FINAL REPORT
NOVEMBER 2019

INDEX OF READINESS FOR DIGITAL LIFELONG LEARNING:

CHANGING HOW EUROPEANS UPGRADE THEIR SKILLS

CEPS – Centre for European Policy Studies in partnership with Grow with Google

Authors:

Miroslav Beblavý, Sara Baiocco, Zachary Kilhoffer, Mehtap Akgüç, and Manon Jacquot

With contributions from Leonie Westhoff, Nina Lopez-Uroz, and country experts

Index of Readiness for Digital Lifelong Learning

Changing How Europeans Upgrade Their Skills

Final Report - November 2019

Miroslav Beblavý
Sara Baiocco
Zachary Kilhoffer
Mehtap Akgüç
Manon Jacquot

With contributions from
Leonie Westhoff, Nina Lopez-Uroz and country experts

CEPS – Centre for European Policy Studies in partnership with Grow with Google

CEPS is an independent policy research institute in Brussels. Its mission is to produce sound policy research leading to constructive solutions to the challenges facing Europe. The views expressed in this book are entirely those of the authors and should not be attributed to CEPS or any other institution with which they are associated or to the European Union.

The Index of Readiness for Digital Lifelong Learning (IRDLL) is the result of a collaboration between CEPS (Centre for European Policy Studies) and Grow with Google. This project was financed by Google, which provided initial app data and assistance in presenting the index results in an attractive and intelligible way. The research was conducted independently by CEPS researchers and national experts selected by CEPS. CEPS bears full responsibility for the project methodology and results.

Photo credit: Shutterstock

ISBN 978-94-6138-751-6

Centre for European Policy Studies
Place du Congrès 1, B-1000 Brussels
Tel: +32 (0)2 229.39.11
E-mail: info@ceps.eu
Internet: www.ceps.eu

The authors would like to thank the country experts for
their valuable inputs in the preparation of this index, especially:

Karolien Lenearts (BE, NL[1])

Stela Baltova (BG)

Hrvoje Balen (HR)

Monika Martišková (CZ)

Athena Michaelidou (CY)

Christian Dalsgaard (DK)

Mohesen Saadatmand (FI)

Jürgen Handke (DE)

Aune Valke (EE)

Dimitris Karantinos (GR)

Ádám Horváth (HU)

Angelica Risquez (IE)

Elina Cirule (LV)

Julija Moskvina (LT)

Joseph Vancell (MT)

Łukasz Sienkiewicz (PL) with support of Ms Karolina Lebek and Ms Alena Ivanova

Neuza Pedro (PT)

Ioana Raluca Goldbach (RO)

Marko Grobelnik (SI)

Inés Gil-Jaurena (ES)

Stefan Hrastinski (SE)

[1] Relevant countries indicated with EU abbreviations.

Table of Contents

List of Figures and Tables

List of acronyms

Acronym	Full name
DEAP	Digital Education Action Plan
DG(s)	Directorates(s)-General
EC	European Commission
EU	European Union
GDP	Gross Domestic Product
IRDLL	Index of Readiness for Digital Lifelong Learning
Member state(s)	MS(s)
MOOC(s)	Mass Open Online Course(s)

EXECUTIVE SUMMARY

Digitalisation brings about disruptive transformations in society, ranging from access to services, interaction with others, obtaining and sharing information, to metamorphoses in the nature and organisation of work. Learning is no exception.

Digitalisation of learning is the process by which education and training, and generally skills acquisition, development and recognition, are being transformed by the use of digital technologies. Digital technologies have already changed access to information and knowledge in everyday life. Online multimedia tutorials can be downloaded for any daily tasks. Nowadays, online tools and forums are the most effective means to master a statistical computer programme.

To measure the current situation of digital learning in European countries and to draw attention to this very important issue, **the Jobs & Skills Unit at the Centre for European Policy Studies (CEPS) has developed an Index of Readiness for Digital Lifelong Learning (IRDLL) for the European Union (EU)'s 27 countries.**

This Executive Summary presents the results of the research divided into four major chapters. The first deals with digital learning as a topic – what it is, and what it is good for. The second chapter presents the results of the IRDLL overall and of its individual subcomponents. It also contains the main messages that can be distilled for national governments and other stakeholders. The third part of the report looks at what the EU, at supranational level, is currently doing with regard to digitalisation of learning and draws recommendations for the next European Commission (EC). The last chapter contains 27 individual country sheets – just one page long – to present a reader-friendly summary of key findings for each EU member state (MS).

DIGITAL LEARNING – WHAT IT IS AND WHAT IT IS GOOD FOR

In the past, the technological and infrastructural angle of the phenomenon dominated discussions on digital learning. More recently, it has become evident that **digital learning encompasses how digital technologies are integrated in teaching and learning approaches**, within an organisational and institutional context, considering also users' ability to make the best use of such technologies and embrace change.

Digital learning loosens the boundaries of formal and informal learning and creates a continuum of learning opportunities. It changes **where and when one learns** – eliminating or at least reducing barriers to accessibility by creating virtual spaces and the possibility to learn at any time. It increases **the potential actors from and with whom one learns.**

Digital learning changes **knowledge production, assimilation, and ultimately how one learns**. Through enhanced connections, learners can tackle any topic in a much more multidisciplinary manner, more easily synthesising one discipline's approach to that of another. Connections facilitate continuous learning in interaction with peers and stimulate on demand and micro-learning of specific skills, competences and topics that learners choose more easily and more independently.

Lastly, digital learning changes **how to show what one learns.** Formal and non-formal institutions can issue digital certificates to validate competences that result from education and training, either online or in-person. Being digitally available, these certificates are more easily shareable and verifiable. Moreover, digital technologies offer a new means of validation for informal learning.

If approached correctly, digital learning can enhance learning in three main dimensions, which can be summarised by explaining how **digitalisation can deliver more, cheaper, and better learning.**

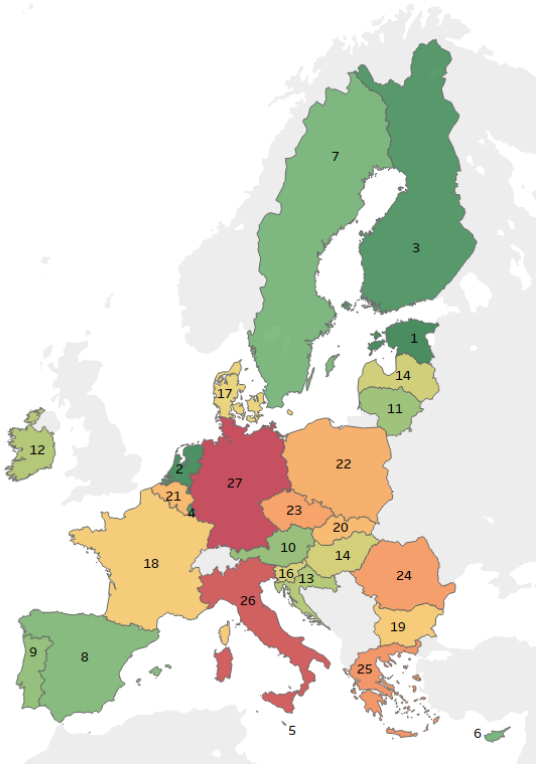
Learning more. Digital learning offers the opportunity to learn "old" subjects with new methods and it paves the way to learn, through a structured and systematic method, new subjects and new skills, which are increasingly important for working and taking part in society. A key example is coding, and more generally digital skills. Opening up and constantly enhancing the possibility to learn remotely, digital technologies also make all sorts of learning opportunities available for people in all locations.

Learning cheaper. Once an initial investment in technology is made, digital learning becomes a highly efficient solution to lower the costs of education and training. It not only provides more opportunities for learning; it can also provide opportunities to more people than was possible before, without significantly increasing costs. This substantially decreases the cost of education and training, allows producers to develop economies of scale and new business models, and to provide cheaper learning opportunities. This lowers entry barriers to education and training.

Learning better. More learning opportunities are available to more people than ever before. Additionally, digital technologies can improve the quality of learning, enhancing its effectiveness in terms of individual outcomes and overall results for society. Teaching methods can be enriched by technological supports to increase participation and interactivity in class, or in virtual learning environments. Digital technologies expand learning opportunities, allowing people (and especially adults) to learn on demand, based on what they need and what they want, personalising their learning process. Personalisation can be further augmented by tracking each learner's performance, making the learning process more adaptable and thus more effective. By better tracking outcomes on a large scale, building big data collected through digital technologies employed in the learning process, we can identify what works best, and what is less successful, for both new and old education and training practices system wide.

INDEX OF READINESS FOR DIGITAL LIFELONG LEARNING IN EUROPE (IRDLL)

Figure 1. Overall results of digital learning index in EU-27



Source: Authors' elaboration based on index calculations.

The countries doing the best overall are Estonia (1st), the Netherlands (2nd), Finland (3rd), Luxembourg (4th), Malta (5th) and Cyprus (6th). The results of most of these countries is not surprising, as north-western countries tend to perform very well in a variety of European rankings considering factors like political institutions and economic performance. As these are likely to impact digital learning readiness, the high performance of these countries is to be expected. Luxembourg is the wealthiest European country per capita, but does not always score well on rankings related to innovation. Surprise comes in 5th and 6th place. Malta and Cyprus – as very small and southern MSs – show that geography is not destiny.

These leaders are followed by countries slightly above and below the European average. Sweden leads in 7th place, followed by Spain (8th) and Portugal (9th), Austria (10th), Lithuania (11th), Ireland (12th), Croatia (13th), with Hungary and Latvia tied for 14th place. Below the EU average are Slovenia (16th), Denmark (17th), France (18th), Bulgaria (19th) and Slovakia (20th).

Countries significantly underperforming the European average are Belgium (21st), Poland (22nd), the Czech Republic (23rd), Romania (24th), Greece (25th), Italy (26th) and Germany (27th). The low ranking of southern and eastern EU MSs at the bottom is not surprising, but Germany's last place highlights an important message discussed further below.

TRENDS AND CONCLUSIONS

Progress is uneven and all countries have room to grow. European countries differ widely in their readiness to utilise digital learning technologies. The gap between the best and the worst EU MS is large across nearly all indicators. Correlation between individual parts of the index is low or even negative, indicating that countries are not uniformly ranked across individual indicators. This also means that all countries, including the top performers, have significant room to grow. At the same time, digital inclusion is not a given, even for wealthier and more successful countries. The latter cannot afford to be complacent; they need to address the risks highlighted in this report to avoid digitalisation hindering rather than fostering better access to learning.

Even the best-performing European country has areas where it should improve. Conversely, even countries with low scores usually have something they can teach others. For example, Romania performs better in terms of institutions and policies (7th in the EU). In neighbouring Bulgaria, new funding opportunities from EU funds are mobilised on a massive scale to drive its development.

Money speaks – up to a point. Wealthier and more economically successful countries generally, but not uniformly, score better than less economically developed MSs. However, there are exceptions – of which Germany and Belgium are most striking.

Neither geography nor history are destiny. A number of central and eastern European MSs seem to be doing quite well in digital learning readiness. Malta, Cyprus, Lithuania, Hungary, and Estonia (accession in 2004), and Croatia (accession in 2013) rank around or above half of all MSs. Notably, Estonia is the absolute winner of this year's index.

Determined action even by a small country can help. Cyprus and Malta are perhaps the most surprising winners of the index. Ranked at the 5th and 6th place, the small Mediterranean island states show the importance of institutions and policies for digital learning, and the potential for less wealthy nations to catch up and even surpass European leaders.

Size matters – negatively, dragging down Europe. Four out of the largest five EU countries by total GDP and population – Germany, France, Italy and Poland - score poorly, with Spain being the only exception. Together, these four countries account for the majority of the EU's population after Brexit, so this is a troubling development. There is no one-size-fits-all solution for this issue. While France has an excellent institutional environment for digital policymaking, it lags behind in investment into the digital skills of educators, which are crucial to digital learning. Italy has recently made strides in creating strong institutions and policies for digitalisation, but this has yet to deliver tangible results.

Europe will not move forward without its biggest economy; that requires changes beyond Germany. Germany's last-place finish is remarkable, but perhaps less so for those closely paying attention to digital trends. Germany has come under scrutiny for under-investment in digital infrastructure. Attitudes are also important, and Germans tend to be sceptical towards digital technologies. However, the salience of this issue goes beyond Germany. If there is one thing that can be observed in several large EU countries, it is a wary attitude towards digitalisation. Unless citizens, students and consumers can trust their privacy and interests will be protected, then the potential of digital learning will never take off.

