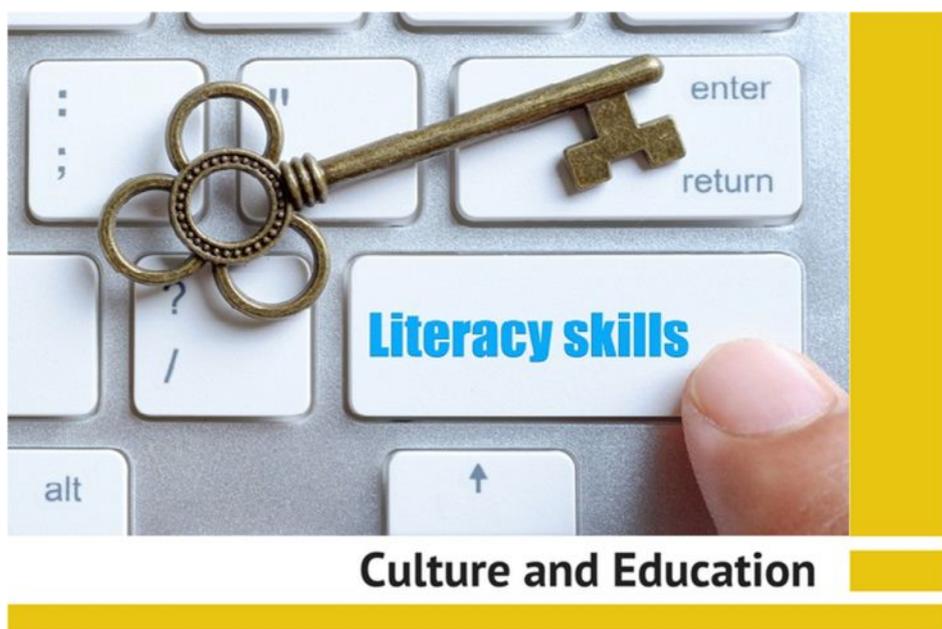


STUDY

Requested by the CULT committee



Research for CULT Committee - Digital Skills in the 21st century



Policy Department for Structural and Cohesion Policies

Directorate General for Internal Policies of the Union

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Research for CULT Committee - Digital Skills in the 21st century

Abstract

This study aims to provide Members of the European Parliament's Committee on Culture and Education with information, analysis and recommendations on digital skills in the 21st century and an adequate EU policy response to contemporary challenges as set out in the Digital Education Action Plan and accompanying Staff Working Document. Based on literature review and policy mapping, the study identifies potential blind spots in the field of digital skills and competences that are not addressed by the Action Plan and other existing initiatives at EU level.

This document was requested by the European Parliament's Committee on Culture and Education.

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LIST OF ABBREVIATIONS

AR	Augmented reality
BCOs	Broadband Competence Offices
CT	Computational thinking
EIAH	European Investment Advisory Hub
ESCO	Classification of Skills, Competences, Qualifications and Occupations
DigComp	Digital competence framework for citizens
DigiCompEdu	European Digital Competence Framework for Educators
DigCompOrg	Digital competence framework for educational organisations
DigCompConsumers	Digital competence framework for consumers
EOSC	European Open Science Cloud
EQF	European Qualifications Framework for Lifelong Learning
EUA	European University Association
HEI	Higher education institutions
ICT	Information and communication technology
MLE	Mutual Learning Exercise
OER	Open educational resources
PISA	Programme for International Student Assessment
STEM	Science, technology, engineering and mathematics
SWD	Staff working document
ETUCE	Trade Union Committee for Education
VR	virtual reality

EXECUTIVE SUMMARY

Introduction

The European Commission released a Digital Education Action Plan and a Staff Working Document setting out how education and training systems can make better use of innovation and digital technology and support the development of relevant digital competences (European Commission 2018b).

Based on literature and policy review, this study aims to provide Members of the European Parliament's Committee on Culture and Education (CULT) with analysis and recommendations on digital skills in the 21st century and an adequate EU policy response to contemporary challenges as set out in the Digital Education Action Plan and the Staff Working Document.

Key findings and recommendations

The Action Plan identifies **low connectivity as one of the main obstacles to uptake of digital tools**. The Action Plan proposes to support connectivity in rural areas through the EU network of Broadband Competence Offices (BCOs) and calls for action in raising awareness of the benefits of broadband and funding opportunities specifically for schools.

The Action Plan stresses **the need for more digitally competent educators and education institutions**. The document suggests the SELFIE self-assessment tool as the main policy initiative to increase the digital readiness of general and vocational schools and a mentoring scheme at national/regional level, supported by an EU-level awareness-raising platform.

- **Recommendation:** The CULT Committee could recommend that the Commission further supports the Member States through strengthening evidence base for education reform. For the next programming period, the Commission may consider setting digital education benchmarks for different levels of education.

The current copyright framework on digitally supported education and training practices still causes uncertainty among users and copyright holders due to low awareness about copyright and different national interpretations of the EU copyright rules.

- **Recommendation:** The CULT Committee may recommend that the Commission considers an awareness raising campaign and an online information platform that would help education institutions, educators and students overcome copyright uncertainty.

Digital services for mobile students are still scarce meaning that sending and receiving institutions are not able to share necessary student information between them. The Action Plan proposes to provide a framework for issuing digitally-certified qualifications and validating digitally-acquired skills.

- **Recommendation:** The CULT Committee could recommend that the Commission initiates a discussion on the potential governance model for the framework of digitally certified qualifications in order to divide responsibilities between institutions and organisations that would be responsible for the development, implementation, and monitoring of such framework.
- **Recommendation:** Building common data exchange and storage standards and templates should remain a priority while developing the framework for issuing digitally-certified qualifications and validating digitally-acquired skills. Clear guidelines, financial and peer support mechanisms should be provided to education institutions in order to facilitate successful transition from paper-based to digitally certified qualifications.

