegelow, K., Brok, J., Johansen, C., Thorsteinsson, T., Simovska, V., & Larsen, H. B. (2016). Facilitation of school re-entry and peer acceptance of children with cancer: A review and meta-analysis of intervention studies. European Journal of Cancer Care (Engl), 25(1), 170–179. https://doi.org/10.1111/ecc.12230

school learners). This is made particularly evident through the frequent personalisation of such telerobots by teachers and peers, *e.g.* through classmates gently touching the telerobot's cheek to comfort the learner or conducting other comforting physical gestures directed at the robot, or learners themselves using terms like 'me' and 'I' when referring to the AV1.[757]

Consultations with beneficiaries conducted in the context of the Belgian initiative BedNet for physically absent learners, also suggested that this social element was particularly important for the long-term sick, whereas the chronically-ill deemed the social connection with school a less important feature of their remote learning offer, likely because the latter beneficiaries often still combined Bednet with going to school[758].

Migrant learners and ethnic minority learners

In terms of key benefits for migrant and ethnic minority learners, our research study has identified two key aspects, namely i. multilingual learning tools, ii. digital tools as a cultural mediator.

Firstly, digital tools can help to **bridge the language barrier for migrant learners, while also drawing on the children's home languages as a rich resource for continued learning**, for instance through online translation apps or the integration of digital multilingual books into teaching activities. In Sweden, Umeå's municipal preschools have purchased a municipal licence to the app Polyglutt, a digital bookshelf for working with language development and literature in preschools. The app has an inclusive focus and has been designed to provide multilingual children with means to develop their language skills in both the Swedish language and their mother tongue, while strengthening their cultural identity. The service is used by 360 000 children and offers more than 2000 books in Swedish and 58 other languages. Additionally, the Polyglutt "Home access" feature allows children to bring books home and read together with their parents. A key observation here made by interviewees for the study, was that language skills tend to spill over between languages, and that by developing their mother tongue, a child would be likely to improve their skills in the language of instruction as well.[759]

The evidence further suggests that digital tools can be used to support cultural mediation for children of different ethnic and cultural backgrounds, especially for younger children (i.e. ECEC and primary). More specifically, our findings suggest that **digital tools could play a key role in promoting cultural and ethnic open-mindedness** by offering young children a glimpse of children's lives in other cultures and allowing them to draw upon multimedia resources from across the world to enhance their cultural literacy[760]. Practices observed include the use of interactive whiteboards to search for relevant maps, pictures and video clips to familiarise children with other

[757] https://onlinelibrary.wiley.com/doi/abs/10.1002/nop2.471
[758] https://www.bednet.be/tevreden-over-bednet/voldoet-bednet-aan-de-verwachtingen#:~:text=Wat%20is%20de%20impact%20van,kinderen%20via%20Bednet%20bereikt%20hebben.&text=G
[759] https://www.regeringen.se/4ad046/contentassets/73de9759ac8a41548fe7a7a7e3641b73/forskola-for-alla-barn--for-battre-sprakutveckling-i-svenska-sou-202067
[760] Masoumi, D (2015). Preschool teachers' use of ICTs: Towards a typology of practice. Available at: https://www.researchgate.net/publication/276462539_Preschool_teachers'_use_of_ICTs_Towards_a_typology_of_practice

children's lives, cultures and countries of origin. Such practices were deemed particularly successful in preschools and primary schools where a large number of the children were of immigrant backgrounds. Apart from enhancing children's cultural awareness, our findings suggest that digital tools can also help highlight cultural similarities. In this sense, digital tools can be leveraged to support cultural mediation to enhance young children's understanding and appreciation of cultural and ethnic diversity.[761]

Moreover, newly-arrived migrant children are likely to have rich, and often complex, stories that can be complicated for the children to relay, and there often aren't appropriate spaces made for these learners to share their stories in an educational context. In this sense, the use of digital tools that present images, videos and other audio-visual supports can represent a facilitating tool to communicate/share their background, heritage and personal stories. For example, the Story of My Life programme focuses on newly-arrived migrant children who do not speak the language of schooling and seeks to improve their digital skills and media literacy by involving them in creating narratives about their life stories and personal background through the use of digital tools and media[762].

Low and high achievers, as well as early school leavers

The research has further underlined the ways in which digital tools have the potential to **present new ways of learning for learners who have struggled with traditional pedagogies, for instance by make learning more practically oriented** through visual or immersive tools and approaches (e.g. AR, VR, gamification), in areas where learning has traditionally been more abstract.

It can also help to **persuade learners who are de-motivated or disengaged to re-engage by way of micro-learning**, *e.g*. through short-cycle learning exercises with specific rewards accessible through mobile apps. An example of this is the Belgian *tickle tool*, where, upon completing an activity, the user is able to collect points, which they can use to "purchase" a reward through the app. Awards include, for example, vouchers to go to the cinema or for use in a local restaurant or café. In this way, such approaches can also seek to engage users in informal micro-learning activities outside of school, with the potential to incentivise learners who have already dropped out to find their way back to more formal learning at school.

Similarly, stakeholders interviewed in the context of this study also stressed the importance of using digital tools with low-achieving learners to **provide them with the additional guidance and support** needed to succeed at school. A key example of this relates to the existence of **digital tutoring systems**. Within this context, SAM-APP is a popular digital coach for learners with SEND in Belgium[763], while the digital assistants Jules and Maya are available to support all learners struggling with their homework in France[764].

[761] Thurston A (2004). Promoting multicultural education in the primary classroom: Broadband videoconferencing facilities and digital video. Computers & Education 43(1–2): 165–177.
[762] Link in de Kable. Story of my life. https://www.lidk.be/story-of-my-life
[763] imec. 'SAM'-APP. https://www.imec.be/sites/default/files/inline-files/Leaflet%20Smart%20Education_SAM-APP_2021.pdf
[764] https://jules.cned.fr/presentation/

Moreover, digital tools can be used to **support learning differentiation** to ensure that all learners, including particularly gifted learners, are challenged to learn at their level. For instance, digital tools can be used to facilitate learning by setting different questions for different pupils, depending on their ability or learning style. If students attempt tasks that are too difficult, they are likely to get frustrated and fail. But, by assessing pupils in a manner appropriate to them – and allowing pupils to work at different paces – technology can allow the needs of students with various backgrounds to be addressed in one classroom, so they are less liable to become disengaged, and more likely to succeed. In this context, AI softwares that employs machine learning holds particular promise, as they can detect patterns in written work, speech, and other actions, which can be individually adapted to students' learning styles and needs. [765]

Rural learners

Digital tools can also help **widen educational approaches and resources for rural schools**. For example, within the Small Schools project in Italy, the **dBook initiative** allows teachers to create a private WiFi network in the classroom. Once connected to the WiFi network with their devices (PC, laptop, tablet, and interactive whiteboard), dBook provides a range of novel tools dedicated to laboratory activities, without the need to install any hardware. Various software packages are available online within dBook.[766] All software is used with a normal browser and does not require any special installation.[767]

Another national Italian initiative for small schools organised by INDIRE is **the School on the Screen** (*La Scuola allo schermo*).[768] This initiative consists of the distribution of digital tools to access a collection of audiovisual resources targeted at teachers and school leaders. A repertoire of films, documentaries, short films, interviews, and other materials are available for use as teaching methods and tools.

Differentiation and learner agency

Beyond looking at specific learner groups, interviewees consulted for this study overwhelmingly urged practitioners to **remember the person sitting in front of the screen and taking the time to understand their reservations, goals and needs as individual users**. In understanding that there is a unique and complex individual putting the digital tools into practice, the importance of **differentiation** was thus reiterated. More specifically, while focusing on ensuring that certain vulnerable learner groups are not left behind, 'a one size fits all' for individual learner groups is unlikely to work, without also considering the diversity of learner needs for individual learners. **As such, a number of interviewees pointed to the potential of digital tools to support the *personalisation of learning* and to cater to individual learner needs through differentiation within and across 'vulnerable learner groups' as the**

[765] Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C. and Ananthanarayanan, V. (2017), "NMC horizon report: 2017 higher education edition", The New Media Consortium, Austin, TX, available at: http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf (accessed 05 March 2018).
[766] Software includes: MCloud: storage and sharing of your personal files; Doku: software for creating a class blog; SugarCAD: 3D modelling software; DStop: software for making stop motion or time lapse videos; synchronisation: software for sending documentation (created with Doku) within the repository shared between the dBooks located in the various schools. With this software it is also possible to consult the repository to review and download the documentation of the other institutes.
[767] INDIRE & Piccole Scuole. (2021, June 11). *dBook*. IL MODELLO DIDATTICO DBOOK. https://piccolescuole.indire.it/iniziative/dbook/
[768] INDIRE & Piccole Scuole. (2021, June 17). *La Scuola allo schermo*. https://piccolescuole.indire.it/iniziative/la-scuola-allo-schermo/

primary benefit of digital tools for inclusion. In this sense, it was advised that the choice of technologies and their use should be tailored to the needs of each learner to the degree possible, and also **consider the agency and views of the learners themselves**.

6.3 Recommendations

Drawing on the evidence outlined in the study, we present below a series of recommendations for key groups of stakeholders, organised by: (1) EU level stakeholders and (2) National (or regional) policymakers and practitioners in the field of education.

EU-level stakeholders

1. **To raise awareness about the potential of digital tools to support inclusion for all learners, as well as for specific vulnerable learner groups, and how the two goals can be mutually reinforcing**. Rather than keeping assistive technologies and universal ICT schemes apart, the study highlights that what works to promote inclusion for disadvantaged learners can benefit all, while learners from minority backgrounds often thrive where good quality digital education is universally available. The evidence base could be used to support awareness-raising activities, and as a source for designing potential future EU communication campaigns.

2. **To strengthen the wellbeing and citizenship dimensions of digital inclusion at European level, encouraging Member States to adopt digital strategies with broad and inclusive definitions of 'digital agency'.** In the wake of the COVID-19 crisis, wellbeing and citizenship digital strategies have increasingly featured in digital strategies, alongside academic attainment. The study showed the potential for digital tools to help overcome isolation (e.g. telepresence robots), widen access to mental health and wellbeing support, and in the acquisition of transversal skills. This broader remit for digitalisation might be helped by strengthening the wellbeing dimension of existing whole school tools and frameworks (e.g. SELFIE).

3. **To support the transfer and diffusion of small-scale digital innovations that have shown promise in addressing access, quality and inclusion.** The research uncovered a good number of promising examples of practices regarding the use of digital education for inclusive education, from a 'School in a Suitcase' to digital picture books opening classrooms to the life-worlds of SEND and multi-lingual learners (Polyglutt). Although some of these schemes have benefited from a combination of entrepreneurialism and good timing, others have suffered from being small scale or isolated. EU level stakeholders might wish to consider how EU funds (e.g. Erasmus+) could be leveraged to nurture talent, and to scale and replicate best practices.

4. **To shine a spotlight on digitalisation in ECEC, including further research and development to establish the fiscal, educational and economic case**. The study has shown that, despite mixed levels of access and use of digital tools in ECEC settings across Europe, there is incontrovertible evidence of benefits for even very young children if they are used in a pedagogically appropriate way. Improved levels of movement, cognitive development and fine motor skills are just some of

the outcomes demonstrated where gamification, coding or digital play have been successfully integrated to ECEC settings. Further research may be beneficial to consolidate the evidence base, with a particular focus on longer term outcomes.

5. **To provide guidelines and tools to support the more widespread use of monitoring and evaluation where digital tools are concerned**. This includes more systematic feedback from learners, parents and teachers on national and local responses to the COVID-19 recovery, drawing on examples where this has been well managed by Member States and the case study examples in the report. Additionally, a special Flash Eurobarometer to gather comparable EU level data from learners, parents and teachers on priorities for education during COVID-19 recovery would be beneficial to complement the established large-scale surveys such as ICILS, Eurostat and PISA-OECD.

6. **To consider the tools and levers at an EU level to promote and strengthen digital leadership within schools and public authorities**. The report has found quite compelling evidence for the importance of effective school leadership and strategy for digital education and inclusion, and indeed for equivalent system leadership roles at ministerial and municipal levels. Studies point towards a far more positive school climate and teacher attitudes towards digital technologies, where leaders have a clear vision for all things digital and adopt a whole school approach. EU funds and the Open Method of Cooperation (OMC) might be leveraged to assist with the development of new programmes of training, knowledge exchanges, and new opportunities for peer learning between school leaders (e.g. via E-Twinning).

7. **To ensure that all possible actions are being taken at EU level to support the development of multi-level governance within digital education**. This support might be leveraged in multiple ways, including investment in supporting EU level networks and communities of practice (e.g. through the Digital Education Hub); for teacher professional networks to access the tools they need to connect and grow, and for learners and their parents or carers to have a voice within key decisions that are taken by Ministries about policy and investment in their digital futures. It is imperative that learners are well represented at all levels, including in EU forums.

8. **To raise awareness and offer guidance on the use of EU tools designed to establish common definitions and standards for digital competences**. Tools and frameworks such as DigComp, DigCompEdu, TET-SAT and SELFIE are all well established and proven and offer a means to avoid wheel reinvention when Ministries and teacher education institutions are seeking to tackle digital skills gaps. There would be merit in ensuring that they are visible, and that sufficient guidance is available to support their implementation, while respecting diversity within the range of tools and approaches that have been developed by individual Member States.