WHAT SHOULD THE EU DO?

The report describes what the EU has been doing with regard to digitalisation of learning. There is already a flurry of activity, and the incoming EC President von der Leyen clearly stated in her programme that this is a topic of growing importance.

We offer three specific recommendations after analysing current policy and practices at the EU level.

1) The EU needs to be more strategic. It can do that by strengthening a comprehensive vision for concerted and coherent policy action on digital learning, building on the positive experience of the Digital Education Action Plan (DEAP), to serve as framework and orientation for MSs. At the moment, a clear orientation, inspired by a holistic vision, is missing. Too often each Directorate-General (DG) tends to have its own perspective and agenda on the topic of digital learning.

2) The EU should more directly support digital learning by immediately creating a dedicated financial instrument. EU funds for digital learning need to be streamlined, which is best accomplished with a dedicated funding instrument. To ensure the sustainability of digital learning projects funded by the EU, this dedicated financial instrument should have criteria to embed financed projects within national policies for digital learning. This would increase the visibility of the topic, raise awareness and allow for

better tracking of the results of funding. In particular, as a short-term priority, the EU should intensify efforts to foster digital skills, especially for vulnerable groups, to ensure equal access and inclusiveness of digital learning. The current shortage of digital skills by almost half of Europeans is particularly worrying, as the process of digitalisation may leave behind those lacking digital skills. In line with EU objectives, such funding should always aim to drive inclusive progress in digital learning.

3) The EU needs to support Europe-wide understanding and knowledge generation about digital learning. It should increase research efforts for digital learning, including a specific financial stream for digital learning in the next EU Framework Programme for Research and Innovation. As digital learning is still new, further and focused research is needed to explore it, identify what works, what does not, and more clearly assess costs, benefits, and risks.

AN INTRODUCTION TO DIGITAL LEARNING

Digitalisation brings about disruptive transformations in society, ranging from access to services, interaction with others, obtaining and sharing information, to metamorphoses in the nature and organisation of work and the disappearance of certain jobs while new ones emerge. Such transformations impact on all aspects of people's lives. Education and training is no exception. On the contrary, important changes in this field appear imminent, advancing at a pace that has to be kept by those willing to develop a sound understanding of the phenomenon and adequate strategies to navigate it. While it has been argued that digital technologies are likely to have, probably more rapidly, the same impact on the learning process as did the printing press, accompanying social and economic factors are important in shaping such transformation (Warschauer 2007).

Such impact is already visible in the way digital technologies have changed access to information and knowledge in everyday life. Online multimedia tutorials can be downloaded for basically every task that people run in their personal lives as well as at work, from cooking and gardening to preparing presentations and analysing databases, or learning a new language for both pleasure and career objectives.

To learn how to master a statistical computer programme, it is much more effective, nowadays, to search on online blogs,[2] which are continuously updated by experts and practitioners, than reading a book written by one or two authors to this aim, as one used to do in university courses of statistics in the past. The possibility of obtaining continuous updates on new developments and practices, as well as exchanging common problems to find collaborative solutions, enhances the capacity to keep learning.

But it is not all about computers. The University of Naples has recently launched, through its online platform, the first MOOC on how to make pizza,[3] developed by university professors in several disciplines, practitioners, businessmen and businesswomen with significant experience in the field. The course is dedicated to skills development for workers and people willing to work in the food services sector, including cooks, managers, business owners, salespeople, and servers. Yet, it is also open to journalists and food bloggers and, simply, to food lovers. Indeed, the course is open to whomever, because it is for free and it can be accessed online from everywhere, at any time.

The potential of digital learning to open up possibilities in education and training to more people than before is enormous. This applies to new learning opportunities in innovative fields for existing education and training systems, such as computer programming or pizza making, but it is also very relevant for more traditional basic skills. An e-learning platform eBac[4] in Luxembourg allows adults that dropped out of school before finishing secondary education to achieve their diploma through

[2] See for example the Stata Blog Stata Blog: Not Elsewhere Classified.
[3] See PizzaMOOC: Pizza Revolution.
[4] See eCampus Luxembourg Platform.

blended distant programmes, with a classical curriculum that prepares for the classical baccalaureate to access to the university, or with a wider range of modules more oriented to vocational training.

Digital learning possibilities are indeed everywhere, so that 'living' the phenomenon appears easier than describing, measuring and assessing it. Yet, a sound understanding of the ongoing transformations is necessary to navigate change and make the most out of it.

What is digital learning?

While a well-established overarching definition is hard to find (Williams 2018), digitalisation of learning describes **the process by which education and training, and generally skills acquisition, development and recognition, are being transformed by the use of digital technologies**. To draw a comprehensive picture of digital learning, therefore, it is necessary to consider the phenomenon in its all its complexity, bearing in mind that **it encompasses any type of learning that is undertaken with the support of digital technology.** This includes learning that occurs in formal and non-formal education and training, as well as voluntary informal learning activities in everyday life, such as visiting museums, reading a manual or watching videos. When taking this broad perspective, it appears evident that **digital technologies impact on learning processes at all ages**, whether for children in early education and schools, for students in higher education or for workers in vocational training at the beginning of or throughout their career.

Therefore, by adopting a comprehensive and lifelong perspective, this definition implies that digital learning can occur in very diverse forms, making use of a variety of tools and practices and involving very diverse actors in the process. To give some examples, digital learning can come through completely informal sources on the internet, such as videos, blogs, social media groups and apps, with material often put together through crowdsourcing processes. Alternatively, digital learning resources can be provided online by formal or non-formal institutions on their websites or dedicated apps, being developed by professionals and experts, for instance in the form of e-books or MOOCs. Finally, digital learning can happen through digital tools and sources in a traditional, physical learning environment like the classroom, namely thanks to virtual and augmented reality, gamification of classes and exercises, tablets and computers to study school subjects – and these are only some of many possible examples.

In the past, especially before the 2000s, **the technological and infrastructural component of the phenomenon** used to dominate discussions on digital learning, focusing on the use of computers or connectivity (Conrads et al. 2017). More recently, it has become evident that **digital learning also encompasses how digital technologies are integrated in teaching and learning approaches, within an organisational and institutional context,** also taking users' skills into consideration so they can make the best use of such technologies and embrace change. Indeed, while technology is acknowledged as the main driver for change in education in the last decade (Vincent-Lancrin et al. 2019), an innovative and functional environment for learning should not undermine the important role of people and their capacity, as well as of organisations and institutions involved in the process. **The skills of both teachers and learners are thus an important component of digital learning.** In particular, digital skills often appear as a closely related topic, being necessary to engage in digital learning activities and, at the same time, improving through digital learning. However, even such skills are only a part of this complex phenomenon that requires and generates a much broader set of cognitive and non-cognitive skills. Enabling infrastructure, technological advancements and digital skills are necessary elements for

digital learning. Yet, these are not sufficient to ensure that it functions properly, which necessitates **a conducive institutional context as well as sound pedagogy and methods in adult education.**

As defined above, digital learning, on the one hand, creates **new channels for learning independently, outside the traditional institutional environments** that modern societies have developed for education and training, namely schools, universities, laboratories and classrooms in general. On the other hand, **it enables forms of blended learning taking place in these traditional learning environments**. Such forms consist of complementing traditional learning methods with digital material and tools, often online, deeply changing even traditional forms of education and training in several aspects. Overall, digital technologies define a new, broader ecosystem for learning, where learning takes place in both physical and virtual environments, through both formal and informal processes (Brown, Conole, and Beblavỳ 2019).

What does digital learning change?

Digital learning loosens the boundaries of formal and informal learning

When it comes to conceptualising learning, a longstanding distinction has been made between formal and informal learning. Rather than being completely clear cut, this distinction has emphasised the different degree of structure, organisation and intention of the learning process throughout these different types of learning, observing when this happens within or outside education and training institutions (Cedefop 2014). Digital learning, as described above, further blurs such a distinction by establishing an enhanced *continuum* between formal and informal learning. Digital technologies make it possible to access learning opportunities in more contexts and ways than in the past, enhancing both formal and informal learning and mixing some aspects of the two. Such technologies extend the formal learning process far beyond formal or non-formal institutions for education and training, complementing a structured learning process with informal sources of learning; for instance, digital technologies in classrooms are used to access digital material from social media (Dabbagh and Kitsantas 2012). On the other hand, thanks to digital technologies, learning can take place completely outside these institutions, yet still in a very structured way and with a strong motivation, for example when learning a new language through mobile apps or when learning to type faster through games on a computer.

Digital learning changes where and when one learns

Along with conceptual boundaries, digital technologies considerably lower physical barriers in the learning process. Thanks to connectivity, which through the internet eases transfers of digital learning material, physical spaces are not strictly necessary anymore to access learning opportunities. Often, such spaces are replaced by virtual spaces that are accessible remotely with the aid of digital devices. Even if a physical space may still exist where, for example, classes take place, individuals can join virtually from different locations. As such, virtual spaces make it possible to overcome physical distance in accessing learning opportunities, and thereby strengthen the transnational dimension of learning and involve actors across different countries. Happening in virtual environments, learning is often not constrained by a specific schedule and timing, and can be undertaken basically at any moment, according to learners' needs and availability in their daily life. Moreover, digital learning also changes when individuals learn throughout their lifespan. Importantly, allowing for more opportunities to access learning, with higher flexibility in time and space, it facilitates continuous learning during adulthood, when time for learning is limited by other duties (Brien and Hamburg 2014).

Digital learning changes the actors from and with whom one learns

Digital technologies, thanks to connectivity, do not only facilitate access to learning material. These technologies also make it easier to share such material, easily produced and provided by a multitude of actors and by learners themselves. The means for this sharing are notably, but not exclusively, websites, social media and mobile apps. This creates virtual communities of practices, where all those involved in the learning process establish mutual relationships that allow them to share information as well as experience, learning and receiving feedback from each other (Lave and Wenger 1991), not necessarily limited to schooling or professional development. In this way, the process of learning becomes more participatory and characterised by a bottom-up approach that discards to some extent the hierarchies that have historically developed around knowledge. This is not limited to the virtual world. Through the introduction of digital technologies, participation and sharing increase also within traditional learning environments. For example, universities put in place spaces where students and teachers can share resources and their own work, or schoolteachers create mechanisms to take on board student inputs and give more feedback during classes, with the aid of tablets or computers, through instantaneous communications.

Digital learning changes how one learns

As described above, when engaging in digital learning, one learns from more sides and in a relationship often more characterised by parity and active participation than in the past. This deeply affects how knowledge is produced and assimilated. Indeed, changing how to access and share material, as well as the relationships around learning, digital technologies have the potential to transform thinking and information processing overall. Those considered digital natives, born and grown up surrounded by digital devices, are believed to have already developed a new cognitive functioning, while others can gradually shift their approach as they engage with digital learning (Prensky 2001). To explain this process, the theory of connectivism stresses the role of digital technologies in facilitating different types of connections: between different sources or communities, between humans and non-human appliances, between fields, ideas and concepts (Siemens 2005). Through enhanced connections learners can tackle any topic in a much more multidisciplinary approach, crossing the barriers from one discipline to the other more easily. Connections facilitate continuous learning in interaction with peers and stimulate on demand and micro-learning of specific skills, competences and topics that learners choose more easily and, in some cases, independently, creating personalised learning environments (Dabbagh and Kitsantas 2012) and thus increasing motivation. This opens the way to developing new pedagogical approaches and reinforcing adult education methods.

Digital learning changes how to show what one learns

In addition to the learning process *per se*, digital technologies have an impact on how to certify and show skills, competences and subject mastery acquired through learning. Formal and non-formal institutions can use such technologies to issue digital certificates to validate competences that result from education and training, either online or in-person. These certificates are more easily shareable and verifiable because they can be made available digitally and often online. Moreover, digital technologies offer a new means of validation for informal learning, happening both online or in real life. This form of learning has been traditionally overlooked precisely for the lack of visibility and measurability of its outcomes (Björnavåld 2001). With digitalisation, barriers to certification of skills are lowered because anyone can engage in verification of skills, even micro-skills, through digital

online tools. As in the example of open badges, these certifications are then easy to embed in social network profiles and thus highly portable (IMS Global Learning Consortium 2016). In these regards, with digital learning means, skills development and validation become more and more decoupled from the formal institutions traditionally dedicated to these functions.

What are the benefits of digital learning?