The Digital Education Action Plan warns **that Europe will lose its competitiveness if education fails to provide digital competences to Europeans of all ages**. To improve digital skills of the European population the Action Plan proposes to create a Europe-wide platform for digital higher education and enhanced cooperation. The Plan, however, provides little information on how this platform would function. The document also suggests strengthening open science and citizen science and scaling up the EU Code Week.

- **Recommendation:** Responses from the main potential higher education hub's stakeholders indicate the need to further explore the added value of such platform. The CULT Committee could recommend that the Commission facilitates discussions with the higher education sector on how to build a useful tool for peer-exchange and collaboration.
- **Recommendation:** The Committee on Culture and Education could recommend that the Commission explores the suggested platform's synergies with already existing initiatives that encourage cooperation between European higher education institutions, namely the Erasmus+ programme.

The Digital Education Action Plan stresses the need to **strengthen critical thinking and media literacy among children and young people**. The Action Plan suggests an EU-wide awareness-raising campaign targeting educators, parents and learners to foster online safety, cyber hygiene and media literacy and a blended course on cyber-security.

The Digital Education Action Plan recognises **lack of interest among girls to pursue studies in ICT or STEM** as a clear problem leading to lost opportunities and risks contributing to gender inequality. The Digital Education Action Plan suggests that the Commission will support measures to further decrease the gender gap in the technology.

- **Recommendation:** The CULT Committee may recommend that the Commission provides a strategic policy framework on increasing female participation in ICT and STEM and develops a clear roadmap for the planned actions such as workshops and stakeholder inclusion mechanisms.
- **Recommendation:** The Committee on Culture and Education could recommend that the Commission further explores synergies with already established grassroots platforms such as the EU Code Week which could be used as a powerful tool to raise awareness about gender stereotypes in technology sector among schools, educators, companies and NGOs.

The Digital Education Action Plan draws attention to a **lack of coherent cross-European data** that could be used to improve education systems through evidence-based policy-making. To address this issue, the Action Plan calls to build evidence on the uptake of ICT and digital skills in schools by publishing a reference study assessing progress in mainstreaming ICT in education (ESSIE2) and collaborating with the OECD to develop a new module in PISA focusing specifically on the use of technology in education. The Digital Education Action Plan also considers exploring relevance and feasibility of new Council benchmarks for digital competences and entrepreneurship.

The Action Plan asserts that **big data for policy making and learning analytics could bring significant added value to education**. The document therefore calls for artificial intelligence and learning analytics pilots that could contribute to improving implementation and monitoring of education policy.

- **Recommendation:** The CULT Committee could recommend the Commission to follow the action plan on learning analytics suggested by the JRC (JRC 2017), and 1) define the role and policy priorities for learning analytics in the context of education; 2) develop a learning analytics roadmap that would support the development of tools and practices; 3) identify organisations and individuals who would be responsible for

coordinating the learning analytics roadmap and stakeholder cooperation at EU and national level.

To initiate strategic foresight in education the Action Plan proposes to release a series of policy, research and guidance papers analysing the impact and potential of digital technologies in education. The Action Plan also proposes to organise an EU-wide education hackathon.

1. INTRODUCTION

Following a communication on 'Strengthening European Identity through Education and Culture' (European Commission 2017c), the European Commission released a Digital Education Action Plan and an accompanying Staff Working Document setting out how education and training systems can make better use of innovation and digital technology and support the development of relevant digital competences needed for life and work in an age of rapid digital change (European Commission 2018b). The plan focuses on initial education and training systems and covers schools, vocational education and training (VET) and higher education.

This study aims to provide Members of the European Parliament's Committee on Culture and Education (CULT) with information, analysis and recommendations on digital skills in the 21st century and an adequate EU policy response to contemporary challenges as set out in the Digital Education Action Plan and accompanying Staff Working Document. Based on literature review and policy mapping, the study identifies potential "blind spots" in the field of digital skills and competences that are not addressed by the Action Plan and other existing initiatives at EU level.

The study provides a succinct summary of existing EU and academic literature on digital skills in education, also considering the changing labour market, in which digitisation and digital skills play an even stronger role. The literature review focuses on challenges and opportunities that digital transformation brings to education, possible causes of these challenges and means to address them. The study also maps the existing EU policy initiatives related to digital skills in education in the context of the Digital Education Action Plan. The mapping exercise presents policy priorities and specific actions aimed at tackling digital transformation challenges and seizing opportunities.

Based on identified policy gaps the study outlines areas for potential policy responses and a set of recommendations for the actions of the Committee.

1.1 Policy context of the Digital Education Action Plan

In this section we discuss the main European Commission's policy developments regarding the importance of digital skills and their development.

The issue of digital skills is by no means new in the European policy agenda and has been discussed in different policy documents since the late 1990s, when computers and the internet first started to influence not only narrow sectors of the economy, but the labour market and society as a whole. The technological change was in fact an inspiration to and a **major influence on the Lisbon strategy**, launched in 2000 (Rodriguez, Warmerdam, and Triomphe 2010). This strategy was a European commitment to overcome Europe's deficit (compared to e.g. United States and Japan) in growth and productivity, mainly due to lack of technological capacity and innovation. The notions of "knowledge economy" and "knowledge society" became the main slogans used to emphasise the importance of ICT and related skills in the implementation of the Lisbon Strategy. However, given the uneven spread of digital technologies at the time and major deficiencies in access to ICT, a much more significant emphasis was put on access to ICT infrastructure and broadband internet coverage, as well as their better use. Adaptation of the skills of the labour force and society in general was generally left in the side-lines.