9. **To conduct further research and pilots examining the most effective ways to engage teachers in recognising the value of digital education**, such as peer educator programmes, informational resources, and communication campaigns highlighting the teacher workload, wellbeing and educational benefits. This will require qualitative and quantitative data collection and analysis, with attention to different national education systems across the EU27 and seeking the views of educationalists in ECEC, primary and secondary and VET settings inclusively. It should not overlook professionals in welfare, counselling and family support roles.

10. **To prioritise overcoming language barriers to accessing digital tools and content, through the use of AI or auto translation**. On the one hand, the country mapping illustrated the extent to which issues of translation posed a challenge when mobilising digital learning content at scale during the COVID-19 crisis. Teachers and learners without the language of instruction, and indeed for those without English language proficiency, have clearly been at a relative disadvantage. SEND learners doubly so. On the other hand, the report has illustrated how digital tools can overcome language barriers through non-verbal communication, video, intercultural learning, and bringing home and classroom closer together. It has also highlighted the potential applications of AI to the development of new multi-lingual resources and realising the potential of non-textual formats. This important work should continue to be prioritised if digital education is to open and inclusive for all.

11. **To actively seek the voices of vulnerable learners** and/or their representatives (e.g. the European Agency for Special Needs and Inclusive Education, the European Roma Grassroots Organisations Network, Rural Youth Europe, the SIRIUS Policy Network on Migrant Education), in debate and action at EU level surrounding the challenges and opportunities of digital tools to promote learner inclusion. Their involvement is key to designing effective long-term digital inclusion solutions, for instance by ensuring that the solutions presented reflect a sufficient understanding of the societal marginalisation faced by these groups. Their involvement can also help to shed light on specific learner needs that may warrant targeted measures, while helping to ensure that such targeted approaches do not run the risk of undermining the immense diversity within specific learner groups.

National (and regional) policymakers and practitioners

1. **To capitalise on the education responses to the pandemic to promote equity and inclusion *beyond* the pandemic.** In particular, education systems have the opportunity to harness effective digital responses implemented during COVID-19 to address challenges facing vulnerable learner groups in the future (e.g. participative learning with stakeholders such as families and social workers to support vulnerable learners, the use of digital systems to monitor learners at risk). The crisis forced accelerated action in this regard, and there is a priority to draw on the learning from practice examples across Europe and not to lose momentum.

2. **To continue to foster intersectoral partnerships beyond the pandemic**. From a digital inclusion perspective, facilitating closer links between schools, the EdTech sector and representative organisations e.g. through support for EdTech testbeds, is an important area of consideration to bring the developments of the sector closer to the classroom generally, and the needs of vulnerable learner groups specifically. This raises question about governance, ethics and data rights where classrooms and private sector intersect, to ensure that education data governance is fit for purpose.

3. **To provide teachers with the necessary training and practical strategies** to use digital tools to implement differentiated and inclusive teaching. Here, it is also crucial that teachers receive sufficient practical training to support learners using digital tools in order to access education, i.e. learners using assistive technologies, to maximise the benefits of these tools for learners in the classroom and avoid these learners feeling unsupported or as burdens to their teachers or peers.

4. Linked to the above, to **ensure the availability of staff with technical competences** at school-level to strategically support teachers in bridging technical and pedagogical uses of different tools/platforms. This could take the form of ICT specialist leaders and leadership models that support teachers in transforming policies into realistic goals, so teachers can focus on putting these goals into action in the everyday teaching practice.

5. **Encourage more experimental uses of digital tools in pedagogical contexts**, particularly to foster playful approaches for younger learners stimulating important soft skills and transversal competences like creativity, innovation, cultural awareness and expression. National sources of innovation funding, or EU funds, provide potential sources to invest in innovation.

6. **To support key competence/transversal competence development**, **further integrating the use of digital tools,** e.g. by facilitating learning by doing through AR/VR-aided simulations. Such simulation approaches can also represent new ways of learning for learners that have struggled with traditional pedagogies, for instance by make learning more practically oriented. AR and VR digital tools can also help learners with physical mobility issues participate in physical training activities.

7. **To further develop blended learning approaches learning from the COVID-19 pandemic** – which differ from online learning. In this context, our findings suggest that "moderate" levels of integration of digital tools to facilitate flexible, mobile and self-paced learning, balanced with the in-person element of classroom-based learning to maintain social connection, engagement and well-being, is more effective than learning taking place solely on or off-line.

8. **To support for teachers' action research and networks where teachers can share practical insights** and participate in peer-learning on digital inclusion. Our findings suggest that such collegial support is highly effective in increasing teachers' confidence in their use of digital tools. This would also be a key tool in organising dissemination of innovation among teachers so that effective methods do not remain limited to the classroom in which they were invented and first tested.

9. **To ensure that digital competence development also considers tailored approaches in teaching digital citizenship and safety to learner groups that might be more vulnerable in navigating online**, such as SEND -learners. This will require a strong cross-sectoral approach so that national policy and funding responsibilities for education, cybersecurity and social inclusion are aligned, avoiding the compartmentalisation that has been a challenge in some Member States.

10. **To support further research regarding how AI can be leveraged to support early-intervention**, e.g. for learners with reading disabilities and other learning disorders in the classroom.

11. To identify, scale-up and disseminate successful approaches showcasing how **gamification and other digital approaches can support learner engagement and motivation**, particularly among low-achievers and learners at risk of dropping out, but also as relates to re-engaging learners that have already left formal education.

12. To identify, scale-up and disseminate successful approaches concerning how **multilingual tools such as digital bookshelves can help to support mother-tongue and language of instruction development** for ECEC and compulsory school-level migrant learners.

13. **To encourage the establishment of nationally and/or regionally coordinated and funded "digital resource-centers"** from which local schools can borrow digital equipment free of cost. This may help to support access and subsequent take up of more costly tools, e.g. AR, VR and AI, for all schools.

7.0 Annexes

Annex I - Research Questions

Linked to our research objectives, below is an overview of the research questions which will guide this study. These have been carefully crafted to link both to the literature identified as well as the overarching research questions.

The first research question in the terms of reference is "**how can digital technologies in compulsory education promote the inclusion of all learners**?"

To answer this question, it is firstly necessary to understand what "inclusion of all learners" means across the EU27 and the strategic appetite for promoting inclusive education:

1) How broad are Member States' definition of inclusion? Does this cover all learners? Does the definition consider equity?
2) To what extent do key strategic stakeholders (including politicians, school leaders, governors, and parents) "buy-in" to the concept of inclusive education?
3) What training and support have teachers received to enable them to effectively identify marginalised groups and adopt inclusive pedagogies to make the curriculum accessible at all?

Secondly, it is important to understand what **resources and frameworks**, if any, schools have at their disposal to promote the inclusion of all learners:

a) Do Member States have any policies or strategies in place for the use of technology in schools?
b) Is there "political appetite" for enabling technology to be integrated within compulsory education?
c) To what extent are learning environments across Europe traditional "chalk and board" environments or "multimedia learning environments"?
d) To what extent have Member States explored the use of, and invested in, new and emerging technologies including augmented and virtual reality and artificial intelligence in the classroom and VET settings?
e) To what extent have Member States invested in distance learning through compulsory education, such as massive open online courses (MOOCs), open education resources (OER) and open education platforms (OEP)?
f) To what extent has technology been effectively integrated within teaching pedagogies and curriculum delivery, and to what extent are such technologies responsive to the wider role and remit of schools, such as those pertaining to student welfare and wellbeing?
g) To what extent are technologies used to support student "choice" and "voice" in their learning?
h) What is the role and influence of young people's wider uses of digital technologies for leisure and non-formal learning, and in what ways does this intersect with school curricula and subject teaching?
i) How confident are teachers in the use of digital technology and what is being done across Member States to raise their competence?

j) What are the specific strengths, weaknesses, opportunities, and threats of integrating technology within (a) classroom and (b) VET settings?

The contextual information above will enable an informed investigation of how digital tools are effectively integrated to promote inclusion for all learners. The specific research questions, which are linked to our definition of inclusion as **access, equity, and quality**, are:

a) Do Member States have any policies or strategies in place for the use of technology to promote inclusive education?
b) Is there "political appetite" for technology within compulsory education to promote inclusion?
c) How are Member States using technology to meet the needs of young people deemed to be at risk of marginalisation in the classroom or VET settings?
d) Does technology have more of an impact on schools'/VET settings' ability to provide inclusive education when compared to more traditional forms of inclusive education?
e) Do young people have the necessary skills to access the digital economy and what is being done through compulsory education to ensure that this is the case for all?
f) Which Member States have used technology most effectively to improve inclusion in compulsory education?
g) How is inclusion, quality and access measured, and what methods are used to assess the effectiveness of policies and initiatives in this regard? Are these measures scalable and transferable?
h) What pedagogical models or curriculum delivery designs exist to deliver inclusive education using digital technology? To what extent are the best models identified scalable and transferable?
i) What provision for assistive technologies exists within each Member State to allow all learners, to access education? To what extent are the best models identified scalable and transferable?
j) To what extent are new and emerging forms of technology being used for inclusive education and what benefits do these add when compared to (a) other forms of digital technology and (b) traditional forms of inclusive education?

Through answering the questions above, we will have a detailed understanding of how, and under what circumstances, technologies can be effectively integrated into inclusive education. The second overarching research question is: "**what lessons can be learned as relates to learners with different learning needs, those living in remote areas, migrants and those from disadvantaged socio-economic backgrounds?**" This will be answered through the following questions:

a) What groups are at particular risk of marginalisation in terms of accessing education and digital tools across Member States (consider urban/ rural split, socio-economic disadvantage, ethnicity & first language)? How is this measured?
b) How, if at all, have Member States attempted to mitigate against the risk of marginalisation for these groups?
c) What digital and non-digital tools and resources do teachers and school leaders have to mitigate against marginalisation in schools? What are the strengths and weaknesses of these tools?
d) To what extent can the examples of policies, strategies, and innovative practices used to improve inclusion for all types of student groups also improve inclusion for

marginalised groups? To what extent are these policies, strategies, and innovative practices transferable and replicable across and between Member States?

Finally, we will look to explore the environment in which decisions around digital technology in education are made. This will involve exploring some of the short, medium- and long-term trends related to incorporating digital technology within education, including an exploration of COVID-19. This will cover:

a) How has the COVID-19 pandemic impacted upon the use of technology in compulsory education?
b) What lessons can be learned from Member States relating to how technology has been used to promote equality, access for all and to improve the quality of education provision?
c) What are the short, medium- and long-term considerations for Member States in effectively integrating digital technology into an inclusive education system?

Annex II - Research tools used during scoping and desk research stage

EU27 country mapping template

Country: XXXXX

Please complete all sections with [Insert answer here] *using information collected through desk research, systematically citing all sources of information by either using footnotes or endnotes. Please add the author, publication year, title, and place of publication for each reference (please do not just provide links).*

Throughout this document we refer to "primary", "secondary" and "VET". By primary, we mean ISCED Level 1 and by secondary we mean ISCED Levels 2 & 3. By VET we mean any vocational or technical education at ISCED Level 1-3. We also ask about Early Childhood Education and Care (ISCED 0) but only in one specific part of the template which is clearly marked.

To assist you with this task, we have included a list of relevant literature and policy documents to review (Annex A) as well as a summary of the available EU-level comparative datasets (Annex B). We have included tips throughout this document to signpost you to potentially relevant information across both Annexes. Please supplement with other relevant information for your country (including statistics, academic literature, and other publications) as appropriate. Please clearly indicate any gaps in evidence on this topic.

Part A: System-level & wider contextual factors

This section has three parts (A1-A3) and looks to understand the extent to which the education system in your country is structured in relation to the integration of digital technology. This includes understanding the extent to which COVID-19 may have changed how digital tools and resources are used in education, as well as looking at both the short and long-term implications of COVID-19 on the use of digital tools in education. In this section we also want to understand the pupil groups in your country which are most at risk of social exclusion and underachievement.

A1. How learners access compulsory education: pre-COVID-19 situation
Instructions for completing this table: *Please briefly describe below how digital tools are / were used to widen and improve access to compulsory education within your country pre-COVID-19. For each level of education, please cover the following:* *1. Tools / modes of access (e.g. remote learning, distance learning, blended learning);* *2. legislation or policies mandating how these arrangements are used;* *3. Funding provided for inclusive education using digital tools;* *4. target groups (types of schools or learners and circumstances);* *5. statistics or other evidence of the scale and extent of this provision.* *Please also use this section to provide information for primary, secondary and VET settings detailing what **assistive technology** is available to pupils across compulsory education and how this is funded (e.g. state funded through schools/ health care, or privately funded).*

If evidence is available, please make sure to also include differences by region or school type. Please also detail any local/ national legislation, guidance, or action plans to facilitate the provision of these resources.

*Note: **assistive technology** is defined as "any device or system that helps maintain or improve a person's ability to do things in everyday life". The term is commonly used to describe tools and resources used to help those with special needs or disabilities – particularly those with visual and hearing impairments, restricted movement and/ or learning difficulties. However, assistive technologies describe any technology used to help learners who struggle to access learning content. For instance, reading pens are useful tools for those who speak a different language to the text/ lesson being taught. This is because they translate words back to the user in a language they understand.*

*Please note that, for this question, we are referring to **business as usual** (i.e. the situation before the COVID-19 crisis). We cover COVID-19 related provision in the next question.*

Tip: Consult Annex B (Part A: Availability and use of ICT) for variables relevant to this section.