Through all these channels of transformation, learning can improve considerably thanks to digital technologies, benefitting individuals, education and training stakeholders and society as whole. Such benefits include a greater accessibility to education and training, with expanded opportunities for learning, as well as a better quality of these more accessible and expanded opportunities.

Learning more

Digital learning offers the opportunity to learn 'old' subjects in new ways. For example, teaching in mathematics, science or literature can benefit from additional tools and methods provided with the support of computers or mobile apps, to do exercises, support rote studying or allowing learners more creativity and interactivity when they approach a subject. Moreover, digital learning paves the way to learn, through a structured and systematic method, new subjects and new skills, which are increasingly important for work and taking part in society. A key example is coding, and more generally digital skills, which is to become a new subject in schools, or for which vocational training courses can be offered more often, with the aid of digital technologies, even remotely. Indeed, opening up and constantly enhancing possibilities to learn remotely, digital technologies also make all sorts of learning opportunities available for more people. Potentially, everyone could take educational and training courses that are provided anywhere, thus no longer being constrained to those subjects offered in their proximity or by institutions they can access physically. Often these learning opportunities are made available with significant flexibility in terms of time schedule, which is a key aspect to pursue learning throughout life, even beyond the period of life dedicated exclusively to learning, traditionally childhood and youth. As a result, access to learning opportunities is facilitated by digital technologies that allow remote access to education and training for all and in particular for those people facing higher barriers, such as people with disabilities. Indeed, as long as an internet connection is available and online learning material is provided in accessible forms (e.g. text captions for deaf or hard-of-hearing people, *ad hoc* screens or audio files for blind or visually-impaired people), people with disabilities can benefit from the removal of barriers to education and training and this will foster inclusive learning opportunities in society as a whole (Kilhoffer and Baiocco 2019). Finally, in addition to facilitated access to formal learning material and opportunities, digital learning, by enabling communities of practices, enhances capacity to access non-codified knowledge on a given subject and expands informal learning opportunities.

National Project for Autonomy and Curriculum Flexibility – PACF (Portugal)

Since 2017, Portuguese schools can join, on a voluntary basis, the "Project for Autonomy and Curriculum Flexibility – PACF" (Projeto de Autonomia e Flexibilidade Curricular). It provides schools with the necessary conditions to manage the curriculum while also integrating practices that promote better learning. Beginning in 2016 with a pilot testing in 10 schools, the project was extended up to September 2017, to over 200 schools. The project relies on the idea that schools must be able to define part of the curriculum, as a way to promote curricular innovation. The PACF pilot not only allowed schools to experiment with new curricular subjects, it also allowed them to implement new pedagogical approaches, as well as to develop new assessment practices, including with the aid of digital technologies. This was developed in order to support a coherent implementation of the "Students' skills profile by the end of compulsory schooling", as this new profile for students required the development of a new curricular approach. The PACF works alongside another national initiative to promote digital skills, including through digital education: the "Essential Core Curriculum" for elementary and secondary education (Aprendizagens Essenciais). It was launched in August 2017 to address the need for a process to update curricula. The aim was to ensure a mastery of core disciplinary subjects, while at the same time allowing space for interdisciplinary learning. Through it, ICT became curricular content across all 12 years of mandatory education. At primary schools, ICT is addressed mainly by the national project "Introduction to Coding in Primary Schools- INCoDe.2030" (Iniciação à Programação no 1º ciclo). These projects are aimed at fostering:

- Development of digital educational resources for different levels of education and subjects;
- Training of pre-school, primary and secondary education teachers, with participation of teachers in training centres and higher education;
- Extension and further development of the ICT curriculum;
- Design and implementation of the subject Information and Communication Technologies (ICT) in compulsory education;
- Design of an ICT reference framework for 1st-cycle students.

Impact

The pilot phase was quite positive, with an evaluation study being developed with 130 out of 226 schools that took part in this project. In 2018/19, the PACF project was extended to all schools/school clusters; though the project remains voluntary nature, 85% of schools/school clusters decided to be part of the initiative. In the coming years, PACF will be applicable to all schools in the country by legislation. This means that more than 7,000 Portuguese primary and secondary schools will have the opportunity to experience the PACF.

Useful Resources: OECD report, 2018; INCoDe2030; Cosme, A., 2018; Palma, C., 2019.

Learning cheaper

Once an initial investment on technology is undertaken, digital learning appears as a highly efficient solution for lowering the costs of education and training. It does not only provide more opportunities for learning. It can also provide these opportunities to more people than was ever possible before, without significantly increasing the costs of production. Considering the simple example of classes or books that are produced and then published online, it is possible to claim that these resources become non-rival goods once they are provided online. In fact, once the producers incur the cost of producing one unit of these resources, costs do not increase for additional individuals accessing the

class or book. These can then be provided more cheaply than before, when the producer incurred printing costs or infrastructural costs to allow in-person participation, thereby limiting the quantity on offer. Most digital learning resources can be accessed by individuals without preventing other individuals benefitting from such resources. In some cases, these resources can even be provided for free online, thereby also becoming non-excludable, so that a potentially infinite number of individuals can access these classes or books without incurring any cost. This considerably lowers the cost of education and training, allowing producers to develop economies of scale, create new business models and provide learning opportunities more cheaply than before, lowering in turn the barriers to entry into education and training.

Global Libraries Initiative "Father's third son" (Latvia)

Driven by the observation that public libraries in Latvia play an important role in reducing the digital divide ensuring no one is left behind, reducing social exclusion, especially in rural areas, the project "Father's Third Son" (Trešā Tēva Dēls) has been financed by the Bill & Melinda Gates Foundation and the Latvian government to develop free access to information technology and digital online resources – through computer and internet – and to receive advice on how to use it. Another activity of the project is the development of a joint access point to the local content of public libraries by digitising local history and other content of local importance and making it available through the joint library portal. Overall, the project aims to connect all Latvian public libraries to the internet with broadband connections, to build a wi-fi network for library users, to provide approximately 3 computers and a scanner per library to meet the anticipated high demand for digital online resources, and to provide training to librarians. Once trained, librarians provide both individual consultations and organise training for different groups. This includes various e-services training to improve users' computer skills and competencies, in particular seniors, the unemployed and children. As such, since 2006, Father's Third Son has been contributing to fostering digitisation initiatives in the country.

Impact

The project has contributed to the development of basic IT skills training programmes for social risk groups and methodological materials for librarians to work with these target audiences. An interactive e-learning course with game elements for children up to grade 4 and methodology has also been developed to adapt to different target audiences. Overall, studies conducted in 2007, 2011 and 2015 show an increasing number of internet users in the country with the use of the free public internet access in public libraries having almost tripled. Library internet usage has doubled in all age groups except among children and teenagers, which can be explained by this generation's greater access to the internet through mobile devices. 874 Latvian libraries (including library branches and book distribution points) installed a total of 4,000 new computers and multifunctional devices for copying, scanning and printing.

Useful Resources: Bibliotekam

Learning better

More learning opportunities are provided to more people than before. Yet, additionally, digital technologies can improve the quality of learning, to enhance its effectiveness in terms of individual outcomes and overall results for the society. First of all, as mentioned above, teaching methods can be enriched to make the best use of technological supports, to increase participation and interactivity in class or in virtual learning environments. A proactive approach is enhanced also when choosing what to learn. Digital technologies expanding learning opportunities, allow people, especially in adult age, to

learn on demand, based on what they need and what they want, personalising their learning process, which is then characterised by higher motivation and therefore likely to be more effective. Moreover, a better tracking of each learner's performance, through the data collected by the digital devices used while learning, can result in personalised learning modules and programmes, to respond to individual characteristics, making the learning process more adaptable and thus more effective for each one. In fact, tracking of outcomes can account for what works best for whom and for unique individual strengths and weaknesses. In addition to effectiveness at individual level, a better tracking of outcomes on a large scale, for example relying on big data collected through digital technologies employed in the learning process, can help identify what works best and what is less successful in terms of both new and old education and training practices in the entire system. Big data can also be very useful in detecting skills that are increasingly demanded, contributing to develop adequate supply of education and training in response.

Mathema-TIC Personalised Learning in Mathematics for every learner (Luxembourg)

To enhance teaching and learning and to transform maths education at schools, the Ministry of National Education, Children and Youth of the Grand Duchy of Luxembourg (MENJE), in collaboration with Vretta, a leader in learning technology solutions, designed and developed the MathemaTIC Personalised Learning Environment for primary and secondary school students. The purpose of MathemaTIC is to enhance student achievement by building a sustainable solution tailored to meet the specific needs of the mathematics curriculum of schools and to engage students in innovative ways to raise their level of numeracy and prepare them for success in mathematics. MathemaTIC is a personalised learning platform that is designed to make the experience of learning mathematics engaging and enjoyable for every learner irrespective of their social origin or level ofaccess to quality information and pedagogical resources. This is beneficial because it is an example of adapting traditional content via digitisation and media preference of the new generation. Students interact with research-backed, engaging resources that are tailored to their needs and aligned to learning outcomes as in the traditional curriculum for primary school students from Grade 3 to 8. MathemaTIC provides teachers and students with real-time academic progress through actionable data. The dashboards let them view feedback that directly aligns students' needs with learning outcomes, pointing out areas of strengths and weaknesses. MathemaTIC contains game-based and problem-solving items throughout its modules. These goal-oriented items let students apply the knowledge they learned in a fun and engaging environment. The mathematical items have been developed in four languages: German, French, Portuguese and English, enabling students to understand and work through problems in the language in which they are most comfortable. The platform can be switched between languages to enable students to understand the problem in a language other than the language of instruction. It also helps parents assist their children throughout the learning process.

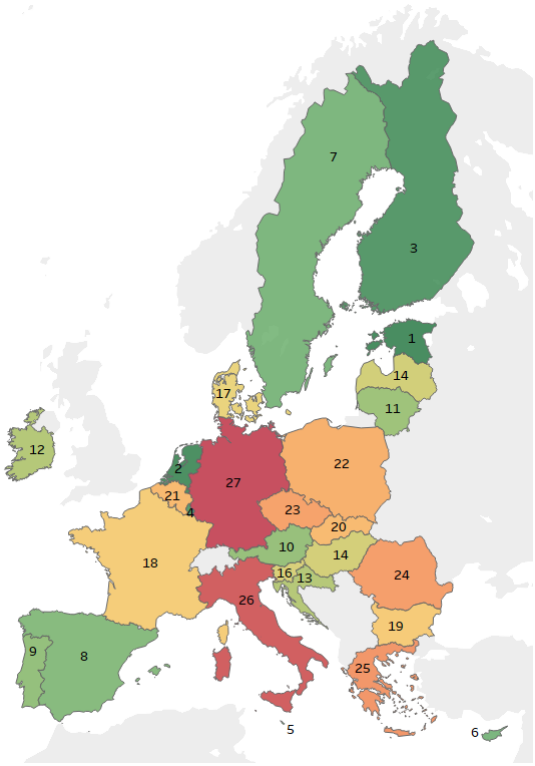
Impact

The successful launch and implementation of MathemaTIC, the personalised learning platform in mathematics, for primary school students in Luxembourg led to the development of about 300 new technology-enhanced items over the past three years for students in lower secondary schools, of which the launch began in autumn 2019 across Luxembourg.

Useful Link: Mathema-TIC

INDEX OF READINESS FOR DIGITAL LIFELONG LEARNING (IRDLL)

Figure 2. Overall results of digital learning index in EU-27



Source: Authors' elaboration based on index calculations.

This chapter presents the newly constructed **Index of Readiness for Digital Lifelong Learning (IRDLL).** First, the results of 27 EU MSs are presented for the overall index. Then, the analysis digs into the individual components of the index and related results for each MS.

Indices are a good way to reach policymakers and the public on complex subjects such as this one. However, **the final objective is not only to rank countries and compare their standing. The index presents a combined qualitative and quantitative assessment of each MS' current situation to help policymakers, social partners, media and the public understand what needs to be done.** All these stakeholders may benefit from the present study by considering national gaps and potential areas for improvement, and learning from innovation and best practices elsewhere in Europe.

The index has been constructed with existing data and new data generated from surveys with national experts from the EU-27. In developing the index, other indices[5] served as a source of inspiration, but we also sought guidance from literature on creating composite indicators.[6]

Moving on to results – **the countries doing the best overall are Estonia (1st), the Netherlands (2nd), Finland (3rd), Luxembourg (4th), Malta (5th) and Cyprus (6th).** The second through fourth countries are not surprising, as north-western countries tend to perform very well in a variety of European rankings considering factors such as political institutions and economic performance. As these are likely to impact digital learning readiness, high performance is to be expected. Surprise comes in the 5th and 6th place. Malta and Cyprus – as very small and southern MSs – show that geography is not destiny.