The Europe Action Plan (launched in March 2001 and re-launched in 2005) was the **first major policy document** to stress specifically the need to develop digital skills (European Commission 2001). In addition to again mentioning the importance of cheaper and faster

internet access in general, it set out a series of specific actions for improving digital skills for both youth and adults:

- Youth into digital age: enabling high-speed internet access in schools and universities, providing access to educational services and e-learning platforms for teachers, pupils, and parents, training teachers in the use of digital technologies, adapting curricula to incorporate new ways of learning and ICTs;
- Working in the knowledge-based economy: improving digital literacy via lifelong learning; increasing the number of IT training places and courses; establishing a European diploma for basic IT skills; public internet access points providing access to training facilities.
- Specific support to improvement of digital skills, such as dedicated programmes, and the use of Structural Funds to provide adults with digital skills.

Soon afterwards, the i2010 initiative (2005) mentioned skilful application of ICT as one of the largest contributors to productivity, and on several occasions reiterated the Commission's commitment to develop ICT skills via appropriate education and training policies (COM/2005/0229 2005). The 2006 Riga Ministerial Declaration recognised the need to improve digital literacy and competences, targeted in particular to groups at risk of exclusion, such as the unemployed, immigrants, low-skilled, disabled and elderly persons; facilitating ICT competences, including digital user rights, via partnerships with the private sector, and enabling appropriate qualification schemes to recognise the levels of digital competence achieved ("Ministerial Declaration 11 June 2006, Riga, Latvia" 2006).

The Europe 2020 initiative adopted in 2010 does not include digital skills among its targets; however, its flagship initiative '**A Digital Agenda for Europe**' ("A Digital Agenda for Europe" 2010) dedicated a specific chapter to digital literacy, skills, and inclusion. It recognises the following issues:

- The internet take-up gap (30% of population were not using the internet at the time of writing in 2010), affecting mainly the elderly, low-income, unemployed and low-skilled persons. As one of the main reasons for take-up gaps, lack of user skills such as digital and media literacy is mentioned. In case of improved skills, the potential of access to e-services of direct interest to such groups was significant;
- Online safety;
- Lack of skilled ICT practitioners to fill numerous potential vacancies;
- Lack of e-business skills for innovation and growth;
- Lack of engagement of women in ICT sector.

The actions suggested included:

- Cooperation – multi-stakeholder partnerships (e.g. multi-stakeholder sectoral council for ICT skills and employment), awareness raising such as the European e-Skills Week;
- Transparency and recognition – better recognition of digital competences in formal education and training systems, effective certification outside formal systems, including re-skilling;
- Specific incentives to SMEs and disadvantaged groups;
- Mainstreaming e-learning in national policies, including curricula, assessment of learning outcomes, and professional development of teachers and trainers.

The Education and Training 2020 strategic framework (ET2020) is the European framework developed in 2010 for cooperation in education and training – a forum for exchanging best practices, mutual learning, gathering and dissemination of information and evidence (European Commission 2016g). One of the main methods of operation of ET2020 is its Working Groups composed of experts nominated by Member Countries and other key stakeholders working on common EU-level tools and policy guidance. Digital competences, along with the use of new ICT tools and teacher training, are mentioned under the overarching Strategic Objective 4 in the ET2020: Enhancing creativity and innovation, including entrepreneurship, at all levels of education and training. Digital skills have had specific ET2020 Working Groups since 2014. The Working Group on Digital and Online Learning was active in 2014-2015. The primary focus of this group was to support the Member States in policy development on digital and online learning. The group focused on three key areas: 1) policy guidance on innovative and open learning environments; 2) policy guidance for educational providers on the use of digital content and open knowledge; 3) observing new trends in 'ICT and education' and their possible implications for policy making. The 2014-2015 WG helped guide the implementation of: Council Conclusions on efficient and innovative education and training to invest in skills¹, and Opening up Education policy communication². The role of the current Working Group on Digital Skills and Competences (2016-2018) is to look at the development of digital skills and competences at all levels and stages of learning, and the potential challenges of digital technology use in education³. The WG on Digital Skills and Competences is expected to contribute to three major Commission initiatives: Digital Single Market, European Skills Agenda and Europe 2020 strategy. The WG regularly meets in Brussels and organises peer-learning activities (PLAs) on a specific topic in host countries. PLAs usually include a visit to schools or higher education institutions to see projects in action and meet teachers and students. In total, the 2016-2018 WG has planned to have six WG meetings, and six peer-learning activities. The current WG on Digital Skills and Competences regularly produces key policy messages following their meetings on a particular topic.

To some extent the topic of digital skills is also touched upon in policy documents in the wider area of digital policy. The **Digital Single Market Strategy for Europe** (European Commission 2015a) mentions digital skills as one area where investment in ICT infrastructures and technologies as well as research and innovation could bring important changes, in the long term resulting in maximising the growth potential of the European Digital Economy. The truly inclusive Digital Single Market would be one in which citizens and businesses have the necessary skills and can benefit from interlinked and multi-lingual e-services, such as e-government, e-justice, e-health, e-energy or e-transport. The Strategy reiterates the digital skills gaps mentioned by the New Skills Agenda and calls for raising the digital skills levels among employees in all economic sectors.