Pre-school (ISCED 0)	[Insert answer here]
Primary (ISCED 1)	[Insert answer here]
Secondary (ISCED 2&3)	[Insert answer here]
VET (ISCED 1-3)	[Insert answer here]

A.2 Groups at risk of exclusion and marginalisation

Instructions for completing this table:

*This table looks to capture **issues of inclusion** in your country, focusing specifically on groups known to be at risk of **marginalisation or underachievement**. In line with the analytical framework for our study, we are looking at **inclusion** from three angles:*

- ***Issues with access**. Here we mean any issues relating to (1) being unable to attend/access quality education provision, and (2) being unable to engage in learning activities due to a physical or mental condition.*
- ***Issues with teaching & learning.** Here we mean any pupil groups with 'below average' attainment and progress across subjects (with a focus on STEM, reading & writing).*

- ***Issues with equity***. *Here we mean any structural, societal, or cultural barriers which may impede pupils from achieving their full potential and stop them from having the basic skills and competences to participate fully in society.*

*Please provide **short sentences/ bullet points** (with references) outlining **issues with access, teaching & learning, and equity** for each pupil groups in your country at risk of marginalisation or exclusion. This may be based on qualitative reports/ inquiries at a national level or national statistics (a mix of both qualitative and quantitative data is preferred). This should include, but is not limited to, students:*

- *from an ethnic minority background (e.g. ROMA);*
- *who are early school leavers (ESL);*
- *living in a low-income household (e.g. socioeconomically disadvantaged);*
- *who have a special educational need or disability;*
- *who are migrant/ foreign born;*
- *living in a rural geographical location;*
- *who are low achievers or gifted and talented.*

Please expand this list as you see fit by identifying other pupil groups in your country which are most at risk of exclusion/ marginalisation.

Tip: Please consult Annex B (Part A: Access and use of internet and computers & Part A: Education outcomes) for variables relevant to this section.

[Insert answer here – please remember to provide bullet points specifically for students: from an ethnic minority background (e.g. ROMA); who are early school leavers (ESL); living in a low-income household (e.g. socioeconomically disadvantaged); who have a special educational need or disability; who are migrant/ foreign born; living in a rural geographical location; low achievers/ or gifted and talented].

A.3 How education providers have adapted to COVID-19.

Instructions for completing this table:

*Please provided details of **how** your country facilitated the continuation of learning through digital means in primary, secondary and VET (ISCED 1-3) settings that have been (or currently are) closed due to COVID-19. This includes any school closures which occurred as part of national lockdowns from March 2020, as well as any closures due to a more recent second lockdown.*

***We are looking for information at both a school and a national level**. If young people received no compulsory schooling during lockdown, or schools did not shut, please write this as your answer.*

*At **a national level**, this may include any country-wide state or private initiatives including, but not limited to, providing software/ hardware to students, offering e-learning or massive online open courses (MOOCS), offering free open educational resources (OER), and/ or providing education through different media (e.g. television).*

*At **a school level**, this may include any qualitative studies or statistics which indicate how schools taught students during lockdown (e.g. through Google Classrooms, Microsoft Teams, apps/ online resources, including any examples of collaboration between schools / pooling resources, etc. Where available, please also include evidence of worked well/ less well).* *Tip: A useful starting point for this section are documents routinely provided in Annex A. This includes, the 'Education and training monitor 2020', the OECD 'School Education During COVID-19: were teachers and students ready?', and the Cedefop report on the VET responses to the COVID-19 outbreak. Please note that not all of these documents will be available for your country.*

National level response to continuing education	[Insert answer here].
School level response to continuing education	[Insert answer here].

What where the main opportunities or barriers to accessing education during the COVID-19 crisis, for students at risk of marginalisation/ exclusion? *Where appropriate, please refer to the groups you identified as being most at risk of marginalisation and exclusion. Please use academic, government or other literature to inform your answers as well as any reliable statistics.* ***For barriers:** Please comment on any issues relating to: lack of access to physical digital tools or online educational resources; attendance, motivation, or engagement issues; and/or cultural, societal, or family barriers which made it harder for pupils to access digital resources in order to learn through COVID-19.* ***For opportunities:** Please comment on solutions identified to mobilise online resources, boost learner motivation and wellbeing, including partnership work with other services / agencies (e.g. social services, employment services), and re-modelling of parental engagement and home-school communication in response to COVID-19.*
[Insert answer here].
Of all of these emergency measures, which has proved the most successful and is (or is likely to be) continued as your country enters a "new normal" and beyond? *Please respond with reference to success for groups most at risk of marginalisation and exclusion. Please use academic, government or other literature to inform your answers as well as any reliable statistics, research, or evaluation evidence.*
[Insert answer here].

Part B: Institutional and individual practices and attitudes

*In this section (B1-B2) we explore **what provision is in place at a school level** for preparing schools and VET settings in your country to use digital tools to improve access, teaching & learning, and equity for excluded or marginalised groups. This includes looking at teacher training and competence in relation to the use of digital tools, and measures to raise digital competencies and skills. As part of this section, we also look at the reactions and attitudes of school and community stakeholders in addressing these challenges.*

B1. Digital tools and teaching & learning

Instructions for completing this table:

*Please use this table to comment on any national curriculums, guidance or advice on teaching digital skills and delivering digitally supported inclusive education across your country. Please complete this table using bullet points and/ or a few sentences for each question. Please provide references for all sources cited and, if appropriate, page numbers. Please remember to cover **all** areas of compulsory education in your country, including primary, secondary and VET settings (ISCED 1-3).*

*Under the **"national curriculum/ guidelines" heading**, if the **yes** box is checked, please **provide a reference to the document(s) for primary, secondary and VET** (ISCED 1-3) and outline what provision exists within this curriculum for (1) teaching young people digital skills and competencies, (2) the use of digital tools/ technologies in other areas of the curriculum, (3) delivering digital citizenship and/ or e-safety support. If **no,** please provide a general overview of how schools are (if at all) expected to offer this provision in your country.*

*Under the **"teaching education/training" heading**, we are looking for any national or local training/ CPD opportunities for teachers (practicing in ISCED 1-3 schools) to enable them to **effectively incorporate digital technology into their teaching practice**. This includes any training programmes ranging from beginner introductions to ICT use in the classroom, to more advanced training on how to effectively blend technology into pedagogical practice. Please note if any training identified is offered as part of initial teacher education/ training or is aimed toward teachers who are already practicing.*

*Under the **advice/ guidance for inclusive education heading**, If the **yes** box is checked, please **provide a reference to the document(s) for primary, secondary and VET** (ISCED 1-3)**,** and outline what provision exists within this advice/ guidance for using digital tools or technologies to support inclusion. If multiple documents exist (e.g. for special needs, Roma, low socio-economic status etc.) please provide references and comment on **all** documents. Please note that, here, we are not looking for strategic or policy documents but practical advice and guidance.*

Tip: Please Consult Annex B (Part B: Teachers' perceptions & practices) for some useful variables on professional development. Also look at Annex A for any policy documents/ literature relating to curriculum guidelines or advice for schools.

National curriculum/ guidelines for digital inclusive education/ digital skills/ e-citizenship & safety.	*Yes* ☐ *No* ☐	[Insert answer here].
Teacher education/training programmes in place for using digital technology.	*Yes* ☐ *No* ☐	[Insert answer here].
Advice/ guidance on using technology and digital tools for inclusive education in schools.	*Yes* ☐ *No* ☐	[Insert answer here].

B2. Individual reactions to policies and programmes

Instructions for completing this table:

*In this table, we go beyond **what** digital tools and technologies are available to schools, to explore **if and how they are used in the classroom** to support learners at risk of marginalisation or exclusion. As such, we are interested in whether schools are making **full use of the digital resources at their disposal to deliver inclusive education** and if so/ if not, why this might be the case***.

Please make sure to also focus on any differences by school type (e.g. state vs. private) or phase (e.g. primary, secondary or VET – ISCED 1-3). Please also ensure that this section is well evidenced and avoid conjecture.

Tip: Please Consult Annex B (All of Part B is relevant to this section). Please also consult the literature identified for your country as material relevant to this section may have been identified.

Making full use of digital tools

*Please **highlight any policy/ research studies or statistical outputs in your country which provide an indication of how, and to what extent, school leaders and teachers use the resources at their disposal to support inclusion in their day-to-day roles**. This may, for instance, include evidence from national surveys or peer-reviewed qualitative studies of:*

- *The amount of time teachers' spend using digital tools in delivering better lessons or assessment;*
- *The extent to which assistive technologies, and other digital tools designed to facilitate access, are not just available, but are incorporated into day-to-day practice to improve access for students;*
- *How or whether schools use digital tools for home-school communication, and to support parental engagement in students' learning;*
- *The extent to which schools adhere to any curriculum guidelines for teaching digital skills and e-safety or, where these do not exist, provide the provision regardless.*

In this section, please also highlight any evidence of the extent to which schools are using digital tools innovatively to find solutions to problems of inclusion in their settings. **Facilitating and hindering factors** *If evidence is available, please provide details of why schools are making the most of, or conversely not making the most of, the digital tools at their disposal to promote inclusion.* *For instance, this may be due to cultural barriers or facilitators within school/ communities which influence how digital tools/ inclusion is viewed. It may also relate to teachers feeling ready/ not ready to use the tools, or any structural indicators (e.g. enough/ not enough time in the school day, or enough/ not enough curricular/ pedagogical autonomy) which facilitate or hinder the use of digital tools for inclusion.*	
Do schools make full use of the digital tools at their disposal for supporting inclusion?	[Insert answer here].
Cultural attitudes/ beliefs which facilitate or hinder the use of digital technology in schools.	[Insert answer here].

Part C: Key policy initiatives and innovative practices

*In this section, we are looking to gain an overview of some of the **main policy initiatives, measures and innovative/ interesting projects (EU and national)** aimed at the use of digital tools and/ or resources to promote inclusion (access, quality teaching & learning, equity) in your country.*

Tip: Please consult Annex A. This contains information on the policy initiatives and measures identified by the Ecorys team based on an initial desktop assessment. Much of the information required to complete this table is included there. We are asking experts to validate this information using the table below and also to expand upon it if they know of other evidence which may exist elsewhere. This particularly applies to documents not available in English.

	Yes / No	**Name of strategy / policy**	**Year**	**Any reference to young people & specific groups at risk of exclusion/ marginalisation?** **(Please use direct quotes)**	**Any reference to using digital tools or resources?** **(Please use direct quotes)**	**Source**
Evidence of a National Action Plan on **digital skills &**	*Yes ☐* *No ☐*			[Insert answer here].	[Insert answer here].	*Insert link*

	Yes / No	Name of strategy / policy	Year	Any reference to young people & specific groups at risk of exclusion/ marginalisation? (Please use direct quotes)	Any reference to using digital tools or resources? (Please use direct quotes)	Source
competencies?						
Evidence of a National Action Plan on **inclusion**? [Or multiple plans if they are aimed at specific pupil groups – e.g. Roma]	*Yes* ☐ *No* ☐			[Insert answer here].	[Insert answer here].	*Insert link*
Evidence of a National Action Plan related to tackling **early school leaving** in compulsory education?	*Yes* ☐ *No* ☐			[Insert answer here].	[Insert answer here].	*Insert link*
Other key policy initiatives and/or measures (please complete)	*Yes* ☐ *No* ☐			[Insert answer here].	[Insert answer here].	*Insert link*

Description of key policy initiatives, programmes and/or projects

*Please identify and provide us with a short description of at least **three examples of policies, programmes or projects** that have been helped to widen access to education, improved teaching & learning quality or outcomes, or increasing equity within compulsory education in your country.*

Please consider for example national or regional policies, projects, or programmes, as well as larger EU- or ESF-funded projects. We are interested here in examples that are evidence-based and have shown some success (whether these are newer initiatives that might be considered 'promising', or whether they are supported by research and evaluation evidence).

Tip: Signposting to some policy initiatives (which require further exploration) identified for your country can be found in Annex A.

Title of the policy measure / initiative / project	
Aim of project	[Insert answer here].
Target group	[Insert answer here].
Level of education	[Insert answer here].
Short description	[Insert answer here].
Funding	[Insert answer here].
Main organisation(s) involved	[Insert answer here].
Outcomes or results (what was achieved, how, and with what supporting evidence?)	[Insert answer here].

Add more tables as appropriate.

Scoping interviews

Topic guide:

Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion

Topic guide for consultations with key policymakers and stakeholders

Background

Ecorys has been commissioned by the European Commission's Directorate-General for Education, Youth, Sport and Culture (DG EAC) to undertake a study titled ''Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion''.

The overall aim of the study is to gather evidence regarding the actual and potential role of digital technologies in promoting the inclusion of all learners in compulsory education (primary, secondary and VET). Over 12 months, from September 2020 to September 2021, the study will draw on the best available evidence to assess how digital technologies can promote the inclusion of all learners, and to identify key messages for learners with additional needs and/or disabilities, learners living in remote areas, migrant learners, and learners from disadvantaged socio-economic backgrounds. This will require a consideration of *what is happening, what should be happening, and how it could be made to happen*.