These leaders are followed by countries slightly above and below the European average. This group is very geographically diverse, but mostly consists of smaller MSs. Sweden leads in 7th place, followed by

[5] For example, the Regional Innovation Scoreboard, Euler Hermes: Enabling Digitalization Index, International Digital Economy and Society Index, Digital Transformation Scoreboard, the European Lifelong Learning Indicators (ELLI).

[6] The most authoritative is the OECD's Handbook on Constructing Composite Indicators (Methodology and User Guide) (2008).

Spain (8th) and Portugal (9th), Austria (10th), Lithuania (11th), Ireland (12th), Croatia (13th), with Hungary and Latvia tied for 14th place. Below the EU average are Slovenia (16th), Denmark (17th), France (18th), Bulgaria (19th) and Slovakia (20th).

Countries significantly underperforming European average are Belgium (21st), Poland (22nd), the Czech Republic (23rd), Romania (24th), Greece (25th), Italy (26th) and Germany (27th). The place of southern and eastern MSs at the bottom are not surprising, but Germany's last place certainly is. This result is discussed further below.

Leaders

Figure 3. EU-27 leaders in digital learning

Source: Authors' elaboration based on index calculations.

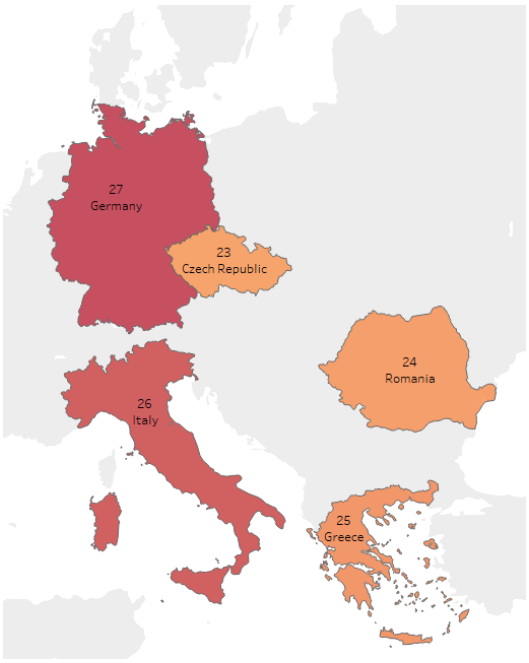
Estonia is a country that, depending on context, can be grouped with the Baltic or Scandinavian states. Estonia's income per capita is well below half that in Sweden, but the country nevertheless has very strong digital performance across the board. Its government, for example, has launched a number of ambitious programmes to ease administrative burdens, and make everything from tax registration to voting possible via digital means. Its ranking reflects its ambitious and innovative digital programmes, particularly as they relate to its educational system and digital infrastructure. Estonia's leadership shows that even a small country with a chequered history can lead Europe.

Looking to other leaders, the Netherlands places well owing to its excellent institutions and policies on digital learning, and high availability and use of digital learning. Finland is well known for its world-class education system from primary school to lifelong education and training, which is reflected in its high rankings across the board in digital learning indicators. Luxembourg scores quite high generally, but it is not as uniformly successful as other top countries. For example, Luxembourg places 24th in learning outcomes, which is a notably poor result considering the country has the highest GDP per capita in the EU.

Also of note, several countries scored higher than expected and certainly above their typical performance in other European rankings. Malta (5th) and Cyprus (6th) are often grouped with other southern European countries, but this index finds they outperform many larger and higher income countries. This could be a reflection of the Maltese and Cypriot governments taking advantage of EU funding opportunities, which contributed to infrastructure and education system upgrades.

Stragglers

Figure 4. EU-27 stragglers in digital learning



Source: Authors' elaboration based on index calculations.

The worst performers in readiness for digital lifelong learning show some expected results mixed with a few surprises.

Overall, southern and eastern Europe performs poorly. This is particularly reflected by the lower rankings of Romania, Greece and Italy, which often score low on European rankings related to economic performance, innovation, and digitalisation. Italy is interesting in that its education simultaneously performs so well and so badly. In learning outcomes, Italy places 8th, while in educational attainment and participation, it is 26th. Greece is nearly the opposite, placing 27th in learning outcomes, but more moderately in learning attainment and participation (16th).

Romania performs poorly overall, but it seems to be improving its digital infrastructure. In 2017 it ranked second in the EU (behind Sweden) by percentage of households with very high speed internet connections. This figure more than tripled compared to 2013. Still, Romania continues to score very poorly in regards to quality of governance and policy implementation, which dramatically decreases its overall rankings.

The low rankings of the Czech Republic (23rd) and Poland (22nd) are more surprising. The Czech Republic leads new MSs in terms of economic performance, but also performs strongly in innovation. Poland has had one of the most dynamic performances across Europe during the last 30 years both in terms of economic development and improvements in education. This is a warning against complacency given the pace of technological and economic change.

Most strikingly, Germany comes in last. While Germany is not known for its investments in digital infrastructure and education, few indices of EU MS place Germany so poorly. Germany's performance cannot be explained by a single indicator, but it performs relatively weakly on a range of indicators, providing robust evidence of underperformance.

Detailed information on IRDLL and its results

Digging into the individual components that lead to the overall results presented above, the IRDLL index is composed of 9 indicators in three categories that are assigned weights according to their relevance for the deployment of digital learning (see Table 1). The construction of the IRDLL stems from the premise that **three broad categories are most relevant to understand digital learning readiness: learning outcomes and participation, institutions and policies, and the availability of digital learning.** The literature suggests that each of these provides insight into a particular aspect of digital learning readiness.

Table 1. Composition of IRDLL

Index section	Weight
A - Learning participation and outcomes	**30%**
Learning outcomes	15%
Educational attainment and participation	7.5%
Participation in lifelong learning	7.5%
B - Institutions and policies for digital learning	**40%**
Institutions and policies	10%
Regulation and funding	15%
Educators and schools	10%
Governance and implementation	5%
C - Availability of digital learning	**30%**
Attitudes towards digitalisation	15%
Accessibility of digital learning	15%

Source: Authors' elaboration.

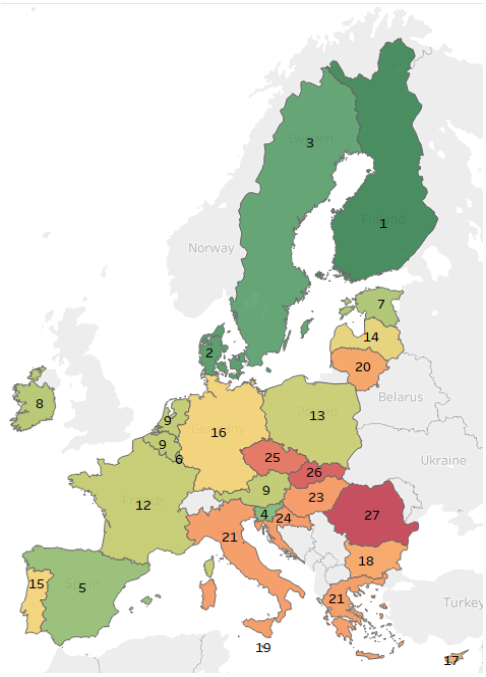
The research team identified existing data suitable for constructing the index through desk research. Such data needed to cover the EU-27, be as recent as possible, and come from reputable sources. As detailed below, main data sources include Eurostat, Eurobarometer, OECD, and the Bertelsmann Stiftung. The United Kingdom has been excluded from the calculation of the index, given its earlier decision to exit the EU by the time this report is published.[7]

It became clear that no existing data sufficiently addressed certain points of interest, particularly the quality of educational institutions, educators, and policy frameworks. For this reason, the research team developed a questionnaire[8] for completion by national experts[9] for each MS in the EU-27. The report now presents results for each of the three top categories.

[7] Should this change, the UK will be included in future editions of the Index.
[8] See the report's website.
[9] Several countries were handled in house by the authors of this report. National experts were found through literature and informal stakeholder consultations. For a few countries where CEPS was unable to identify suitable and available experts, Google's team assisted with suggestions for national experts and their contact information.

Section A – Learning participation and outcomes

Figure 5. Learning outcomes performance among EU-27



Source: Authors' elaboration based on index calculations.

This portion of the index measures how much of the population participates in learning, how successful the country is in terms of learning outcomes, and how educated the populace is. More participation, better outcomes, and higher levels of educational attainment correspond to people and infrastructure better suited for digital learning. Of course, this pillar does not measure the effects of digital learning directly, but rather various aspects of learning in general that appear conducive for digital learning. That is why it is only one of three elements in the index.

For learning outcomes, the index focuses on measures most relevant to digital skills. Learning outcomes are measured with mean standardised test scores – a well-established and frequently used indicator – as well as educational outcomes measured by reputable surveys. Test scores for both children and adults are considered. Together, they cover proficiency in mathematics, reading and science, literacy, numeracy, and problem solving in a tech-rich environment. The standardised tests used are from the PISA and PIAAC surveys, TIMSS, and PIRLS.

Educational attainment and participation measures refer to the share of the population with tertiary education. These data come from Eurostat for the most recent year (2018).[10]

Participation in lifelong learning is essential given the pace of technological change – the skills and proficiencies in highest demand shift at a faster pace than before. Therefore, continuous up- and re-skilling is an important measure. To this end, the share of the adult population (25-64 years) in education and training in the past four weeks is considered. These data come from Eurostat (2018).[11]

It is also useful to measure the intensity of lifelong learning, and not simply the proportion of people taking part. For this, the index also considers the mean instruction hours spent by participant in education and training. These data are also from Eurostat (2016).[12]

After combining the data on learning outcomes and participation, Scandinavia rules the roost. Finland leads, with Denmark (2nd) and Sweden (3rd) just behind. Thereafter the picture becomes more diverse, with Slovenia (4th), Spain (5th), Luxembourg (6th) and Estonia (7th).

[10] According to data from the Eurostat Labour Force Survey – Population by educational attainment level, sex and age (%) - main indicators, available here.
[11] According to data from the Eurostat Labour Force Survey – Participation rate in education and training (last 4 weeks) by sex and age, available here.
[12] According to data from the Eurostat Labour Force Survey – Mean instruction hours spent by participant in education and training by age, available here.

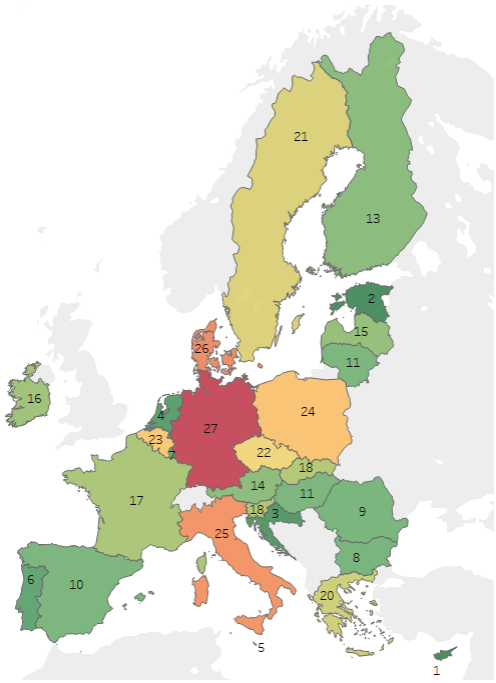
A large group of countries from all over Europe sit in the middle of the ranking – Ireland (8th), then Austria, Belgium, and Netherlands tied for 9th place, followed by France (12th), Poland (13th) and Latvia (14th). Below-average results are achieved by Portugal (15th), Germany (16th), Cyprus (17th), Bulgaria (18th), Malta (19th), Lithuania (20th), with Greece and Italy together occupying 21st place. At the bottom, Hungary (23rd), Croatia (24th), Czech Republic (25th), Slovakia (26th) and Romania (27th) perform the worst.

Section B – Institutions and policies for digital learning

Because quality institutions and policies are important for digital learning outcomes, expert surveys generated new data to measure this element specifically related to digital learning. The 'governance and implementation' indicator, however, relies on existing measures. For the other indicators, national experts filled in a detailed standardised questionnaire about the situation in their country with regard to policies and institutions for digital learning. This introduces a measure of subjectivity, but this is minimised by using many detailed and fact-based questions. Overall, the questionnaire captures aspects of the learning environment that no existing measures can.