The necessary changes in education and training systems could draw on EU-level initiatives such as the "Grand Coalition for Digital Jobs", "EU Code Week" and "Opening up Education". Introduced in 2013, these initiatives aim to address the lack of ICT skills among EU citizens

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- 1 Council of the European Union (2014), Conclusions on Efficient and Innovative Education and Training to Invest in Skills - supporting the 2014 European Semester. Available at: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/educ/141138.pdf
 - 2 OpenEducationEurope (Europe's community for innovative education): <https://www.openeducationeuropa.eu/en>
 - 3 Specific priorities are provided in European Commission. Education and Training 2020: Working Group Mandates 2016-2018. Available at: http://ec.europa.eu/dgs/education_culture/repository/education/policy/strategic-framework/expert-groups/2016-2018/et-2020-group-mandates_en.pdf

from various perspectives. The “Grand Coalition for Digital Jobs” initiative is based on the partnership among different stakeholders with a shared purpose to attract young people to ICT sector and address the digital skills gap (European Commission 2014). The “EU Code Week” aims to promote coding and make programming more visible. The movement is run by volunteers and coordinated by the Ambassadors in each EU Member State (European Commission 2018c). The “Opening up Education” programme is targeting schools and universities in order to widen access and engagement to everyone by removing barriers and making learning more accessible. The “Opening up Education” initiative focuses on three areas: 1) creating opportunities for educational institutions, teachers and students to innovate; 2) increasing use of Open Educational Resources (OER); 3) improving ICT infrastructure and connectivity in schools (Inamorato dos Santos, Punie, and Castaño Muñoz 2016).

While the responsibility for curricula lies with the Member States, the Digital Single Market Strategy states that the Commission will support their efforts and play its role in enhancing the recognition of digital skills and qualifications and increasing the level of ICT professionalism in Europe. The Commission will also address digital skills and expertise as a key component of its future initiatives on skills and training.

The most important recent EU policy document in the area of skills is the **New Skills Agenda for Europe** (European Commission 2016d). In this Agenda, focus on digital skills is one of the specific areas under the first priority for action ‘Improving the quality and relevance of skills formation’. This policy document recognises that almost all jobs, as well as participation in society at large, now require some level of digital skills. The document highlights developments such as changing business models, robotisation and artificial intelligence, and e-services as main types of developments bringing about the increased need for digital skills. The attention is also drawn to the growing gaps between digital skills demand and supply in the labour market – pointing to the 4% annual demand growth for digital technology professionals in the last decade and the forecast that unfilled vacancies could double to 756000 by 2020 compared to 2016. The Agenda also emphasises that almost half of the EU population lacks basic digital skills and 20% have no digital skills at all. The document calls for higher investment in digital skills across all levels of education and training and by all actors – public administrations, businesses, providers and individuals. It also points to research and innovation hubs as potential catalysts for their development and transfer, as well as investment, business and job creation.

The New Skills Agenda for Europe sets a framework for the Digital Skills and Jobs Coalition, which has an objective to develop a large digital talent pool and ensure that individuals and the labour force are equipped with adequate digital skills. In this context, the Member States were invited to develop national skills strategies on the basis of specific targets. These include the formation of national digital skills coalitions and developing concrete measures to bring digital skills to all levels of education and training, support teachers and educators, and promote active involvement of businesses and other organisations. The Member States and stakeholders were also invited to pledge action, identify best practices, and improve the dissemination of information about available funding.

Furthermore, the New Skills Agenda for Europe mentions innovation in pedagogy as an important support area. This includes, among other issues, the integration of digital tools into the classroom.

The importance of digital skills is well recognised in the most relevant recent policy documents focusing on all levels of education and training. **At the early childhood education and care (ECEC) / primary education level**, digital skills are discussed in the Council conclusions on the role of early childhood education and primary education in fostering creativity, innovation and digital competence (27 May 2015; updated 22 May 2018).

These documents argue that promoting creativity, innovation and digital competence through education during the early years can produce benefits later on, by laying the foundations for further learning, enabling further knowledge development and generally improving each child's ability to develop creative and critical thinking skills. The documents state that harnessing the benefits of the digital revolution and using them for economic success e.g. by developing new products and services in the coming decades will depend a lot on citizens who display creative and innovative capacities and who possess high-level digital competence. While digital tools cannot be used to replace essential classroom activities, experiences and materials, they can contribute to quality and effectiveness of education, as well as better motivation, understanding and learning outcomes of pupils. This however has important implications to pedagogical approaches, assessment, pedagogical resources and learning environments, as well as the initial education and continuous professional development of both teachers and ECEC professionals, with a view to ensuring that they develop the capacity, methodology and skills. Education and training also have an important role in promoting the safe and responsible use of digital tools and in developing media literacy.

The Conclusions focus on several different areas of action:

- Access to and promotion of age-appropriate, safe and responsible ICT, digital equipment and digital tools in early childhood education and primary education;
- Focus on teachers and school leaders, including their abilities to use ICT for teaching, new pedagogical approaches and provision of more personalised teaching for a wide range of abilities and disadvantages;
- Cooperation – this includes eTwinning and other collaboration at all levels, open source communities, and exchange of good practice, most effective methods of learning and teaching.

At the **secondary education level**, the Communication 'School development and excellent teaching for a great start in life' (European Commission 2017b) discusses that many of today's school children will later work in jobs that do not yet exist, and that already 90% of all current jobs require at least some level of digital skills. The development of digital skills should therefore go hand in hand with the development of resilience and ability to adapt to change. Although the digital technologies can enrich learning experiences and support development beyond digital competence, currently only a quarter of European school children are taught by digitally confident teachers.

In the light of such developments, the Commission committed to:

- Focus on teachers, as they need to be prepared for collaborative work and career-long professional development, for dealing with diversity in the classrooms and for using digital technologies with confidence. This can be done via a Digital Competence Framework to support teachers' self-assessment and development, online courses (including MOOCs), online resources for school professionals.
- increase cooperation, by school partnerships and pupil mobility under Erasmus+, participation in eTwinning, online communities for school professionals, online networks for early career teachers and their mentors, exchange of best practice among providers of Initial Teacher Education;

Additionally, the Communication suggests strengthening the monitoring of digital capacity via European Commission's developed self-assessment tool SELFIE (Self-reflection on Effective Learning by Fostering Innovation through Educational Technologies) so that schools in the EU can, on a voluntary basis, self-evaluate where they stand in relation to common criteria and are supported in developing and improving their effective use of technologies for

digital age learning. Using the tool, schools could choose to report on their progress in the availability, use, competences and attitudes to ICT, building a database across all participating Member States.