Based on the research conducted as part of our study – which will involve a mix of desk research (secondary data collection) covering all EU27 Member States and interviews (primary research) in selected Member States – the study will serve as an evidence-base, offering key recommendations to institutions and policy makers on the topic.

Study Objectives:

We have distilled seven key objectives for the study as follows:

- ✓ **Objective one**: To understand how technology is being used in compulsory education and VET settings across the EU27 to deliver a quality and inclusive education, particularly for those groups at risk of marginalisation
- ✓ **Objective two**: To explore the extent to which compulsory education systems across the EU27 are preparing young people for the "digital economy"
- ✓ **Objective three**: To understand how EU27 Member States are using technology to ensure access to compulsory education for all learners
- ✓ **Objective four:** To consider the barriers and obstacles which impede young people's and schools' ability to access and use digital technology to promote inclusion
- ✓ **Objective five**: To understand how the COVID-19 pandemic has impacted upon the use of technology in compulsory education.

- ✓ **Objective six**: To explore how digital technology has impacted upon teacher training and development to promote inclusive education.
- ✓ **Objective seven**: Through a detailed exploration of objectives one to six, isolate "lessons learned" relating to how technology has been used to promote quality education, access for all and improved equity.

Purpose of the scoping interview:

As part of the initial scoping for this study, we are carrying out a small number of interviews with key experts and stakeholders. The purpose of these interviews will be:

- To gain a better understanding of the policy framework and recent political and social developments surrounding the growing use of digital technologies in compulsory education and VET at EU-level, as well as how such practices can help to support those who are most at risk of social exclusion;
- To gather views on key literature (including data or studies not available in the public domain) and suggestions in relation to good practices to consult as part of our study.

Note on privacy and data protection:

Taking part in the study is voluntary. Ecorys and The European Institute of Education and Social Policy (EIESP) are entirely independent, and your views, personal data and opinions will be treated as confidential, in line with the EU's General Data Protection Regulation (GDPR).[769] We will not attribute quotes to any consultees. We will be using the evidence from the interviews to guide the next stages of our research.

Interview details	
Format	Online
Software	Microsoft Teams
Date of conduction	[To be filled in]
Researcher(s) responsible	[To be filled in]

[Researcher note – *please delete before sending to interviewees*:

Welcome, and thank you for giving up your time to be here today.

My name is [X], and I work for [an independent research company called Ecorys/ The European Institute of Education and Social Policy].

We are carrying out a study for DG EAC of the European Commission on Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion. The overall aim of the study is to gather evidence

regarding the actual and potential role of digital technologies in promoting the inclusion of all learners in compulsory education (primary, secondary and VET).

Before we start, there are just a few things that I wanted to explain:

- The information you share today will be used for research purposes only and will be deleted following the end of the project. You will not be named or identified in any reports.

- We will probably be speaking for around 45 minutes. I would like to record our conversation. This is for our internal use only, alongside our notes. The recordings will be deleted at the end of the project.

Do you have any questions before we begin?]

Questions

1. Respondent profile and expertise

- Please provide a brief overview of your role and the work of your organisation / unit including how / whether this relates to the core study themes:
    - Digital tools & technologies
    - Inclusive education

2. Global developments

- Please highlight your awareness of policy, research, and practice at an international scale, e.g. work of UNESCO, OECD, which might provide useful points of comparison for this study?
    - COVID-19 related
    - Pre-COVID

3. EU level developments

<u>Policy, legislation, and strategy</u>

- What are the main EU level policies in this area?
    - probe on awareness of and views about the effectiveness of the DEAP specifically
    - other EU level policies, funding, strategy, research:
        - digital competences
        - citizenship
        - online safety
        - e-learning
- How joined-up is this activity, e.g., synergies between work of EC DGs and EU Agencies?
    - any gaps
    - opportunities

<u>Research and practice</u>

- Are you aware of any EU-level research in this field?
    - studies evaluations, and what they show
    - sources of data they are aware of that might be useful

Member State level

- Could you please provide an overview of what is happening in EU regions and/or Member States to your knowledge, as relates to:
    - Trends and data relating to digital technologies and education on the subject of:
        - access

        - quality
        - inclusion
    - Differences according to:
        - ISCED Phase – ECEC / primary / secondary
        - Type of education (general education & VET)
        - universal vs targeted (the list in our brief)
    - In promoting the inclusion of learners:
        - The role of digitalisation in teacher training/ development
        - The role of families, wider community, and other stakeholders
    - What are the barriers / enablers?
    - What works? Examples of poor / good practice & evidence
        - In general
        - Anything more specific, e.g. probe:
            - Whole school approaches
            - Development of teachers and school leaders (ITE / CPD)
            - Teaching and learning / pedagogies
            - Student assessment
            - Assisted technology / learner support
            - Home-school communication & parental engagement
    - Signposting or recommendations to
        - Useful country case studies or projects
        - Programmes in particular MS

Wrapping up / suggestions

- What are your three main recommendations for the EC on how to maximise the potential of digital tools to promote access to school education?
- Do you have any nominations for other key stakeholders to interview (or to include in Delphi)?

[Thank and close]

Additional interviews – key messages

The key messages from the additional interviews are as follows:

Highlighted initiatives of relevance to the study

- **Network of Small Schools in rural areas**[770]. The Italian National Institute for Documentation, Innovation and Educational Research (INDIRE) - funded by the Ministry of Education – has promoted the creation of a network of Small Schools. The main objective is to promote the adoption of innovative teaching models (based around the use of digital tools) in schools of a reduced size in rural and/or isolated locations of Italy. The observation and support scheme that INDIRE uses with the networks of small schools allows it to identify and analyse models and methodologies that are transferable to other small Italian schools, thus launching a training/information provision scheme on how to improve teaching in these contexts.
- **The DREAMS project supporting Roma learners and their families**[771]**.** This project running from Sept 2019- March 2021, has aimed at fostering the social, civic and intercultural competences of low-skilled Roma parents through digital education in order to promote their social inclusion and tackle discrimination in schools, segregation, racism, bullying and violence. The idea was to strengthen the collaboration between schools and families to help Roma parents understand the problems their children face in schools, to learn and talk about their rights as parents in the school, to have their voices heard and involved in school activities.
- **ICT for Information Accessibility in Learning (2012–2015)**[772]. This was a multi-disciplinary network of European and international partners that represent both learning and ICT communities. Aims were to raise awareness and increase the visibility of the issue of accessible information provision and its relevance for equitable lifelong learning opportunities and to support accessible information provision within organisations through the development, trialling and evaluation of guidelines that build upon already existing work in the field. The main output of the project was the Guidelines for Accessible Information developed to support organisations (especially in education) in providing accessible information[773]. The Guidelines are also available on a separate project website as an online tool[774].
- **I-access: Accessible Information Provision for Lifelong Learning (2011)**[775]. The i-access project built on the premise that every organisation whose mission is to act as providers in the field of lifelong learning has a duty to make their information accessible for everyone and can do so by using innovative information and communication technology (ICT) solutions in a sustainable way.

[770] https://piccolescuole.indire.it/en/what-we-do/
[771] https://all-digital.org/projects/dreams/
[772] https://www.european-agency.org/projects/ict-information-accessibility-learning
[773] https://www.european-agency.org/resources/publications/guidelines-accessible-information
[774] https://www.ict4ial.eu/guidelines-accessible-information
[775] https://www.european-agency.org/projects/i-access

The main outcome was a project report presenting guiding principles and key areas for recommendations for information providers.[776]

- **ICT for Inclusion (2012–2013)**[777]. This project's aim was to explore how ICT can be used to support learning and teaching in inclusive settings. Outputs included a comprehensive review of European and international policy information[778], a review of research literature[779] relating to the use of ICT in inclusive education, individual country reports[780], the project synthesis report Information and Communication Technology for Inclusion – Developments and Opportunities for European Countries[781] and the ICT4I Policy Monitoring Framework[782] document accompanying the report, a tool for supporting the different phases of policy delivery.
- An interviewee also noted that the Roma Education Fund has piloted programs to invest in digital infrastructure and literacy programs for Roma learners and their families during COVID-19, and that such programs could inform the future design of larger programs looking beyond the crisis.[783]

Lessons from COVID-19

The impact of social isolation on vulnerable learners must not be overlooked. Interviewees stressed that learners have not only been losing out on educational support, but also the full spectrum of social and emotional support available in schools during the COVID-19 crisis. For instance, an interviewee noted that migrant learners may not yet be fully acclimatised and may struggle to maintain a social life without the opportunities afforded through school. Several interviewees thus highlighted the importance of education authorities providing platforms for interaction between teachers and learners, as well as between learners themselves, in order to sustain the social aspect and lessen the negative impact of social isolation on learners. An interviewee also stressed the importance of school institutions preventatively offsetting the likely rise in cyberbullying while educational activities are mainly taking place in online settings.

Widened access through digital tools does not translate to access for all. Several interviewees stressed that the limitations of access afforded through digital tools needs to be considered for specific vulnerable groups. For instance, one interviewee noted that assistive technology still provides few solutions for learners with behavioural disorders. Another interviewee noted that even when access to digital infrastructure is provided, digital competences often constitutes a second-tier barrier to the effective use of digital tools for educational purposes. Lastly, an interviewee stressed that due to slow internet

[776] https://www.european-agency.org/resources/publications/promoting-accessible-information-lifelong-learning
[777] https://www.european-agency.org/resources/publications/ict-inclusion-developments-and-opportunities-european-countries
[778] https://www.european-agency.org/resources/publications/european-and-international-policy-supporting-ict-inclusion
[779] https://www.european-agency.org/resources/publications/information-and-communication-technology-inclusion-research-literature
[780] https://www.european-agency.org/projects/ict4i/country-reports
[781] https://www.european-agency.org/resources/publications/ict-inclusion-developments-and-opportunities-european-countries
[782] https://www.european-agency.org/sites/default/files/ICT4I-policy-monitoring-framework.docx
[783] https://www.romaeducationfund.org/

connections in many isolated/rural areas across the EU, online learning is sometimes not a viable option. As an example, the interviewee shared a testimony from Ireland, where a learner recently had to relocate to a more densely populated area to be able to attend Massive Open Online Courses (MOOCs).

Key literature:

The key **resources to review suggested during the interviews** are as follows:

- **Model Policy for ICTs in Education for Persons with Disabilities**[784] - collaborative publication (joint publication with UNESCO, 2014).
- The publication focuses on the use of ICTs to support the implementation of the UNCRPD, specifically: Article 9 on Accessibility; Article 21 on Freedom of Expression and Opinion and Access to Information, and; Article 24 on Inclusive Education.
- **ICTs in Education for People with Disabilities - Review of Innovative Practice** (joint publication with UNESCO IITE, 2011)[785].
- This Review presents innovative practices highlighting a range of different ways of using ICT in education for people with disabilities and identifies key messages for policy and practice in this area.

EU publications:

- European Commission, (2012). National Roma Integration Strategies a first step in the implementation of the EU Framework: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM (2012) 226. [pdf] Brussels: European Commission. Available at: http://ec.europa.eu/justice/ discrimination/files/roma_nat_integration_strat_en.pdf.
- European Commission, (2014). Report on discrimination of Roma children in education. [pdf] Brussels: European Commission Directorate-General for Justice. Available at: http://ec.europa.eu/justice/discrimination/files/rom a_childdiscrimination_en.pdf
- European Commission, (2016). Assessing the implementation of the EU Framework for National Roma Integration Strategies and the Council Recommendation on Effective Roma integration measures in the Member States 2016: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM (2016), 424. [pdf] Brussels: European Commission. Available at: http://ec.europa.eu/justice/discrimination/files/romareport-2016_en.pdf
- European Union Agency for Fundamental Rights, (2014). Roma survey – Data in focus Education: the situation of Roma in 11 EU Member States. [pdf] Luxembourg: Publications Office of the European Union. Available at: http://fra.europa.eu/sites/default/ files/fra-2014_roma-survey_education_tk0113748enc. pdf.

Academic literature:

- Turner-Cmuchal, M. and Aitken, S. (2016), "ICT as a Tool for Supporting Inclusive Learning Opportunities", *Implementing Inclusive Education: Issues in*

[784] https://www.european-agency.org/news/model-policy-icts-education-persons-disabilities-new-collaborative-publication
[785] 1.%09https:/www.european-agency.org/resources/publications/icts-education-people-disabilities-review-innovative-practice

Bridging the Policy-Practice Gap (*International Perspectives on Inclusive Education, Vol. 8*), Emerald Group Publishing Limited, pp. 159-180.

- TURMAINE, I., & TURNER-CMUCHAL, M. (2016). The Journey of Making Information for Learning Accessible for All. *Universal Learning Design, Linz 2016*, 53.
- Karrera, I.; Garmendia, M. ICT use and digital inclusion among Roma/Gitano adolescents. Media Commun. 2019, 7, 22–31.

Annex III: WP 3 – Case study and Virtual Policy Delphi research tools

Case study country selection: Digital Inclusion Index

Our methodology for creating the below index followed four steps: step 1: Create an EU level dataset with a row for each Member State and a column for each of the variables representing the above indices; step 2: Assign a ranking to each country (1-27) according to their performance against these indices (e.g. a country with better access to internet will be higher in the ranking, while a country with a higher ESL rate will be lower); step 3: Create an index for digital skills and infrastructure, as well as one for educational and social inclusion based on the average ranking produced by the performance against their respective indicators ; and, step 4: Group countries into four clusters based on their ranking in the two indicators compared to the EU average.