For institutions and policies, national experts were asked a number of questions to assess the quality of institutions and policies relevant for digital learning. These included questions on the awareness of policymakers on digital learning, the existence of policies and priorities on digital learning, and clear delegation of responsibilities in this area.

Figure 6. Institutions and policies performance among EU-27



Source: Authors' elaboration based on index calculations.

For regulation and funding, national experts were asked a number of questions to better understand if regulatory and funding frameworks were harmful, neutral, or beneficial towards digital learning. Questions focused on curricula, funding, use of digital technology in the classroom, use of digital technology beyond the classroom, personnel rules, and outcome requirements. These questions were specifically asked for primary and secondary level, university and higher education level, and in adult/ongoing-learning institutions.

To assess the situation regarding educators and schools, national experts answered a number of questions on the skills of educators and availability of resources to educators. These questions were specifically asked for primary and secondary level, university and higher education level, and in adult learning institutions. This section also considers the presence (or absence) of programmes supporting system-wide or school-wide change in digital learning.

Finally, World Bank (2017) and Bertelsmann Stiftung (2018) data are used to measure the overall quality of governance and policy implementation.

With regard to policies and institutions for digital learning, Cyprus leads the European Union, followed by Estonia (2nd), Croatia (3rd) and Netherlands (4th). Malta and Portugal are in 5th and 6th place, with Luxembourg, Bulgaria Romania and Spain ranked from 7th to 10th place. Altogether, Southern countries have a much stronger position in this category, reflecting strong push many of them are making to succeed in the digital arena.

The middle group is occupied by Hungary and Lithuania in 11th place, followed by Finland (13th), Austria (14th) and Latvia (15th). Performance slightly below European average in this category is evidenced by Ireland in the 16th place, followed by France (17th), and Slovakia and Slovenia sharing 18th place. Greece is 20th, followed by Sweden. The biggest underachievers in this category are the Czech Republic (22rd), Belgium Poland (24th), Italy (25th), Denmark (26th) and Germany (27th).

Section C – Availability of digital learning

This part of the index measures the availability and attitudes towards digital learning tools. These give insights into people's possibilities, behaviour and feelings regarding digital technology.

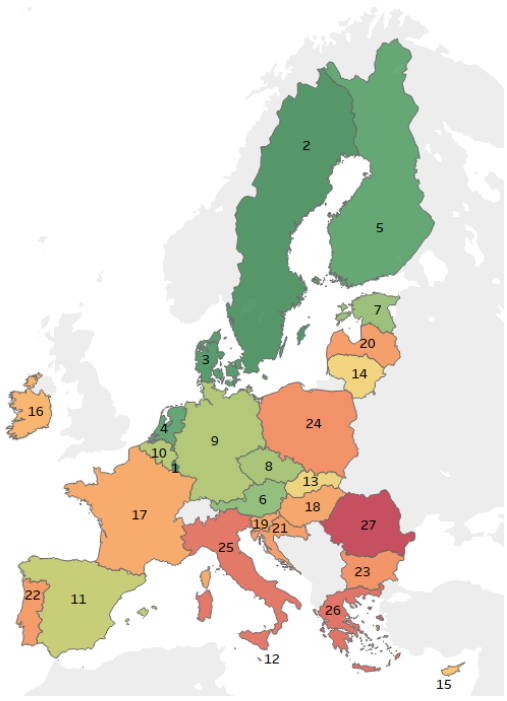
Attitudes towards digitalisation are presumed to be important, as sceptical or negative attitudes may translate to behaviours and policies harmful to digital learning. To measure attitudes, a number of questions from a Eurobarometer study (2017)[13] were selected. These ask participants questions such as: How do you think new digital technologies affect society? How do you think new digital technologies affect the economy? How do you think new digital technologies affect quality of life? How do you feel about robots and artificial intelligence?

For availability and usage of digital means of learning, the index considers several factors from OECD (PISA) data (2015) and Eurostat (2015-2018). This includes:

- Level of internet access (percentage of households);
- Individuals using mobile devices to access the internet on the move (percentage of individuals aged 16 to 74);
- Individuals using the internet for consulting wiki (percentage of individuals aged 16 to 74);
- Individuals using the internet for doing an online course (percentage of individuals aged 16 to 74);
- Individuals using the internet for looking for information about education, training or course offers (percentage of individuals aged 16 to 74);
- Individuals who have basic or above basic overall digital skills by sex (percentage of individuals aged 16-74).

[13] Special Eurobarometer 460: Attitudes towards the impact of digitalisation and automation on daily life, available here.

Figure 7. Availability of digital learning performance across EU-27



Source: Authors' elaboration based on index calculations

In this category, Luxembourg (1st), Sweden (2nd), Denmark (3rd), the Netherlands (4th), Finland (5th), Austria (6th) and Estonia (7th) lead the European Union, giving it a clear Nordic tinge. The Czech Republic is in 8th place, followed by Germany (9th), Belgium (10th), Spain (11th), Malta (12th), Slovakia (13th) and Lithuania (14th). Cyprus is 15th, Ireland 16th, France is in 17th place, followed by Hungary (18th), Slovenia (19th) and Latvia (20th). This middle group is followed by stragglers, namely Croatia (21st), Portugal (22nd), Bulgaria (23rd), Poland (24th), Italy (25th), Greece (26th) and Romania (27th).

Trends and conclusions

Progress is uneven and everyone has a room to grow

European countries differ widely in their readiness for digital learning. The gap between the best and the worst EU MSs is large across nearly all indicators. Since historical time series are not available, it is impossible to assess whether there is convergence or divergence within the Union. Given the importance of digital learning, the current large gap between EU countries cannot be considered an acceptable outcome. For this reason, a separate chapter below is dedicated to the role of the EU and its policies in this area.

Correlation between individual parts of the index is low or even negative, indicating that countries are not uniformly ranked across individual indicators. This also means that all countries, including the top performers, have significant room to grow. For example, Luxembourg places 4th overall, but among the worst in terms of learning outcomes. Even the Netherlands scores in the bottom half of MSs in terms of lifelong learning. These results illustrate that even the highest ranking countries should not become complacent. Given the high pace of change associated with digitalisation, today's winners could very easily fall behind.

At the same time, digital inclusion is not a given even for successful countries. People lacking adequate digital skills and technology, including connectivity, to access emerging opportunities are likely to lag behind in the process of digitalisation of learning. This process could then turn out to be rather exclusive, failing to deliver benefits to the society as whole. This risk exists especially when looking at vulnerable socio-economic groups and elderly, who are often short of such skills or technology. In addition, when designing technological supports for digital learning, accessibility is to be considered in its broader meaning, making sure that all standards are respected for people with disability to access all possible opportunities that digital learning can deliver. When all these preconditions are not met, accessibility of learning could conversely be hindered by digitalisation rather than fostered.

To conclude, even the best-performing European country has areas where it should improve. Conversely, even countries with low scores usually have something they can teach others. For example, Romania performs better in terms of institutions and policies (7th in the EU). Policymakers that are aware of the importance of digitalisation of education and, in cooperation with the European Commission, have developed a national strategy in this regard. In neighbouring Bulgaria, new funding opportunities in development and EU funds are also mobilised on a massive scale to help with the matter.

Money speaks – up to a point

Wealthier and more economically successful countries generally, but not uniformly, score better than less economically developed MSs. This correlation is not surprising and causality is likely in both directions – more developed economies have more resources (both financial and human) to invest, but they are also more developed because they are further along the innovation frontier of which digitalisation is an important element.

However, there are exceptions. Belgium is in the bottom third of MSs despite being one of the wealthiest. The country is around the average in terms of availability and use of the digital learning but among the worst European performers when it comes to institutions and policies (21st). Education is a competence of Belgium's language communities as a result of the division of competences across the federal and regional levels. As such, the country's ranking suffers from the non-alignment between policies set at different levels. Lifelong learning is also underdeveloped, and public attitudes towards digitalisation are rather sceptical. Evidently, the means to finance digital learning does not always translate into success on the ground.

Neither geography, nor history are destiny

A number of central and eastern European MSs seem to be doing quite well in digital learning readiness. Estonia, Malta, Cyprus, Lithuania, Latvia, Hungary (accession in 2004), and Croatia (accession in 2013) rank around or above half of all MSs. Estonia is the winner of the overall index. In the national surveys used to construct the index, several experts noted these countries benefited from EU assistance in improving their digital policies. This provides anecdotal evidence of success for EU programmes and funding targeted at digital learning.

Determined action even by a small country can yield results. Cyprus and Malta are perhaps the most surprising "winners" of the index. Ranked 5th and 6th, the small Mediterranean island states show that importance of institutions and policies for digital learning. For example, Cyprus is ranked 1st in terms of regulatory environment and funding. Digitalisation of learning is one of the main policies of the government and is part of the government's Digital Agenda – with full integration of ICT in teaching and learning as a key objective. This involves developing modern infrastructure in schools to provide adequate equipment and software to make effective use of ICT in teaching, but also focus on training educators.

Size matters – negatively, dragging down Europe

Out of five largest EU countries – Germany, France, Italy, Poland and Spain – four score in the bottom half, and mostly in the bottom third. The only exception is Spain, which delivers good performance especially in learning outcomes and accessibility of digital learning. What sets Spain apart from its peers is that it does not score especially poorly on any single dimension.

The underwhelming performance of large countries does not have a single obvious explanation. One could hypothesise that ensuring successful digital education, both in terms of physical infrastructure and programme quality, is more difficult across large and diverse countries. For example, Germany, France, and Italy all place in the bottom ten MSs by percentage of households with very high speed internet connections.[14] However, one could just as easily argue the inverse – given the lower marginal costs of digital learning compared to the traditional kind, one could expect larger countries to both invest more and reap more benefits, as it makes more economic sense compared to smaller states. Overall, we observe that larger nations struggle to achieve successful digital learning infrastructure and programmes.

Together, these four countries account for majority of the EU's population after Brexit, so this is a troubling development. There is no one-size-fits-all solution for this issue. While France has an excellent institutional environment for digital policymaking, it lags behind in investment into digital skills of educators, which are crucial. Italy has recently made strides in creating strong institutions and policies for digitalisation, but this has yet to deliver performance.

Europe will not move forward without its biggest economy; that requires changes beyond Germany

Germany's last-place finish is remarkable, but perhaps less so for those closely paying attention to digital trends. A Reuters special report from 2018 reads:[15]

> Germany, at the forefront of industrial innovation for decades, is struggling to adapt to the digital age. Creaking broadband, government bureaucracy and resistance to change share the blame.

Germany has come under scrutiny for under-investment in digital infrastructure, low internet connection speeds, and a lack of broadband access throughout its territory. A 2017 OECD study on high-speed internet connections found Germany ranked 29th out of 34 industrialised countries. German mobile data subscriptions remain very expensive, and broadband access is lacking in many rural areas.[16]

Attitudes are also important, and Germans are known for their sceptical and negative attitudes towards digital technologies. This impacts private economic behaviour, as well as the government's policy choices. Some 80% of transactions in Germany still take place in cash,[17] and cash is even preferred for large (over €100) payments.[18] Our index uses surveys which asked participants if they believe recent digital technologies have a very positive impact on their quality of life.[19] Germans ranked second lowest in the EU (with France in last place). Germany's aversion to digitalisation is likely related to the high value Germans place on privacy; Germany ranks highest among OECD countries for concerns over online privacy, and Germans are sceptical on data sharing and uploading their data to the cloud.[20] In spite of its strong economy, Germany has a lot of ground to make up in digital learning.

---

[14] See European Court of Auditors Special Report No. 12 (2018), Figure 5, available here.
[15] Reuters (2018), "Where Europe's most powerful economy is falling behind", 25 June.
[16] The Local (2019), "Germany's disconnectivity", 29 August.
[17] By comparison, the same figure is 45% in the Netherlands.
[18] Own analysis using data from ECB, Deutsche Bundesbank and De Nederlandsche Bank. This analysis contributed to De Groen, Kilhoffer and Musmeci (2018) "The Future of EU ATM Markets", available here.
[19] Eurobarometer data, used in index calculation.
[20] See here.

However, the salience of this issue goes beyond Germany. If there is one thing that can be observed in several large EU countries, it is a wary attitude towards digitalisation. For example, while the use of data gathered using digital technologies for teaching and learning can give important insights on how to improve education and training, general concerns persist regarding how and by whom such data are owned and used.