At the **tertiary education level**, the Renewed EU Agenda for Higher Education (European Commission 2017a) recognises that the digital technology is making jobs more flexible, but also more complex. This requires strong capacities, among others, to be entrepreneurial, manage complex information, communicate effectively, think autonomously and creatively, be resilient, and smartly use digital resources. The document stresses the need for Europe to have more high achievers, who can develop cutting edge technologies and solutions, whereas at the moment too many students graduate higher education with poor basic skills, including digital ones. High-level digital skills are recognised as crucial attributes of all students in advanced learning, irrespective of discipline. The Agenda, similarly as at other levels of education, focuses on cooperation: it points out the Commission's intention to further strengthen Erasmus+ business consortia to increase the availability and quality of work placements and support Erasmus+ student work placements with a particular focus on digital skills and to develop and roll out a digital readiness model to help HEIs (higher education institutions), their staff and students implement digital learning strategies and exploit the potential of state-of-the-art technology, including learning analytics, accompanied by guidance on open education initiatives.

The Commission Communication on Strengthening European Identity through Education and Culture (European Commission 2017c) also discusses digital skills to some extent. It mentions that in order to reap the benefits of technological developments, existing shortcomings concerning teaching digital skills such as coding or cyber security skills, media literacy and entrepreneurship skills must be addressed. In this context, the Communication calls for new Council benchmarks that could be agreed for digital competences and entrepreneurship. In the follow-up to this Communication, the European Council in December 2017 inter alia asked for examining measures to address the skills challenges linked to Digitisation, cybersecurity, media literacy and artificial intelligence and the need for an inclusive, lifelong learning-based and innovation-driven approach to education and training.

As digital skills are usually understood as **key competences** (also often called transversal, soft or basic skills), the policy documents in this area also discuss their development in detail. The Proposal for a Council Recommendation on Key Competences for Lifelong Learning (European Commission 2018b) continues to mention digital skills as one of the top priorities for transversal / basic skills development in Europe. The document states that digital skills are now as vital as literacy and numeracy and Europe therefore needs digitally competent people who are not only able to use but also to innovate and lead in using these technologies. The proposed Recommendation states that Member States should pay special attention to increasing and improving the level of digital competences at all stages of education and across all segments of population.

According to this Proposal, digital technologies also help develop more flexible learning environments adapted to the needs of highly mobile societies. The Proposal calls for better use of new opportunities, including distance learning and mobile digital devices, to actively support the development of competences throughout life. The proposed Recommendation states that the Member States should promote a variety of learning approaches and contexts, including the adequate use of digital technologies in education, training and learning settings.

The Digital Education Action Plan operates **in a context of numerous policy documents and initiatives** focusing on the issues of digital society and digital economy as well as those related to skills, labour market, and education and training. These include, most importantly, the 2015 Digital Single Market Strategy, dedicating a specific sub-chapter to digital skills and expertise; the 2016 New Skills Agenda for Europe; the European Reference Framework of

Key Competences for Lifelong Learning, stating that the definition of digital competence needs an update in the light of changing digital and technological environments, and having in mind the lessons learnt in developing and supporting the Digital Competence Framework; and a set of policy documents targeted at digital skills at specific levels of education. At the same time, the Digital Education Action Plan will still work in the framework of major policy documents adopted in 2010 - Europe 2020 and Education and Training 2020 (ET2020).

1.2 Defining digital skills

The Digital Education Action Plan describes digital skills as basic skills “alongside literacy and numeracy, needed in all walks of life” (European Commission 2018a). The Action Plan uses the terms digital skills and competences interchangeably, and applies a definition provided by the revised European Reference Framework of Key Competences for Lifelong Learning. “Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), and problem solving” (European Commission 2018c).

The Action Plan notes that the Key Competence Framework recommendation was adopted the same day as the Digital Education Action Plan. The updated framework extended the digital competence definition to reflect the changing nature of technology in society and the labour market. Compared to the previous digital competence definition of 2006⁴, there have been a few important changes. The new definition mentions *responsible* use of digital technologies, implying there are possible threats caused by technologies. The new definition also added *engagement with digital technologies* encouraging citizens to not only use technology, but also engage in its development. An important change proposed by the new digital competence definition is also related to ICT use for learning purposes. Including the learning aspect into the digital competence definition emphasises the growing importance of ICT use for education purposes. The new definition emphasises that it is crucial to actively promote ICT in teaching and learning and seize technological opportunities so that education can keep up with other sectors.

The JRC also introduces the concept of computational thinking (CT). The distinctive characteristic of CT is its focus on problem-solving processes and methods, and on creating computable solutions. Computational thinking is related to the concept of digital competence. Digital competence, however, may not fully capture the set of core ideas and skills associated with CT (Joint Research Centre 2018).

Academic literature tends to provide more detailed definitions of digital competence distinguishing digital skills and digital literacy as two different (but interacting) fields. By digital skills scholars refer to specific technical skills while digital literacy is perceived as more complex and systematic ICT knowledge. Division between digital skills and digital literacy enables academics to provide very specific operational definitions of digital competences to examine various digital and social phenomena (e. g. advanced person’s technical ICT usage alongside with poor capability to use ICT for communication purposes). Scholars tend to highlight theoretical distinctions making digital competence definition fragmented and less descriptively complex but more challenging to effectively put into action. Accordingly, digital

4 2006 Definition: Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet (“Digital Competences and Technology in Education - Education and Training - European Commission” n.d.).

competence definition provided by the Commission creates a generic view encompassing not only technical users' abilities to apply ICT but digital literacy as well, thus digital competence is perceived as a complex set of technological, cognitive and non-cognitive aspects. Although different in their disposition, the definitions provided by the Commission and academic literature do not deny or contradict each other; on the contrary, they should be seen as complementary.