Digital skills and infrastructure	Educational and social inclusion
• Household access to internet across the EU27.[786] • Level of "classroom connectivity" across the EU27.[787] • The extent to which young people (i.e. those aged 24 or under) have basic or above basic digital skills.[788] • Teachers' confidence in engaging with different ICT based activities in schools.[789]	• The early school leaver (ESL) rate.[790] • PISA 2018 index "Strength: Percentage of variance in reading performance explained by Economic, social and cultural status (R^2)"[791] • The % difference between citizens with low educational attainment (less than primary) living in cities compared to those in rural areas.[792] • The % difference between citizens with low education (less than primary) who are born in each Member State compared to those born outside of the EU.[793] • People at risk of poverty and social exclusion.[794]

[786] Based on 2019 Eurostat data "Level of internet access – households" (Data code: TIN00134).
[787] Based on cluster analysis from Ipsos Mori. (2019). 2nd survey of Schools ICT in education. European Commission: Brussels. Overview of variables includes in Chapter 2.
[788] Based on 2019 Eurostat data "Individuals' level of digital skills" (Data code: isoc_sk_dskl_i).
[789] Based on cluster analysis from Ipsos Mori. (2019). 2nd survey of Schools ICT in education. European Commission: Brussels. Overview of variables includes in Chapter 2.
[790] Based on 2019 Eurostat data "Early leavers from education and training by sex" (Data code: t2020_40).
[791] Data taken from OECD. "PISA 2018 Results: Combined Executive Summaries Vol I, II & III. Table II.1 'Snapshot of socio-economic disparities in academic performance'.
[792] Based on 2019 Eurostat data "Population by educational attainment level, sex, age, citizenship and degree of urbanisation" (Data code: edat_lfs_9916).
793 Also based on 2019 Eurostat data "Population by educational attainment level, sex, age, citizenship and degree of urbanisation" (Data code: edat_lfs_9916).
794 Based on 2019 Eurostat data "People at risk of poverty or social exclusion" (Data code: T2020_50).

Case study country selection: Clustering Matrix

[This clustering was used to ensure a good balance of case study countries with combinations of high/low rates of educational and social inclusion, as well as high/low rates of digital skills and infrastructure to reflect the current state of digital inclusion across the EU27]

		Educational and social inclusion	
		High	Low
Digital skills and infrastructure	Low	IE, FR, HR, PL, SI, SK	BG, EL, IT, CY, LU, HU, MT, PT, RO
	High	CZ, DK, ET, LV, LT, NL, AT, FI, SE	BE, DE, ES

Matrix for selection of examples

Matrix for selection of examples (of digital tools, initiatives or measures)

The results from the above clustering exercise are presented in the matrix below. Here we can see that countries are grouped according to high / low education and social inclusion, and high / low digital skills and infrastructure. These groupings have allowed for a systematic exploration of practices in countries where there are greater or lesser challenges regarding socio-economic and educational disparities on the one hand, and where there is a greater or lesser level of digital infrastructure on the other. This has in turn allowed us to return to the question of *context* (i.e. to explore what solutions work under which circumstances).

SELECTION CRITERIA		COUNTRY A			
		Initiative or measure 1	Initiative or measure 2	Initiative or measure 3	Initiative or measure 4
A. Effectiveness and outcomes	*Validated example (standards of evidence?)*	Y	Y	Y	Y
B. Types & levels of education	*General education*	√	√		√
	VET		√	√	
	ISCED levels (1-3)	1,2	3,4	3,4	1,2,3
C. Targeting & activation	*Universal*	√	√		√
	Selected			√	√
	Indicated				√
D. Learner characteristics	*SEN or disabilities*	√	√	√	
	Ethnic minorities		√	√	√
	Rural isolation	√		√	
	Low SES		√		√

Case study template [Member State]

*Building on the country mapping template you prepared in early 2021, please complete the different sections below drawing on information collected through the case study desk research and interviews. Your case study will be added in full to a ''**case study compendium'' submitted alongside the Final Report by Ecorys to the European Commission**. Since this document will be published, it is important for your final product to be concise (between 10 and 15 pages in length), well-written and formatted: the focus should be on quality of information rather than quantity. Please also make sure to **systematically cite all sources of information by using footnotes**. Please add the author, publication year, title and place of publication for each reference (APA referencing).[795] Please also clearly highlight when drawing on interviewee feedback or your own expert assessment.*

*Beyond **preparatory research to identify/expand on promising measures and fill gaps from the country mapping template**, the primary focus of the case study research should be on **conducting interviews with relevant stakeholders in your country**. These interviews should provide critical insight related to the main trends, policies, opportunities and challenges in your country regarding leveraging digital tools for inclusion in compulsory education (and ECEC). You are asked to **conduct a minimum of 10 interviews** in total among the following groups of stakeholders (please make sure a balanced selection of stakeholders is interviewed – e.g. do not limit yourself to speaking with policy makers or promising measure leaders only):*

- *National level policymakers: 2-3 interviews (i.e. experts from Education Ministries, Ministries responsible for digital affairs/innovation)*
- *Promising measure leaders: 5-6 interviews (i.e. a project coordinator/implementor from each of the 4 measures)*
- *National level representative organisations for at-risk target groups, associations representing students, parents or teachers: 2-3 interviews (e.g. national association for Roma rights or special needs/inclusive education, national teaching unions, national school student unions, national members of OBESSU, other representative organisations for pupils/students or young people, youth NGOs, organisations providing student counselling/guidance services, etc.)*
- *Academics: 1-2 interviews*
- *National ed-tech company representatives: 1-2 interviews (where possible/relevant[796])*

***NB for promising measures** to ensure you have sufficient information to draft a comprehensive and informative write-up for each of the 4 case study measures; 1. where further information is needed to fill gaps in information relating to a selected promising measure, an alternative can be to forward targeted questions via email for additional respondents to fill out (make sure to attach the endorsement letter). We also encourage where possible, to liaise with the project coordinator for each measure to ensure that key representatives are present wherever practical for a joint call (e.g. the interview could potentially include 2 or 3 people, to boost representation). Please*

[795] When in doubt, please consult this full list of APA style reference examples for guidance: https://library.flcc.edu/APA_FLCC.pdf

[796] If your country has a strong ed-tech sector, this would be of particular relevance.

conduct desk research for individual measures ahead of the interviews to make sure that the interviews are used to fill potential gaps.

Please forward the core team (XXXX) your list of secured interviews by May 17 using the below format:

	Name	**Organisation**	**Type of stakeholder**	**Interview date**	**Contact details**
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
…					

Section 1: Country context [approx. 3 pages]

*Section 1 should focus on **providing an overview of each country's contextual factors of relevance to digital inclusion**[797]. This should include 1: providing a brief overview of a) the state of educational and social inclusion in your country, b) the state of digital skills and infrastructure as well as c) related policy and funding actions, and 2: key success factors and barriers in the national approach to digital education and inclusion. The purpose is to **provide an understanding of the country context in which the 4 selected inspiring practice measures (covered in section 2) are situated.** This will allow the core research team to return to the question of context in assessing the transferability of promising measures across Member States later on.*

1.1 Key contextual factors and actions (approx. 1.5 pages)

- ***Social and educational inclusion:*** *Please provide **a brief elaboration on the state of socio-economic and educational disparities in your country**. Please*

[797] We define digital inclusion as leveraging digital tools to widen access and enhance the quality of teaching and learning for the purpose of delivering equitable education.

make sure to link key trends to the EU average and highlight features that stand out (e.g. a particularly prominent rural/urban divide, poor educational outcomes for migrant learners, high-levels of educational equity in relation to socio-economic status). For the sake of coherence across the case study reports, please base this overview on relevant Eurostat/PISA indicators.[798] *In this section we also want to understand the pupil groups in your country which are most at risk of social exclusion and underachievement (e.g. Roma learners; learners with special needs/disabilities; migrant/ foreign-born learners; rural learners, learners from a low-socioeconomic background).*

- ***Digital infrastructure and competences:*** *Provide* ***a brief elaboration on the state of digital infrastructure and competences in your country****. Please make sure to outline the extent to which individual features compare to the EU average and highlight trends that stand out (e.g. low levels of internet access at household levels, high-levels of digital confidence among teachers). For the sake of coherence across the case study reports, please base this overview on relevant Eurostat indicators.*[799] *In this section, please also make sure to highlight whether a wider digital divide exists for the aforementioned at-risk learner groups.*
- ***Policy and funding:*** *Building on the above sub-section, please elaborate on* ***the extent to which digital education and, more specifically, the activation of digital tools to promote learner inclusion is on the policy agenda*** *at national level. Please describe whether this is more of a basic focus on providing digital infrastructure/ digital competences or a comprehensive system-level focus on meaningful integration into pedagogical practice, teacher training, quality assurance of digital tools, evaluations of digital education strategies etc. If a specific focus on digital inclusion is observed, please highlight whether the focus is on widening access to education through digital tools (e.g. by way of assistive technologies or distance learning), or using digital tools to enhance learning, teaching or assessment for all/specific groups. This section should also provide a brief overview of* ***the national (and where possible regional) policy strategies and actions*** *of most relevance to digital inclusion. Evidence of their perceived or verified impact (e.g. policies or programmes evaluations/feedback from interviewees) can be elaborated on in the subsequent section.*

1.2 Key success factors and barriers (approx. 1.5 pages)

- *With a focus on policy actions pre-dating COVID-19, please highlight* ***what works and what could be improved*** *regarding the strategic approach to digital education generally, and the use of digital tools to promote inclusion in your*

[798] We suggest looking at key indicators such as: Eurostat early school leaver (ESL) rate, the PISA 2018 index "Strength: Percentage of variance in reading performance explained by Economic, social and cultural status, Eurostat data on the % difference between citizens with low educational attainment (less than primary) living in cities compared to those in rural areas, Eurostat data on the % difference between citizens with low education (less than primary) who are born in each Member State compared to those born outside of the EU and Eurostat data on people at risk of poverty and social exclusion.

[799] We suggest looking at key indicators such as: Household access to internet across the EU27 (Eurostat), level of "classroom connectivity" across the EU27 (2nd survey of Schools ICT in education), the extent to which young people (i.e. those aged 24 or under) have basic or above basic digital skills (Eurostat) and teachers' confidence in engaging with different ICT based activities in schools (Eurostat).

country (e.g. successful action plans/strategies, better cross-ministerial cooperation, insufficient funding, a greater focus on teacher training or meaningful pedagogical integration of digital tools etc.).

- *Building on the above, highlight **key challenges/ success factor related to the transition to online learning during COVID-19.***
  [NB: section 1.2 should focus primarily on learning and insights relating to digital inclusion pre-dating the crisis, with the COVID-19 section ideally taking up no more than 0.5 page)

Section 2: Selected promising measures [approx. 6 pages]

*Please present **four examples of successful or promising measures (policies, programmes, initiatives, projects or digital tools/applications)** identified throughout the research. For these examples, we are looking where possible for concrete initiatives that have been put in place in the Member State where the use of digital tools in compulsory education or ECEC have either: **a) widened access to education** (e.g. national/regional/local initiatives around the provision of assistive technologies for SEN -learners or distance learning approaches for rural learners), **b) enhanced teaching, learning and/or assessment for all learners or specific groups** (e.g. specific pedagogies or tools enhancing learners' behaviour, engagement, motivation or learning outcomes) **and/or c) improved educational equity more broadly**. These could be national, regional or local initiatives. Measures for which there is evidence that the digital tools/approaches/initiatives have widened access to education, improved quality or outcomes, or increased equity should be prioritised (e.g. evaluated measures). Prioritising measures where sufficient information is available is also advised.*

*Once a measure has been identified, either through the practices outlined in the country mapping template or additional desk research, **please make sure to organise at least 1 interview with a promising practice leader as soon as possible.** This will help to ensure that you have sufficient insight to cover all the information that needs to be included for each promising measure. The core research team will provide you with a few measures already identified for each country, which the case study researchers are expected to build on.*

***The examples should be presented (one after another) in formatted boxes under section 2 in the final case study write-up**. Under each sub-heading in a box, please avoid presenting the text as "intervention type: xxx. Target group: xxx" etc. Instead, present the information in full sentences and fluent text for a seamless presentation of each measure.*

As the 4 measures per country will provide critical insights regarding what works and under what conditions, we urge you to select measures where sufficient information is available to write a substantive elaboration of at least 1.25 page per measure. ***Please send the core team a list of your 4 selected measures (highlighting the title, intervention type, aim of measure, key target group and a link to further information) as soon as you arrive at a final selection (by May 11 at the very latest).** If you are in doubt about the eligibility of a measure, please contact the core team (XXXX).*

The case study format can be found below.