Personal data protection represents a key policy issue in developments of digital learning, especially considering that private sector companies are involved in the process of digitalisation, and thus likely to pursue private interests with the use of such data, while citizens' privacy is at stake. In other words, if citizens, students and consumers cannot trust that their privacy and interests will be protected, then the whole premise of digital learning is unlikely to take off. Governments need to reassure a sceptical public that digital learning and privacy need not be a zero-sum game.

THE EU AND DIGITAL LEARNING

The EU level policy analysis

The research team scanned EU policy documents with reference to digital learning and related topics, which helped identify relevant EU level stakeholders. Then, the research team undertook 15 semi-structured interviews with EU level stakeholders, including representatives of the European Commission (EC), as policymakers and experts, social partners, business-sector and other stakeholder associations that are relevant in the field. The table below summarises the organisations involved in the interviews, held during July and August 2019.

List of organisations involved
European Commission – Employment, Social Affairs & Inclusion (EC – DG EMPL)
European Commission – Education, Youth, Sport and Culture (EC – DG EAC)
European Commission – Communications Networks, Content and Technology (EC – DG CONNECT)
European Commission – Internal Market, Industry, Entrepreneurship and SMEs (EC – DG GROW)
European Commission – Joint Research Centre (EC – JRC)
European Trade Union Committee for Education (ETUCE)
European Trade Union Institute (ETUI)
European Federation of Education Employers (EFEE)
European University Association (EUA)
European Students Union (ESU)
Firm involved in EU projects on digital learning
Firm involved in digital learning in several MSs

The very varied situation in the EU shows that all EU countries can learn from each other, in general and regarding the specific dimensions of digital learning analysed by the index. To support this, the EU provides an appropriate setting and puts in place policy actions to enable a smooth process of digitalisation of learning across countries with different background conditions. Why does the EU care about digital learning?

On the one hand, digital learning can contribute to EU objectives and targets as set out in the Europe2020 Strategy.[21] Some of these refer to education and training specifically, while others involve a broader perspective, where digital learning is nonetheless relevant, such as the Digital Single Market priorities in the Digital Agenda for Europe.[22] Improvements of education and training through digital learning are useful in reaching EU social and economic objectives, especially considering emerging trends and the needs resulting from digitalisation. The need for up- and re-skilling of the workforce leads to **the strategic importance of lifelong learning** for the achievement of EU objectives for jobs and growth. As adult learning remains insufficiently below the set target in the EU,[23] digital learning, and any EU action to foster its development, can contribute to overcoming financial, organisational and methodological barriers that prevent the roll-out of lifelong learning opportunities, in particular regarding higher education and continuous Vocational Education and Training (VET). Moreover, digital learning represents a key method, at all ages, for **the acquisition of digital skills,** which 43% of Europeans still lack in their basic form,[24] while being necessary for 90% of

[21] COM(2010) 2020: EUROPE 2020. A Strategy for Smart, Sustainable and Inclusive Growth
[22] COM(2010) 245 final: A Digital Agenda for Europe
[23] According to data from the Eurostat Labour Force Survey, available here
[24] Data drawn from the Digital Economy and Society Index (DESI) 2019, available here.

future jobs.[25] By lowering barriers to access for learning opportunities, such as distance, costs and supply constraints, digital learning is potentially a key driver for **the universal "right to quality and inclusive education, training and lifelong learning" set forth in the European Pillar of Social Rights.**

On the other hand, EU policy action in several domains that pertain to digital learning can generate significant added value for MSs in taking advantage of this opportunity. Coordinated efforts at EU level provide support and synergies for progress in MSs, considering the transnational nature of both the phenomenon of digital learning and the challenges that it can address, such as disruptive change in the labour market and the transformation of industry. **The EU, with the authority and legitimacy of a supranational organisation, can set the agenda for digital learning**, to guide, lead and raise awareness on the issue and create a common vision across MSs. It can play a key role in providing guidelines and frameworks to create common terminology, indicators, regulatory and quality standards for digital learning. For instance, the EU already provides standards for data protection of digital learning users through the General Data Protection Regulation (GDPR). Its action also develops the frameworks to enable issuing and sharing digital certifications and ensure the interoperability of these systems across MSs. In addition, EU-level **cooperation, mutual learning and exchange** make it possible to track successes and failures in different contexts, smoothening and speeding up the process of digitalisation of education and training in a heterogeneous landscape. Last, but not least, developing a European industry for digital learning, through setting common standards and fostering collaboration, can generate **a competitive advantage on the global market for European companies in this sector**.

What does the EU do for digital learning?

EU action for digital learning is framed in the system of competences between MS and the EU, with education and training being primarily a policy area under the competence of MSs. Thus, such action consists in **structuring cooperation through several initiatives at different levels of governance, in providing funding and in monitoring policy developments and outcomes in MSs**,[26] according to the Open Method of Coordination (OMC), or 'soft law'.[27] Yet, what the EU does for digital learning is developing into providing an important framework for cooperation and exchange, as well as supporting and influencing policy developments at national level.

The ET2020 Strategic Framework

EU policies on digital learning have been developed mainly under the umbrella of the strategic framework for European cooperation in education and training (ET2020),[28] through exchange of information and experience among MSs with peer learning, monitoring and reporting and development of common reference tools. Its four key strategic objectives point to the instrumental role of digital learning in strengthening the capacity of education and training systems to meet economic and societal challenges. Such objectives, in fact, aim to make European education and training systems more responsive to change, as well as to increase the quality and efficiency of education and training so as to raise both basic and advanced skills, including those related to innovation and entrepreneurship, such as digital skills. For this reason, digital learning is tackled in different ways by all seven working groups under ET2020, though more by some than in others.

[25] This is a widely cited figure at EU level, in addition, detailed estimation of digital skills required at workplace are presented in a recent study for the EC (Curtarelli et al. 2016).
[26] See Title XII of the TFEU.
[27] The functioning of the OMC is described extensively here.
[28] Council Conclusion 2009/C119/02.

In particular, **the working group "Digital Education: Learning, Teaching and Assessment" (DELTA)** aims at discussing the use of digital technologies and the development of digital competences for teachers and learners. Its members, including representatives of the EC, national ministries of education, experts, social partners and stakeholder organisations, engage in online or in-person meetings and study visits, to explore how education systems can best respond to changes driven by the digital transformation, share and promote best practices as well as new ideas. The DELTA working group is very important for capacity building and to exchange lessons learnt between those countries that are more active in digital learning and those that are progressing more slowly, while also taking into consideration that the phenomenon has different aspects and countries can be a frontrunner in one aspect while learning on another from other countries. Moreover, fostering of digital learning policy in MSs can be facilitated with formal and informal recommendations that emerge out of the working group. Similarly, **the working group on VET** focuses its work on digitalisation, as means to enhance the flexibility and quality of VET, as well as taking into account the changes that digitalisation brings about in the labour market.

The Digital Education Action Plan

In 2010-2020, through the ET2020 working groups, the EC has developed many policy documents involving digital learning.[29] However, the turning point for a comprehensive approach and strong focus on the topic is marked by **the Digital Education Action Plan (DEAP)**,[30] a key reference for EU policy on digital learning. The DEAP sets out three priorities, which in turn inspire eleven actions, to support technology use and development of digital competences in education. These priorities and actions regard education at all stages in life, covering schools, higher education and VET. Given its extensive and transversal scope, the implementation and monitoring of the DEAP involves several DGs within the EC, more prominently DG EAC, DG EMPL and DG CONNECT, as well as other EC bodies, such as the JRC.

THE DEAP: A best practice for policy development

In previous years, the EU action on digital learning had been relatively fragmented, with several DGs working alongside each other but lacking a common vision and often focusing mainly on the technological aspect of the phenomenon. Resulting from the DELTA working group, the DEAP represents the first effort to develop a coordinated, coherent and comprehensive policy on digital education, and as such, can be considered a best practice of policy development at EU level. Several DGs, including EAC, EMPL and CONNECT, worked together in a concerted manner to obtain a holistic and transversal policy, encompassing all relevant dimensions of digital learning, such as technology and infrastructure, organisational and institutional aspects and the 'human factor', such as adequate competences to make the best use of technology in education and training, in a lifelong learning perspective. In the future, the DEAP could and should serve as the basis for improved coordination of EU Policy on digital learning, and for strengthening and streamlining EU action in this field, as well as providing an example for policies at national level. Its success has already been demonstrated by the fact that the EC President-elect Ursula von der Leyen explicitly mentioned the DEAP and recommended further focus on it in her priorities for the new Commission.

[29] See for example COM(2013) 654 Final: Opening up Education, COM(2017) 248 Final: School development and excellent teaching for a great start in life, COM(2017) 247 Final, COM(2017) 673 Final: Strengthening European Identity through Education and Culture.
[30] COM(2018) 22 Final.

The three DEAP priorities highlight different aspects of digitalisation and its impact on education and training systems, thus showing a very advanced and comprehensive approach to digital learning. The first priority **"making better use of digital technology for teaching and learning"** focuses on digital technology contributes to improve education and training. The second, **"developing relevant digital competences and skills for the digital transformation"**, insists on using digital technology in education for the acquisition of skills required in the changing economy and society. The third, **"improving education through better data analysis and foresight"**, stresses the importance of understanding the learning process better thanks to digital technologies, so as to improve and adapt education and training systems to change. Under these priorities, eleven actions are designed to support MSs in the digitalisation of education and training.[31]

Under the first priority, **Action 2: SELFIE - self-reflection tool & mentoring scheme for schools** supports the digital capacity of primary, secondary and vocational schools. The action makes available a free online self-reflection tool, SELFIE, for schools to assess through a series of questions to teachers, students and school leaders their capacity in digital teaching and learning. Such assessments reflect a holistic approach to digitalisation in schools, which is not limited to infrastructure, but duly takes into account pedagogy and the school context. Schools can customise the tool by adding or changing questions for their particular situation. As a result, these schools receive a tailor-made report outlining strengths and areas for improvement, as a basis for an action plan for the school. The SELFIE tool is available in all twenty-four official EU languages, and in six additional languages, to extend its use beyond the EU. In addition to the tool, the action provides a mentoring scheme, to be operative by 2020, to scale up ICT-based innovative practices, to build capacity in an inclusive and sustainable network and to mainstream digital learning.

Regarding the use of digital technology for accreditation and recognition, **Action 3: Digitally-signed qualifications**, again under the first priority, focuses on facilitating storage and sharing of qualifications online. Digitally-signed qualifications are electronic documents that education and training institutions issue to confirm the awarding of a qualification. This document can be trusted by employers, education providers or other parties. A common technical approach for issuing digitally-signed qualifications is currently under development, to provide for a shared understanding and interpretation across MSs. Indeed, digitally-signed qualifications aim to make the best use of digital technology to respond to the heterogeneity of national education and training systems, providing the means for ensuring comparability and verification of qualifications across countries, so as to support the mobility of workers and students in the Union. The action will be integrated in the new Europass platform,[32] to be launched in early 2020, which will allow everyone to store and share digitally-signed qualifications.[33] Current developments are exploring the possibility to use blockchain technology for the digitally-signed qualifications, overcoming privacy issues to a certain extent (Grech and Camilleri 2017).

[31] The full list of the eleven actions is available here.
[32] Decision (EU) 2018/646.
[33] In the new Europass, digitally-signed qualifications are referred to as digitally-signed credentials.

SELFIE: A best practice for policy tools

Discussing within the DELTA working group, MS representatives expressed a demand for practical tools to assess competency in digital education and develop concrete recommendations for educational stakeholders. SELFIE is the EC's response to these requests. A self-assessment tool for schools, SELFIE is an innovative development in EU-level policymaking, which has traditionally been less focused on the development of practical tools, focusing rather on guidelines and recommendations. It can be considered a best practice because it offers concrete advice to stakeholders and establishes a close connection with the end-users of digital learning, the schools and students. The fact that each school can build up its own questionnaire leads to tailored, context-specific recommendations. The response from MSs has been overwhelmingly positive in the piloting, and scaled-up efforts beyond the EU are underway. While SELFIE is already applicable to vocational schools, possibilities are being explored to enlarge the use of SELFIE for assessing worked-based learning in companies, enhancing its role for lifelong learning. This success is arguably a result of close cooperation between MS representatives, practitioners and other institutions in developing the tool, and of the way the resulting application is flexible to the needs of users and incorporates the view of all involved, including students. The development of SELFIE can be seen as an example of a coherent process of policy development from start to finish, beginning with a process of mutual exchange and co-design and culminating in the development and implementation of a practical and user-friendly tool, including effective communication to involve stakeholders and practitioners in the field. In future, SELFIE could serve as an example to EU and national policymakers on how to develop accessible and practical policy tools, in the field of digital education and beyond.