The definition provided in the Key Competence framework demonstrates the increased importance and dynamic nature of the digital competence. The Commission's digital competence concept provides a holistic understanding of the digital competence encompassing not only technical abilities to apply ICT, but also digital literacy, collaboration, and content creation. The Commission identifies practical digital competence implications on job and occupation, personal development, learning, civic engagement and other domains (European Commission 2016g).

To operationalise the definition of digital competence, the European Commission's Joint Research Centre (JRC) developed a set of **digital competence reference frameworks**. The following projects contribute to building capacities of citizens, educators, education organisations and consumers to cope with challenges brought by the digital transformation:

Digital competence framework for citizens (DigComp)

The DigiComp framework describes what it means for citizens to be digitally competent. DigComp describes different areas identified to be part of digital competence; provides specific competence descriptors and titles; describes proficiency levels for each competence; explains knowledge, skills and attitudes applicable to each competence and provides examples of use, on the applicability of the competence to different purposes (Carretero, Vuorikari, and Punie 2017). For citizens the framework can help to self-assess their digital skills, set further learning goals, or help identify potential job opportunities. For policy-makers, it is beneficial to understand where citizens of each country stand in comparative perspective. According to the examples provided in the DigComp, citizens with different digital proficiency levels can act in five areas to benefit for their employment and learning process: 1) information and data literacy; 2) communication and collaboration; 3) digital content creation; 4) safety; 5) problem solving. DigComp-identified proficiency levels include foundation, intermediate, advanced and highly specialised. Depending on their ICT competence level, citizens are capable to complete tasks of different complexity, for example, looking for vacancies, organising group work using different devices and channels, creating digital content without copyright violations, protecting data and content from external threats, identifying and fixing technical problems arising while using ICT for working or learning. DigComp can contribute to policy making and support; planning in education, training and employment areas and digital competence assessment (Joint Research Centre et al. 2016).

Digital competence framework for educators (DigCompEdu)

This framework aims to describe how digital technologies could be used to innovate and enhance education and training. DigCompEdu can be used to support educators at all levels of education in formal and non-formal learning contexts ("Digital Competence Framework for Educators (DigCompEdu) - EU Science Hub - European Commission" 2016). To describe digital competence of educators, the DigCompEdu provides six different areas:

1. Professional engagement area which encompasses organisational communication, collaboration, reflective practice and digital continuous professional development meaning that educators are capable to use digital technologies to enhance

organisational communication with learners, parents, colleagues and third parties, critically assess and develop their digital pedagogical practice and use digital sources for professional development.

2. Digital resources area, involving selecting, creating, modifying, managing, protecting and sharing digital resources.
3. Teaching and learning area, consisting of applying digital devices and resources to guide learners, to enhance teaching, collaboration and self-learning process.
4. Assessment area, including use of digital resources to diversify assessment approaches, analyse learning activity, provide feedback and plan future learning priorities.
5. Learners' empowering area, consisting of equal accessibility to learning resources for all learners, addressing diverse learning needs and to foster learners' engagement.
6. Facilitating learners' digital competence area, consisting of learning activities which enable learners to improve their information and media literacy, digital communication, collaboration and digital content creation skills, as well as digital technology use in a responsible way.

Digital competences of educators encompass professional collaboration and continuous professional improvement, ability to use ICT for organisation and communication purposes in collaboration with other actors involved in learning processes. DigCompEdu also emphasises the importance of proper use of digital resources. Educators face a wide range of digital materials and it is therefore essential to enhance digital literacy. Digitally competent and literate educators should be capable to enable and support learners to use ICT for autonomous, self-reflective learning (Joint Research Centre et al., 2017).

Digital competence framework for educational organisations (DigCompOrg)

DigCompOrg provides a comprehensive and generic conceptual framework that reflects all aspects of the process of systematically integrating digital learning in educational organisations from all education sectors ("DigCompOrg Framework - EU Science Hub - European Commission" 2015). DigCompOrg helps educational institutions to consider their level of engagement in digital learning and teaching practices and enables decision makers to form and put innovative projects into action. DigCompOrg suggests strategic changes in pedagogical, technological and organisational domains. As noted in the DigCompOrg report, educational institutions are recommended to use this framework alongside with digital competence framework for citizens (DigComp), educators (DigCompEdu) and consumers (DigCompConsumers) to achieve the best results (Joint Research Centre et al., 2015).

Digital competence framework for consumers (DigCompConsumers)

This framework was launched in 2015 to improve consumers' position in today's digital market. The main objectives of the framework are to provide information on consumer education and update the discussion about possible ways to deliver high quality support and training to consumers. The framework is tailored to name users' needs and challenges in the e-commerce environment. DigCompConsumers complements and elaborates on the DigComp project with specified contribution to consumer-related topics (Joint Research Centre et al., 2016a).

All four reference frameworks (DigComp, DigCompEdu, DigCompOrg and DigComp Consumers) complement each other and provide a holistic meta-framework that aims to unify concepts, practices and approaches to digital skills at European level. The holistic digital competence definition provided by the Commission and operationalised by JRC via digital competence frameworks for citizens, educators, educational organisations and consumers indicates the development direction for further initiatives presented in the Action Plan.