Measure 1: Title of promising measure *Please indicate first the title in English, then (in brackets and italics) in original language*
Sub-heading: Introduction and context (0.25 page) *Include:* • *Intervention type* • *Where the practice is implemented (e.g. national level/regional level/ school-level practice)* • *Period of implementation (start and end dates; also indicate if ongoing)* • *Target group(s)* • *Why it was implemented (what problems/issues it is addressing)* • *Aim of measure*
Main activities (0.5 page) *Describe the main activities/actions implemented*
Evidence of effectiveness, sustainability and transferability (0.5) *Include:* • *What evidence of effectiveness exists (evaluation and/ or assessment, feedback from interviewees)* • *What makes the practice successful?* • *What barriers/ challenges to implementation has been observed?* • *Is the practice sustainable in the medium and long term (e.g. in terms of staff/ resources needed)?* • *Is the practice cost-effective/efficient?* • *Is the practice scalable?* • *Is the measure transferable and replicable across and between Member States? Under what conditions?*
Contact Website: For further information contact:

Section 3: Overall Assessment [approx. 1.5 page]

Key insights/lessons: *This section should* ***list and expand on at least three key insights and/or lessons identified while conducting the case study research.*** *This could build on transferable lessons from particular measures examined, or based on key insights from specific interviewees. NB: this section should seek to produce general transferable lessons/insights, not Member State specific ones (e.g. specific strengths, weaknesses, opportunities, and threats of*

integrating technology within compulsory education settings for the purpose of improving inclusion).

Case studies: Draft interview topic guide

Draft topic guide for interviews with key stakeholders

This topic guide is designed for use with key stakeholders at national and institutional level as part of the case study research of the study on digital inclusion across **five main stakeholder groups (min. 10 interviews in total)**:

- *National level policymakers: 2-3 interviews (i.e. experts from Education Ministries, Ministries responsible for digital affairs/innovation)*
- *Promising measure leaders: 5-6 interviews (i.e. a minimum of 1 project coordinator/implementor from each of the 4 measures)*
- *National level representative organisations for associations representing students, parents, teachers or at-risk groups: 2-3 interviews (e.g. national teaching unions, national members of OBESSU, other representative organisations for pupils/students or young people, national association for Roma rights or special needs/inclusive education etc.)*
- *Academics: 1-2 interviews*
- *National ed-tech company representatives: 1-2 interviews (where possible/relevant[800])*
- ***NB for promising measures** to ensure you have sufficient information to draft a comprehensive and informative write-up for each of the 4 case study measures: 1. where further information is needed to fill gaps in information relating to a selected promising measure, an alternative can be to forward targeted questions via email for additional respondents to fill out (make sure to attach the endorsement letter). We also encourage where possible, to liaise with the project coordinator for each measure to ensure that key representatives are present wherever practical for a joint call (e.g. the interview could potentially include 2 or 3 people, to boost representation). Please conduct desk research for individual measures ahead of the interviews to make sure that the interviews are used to fill potential gaps.*

The function of these stakeholder interviews is to collect further evidence to answer the research questions in the case study template, building on your desk research. Given the diversity of the stakeholders, **this topic guide should be used as 'source catalogue'** for relevant questions and tailored according to the roles and responsibilities of individual respondents. Moreover, each main section of interview questions includes an indication of which stakeholder groups should be consulted (in brackets under each heading). It is the responsibility of country experts to undertake any further tailoring, where appropriate in liaison with the core study team.

[800] If your country has a strong ed-tech sector, this would be of particular relevance.

Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion

Topic guide for consultations with key policymakers and stakeholders

Background

Ecorys has been commissioned by the European Commission's Directorate-General for Education, Youth, Sport and Culture (DG EAC) to undertake a study titled ''Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion''.

The overall aim of the study is to gather evidence regarding the actual and potential role of digital technologies in promoting the inclusion of all learners in compulsory education, as well as ECEC. Over 12 months, from September 2020 to September 2021, the study will draw on the best available evidence to assess how digital technologies can promote the inclusion of all learners, and to identify key messages for learners with additional needs and/or disabilities, learners living in remote areas, migrant learners, and learners from disadvantaged socio-economic backgrounds. This will require a consideration of *what is happening, what should be happening, and how it could be made to happen*.

Based on the research conducted as part of our study – which involves a mix of desk research (secondary data collection) covering all EU27 Member States and interviews (primary research) in 8 selected Member States – the study will serve as an evidence-base, offering key recommendations to institutions and policy makers on the topic.

Purpose of the scoping interview:

As part of the primary research for this study, we are carrying out a small number of interviews with key experts and stakeholders in 8 Member States. The purpose of these interviews will be:

- To gain a better understanding of the **policy framework and recent political and social developments surrounding the use of digital technologies and learner inclusion in compulsory education** in your Member State;
- To get a better understanding of not only of what has been done, but also **how and why certain approaches using digital tools/approaches in education have been successful or faced challenges** in levering improved educational access, quality and equity, and the conditions that support their success;
- To gather information regarding **concrete measures/initiatives** that have been put in place in your Member State where the use of digital tools in compulsory education or ECEC have either: **a) widened access to education** (e.g. national/regional/local initiatives around the provision of assistive technologies for SEN - learners or distance learning approaches for rural learners), **b) enhanced teaching, learning and/or assessment** for all learners or specific groups (e.g. specific pedagogies or tools enhancing

learners' behaviour, engagement, motivation or learning outcomes, for example by re-engaging learners at risk of drop-out) **and/or c) improved educational equity** more broadly. These could be national, regional or local initiatives.

Note on privacy and data protection:

Taking part in the study is voluntary. Ecorys and The European Institute of Education and Social Policy (EIESP) are entirely independent, and your views, personal data and opinions will be treated as confidential, in line with the EU's General Data Protection Regulation (GDPR).[801] We will not attribute quotes to any consultees. We will be using the evidence from the interviews to guide the next stages of our research.

Interview details	
Format	Online
Software	Microsoft Teams
Date of conduction	[To be filled in]
Researcher(s) responsible	[To be filled in]

Note for interviewer*: Ideally, we record all interviews. Please ask all interviewees for permission to record the interview prior to starting the recording [please delete this sentence before sending to your interviewee].*

A. Organisational and stakeholder background

[All stakeholders]

1. Please provide an **overview of your position, and your key areas of responsibility** in the field of [education/ digitalisation/ social inclusion] within your [school/ organisation/ country].
2. How long have you been working in this field?

B. Key contextual factors and actions relating to digital education and inclusion

[All - except promising measure leaders]

3. Focusing on young people of compulsory school age, what learner groups are particularly at risk of unequal access to educational opportunities or outcomes in your country?

- [Ask generally, then probe based on specific learner groups, e.g. migrant learners, learners with disabilities or special needs, rural learners, ethnic minority learners (e.g. Roma), learners with low socio-economic status etc].
- [Probe: What are the barriers to inclusion that the learner groups you have identified face?]

4. To your knowledge, what national/ regional/ school level strategies or policies exist in your country to promote the use of digital technology in education settings?
    - [Probe: What national/ school level strategies or policies are in place to (a) provide access to digital infrastructure/ technology in schools and (b) To what extent are school curricula in your country preparing young people for the "digital economy"? Are there any perceived gaps, and if so what measures are being taken to address them?
    - [Probe: to what extent do these policies/strategies include a focus on meaningful integration of digital tools into pedagogical practice, e.g. through specific stipulations in the curricula or external school evaluation frameworks regarding their use?)
    - [Probe: To what extent have these initiatives been successful? What evidence exists to support this (e.g. evaluations, annual reports)]?
5. Can you think of any specific policies, interventions, initiatives or programs to promote inclusion in ECEC/ compulsory education settings using digital tools? These can be national, regional or school-level.
    - [Ask generally, then list a few examples to get the interviewee to reflect: e.g. initiatives widening access to education by providing assistive technology for learners with disabilities/special needs or remote learning for rural learners, or using digital tools to improve engagement or learning outcomes among low-achievers/learners at risk of dropping out, or the use of artificial intelligence to improve diagnostic/formative assessment practices?]
6. What digital resources are available for teachers and school leaders to use in schools and VET settings?
    - [Probe based on comprehensive list of basic tools (such as computers, laptops, interactive white boards) and more advanced tools (such as Artificial Intelligence and VAR)].
7. To your knowledge, what digital and non-digital tools and/ or resources do teachers and school leaders have at their disposal to support learners at risk of marginalisation?

- [Probe for specific examples of their implementation/use].

8. To what extent can schools get access to digital tools and infrastructure from (a) the state, (b) charities or (c) private companies? What do they cost, and what subsidies are available?
9. What, if any, assistive technologies do schools have access to for (a) young people with special educational needs/ disabilities, (b) other students struggling to access education?
10. What personal development is offered to teachers and school leaders to help them: (a) incorporate technology into their pedagogies and/ or curriculum delivery, (b) create "inclusive" classroom environments and make education accessible to all?
11. How are digital technologies used within compulsory education to support other aspects of the functioning of schools, beyond teaching and learning? For example, probe:
    - Social and emotional wellbeing of students
    - Home-school communication
    - Educational management and administration
    - Cybersecurity
12. What is the role of digital tools and infrastructure in supporting collaboration between schools, or for working in partnership with other organisations (e.g. clusters / multi-professional teams)?

C. Key Success factors and barriers
[All except promising practice leaders]

13. To what extent do you think other teachers, school leaders and national politicians in your country "buy-in" to the importance of (a) inclusion, (b) technology in the classroom?
14. Please highlight what works and what could be improved regarding the strategic approach to digital education generally, and the use of digital tools to promote inclusion in your country (e.g. successful action plans/strategies, better cross-ministerial cooperation, insufficient funding, a greater focus on teacher training or meaningful pedagogical integration of digital tools etc.).
    - [Looking ahead, how can your country take concrete steps to make related improvements?]
15. What do you think are some of the most and least successful examples of integrating technology within education in your country?
    - [Probe: Why is this the case? What conditions were key to their success?]
    - [Probe: How have these examples affected learner inclusion?]

16. In your view, to what extent has technology improved student autonomy and give students more opportunities and choice relating to their education?
17. To what extent has technology enabled teachers and school leaders to "do more" in the classroom?
18. What digital practices, programmes of strategies worked well in relation to COVID-19 in your country and what did not work so well?
19. Thinking to the future, what digital tools, resources and strategies used during the COVID-19 crisis do you think could be successfully integrated into the education system long-term?

D. Key initiatives and measures

***[For promising measure leaders only**.]*[802]

20. Please provide us with the full title of the measure, as well as your position/involvement?
21. How long have you been involved?
22. What is the **implementation timeframe**?
23. Who are the **main stakeholders/organisations** involved?
24. What is the measure's **funding structure**?
25. Could you please provide a more **in-depth description of the measure** in question (aims, target group, implementation approach, how it addresses the issue of activating digital tools to promote learner inclusion)?
26. What is the **role of partnership** in implementing this measure (e.g., school networks, teachers, NGOs, social partners, and experts)?
27. What are the **success factors** of the measure?
    - [Probe: What elements of the measure do you consider to be particularly good practice? Why?]
    - [Probe: Can you provide any specific examples of schools or localities where the measure had promising results? What was the context, and how / why was the measure effective?]
    - [Probe: Is there available evidence to document the impact or effectiveness of the measure thus far (e.g., annual reports, evaluations, beneficiary feedback)?] IF YES, PLEASE EXPLORE ACCESS / AVAILABILITY FOR THE STUDY
28. In your opinion, what **weaknesses** does the measure currently have? What barriers have you experienced throughout the course of implementation?

[802] Researcher note: Please interview at least 1 representative from each of the four promising measures identified throughout the course of the research.

29. Is the practice sustainable in the medium and long term (e.g. in terms of staff/ resources needed)?
30. Is the practice cost-effective/efficient?
31. Is the practice scalable? Has it been replicated in multiple schools, and if so with what results?
32. Is the measure transferable and replicable across and between Member States? Under what conditions? What barriers do you see to transferability of the measure?

33. Recommendations and concluding remarks *[All]*

34. Could you please provide us with **three lessons or recommendations** as to what could be done better activate digital technologies for the purpose of enhancing learning and/or inclusion for all in compulsory education? Your recommendations could address learners, parents, the wider community, school-level stakeholders or policymakers at regional/national or EU-level.
35. Are there **any other discussion points** related to digital education or inclusion generally - or digital inclusion specifically - that we have not discussed thus far that you would like us to cover?

European Commission

Virtual Policy Delphi Questionnaires

Delphi Questionnaire 1

Using digital tools to promote inclusion in compulsory education across the EU27.

Delphi consultation paper

Stage 1

[Please send your filled in questionnaire and/or any questions to the project manager Maria Melstveit Roseme at: maria.melstveit@ecorys.com and project support Thomas Pickford at: thomas.pickford@ecorys.com. Please make sure to include both email addresses to ensure safe reception

Many thanks for your participation!]

Background to the consultation

You are invited to take part in a Delphi consultation exercise for an important pan-EU study on the subject of digital education and inclusion.

About the study

Ecorys has been appointed by the European Commission to carry out a study titled: *Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion.* The study aims to assess the actual and potential role of digital technologies in promoting access, quality and equity in compulsory school education across the EU27, and their role in complementing and enhancing traditional forms of teaching and learning.

The study is concerned with how digital technologies can promote the inclusion of all learners, but also specifically to identify their role with regard to learners with different learning needs, such as those living in remote areas, migrants, those from disadvantaged socioeconomic backgrounds, or facing additional challenges such as special educational needs and disabilities.

The following levels of education are within scope: primary (ISCED Level 1); secondary (ISCED Levels 2 & 3), and vocational education and training (VET) at ISCED Levels 1-3. The study will also learn from practices in Early Childhood Education and Care (ISCED 0) where relevant to do so.