Responding to the second priority of the DEAP, **Action 6: EU Code Week in schools** focuses on acquiring digital skills. The EU Code Week is a pre-existing initiative, started in 2013 through a markedly bottom-up approach, promoted by the young advisers for the Digital Agenda for Europe and supported by the EC in the framework of the Digital Single Market and the Digital Skills and Jobs Coalition. It was later incorporated in the DEAP, with the specific aim of involving more schools, up to 50% of all schools in Europe by 2020. The EU code week aims at stimulating creativity, problem solving and collaboration through programming and other activities involving digital technology. It takes place for two weeks every year, normally in October, and it is coordinated at national level by code week ambassadors, although anyone can organise their own activity and add it to the code week map available on the platform developed by the EU for the initiative. The aim of this action consists, by its nature, in raising awareness about the field, making programming more visible to the young, adults and the elderly, with a view to demystifying digitalisation and related skills.

The Digital Competences Frameworks

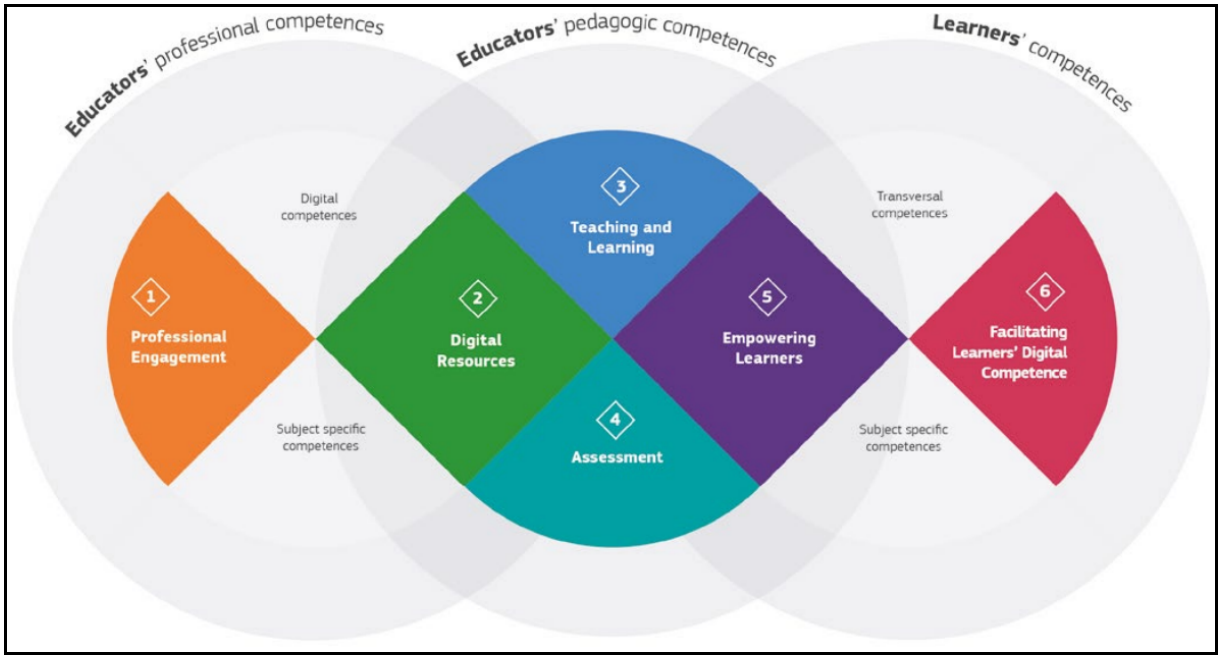
The DEAP and its actions build on the Digital Competences Frameworks, developed by the JRC to smoothen the process of digitalisation in education and training and its effects in the labour market. The Frameworks provide a conceptual understanding of digital skills, needed to harness the potential of digitalisation. In addition, they offer a tool for assessment and improvement of such skills. Three of

these frameworks are specifically relevant for digital learning, providing for the common language for exchange and cooperation (Carretero, Vuorikari, and Punie 2017).

The Digital Competence Framework for Citizens, **DigComp**, represents the most general framework. Its latest version, DigComp 2.1, contains a fine-grained **description of eight proficiency levels, which supports the development of adequate learning material and helps in the design of instruments for assessing competence, career guidance and promotion at work.** The proficiency levels apply to five competence areas, namely information and data literacy, communication and collaboration, digital content creation, safety, problem solving, which together constitute the capacity to interact with digital technology. Examples of specific situations are provided in the Framework to illustrate to what each level of each competence corresponds in real life, facilitating understanding and implementation by users (Carretero, Vuorikari, and Punie 2017). DigComp is a reference for the development and strategic planning of digital competence initiatives at both EU and national level, being **also integrated in the Europass CV as an important instrument for (self) assessment, validation and recognition of digital skills**.

The Digital Competence Framework for Educators**, DigCompEdu**, provides a more specific reference, **merging digital skills with skills that are key for educators, to support MSs in fostering educators' digital competence, as a prerequisite for digital learning** (Redecker 2017). It has been developed as a response to the acknowledgement of educators' need to master a set of digital competences specific to their job in order to harness the potential of digital technologies in education and training. Such competences **are organised in six areas, reflecting all aspects of the profession of educator (Figure 8), and have different levels of proficiency**.

Figure 8. DigCompEdu Areas and Scope

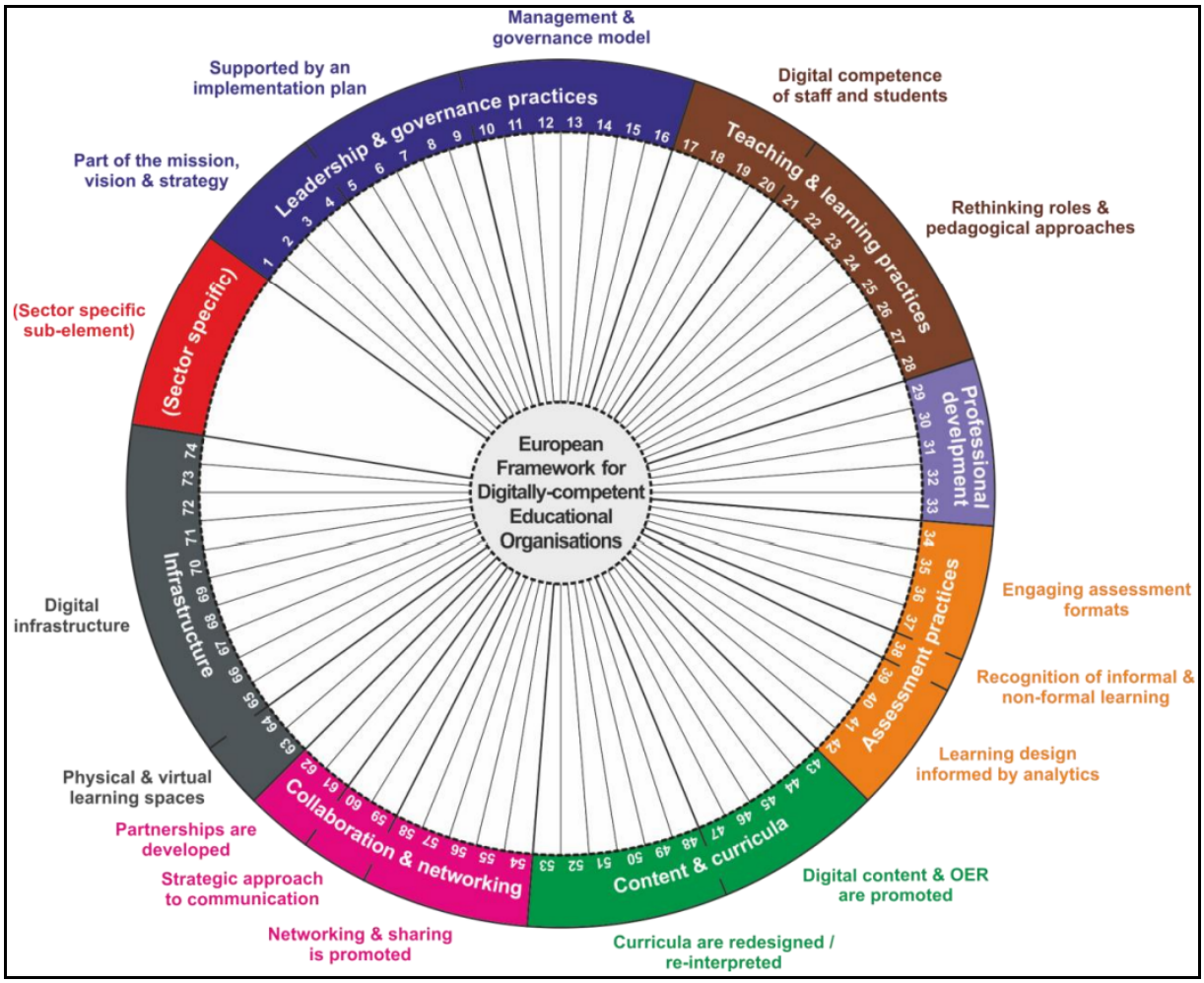


Source: Redecker 2017.

The Framework for Digitally-Competent Educational Organisations, **DigCompOrg**, offers a comprehensive conceptualisation taking into account all aspects of digitalisation for learning in educational organisations (Panagiotis, Punie, and Devine 2015). It helps educational organisations in

self-reflection and self-assessment in their process of digitalisation and it enables policymakers to develop policies for digital learning. DigCompOrg is developed to reflect three fundamental dimensions in the process of digitalisation of education, namely the pedagogical, technological and organisational dimensions. In fact, it defines seven key elements in these three dimensions: infrastructure, collaboration and networking, content and curricula, teaching and learning practices, assessment practices, professional development, leadership and governance practices – all represented in a circle to highlight their interconnectedness (Figure 9). The Framework also leaves room open to additional sector-specific elements, resulting in it being highly adaptable to different contexts. SELFIE, mentioned above, represents the practical implementation of DigCompOrg, operationalising and assessing the digital readiness of schools, providing initial evidence on how the Framework can be used in reality.

Figure 9. DigCompOrg Areas and Scope



Source: Panagiotis, Punie, and Devine 2015.

EU funds for digital learning

Through its financial instruments, **the EU provides additional resources at national level for the deployment of programmes and initiatives, as well as research, related to digital learning**. Whereas it does not have a dedicated financial instrument, digital learning is a cross-cutting topic in several EU funding programmes.

The Erasmus+ Programme (co-)funds several initiatives that make use of digital technology to foster cooperation for improving education and training and to boost digital learning in particular, such as online platforms like **the Electronic Platform for Adult Learning in Europe (EPALE)**[34] or **the OpenupEd portal**,[35] which hosts a pan-European MOOCs initiative.[36] Erasmus+ acknowledges digital learning as horizontal priority for open education and innovative practices in the digital era, indicating that priority for funding is given to initiatives that encourage the use of digital technologies for innovative practices in teaching, learning and assessment, as well as to those initiatives that support educators and educational institutions in integrating digital technologies and resources in education and training. DigCompEdu, DigCompOrg and SELFIE are mentioned as important tools for implementation of digital learning strategies and their integration in the initiative awards priority for funding.[37]

For 2014-2020, **the Horizon2020 Framework Programme for Research and Innovation (H2020)** has provided funds to support digital learning. Depending on the type of action, the projects funded are oriented towards research, exploring drivers, challenges and outcomes of the integration of digital technologies in education and training, or focused on the development and piloting of technological solutions for digital learning. When mainly focusing on technology, projects are funded in particular under H2020 Leadership in Enabling and Industrial Technologies, while other aspects of digital learning are in the scope of funding in the H2020 Societal Challenges. Private actors in the industry sector can access these funds when partnering with public and private research organisations, non-governmental organisations (NGOs) and public bodies. Before H2020, in 2007-2013, the Seventh Framework Programme for Research and Innovation of the EU (FP7) invested more than €185 million in supporting Technology-Enhanced Learning and the Competitiveness and Innovation Framework Programme (CIP) financed projects worth €5.7 million, covering e-learning for science, technology, engineering and math, and showcasing excellence in digital learning.[38]

The **European Structural and Investment Funds (ESIF)**,[39] which channel over half of EU funding, co-finance MS initiatives in deploying digital learning, within the streams dedicated to infrastructure, skills enhancement, education and training. One ESIF focus is digital technology, including for research and innovation. Part of the ESIF, the European Social Fund (ESF) has funded many projects to reinforce the infrastructure and provide devices for digital learning in educational institutions; additional funds have been devoted to strengthening broadband in general and in educational institutions (European Court of Auditors 2018). As the topic of digital learning cuts across several themes of the ESF, tracking all projects and the amount of funds is problematic.[40]

[34] Further information is available here.
[35] Further information is available here.
[36] Similarly, the School Education Gateway is an online platform for professionals in schools to share teaching material as well as European and international research and projects, and the e-Twinning Platform connects school staff in Europe to collaborate and exchange ideas, also offering resources to build their own projects, facilitate self-assessment and professional development and showcase best practices.
[37] Erasmus+ Programme Guide.
[38] Detailed information about research and innovation for ICT in education are available here.
[39] More information on the ESIF can be found here.
[40] Data on ESIF funding can be explored here.