2 ACTION PLAN PRIORITIES

KEY FINDINGS

- The Action Plan identifies **low connectivity as one of the main obstacles to uptake of digital tools** that can trigger innovation in education. The Action Plan proposes to support connectivity in rural areas through the **EU network of Broadband Competence Offices (BCOs)**. The BCOs focus on developing, promoting and expanding the BCO network across the EU, however, it does not target education institutions specifically. The Action Plan is therefore right to call for action in raising awareness of the benefits of broadband and funding opportunities specifically for schools.
- The Action Plan asserts that **educators do not possess sufficient knowledge to apply digital education materials**, while **initial and on-the job training to prepare educators for the digital era is also not sufficient**. The Digital Education Action Plan suggests the **SELFIE self-assessment tool** as the main policy initiative aiming to promote digital learning and support the digital readiness of education institutions. The Action Plan also proposes a **mentoring scheme at national/regional level**, supported by an EU-level awareness-raising platform that would provide collaboration and peer-exchange opportunities to educators. The literature also notes high level of **uncertainty about copyright** in teaching and learning. This situation calls for more information and support measures that could address low awareness and passive attitude towards copyright in education.
- **Digital services aimed at mobile students are still scarce** meaning that sending and receiving institutions are not able to share necessary student information between them. The Action Plan proposes that the way forward should be to provide **a framework for issuing digitally-certified qualifications and validating digitally-acquired skills**.
- The Digital Education Action Plan warns that **Europe will lose its competitiveness if education fails to provide digital competences** to Europeans of all ages. First, to improve digital skills of the European population the Action Plan proposes to create a **Europe-wide platform for digital higher education and enhanced cooperation**. Second, the plan also suggests **strengthening open science and citizen science** in Europe. Finally, the Action Plan suggests **scaling up the EU Code Week** by collaborating with authorities in EU Member States, Code Week ambassadors, the eTwinning network, the Digital Skills and Jobs Coalition and related actions.
- The Digital Education Action Plan stresses **the need to strengthen critical thinking and media literacy** among children and young people. To tackle the challenges for online safety and cyber-hygiene the Digital Education Action Plan suggests **an EU-wide awareness-raising campaign** targeting educators, parents and learners to foster online safety, cyber hygiene and media literacy. The Action Plan also recommends **a blended course on cyber-security** that will potentially provide educators with useful tools to further increase media literacy of young people.
- The Digital Education Action Plan **recognises lack of interest among girls to pursue studies in ICT or STEM** as a clear problem leading to lost opportunities and risks contributing to gender inequality. To increase female participation in ICT and STEM careers, the Digital Education Action Plan suggests measures to further decrease the gender gap in the technology and entrepreneurial sector.

- The Digital Education Action Plan draws attention to a **lack of coherent cross-European data** that could be used to improve education systems through evidence-based policy-making. To address this issue, the Action Plan calls for more evidence on the uptake of ICT and digital skills in schools, by **publishing a reference study assessing progress in mainstreaming ICT in education (ESSIE2)**; and **collaborating with the OECD to develop a new module in PISA** focusing specifically on the use of technology in education. The Digital Education Action Plan also considers exploring relevance and feasibility of **proposing new Council benchmarks for digital competences and entrepreneurship**.
- The Action Plan asserts that **big data for policy making and learning analytics could bring significant added value to education**. The document therefore calls for **artificial intelligence and learning analytics pilots** that could explore specific problems and improve implementation and monitoring of education policy.
- **To initiate strategic foresight in education the Action Plan proposes to release a series of policy, research and guidance papers** that would analyse the impact and potential of digital technologies in education. Foresight enables various stakeholders to think and discuss potential future visions in order to shape future using different policy instruments, therefore it can meaningfully complement traditional policy tools. The Action Plan also proposes to organise an **EU-wide education hackathon**. Hackathons are known as intense events where teams of data scientists, computer programmers, graphic and interface designers and project managers try to creatively tackle data problems and prototype data analytics products.

The Action Plan introduces three priorities outlining measures that aim to “help EU Member States meet the challenges and opportunities of education in the digital age” (European Commission 2018a). The priorities are the following:

- 1) Making better use of digital technology for teaching and learning
- 2) Developing digital competences and skills
- 3) Improving education through better data analysis and foresight

Under each priority the Action plan discusses challenges and opportunities that digitisation brings to education, specific actions aimed at addressing them as well as current EU policy initiatives.

This chapter discusses the three Action plan priorities in the context of the broader academic literature, applied research, and EU policy. The structure of the sub-chapters is the following:

- We firstly summarise challenges and opportunities discussed in the Action Plan and accompanying Staff Working Document (SWD) under each priority and action. We also present how academic literature and applied research analyse the discussed issues and try to identify whether there are any contradictions or additional points.
- We then summarise the action proposed to address the identified challenges and opportunities and give a broad overview of underlying EU policy initiatives.
- If applicable, we present other EU policy initiatives relevant to the proposed action. This sub-chapter provides a wider policy context in which the proposed actions would operate.
- Finally, we assess the proposed action’s fitness for purpose by analysing whether the measures proposed in the Action Plan are sufficient to address the identified challenges, taking into account already existing policy initiatives. This activity will give

indications of potential “blind spots” in the field of digital skills and competences that are not addressed by the Action Plan and other existing initiatives at EU level.

2.1 Priority 1: Making better use of digital technology for teaching and learning

2.1.1 Schools still lack access to broadband infrastructure

Low connectivity of education institutions

The Action Plan asserts that technology can enrich education through “opening classrooms, real-life experiences and projects, and from new learning tools, materials and open educational resources” (European Commission 2018a). A wealth of information available online enables teachers and learners to interact with learning materials in new ways both in formal and non-formal education settings. For schools, being connected can give access to specialised material, collaboration platforms, or sophisticated software. For instance, applications requiring high speed connection such as video conferences or cloud computing can create opportunities to bring outside speakers to the classroom. Virtual or augmented reality applications or immersive learning require bandwidth connection and advanced software/hardware, but it has great potential in increasing or even personalising students’ learning experience (European Commission 2018d).

The Action Plan’s SWD presents digital technology as “enabler of innovation in education”, perceived as newness that brings value (European Commission 2018d). The SWD provides an example of educational robotics that can stimulate pupils to develop not only digital skills, but also STEM, humanities, cognitive and social skills. The document points out, however, that innovative practices are still scarce and operate in isolation, even though all educational sectors benefit from them (European Commission 2018d).