Timescales and outputs

The research is taking place between November 2020 and September 2021 and will culminate in a final report and executive summary for publication. The results of the study will, among others, serve as an evidence-base and offer recommendations to education institutions and policy makers.

Instructions for the Delphi consultation

To date, we have carried out desk research which includes a literature review and an in-depth mapping exercise across all 27 EU member states.

This consultation looks to ask expert participants for their opinion on some of the interim findings and key messages. This is an important step, to contextualise what we have found, and to inform our approach towards the case study visits with selected countries over the summer of 2021.

There are two stages involved:

- Stage 1 (May 2021) – this involves a first set of consultation questions, which are focussed on better understanding the issues. The findings will be collated and analysed by the study team. We will share these findings in anonymous format with all participants.
- Stage 2 (June 2021) – we will issue a second paper, presenting the results of the first consultation and with a further set of questions, aiming to build consensus around identifying what needs to be done. Again, we will share these findings in anonymous format with all participants.

We would be grateful if you could complete this short online consultation form (or as many of the questions as you wish) by midnight on Wednesday June 9, 2021 (09/06/2021).

Thank you in advance for your participation!

Data protection

This questionnaire is being carried out in accordance with the EU General Data Protection Regulations (GDPR). Ecorys is a registered data controller: UKICO, No.Z5564761. Any information you provide is confidential. We will analyse your response alongside those from other participating organisations, but you will not be named or otherwise identified in any reports.

A copy of the privacy notice will be forwarded as a separate attachment.

Please tick the box to indicate that you have read and are satisfied with the terms of the privacy notice. ☐

European Commission

Consultation response

Name	
Position	
Organisation	
Date	

Key Theme 1:
Our research examined the benefits of digital technology in promoting access, quality and equity in education for *all* learners, with a specific focus on learners or groups at risk of exclusion and marginalisation.

These might include, for example:

- Roma learners
- Those with special educational needs or disabilities
- Rural location / isolated learners
- Migrant or foreign born
- Those from a low socio-economic background
- High achievers and low achievers at school.

Questions:

- From your professional experience, does this list capture the learners or groups at greatest risk of exclusion or marginalisation?
- Are there any other learners or groups who are not identified here? If so, who are they and what barriers do they face to accessing education?

Key Theme 2:
The table below summarises the ways in which digital tools can improve teaching and learning across the EU27, based on our preliminary research.

Table 1: Ways in which digital tools can improve teaching and learning

Pre-school / Early Childhood Education and Care (ECEC)	✓ To encourage movement ✓ To support the development of early basic skills and key competences ✓ To enrich audio-visual experiences ✓ To serve as a cultural mediator for children of different ethnic and cultural backgrounds ✓ To provide a way to entertain young children ✓ To facilitate inclusive communication
Primary and Secondary School	✓ To support learners' cognitive development, understanding and higher order thinking skills ✓ To influence students' behaviour, engagement, and motivation ✓ To deepen summative and formative assessment practices within and beyond the classroom ✓ To connect different places of learning together ✓ To provide opportunities to engage with peers
VET	✓ To allow students to rehearse risky or expensive processes in safe and controlled conditions ✓ To develop transversal skills as well as occupational competences.

Questions:

- To what extent are you aware of these uses of digital tools? Do you have any concrete examples to share?
- Other than those listed above, how else can digital technology be used to improve teaching and learning in the classroom and beyond?

Key Theme 3: Our findings suggest that digital tools have been successfully integrated to ECEC settings within some EU Member States to support with communication, learning and play. Public and professional opinion about the benefits remains divided, however, with some reservations about the potential disruption to learning and social development or exposure to harmful content. Questions: • To what extent are these debates present within your country? • From your professional experience, do you have any examples where digital technology has had either a positive or an adverse effect on children's learning and development within ECEC settings?

Key Theme 4: Our findings further indicate that technology can improve the quality of teaching and learning and provide more opportunities and access to vocational training. There is, nonetheless, less evidence on the use of technology in vocational education and training (VET) than in general education. Questions: • Do you have any specific examples of how technology has been used in VET to improve teaching and learning, increase access, and improve equity for all learners? • Do you have any specific examples for groups at risk of marginalisation?

Key Theme 5: Investing in digital technology in schools is an important enabling factor for ensuring that it is used effectively for inclusive education. However, a collaborative approach to school leadership, a culture which embraces inclusive practices and the use of technology, and teacher competency are MORE important factors than infrastructure. Evidence shows that Member States have different views on what makes a 'digitally competent' teacher. Questions: • In your professional opinion, do you agree that leadership, culture and competency are more important factors than infrastructure for using digital tools for inclusive practices? • Are there any other factors not included above, and can you offer any examples as to why they are important?

Key Theme 6: The research suggests that, prior to the shock of the COVID-19 crisis, EU Member States had mixed success with using digital tools to support inclusion. On the one hand, digital education strategies were often designed with all learners in mind, without sufficient attention to the specific barriers faced by marginalised learners or groups. On the other hand, inclusive education measures have not always included a clear 'digital' dimension. This situation has posed a greater risk of educational exclusion for marginalised learners or groups, which was somewhat exposed during the rapid shift to distance learning during the COVID-19 crisis. Questions: • To what extent would you agree or disagree with this overall assessment of policies and practices for digital education prior to the COVID-19 crisis? • How much of a difference has the COVID-19 crisis made in practice? Would you say that the crisis has prompted stronger action on digital inclusion across the EU, and if so what examples would you give?

Key Theme 7: Using digital tools in education goes beyond improving teaching and learning. Young people require digital competencies, skills and citizenship to thrive. They risk being excluded from social and economic life if they do not have these qualities. Social and emotional wellbeing is also an important consideration when thinking about the use of digital technology. Questions: • In your professional opinion, to what extent are young people across the EU being equipped with the digital competencies, skills and citizenship to thrive in the 21st Century? • Can you think of any examples of how can schools, policy makers and parents are promoting the wellbeing of students in relation to the use of digital tools?

Key Theme 8:
Based on the research, a number of common factors were often present where countries experienced greater success with the shift to remote learning during the COVID-19 crisis. Some of these related to the effectiveness of the strategy that was adopted, and some reflected the pre-existing levels of digital infrastructure, digital competences and practices among teachers and leaners.

Table 2: Factors affecting the effectiveness of country-level access measures during COVID-19

Intervention factors	Structural factors
✓ A coherent and coordinated approach from both central and regional government. ✓ Stakeholder engagement and mobilisation (including a pivotal role for NGOs). ✓ Utilising existing digital resources and infrastructure. ✓ Effective use of monitoring, evaluation and feedback.	✓ Prior digital infrastructure. ✓ Workforce readiness. ✓ Parent, carer and learner readiness. ✓ Scale and scope of equity challenges. ✓ Resources within the system.

Questions:

- To what extent would you agree or disagree with the range of factors highlighted in the table above?
- What other factors influenced the success with which Member States responded to the COVID-19 crisis, in your professional experience?

Key Theme 9: The emergency response to the COVID-19 crisis has seen the emergence of new cross-sectoral partnerships within education, bringing together public and private sectors with NGOs. While such partnerships have helped to ensure continued access to resources and infrastructure across the EU, they also present questions about educational governance beyond the crisis. For example, relating to lines of accountability, data rights and responsibilities, and to the roles of global corporations within the education landscape. Questions: • What have been the positive and / or negative impacts of the COVID-19 crisis on partnerships and governance arrangements within education in your country and / or sector? • What would you consider to be the key priorities for ensuring the effective governance and regulation of digital technologies within education, beyond the crisis?

Key Theme 10: Digital tools have the ability to change the relationship between the teacher, learner and parents/ carers. For instance, during the COVID-19 crisis, many parents and carers played a much larger role in teaching or supporting their children than if they were actually in school. Effective home-school communication has proven to be one of the most important factors in facilitating a smooth and effective transition to online learning for individual learners and schools. Questions: • Other than through the COVID-19 crisis, can you think of any examples where parents and carers have played a lead role in facilitating the use of digital tools for inclusive practices? • In your professional opinion, how best can schools and policy makers obtain parent/ carer buy-in when using digital tools for education in the future?

Key Theme 11:
In the next phase of this project we are looking at promising and innovative digital tools or practices that have shown signs of success with regards to improving teaching and learning, improving access, and providing equitable education for all learners, but particularly those from marginalised groups.

Questions:

- Can you provide any specific examples of digital tools or practices that have improved access, quality and / or equity within education within the settings or contexts in which they were developed?
- If so, please provide a brief description of the example, including:

1) the EU Member State(s) where this can be found
2) the timescales (pre and or post the COVID-19 crisis)
3) the main target groups (all learners or those facing marginalisation)
4) the educational context(s): ECEC, primary, secondary and / or VET
5) why the example might be described as promising or innovative, including any data or evidence from monitoring or evaluation.

Please provide details of where further information might be obtained.

Many thanks for taking part in this consultation. We will collate the results and will re-contact you next month for part two.

European Commission

Delphi questionnaire 2

Using digital tools to promote inclusion in compulsory education across the EU27.

Delphi consultation paper

Stage 2

[Please send your filled in questionnaire and/or any questions to the project manager Maria Melstveit Roseme at: maria.melstveit@ecorys.com.

Many thanks for your participation!]

Background to the consultation

This is the second (and final) stage of the Delphi consultation exercise you contributed to in June.

About the study

As a brief reminder, Ecorys has been appointed by the European Commission to carry out a study titled: ***Enhancing learning through digital tools and practices: how digital technology in compulsory education can help promote inclusion***. The study aims to assess the actual and potential role of digital technologies in promoting access, quality and equity in compulsory school education across the EU27, and their role in complementing and enhancing traditional forms of teaching and learning.

The study is concerned with how digital technologies can promote the inclusion of **all learners**, but also specifically to identify their role with regard to learners with **different learning needs**, such as those living in remote areas, migrants, those from disadvantaged socioeconomic backgrounds, or facing additional challenges such as special educational needs and disabilities.

The following **levels of education** are within scope: primary (ISCED Level 1); secondary (ISCED Levels 2 & 3), and vocational education and training (VET) at ISCED Levels 1-3. The study will also learn from practices in Early Childhood Education and Care (ISCED 0) where relevant to do so.

Timescales and outputs

The research is taking place between November 2020 and September 2021 and will culminate in a final report and executive summary for publication. The results of the

study will, among others, serve as an evidence-base and offer recommendations to education institutions and policy makers across the EU27.

Instructions for the Delphi consultation

This consultation looks to ask expert participants for their opinion on some of the interim findings and key messages from the ongoing study. This is an important step, to contextualise what we have found, and to inform our approach towards the drafting of the final report to be published shortly thereafter.

There are two stages involved:

- **Stage 1** (COMPLETED) – this involved a first set of consultation questions, focussed on better **understanding the issues, as well as testing the validity of our interim findings**. The responses you provided in stage 1 have now been collated and analysed by the study team.
- **Stage 2** (July 2021) – this current paper briefly presents key feedback from the first consultation with a further set of questions, geared at **identifying what should be done in the medium and long-term at school, national and EU-levels**.

We would be grateful if you could complete this short online consultation form (or as many of the questions as you wish) by 12:00 CET on Monday July 19, 2021. (18/07/2021).

Thank you in advance for your participation!

Data protection

This questionnaire is being carried out in accordance with the EU General Data Protection Regulations (GDPR). Ecorys is a registered data controller: UKICO, No.Z5564761. Any information you provide is confidential. We will analyse your response alongside those from other participating organisations, but you will not be named or otherwise identified in any reports.

A copy of the privacy notice was forwarded as a separate attachment in Delphi Paper 1.

Please tick the box to indicate that you are still satisfied with the terms of the privacy notice.

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Consultation response

Name	
Position	
Organisation	
Date	

Follow-up 1: Learner groups at risk

In our first Delphi Paper we provided an initial list of learner groups identified through our research as being particularly at risk of exclusion within education systems across Europe. These encompassed: learners with special educational needs or disabilities; rural location / isolated learners; migrant or foreign-born learners; those from a low socio-economic background; high achievers and low achievers at school, and Roma/ traveller community learners.

8.0

Through our first Delphi consultation, consultees highlighted a number of **additional learner groups at risk of exclusion**. These included:

- Learners with mental health and/or emotional problems
- Learners with tumultuous/difficult home lives
- LGBTQI+ learners
- Learners in detention and care
- Ethnic and religious minority learners
- Refugee learners, as distinct from migrant/foreign-born
- Underachieving boys
- Learners with addictions (e.g. gaming/gambling addictions)

Questions:

- In your expert view, what local, national and/or EU-level **targeted measures,** if any, should be put in place to promote the digital inclusion of one or more of these specific learner groups?
- Please also **cite any relevant good practice** initiatives, studies or academic articles on the subject that you are aware of.
  - Note: Feedback received suggests that **high achieving / gifted learners** are often overlooked as an at-risk group. Any information you may be able to share, e.g. relevant studies, academic articles or good practice initiatives targeting this group in particular would thus be much appreciated.

Follow-up 2: Key conditions for promoting digitally inclusive practices

In our first Delphi paper, we posed the question of whether a collaborative approach to school leadership, a culture which embraces inclusive practices and the use of technology, and teacher competency are MORE important factors than infrastructure. Feedback from consultees underlined that these factors cannot be considered in isolation, with digital infrastructure constituting a pre-condition for digitally enhanced learning to take place. Moreover, consultees stressed that a lack of continued focus on infrastructure could exacerbate inequitable access issues. Two particular themes stood out from the consultation, which we now go on to consider in turn.

a) Strategic school leadership for digital education

Consultees emphasised that digital infrastructure risks having little added value unless accompanied by a clear culture of inclusion, developed alongside teacher competencies within a framework of clear strategic leadership.