What should the EU do better for digital learning?

The topic of digital learning will grow in importance in EU policy, accompanying the digitalisation trend. EC President-elect von der Leyen has stated this in her programme, referring in particular to the DEAP (von der Leyen 2019). There is *momentum* behind reflection on how to better structure EU action and to increase its effectiveness in supporting MSs in harnessing the potential of digital learning. As the DEAP is likely to evolve, it could represent an umbrella for all policy initiatives and funds for digital learning in a lifelong perspective. Similarly, the ET2020 will soon evolve into the ET2030, where digitalisation of education and training is expected to be given prominence. In addition, EU financial instruments that are relevant for digital learning are undergoing an important reorganisation. The ESIF are restructured in the new Multiannual Financial Framework, to limit dispersion of resources and duplication. Erasmus+ will grow significantly in importance. H2020 will come to an end and the new Framework Programme is expected to be solution-oriented, financing highly transdisciplinary research with the aim of accomplishing key 'missions' for the EU. Based on progress so far and considering current challenges at EU level in this area, the EU policy for digital learning could significantly benefit from some adjustments and improvements.

The EU needs to strengthen a comprehensive vision for concerted and coherent policy action on digital learning, building on the positive experience of the DEAP, to serve as framework and orientation for MSs. By its nature, digital learning is a complex and cross-cutting topic, touching upon diverse policy areas and involving many stakeholders and actors at EU level, including different DGs. In spite of many examples of cooperation, each DG still too often tends to look at digital learning from their own perspective and within their own competences and mission. As a result, a clear orientation, inspired by a holistic vision, is missing. In several cases, digital learning comes out only in its partial representations related to digital skills or digital technologies. By contrast, technology in education and training must be always seen as supporting a sound enhanced pedagogic and teaching approach, which should remain the focus of any policy actions in this field. A comprehensive approach must also look at all types of learning, from early childhood to continuous professional development. This is to be developed jointly, to avoid fragmentation of actions across different levels of education by different DGs, which might lead to some important parts of lifelong learning being overlooked, such as vocational training.

EU policy on digital learning has necessarily to be developed through a bottom-up approach, involving MSs and key stakeholders in education and training in continuous dialogue and consultations, to take the diversity in background conditions and interests sufficiently into account. First, MSs are in the best position to consider cultural and contextual specificities in the actual deployment of digital learning, avoiding one-size-fits-all types of policy measures and technical solutions. So far, the engagement of MSs in EU action in this field is reckoned to be very good. However, large disparities in digital infrastructure and the heterogeneity of educational and training systems pose a challenge that could lead to divergence in both efforts and outcomes. By contrast, differences should be treated as a stimulus for further cooperation and a greater scope for exchanging best practices. As the process of innovation, and particularly digitalisation, is not linear and is characterised by a high degree of uncertainty, diversity represents a precious resource for differentiating strategies and learning from each other's successes and failures. Moreover, given its enormous potential impact on the economy and society, there are multiple interests at stake around digital learning developments. Rather than becoming a matter of *impasse*, such interests have to come together in the definition of policies, to make sure that each actor has clear incentives to play its role in the deployment of digital learning. For

instance, industry can be an important actor in developing and testing solutions, leading innovation for digital learning, providing informed insights for policy design and regulations. At the same time, the involvement of national and local stakeholders in the education sector is crucial for ensuring that what is developed fits the purpose in the field. Engaging local organisations and taking on board the experience of individuals is critical for developing successful policies, as well as for the smooth running of initiatives and taking into consideration the contextual specificities, heterogeneity and uncertainty that characterise the process of digitalisation of education and training systems. In this, social partners should play a key role, being the actors that are best connected to the individuals implementing and affected by change. While consultations of social partners in education are well established, these could be further developed specifically in the new area of digital learning.

As a short-term priority, the EU should intensify efforts to foster digital skills, to ensure equal access and inclusiveness of digital learning. The EU has already put in place significant initiatives, measures and funds that have indeed made significant progress in this field possible, as shown by the improvement of specific components in the DESI index. However, the current remaining lack of basic digital skills among almost half of Europeans is particularly worrying when it comes to ensuring that the process of digitalisation of learning does not leave them behind. While digital skills are not sufficient to ensure that the process of digital learning works well, they are certainly a necessary condition to become involved and potentially benefit from it, so efforts must be continued and strengthened where necessary, with specific attention to vulnerable groups.

EU funds for digital learning need to be streamlined, creating a dedicated funding instrument. This would make it possible to track digital learning projects and programmes better, as it is necessary to avoid duplication and isolation of funded initiatives, as well as to allow an overall evaluation of the results achieved by EU funds in digital learning. Although the nature of the phenomenon makes it relevant for different financial streams, having a dedicated funding mechanism to finance, track, monitor and evaluate what is financed for digital learning can facilitate the identification of what works best. Such a mechanism, possibly linked directly to the DEAP, could encourage further exchange and cooperation among DGs. It could also reduce the number of different procedures to apply and increase clarity on what funds are relevant for digital learning, fostering access to such funding. To ensure the sustainability of digital learning projects funded by the EU, this dedicated financial instrument should have criteria to embed financed projects within national policies for digital learning.

The EU needs to increase research efforts for digital learning, including a specific financial stream for digital learning in the next EU Framework Programme for Research and Innovation. As digital learning is still a largely unknown phenomenon, further and focused research is needed to explore its outcomes, to identify what works and what does not and to gain a clearer assessment of risks. Being a complex phenomenon, such research should be highly transdisciplinary, including technical sciences – to develop technologies – as well as social sciences – to look at the impact of such technologies. Scientists in these fields and practitioners should work together in solution-oriented research that considers digital learning in both its theoretical and implementation aspects. These research efforts should aim at the definition of adequate indicators, linked to the development of a sound and coherent theoretical framework and terminology to study the phenomenon. As such, research results would inform policy and help in addressing a still high level of scepticism and controversial opinions about technology in learning, especially for children. Evidence about solutions and practices in place should be systematised and disseminated, to increase visibility, benchmarking and scaling up of experiences. By identifying initiatives that work especially well, a culture of excellence would foster investment and policy developments in digital learning.

BIBLIOGRAPHY

Björnavåld, Jens. 2001. "Making Learning Visible: Identification, Assessment and Recognition of Non-Formal Learning." *Vocational Training: European Journal*, no. 22: 24–32.

Brien, Emma O., and Ileana Hamburg. 2014. "Supporting Sustainable Strategies for SMEs through Training, Cooperation and Mentoring." *Higher Education Studies* 4 (2): p61. https://doi.org/10.5539/hes.v4n2p61.

Brown, Mark, Gráinne Conole, and Miroslav Beblavỳ. 2019. "Education Outcomes Enhanced by the Use of Digital Technology: Reimagining the School Learning Ecology." EENEE Analytical Report No.38, prepared for the EC - DG EAC. http://publications.europa.eu/publication/manifestation_identifier/PUB_NC0318133ENN.

Carretero, Stephanie, Riina Vuorikari, and Yves Punie. 2017. "DigComp 2.1. The Digital Competence Framework for Citizens with Eigth Proficiency Level and Examples of Use." http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_(online).pdf.

Cedefop. 2014. *Terminology of European Education and Training Policy*. 2nd edition. Luxembourg: Publications Office of the European Union. https://www.cedefop.europa.eu/files/4117_en.pdf.

Conrads, Johannes, Morten Rasmussen, Niall Winters, Anne Geniet, and Laurenz Langer. 2017. *Digital Education Policies in Europe and Beyond*. Edited by Christine Redecker, Panagiotis Kampylis, Margherita Bacigalupo, and Yves Punie. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC109311/jrc109311_digedupol_2017-12_final.pdf.

Curtarelli, Maurizio, Valentina Gualtieri, Vicki Donlevy, and Maryam Shater Jannati. 2016. "ICT for Work: Digital Skills in the Workplace." Study for the EC, DG CONNECT. https://ec.europa.eu/digital-single-market/en/news/ict-work-digital-skills-workplace.

Dabbagh, Nada, and Anastasia Kitsantas. 2012. "Personal Learning Environments, Social Media, and Self-Regulated Learning: A Natural Formula for Connecting Formal and Informal Learning." *The Internet and Higher Education* 15 (1): 3–8. https://doi.org/10.1016/j.iheduc.2011.06.002.

European Court of Auditors. 2018. "Broadband in the EU Member States: Despite Progress, Not All the Europe 2020 Targets Will Be Met." Special Report No. 12/2018. https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf.

Grech, Alexander, and Anthony F. Camilleri. 2017. *Blockchain in Education*. Edited by Andreia Inamorato dos Santos. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108255/jrc108255_blockchain_in_education%281%29.pdf.

IMS Global Learning Consortium. 2016. "About Open Badges." 2016. https://openbadges.org/about/.

Kilhoffer, Zachary, and Sara Baiocco. 2019. "The Impact of Digitalisation on Labour Market Inclusion of People with Disabilities: Lessons from Two Case Studies on Austria and Platform Work." Bundesministerium für Arbeit, Soziales, Gesundheit und Konsumentenschutz. https://www.sozialministerium.at/cms/site/attachments/2/3/1/CH3839/CMS1563200794559/endbericht-en.pdf.

Lave, Jean, and Etienne Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

OECD. 2008. *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing.

Panagiotis, Kamplys, Yves Punie, and Jim Devine. 2015. "Promoting Effective Digital-Age Learning: A European Framework for Digitally-Competent Educational Organisations." https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/promoting-effective-digital-age-learning-european-framework-digitally-competent-educational.

Prensky, Marc. 2001. "Digital Natives, Digital Immigrants." *On the Horizon* 9 (5): 15.

Redecker, Christine. 2017. *Digital Competence of Educators*. Edited by Yves Punie. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/promoting-effective-digital-age-learning-european-framework-digitally-competent-educational.

Siemens, George. 2005. "Connectivism: A Learning Theory for the Digital Age." *International Journal of Instructional Technology and Dinstance Learning* 2 (1): 59.

Vincent-Lancrin, Stéphan, Joaquin Urgel, Soumyajit Kar, and Gwénaël Jacotin. 2019. *Measuring Innovation in Education 2019: What Has Changed in the Classroom?* Paris: OECD Publishing.

Von der Leyen, Ursula. 2019. "A Union That Strives for More. My Agenda for Europe - Political Guidelines for the Next European Commission 2019-2024." https://www.europarl.europa.eu/resources/library/media/20190716RES57231/20190716RES57231.pdf.

Warschauer, Mark. 2007. "The Paradoxical Future of Digital Learning." *Learning Inquiry* 1 (1): 41–49. https://doi.org/10.1007/s11519-007-0001-5.

Williams, Kenny Jr. 2018. "Digital Learning: What Exactly Do You Mean?," 2018. https://hub.msu.edu/digital-learning-what-exactly-do-you-mean/.

INDEX OF READINESS FOR DIGITAL LIFELONG LEARNING:

CHANGING HOW EUROPEANS UPGRADE THEIR SKILLS

Digitalisation of learning is the process by which education, training and skills are being transformed by the use of digital technologies. With the Index of Readiness for Digital Lifelong Learning (IRDLL), CEPS assesses and ranks 27 EU Member States' performance, offering policy guidance at national and EU levels.

ISBN 978-94-6138-751-6