Question:

- In ensuring the effective integration of digital tools in the classroom for inclusive education, **what does a clear strategic leadership framework look like at school-level?** Please list all the components you consider key to configuring such a framework.
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b) Teacher education requirements

Feedback from our first Delphi paper also suggested that beyond general digital competences, teachers need specific pedagogical digital competencies in order to effectively leverage digital tools in the classroom for didactic aims.

Question:

- In your expert view, what can be done to better respond to the need for **specific pedagogical digital competences for teachers**?
- What can be done to better respond to the **inclusive education competences** teachers need to possess in order to promote digitally inclusive practices?

Follow up 3: Structural changes post-COVID

Feedback from the first policy Delphi suggests that **a lack of specific efforts to ensure access to digital tools and competences for all learners and teachers**, coupled with an **inadequate digital dimension to inclusive education efforts**, represent important barriers to educational inclusion in the 21st century. The consequences of this 'digital divide' were largely exposed during the rapid shift to distance learning during the COVID-19 crisis.

Questions:

- What **medium** and **long-term actions** need to be introduced post-COVID to better promote digital inclusion (in terms of i. digital literacy for all, ii. access to digital infrastructure/tools for all and iii. The leveraging of digital tools to promote enhanced/inclusive learning?) What concrete steps should be taken in order to get there in the next 1-2 years? What concrete steps need to be taken in the next 5+ years?

- Looking to the future, how sustainable are the measures that were introduced during COVID-19. Please identify and justify, as appropriate:
  - Any measures or approaches introduced during the crisis that should be **retained and embedded or scaled-up** in the future (please explain how and why this should be done)
  - Any measures or measures or approaches introduced during the crisis that should be **discontinued or scaled** back in the future (please explain how and why this should be done)

Follow-up question 4: Competencies, citizenship and well-being

Feedback from consultees underline that despite the importance of **digital competencies, skills and citizenship** to thrive in an increasingly digital society, different views persist regarding what makes a 'digitally competent' teacher and learner, with the concept evolving in line with wider technological developments. Consultees also stressed that the **'digitally competent' parent** is another important consideration in ensuring the effective use of digital tools. Lastly, the feedback suggests that digital education efforts increasingly incorporate a **social and emotional wellbeing** dimension.

Questions:

- Beyond the use of SELFIE and other self-assessment tools, **what concrete steps can be taken to better standardise descriptors of digital competences and skills** needed to thrive in the 21st Century across EU countries and classrooms?
  In your professional opinion, what additional efforts are required to ensure learners across the EU are being equipped with these digital competencies at school, national and EU levels?

- What concrete steps can be taken to better **support the digital competence development of parents and carers?** Please outline concrete steps that can be taken in the medium (next 1-2 years) and long-term (next 5+ years).

- Looking ahead**,** how should schools and policy makers use digital tools to **improve the social and emotional wellbeing of students?** Please outline concrete steps that can be taken in the medium (next 1-2 years) and long-term (next 5+ years).

Follow-up 5: Cross-sectoral partnerships

Feedback from consultees provided numerous examples of the benefits of cross-sectoral partnerships during COVID-19, bringing together public and private sectors with NGOs.

However, looking beyond the crisis, **feedback also emphasises the importance of ensuring that 'quick fixes' do not automatically become permanent**. In particular, concerns were raised regarding private sector actors creating dependencies on licences/subscriptions that will no longer be free of charge after the crisis, a lack of technical know-how on the part of government actors in steering and quality assuring the cooperation, as well as concerns regarding how data is processed. **Questions:** • What specific systems, structures and collaborative arrangements could be put in place to ensure that the educational sector continues to benefit from **digital cross-sectoral partnerships** in the medium and long-term? • What are the structural barriers to doing so, and what needs to be done at a European Commission and individual Member States level to facilitate this?

Many thanks for taking part in this second, and final, part of the consultation.

If you wish to receive a notification when the final report is published, please indicate by ticking the box below.

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Annex IV: Key datasets

Based on feedback from the European Commission, we extracted data from the sources indicated in the table below. Data for each Member State was extrapolated and shared with the country experts carrying out the country mapping exercise.

Overview of data given to each of the country experts to consult during the country mapping exercise

Outcome	Sub-section	Indicator	Level	Year	Data source
Access and use of internet and computers	Internet access	Household level of internet access by urban and rural areas	National, EU	2010-2019	Eurostat
	Internet access	Household level of internet access by household income quartile	National, EU	2010-2019	Eurostat
	Computer use	Percentage of individuals using a computer in the past 3 months by age	National, EU	2008-2017	Eurostat
	Computer use	Percentage of individuals using a computer in the past 3 months by education	National, EU	2008-2017	Eurostat
	Computer use	Percentage of individuals using a computer in the past 3 months by country origin	National, EU	2008-2017	Eurostat

Outcome	Sub-section	Indicator	Level	Year	Data source
	Computer use	Percentage of individuals using a computer in the past 3 months by urban and rural areas	National, EU	2008-2017	Eurostat
	Computer use	Percentage of individuals using a computer in the past 3 months by household income quartile	National, EU	2008-2017	Eurostat
	Frequency of internet use	Percentage of individuals using the internet once a week (including daily) by age	National, EU	2010-2019	Eurostat
	Frequency of internet use	Percentage of individuals using the internet once a week (including daily) by education	National, EU	2010-2019	Eurostat
	Frequency of internet use	Percentage of individuals using the internet once a week (including daily) by country origin	National, EU	2010-2019	Eurostat
	Frequency of internet use	Percentage of individuals using the internet once a week (including daily) by urban and rural areas	National, EU	2010-2019	Eurostat
	Frequency of internet use	Percentage of individuals using the internet once a week (including daily) by household income quartile	National, EU	2010-2019	Eurostat
Education outcomes	Digital skills	Individuals who have basic of above basic digital skills by age	National, EU	2015-2019	Eurostat

Outcome	Sub-section	Indicator	Level	Year	Data source
	Skills and performance	Students' CIL (Computer and information literacy) score	National	2018	ICILS Student survey
	Skills and performance	Students' CT (Computational Thinking) score	National	2018	ICILS Student survey
	Skills and performance	Percentage of underachieving students in reading by Economic and Social Background -ESCS (PISA Index of economic, social and cultural status)	National	2018	PISA-OECD
	Skills and performance	Percentage of underachieving students in math by Economic and Social Background -ESCS (PISA Index of economic, social and cultural status)	National	2018	PISA-OECD
	Skills and performance	Percentage of underachieving students in science by Economic and Social Background -ESCS (PISA Index of economic, social and cultural status)	National	2018	PISA-OECD
	Skills and performance	PISA Average reading score by Index Immigration status (IMMIG)	National	2003-2018	PISA-OECD
	Skills and performance	PISA Average math score by Index Immigration status (IMMIG)	National	2003-2018	PISA-OECD

Outcome	Sub-section	Indicator	Level	Year	Data source
	Skills and performance	PISA Average science score by Index Immigration status (IMMIG)	National	2003-2018	PISA-OECD
	Early leaving	Early leavers (18-24 years old) from education and training (%)	National, EU	2010-2019	Eurostat
	Early leaving	Early leavers (18-24 years old) from education and training (%) by country of origin	National, EU	2010-2019	Eurostat
	Early leaving	Early leavers (18-24 years old) from education and training (%) by labour status	National, EU	2010-2019	Eurostat
	Early leaving	Early leavers (18-24 years old) from education and training (%) by degree of urbanisation	National, EU	2010-2019	Eurostat
Availability and use of ICT	Availability of ICT at home and school	Available for you to use at home: Desktop computer [IC001Q01TA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at home: Portable laptop, or notebook [IC001Q02TA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at home: Internet connection [IC001Q04TA]	National	2018	PISA-OECD Student survey

Outcome	Sub-section	Indicator	Level	Year	Data source
	Availability of ICT at home and school	Available for you to use at home: Cell phone with Internet access [IC001Q07TA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at school: Desktop computer [IC009Q01TA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at school: Portable laptop or notebook [IC009Q02TA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at school: Internet connected school computers [IC009Q05NA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at school: Data projector, e.g. for slide presentations [IC009Q10NA]	National	2018	PISA-OECD Student survey
	Availability of ICT at home and school	Available for you to use at school: Interactive Whiteboard, e.g. [Smartboard] [IC009Q11NA]	National	2018	PISA-OECD Student survey
	Time Spent on digital devices	During a typical weekday, for how long do you use the Internet at school? [IC005Q01TA]	National	2018	PISA-OECD Student survey
	Time Spent on digital devices	Time spent using digital devices during classroom lessons in a typical school week: [Test language lessons] [IC150Q01HA]	National	2018	PISA-OECD Student survey

Outcome	Sub-section	Indicator	Level	Year	Data source
	Time Spent on digital devices	Time spent using digital devices during classroom lessons in a typical school week: [Mathematics] [IC150Q02HA]	National	2018	PISA-OECD Student survey
	Time Spent on digital devices	Time spent using digital devices during classroom lessons in a typical school week: [Science] [IC150Q03HA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices outside of school: Doing homework on a computer. [IC010Q09NA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices outside of school: Doing homework on a mobile device. [IC010Q10NA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices outside of school: Using learning apps or learning websites on a computer. [IC010Q11HA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices at school: Browsing the Internet for schoolwork. [IC011Q03TA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices at school: Doing homework on a school computer. [IC011Q08TA]	National	2018	PISA-OECD Student survey
	Use of digital devices	Use digital devices at school: Using learning apps or learning websites. [IC011Q10HA]	National	2018	PISA-OECD Student survey

Outcome	Sub-section	Indicator	Level	Year	Data source
Responses/attitudes of students on digital tools and learning	Student perceptions/attitudes on ICT use	Agree: The Internet is a great resource for obtaining information I am interested in (e.g. news, sports, dictionary). [IC013Q04NA]	National	2018	PISA-OECD Student survey
	Student perceptions/attitudes on ICT use	Agree: I like using digital devices. [IC013Q13NA]	National	2018	PISA-OECD Student survey
	Student perceptions/attitudes on ICT use	Agree: I feel comfortable using digital devices that I am less familiar with. [IC014Q03NA]	National	2018	PISA-OECD Student survey
	Student perceptions/attitudes on ICT use	Agree: When I come across problems with digital devices, I think I can solve them. [IC014Q08NA]	National	2018	PISA-OECD Student survey
Teachers' perceptions & practices	Teacher perceptions and practices	Within the last month, have digital devices (such as a tablet, computer, smartphone, e-reader or interactive whiteboard) been used in your teaching of <test language lessons>? [TC167Q01HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Searching for subject-related information online[TC168Q01HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Working on extended projects (e.g. over several weeks) [TC168Q02HA]	National	2018	PISA-OECD Teacher (test language) survey

Outcome	Sub-section	Indicator	Level	Year	Data source
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Working on short assignments (e.g. within a week) [TC168Q03HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Working at their individual pace [TC168Q04HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Working on individualised material [TC168Q05HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Planning [...] learning activities for themselves [TC168Q06HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Submitting homework or classwork [TC168Q07HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Practicing or drilling [TC168Q08HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Coordinating schoolwork with other students [TC168Q09HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Following up on missed lessons or material [TC168Q10HA]	National	2018	PISA-OECD Teacher (test language) survey

Outcome	Sub-section	Indicator	Level	Year	Data source
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Reading texts electronically instead of paper versions [TC168Q11HA]	National	2018	PISA-OECD Teacher (test language) survey
	Teacher perceptions and practices	During the last month, asked students to use digital devices for: Writing a text such as a blog or a wiki [TC168Q12HA]	National	2018	PISA-OECD Teacher (test language) survey
	Policies on digital device use	Does your school have a policy concerning the use of digital devices for teaching? [TC184Q01HA]	National	2018	PISA-OECD Teacher (general) survey
	Teacher perceptions and practices	Preparedness for teaching elements: Use of ICT in teaching [tt3g06h2]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	Professional development activities during the last 12 months: ICT skills for teaching [tt3g23e]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	Professional development activities during the last 12 months: Approaches to individualised learning [tt3g23h]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	Professional development activities during the last 12 months: Teaching students with special needs [tt3g23i]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	In need of professional development: ICT skills for teaching [tt3g27e]	National	2018	TALIS 2018 (Teacher) survey

Outcome	Sub-section	Indicator	Level	Year	Data source
	Teacher perceptions and practices	In need of professional development: Approaches to individualised learning [tt3g27h]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	In need of professional development: Teaching students with special needs [tt3g27i]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	Extent to which teachers can support student learning through the use of digital technology [tt3g34m]	National	2018	TALIS 2018 (Teacher) survey
	Teacher perceptions and practices	Frequency of teachers letting students use ICT for projects or class work [tt3g42p]	National	2018	TALIS 2018 (Teacher) survey
School perceptions and practices	School views and priorities on ICT	View on using ICT for educational outcomes [P_VWICT]	National	2018	ICILS School survey
	School views and priorities on ICT	Priorities of increased ICT professional learning resources [P_PRIORS]	National	2018	ICILS School survey



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