The Action Plan elaborates that the use of technology for educational purposes has been lagging behind despite the growing general use of internet and technology. A recent study showed that around 18% of primary and secondary schools did not have broadband connection in 2015 (European Commission 2018a). The accompanying Staff Working Document (SWD) elaborates that low connectivity remains one of the main obstacles to the uptake of digital tools that can trigger innovation in education. Without fast internet connection both simple digital student services and more advanced innovative learning applications requiring VR (virtual reality) or AR (augmented reality) can become physically impossible (European Commission 2018d).

The Key Messages from the PLA on Education 4.0 report emphasises that one-off infrastructure investments might not be enough to sustain the growing use of audio-visual content in classrooms. Teachers and students are using more and more devices simultaneously; therefore improvement of infrastructure should become a continuous effort. The report also notes that schools often lack technical competences for making credible decisions on digital infrastructure and its strategic development (European Commission 2017d).

Digital divide

The Action Plan acknowledges significant variations in equipment and approaches to technology among schools and training institutions in Europe (European Commission 2018a). The SWD states that accessibility and quality of connectivity are crucial to ensure equity. The document also stresses the importance of access to technology outside the classroom. It provides evidence that disadvantaged students with limited access to computers outside

school are less likely to do schoolwork or communicate about it with teachers and classmates than their more advantaged counterparts (European Commission 2018d).

The topic of the digital divide is also prominent in academic and EU research. The studies argue that people who cannot afford appropriate ICT devices in their everyday life are not capable of ameliorating their digital skills and therefore become even more disadvantaged in digital society (Davaki 2018; European Commission 2017d, 2016a). Resta and Laferrière apply the OECD's definition of the digital divide: "differences between individuals, households, companies, or regions related to the access to and usage of ICT" in their study on digital equity and intercultural education. The study lists numerous causes of the digital divide, including but not limited to access to devices or internet connectivity. The authors also elaborate that "autonomy of use; digital and literacy skills; availability of technical and social support; and access to educators skilled in the use of information and communication technologies" comprise a complex set of factors contributing to the digital divide (Resta and Laferrière 2015).

Action 1 - Wifi 4 Schools

Supporting the roll-out of high-capacity broadband in schools

The SWD stresses that poor connectivity is a factor limiting the opportunities brought by developments in technology. Broadband infrastructure is crucial for schools that currently rely on poor connections that serve multiple users at the same time (European Commission 2018d). The Action Plan stresses that ensuring equal access to high-quality infrastructure should be a starting point for digital education. Even though access to infrastructure tackles only one dimension of the digital divide, it is crucial in reducing inequality and exclusion, as well as offering a more innovative learning experience (European Commission 2018a).

The Action Plan highlights three action areas for tackling the connectivity divide:

1. Raising awareness of the benefits for schools, and of available funding opportunities;
2. Supporting connectivity e.g. through a voucher scheme focusing on disadvantaged areas and ensuring full implementation of the toolkit for rural areas (see below);
3. Publishing data about progress.

The main policy initiative that could contribute to raising awareness and support for connectivity in rural areas is the **EU network of Broadband Competence Offices (BCOs)**.

The BCOs have been set up by the European Commission together with the Member States to "advise local and regional authorities on ways to develop broadband, and help citizens and businesses get better internet". The overall goal of the BCO network is to "ensure that all EU citizens, even in rural and remote areas, have high-speed broadband access, allowing everyone to benefit equally from all the opportunities available online – such as education, health, government services, and business" ("Broadband Competence Offices Network" 2017). Since the establishment of the BCO network in 2017, the national BCOs have already been established in 27 EU Member States, and the network is growing at regional level.

The BCO network initiative includes a five-point toolkit focusing on how to bring broadband to rural Areas of the EU ("European Commission Joins Forces to Help Bringing More Broadband in Rural Areas" 2017). The toolkit specifies five steps in setting up the Broadband Competence offices: the deployment of "Broadband missions" to Member States and regions with low levels of rural broadband coverage; designing a "common methodology" for the planning, reporting, and monitoring of broadband investments; introduction of a "rural proof test" which will prioritise rural broadband in the reprogramming of any structural and investment funds; and updating the Commission's guide to high-speed broadband

investment to help local communities launch successful projects (“European Commission Joins Forces to Help Bringing More Broadband in Rural Areas” 2017). These measures should help managing authorities, regional and local authorities and other types of beneficiaries of EU funds, to invest more easily in the deployment of broadband in rural areas (“Broadband Days – to Promote Broadband Development at Local Level” 2017).

The BCO network supports the implementation of the 2020 Digital Single Market goals (European Commission 2015b) and the 2025 Gigabit Society objectives (European Commission 2016f). The main functions of the network include enhancing the efficiency and effectiveness of broadband investments; supporting the expertise/administrative capacity of public authorities in the planning, implementation and monitoring of broadband projects; and promoting the use of financial instruments, among others. One of the BCO network’s functions is to help participants in coordination with relevant EU entities: EIAH⁵, Jaspers⁶, DG REGIO, DG AGRI, DG COMP, DG CNECT (“Broadband Competence Offices Network” 2017).

The target groups of these activities include:

- Ministries and authorities in charge of the planning and implementation of Next Generation Access Network strategies;
- Municipalities and public bodies responsible for the funding and the deployment of broadband;
- Any entities seeking guidance on the planning and execution of broadband projects using a variety of business and investment models and financing structures;
- Citizens, enterprises and other bodies that wish to be informed about broadband developments, national or regional plans for broadband connectivity, and EU support available in their area.

DGs working on BCOs initiative:

DG CNECT, DG AGRI, DG REGIO, DG COMP

Fitness for purpose of the action 1

The Plan’s response to the connectivity challenge is based on the newly established EU network of Broadband Competence Offices (BCOs). The network’s activity report for the year 2017 concluded that the BCOs support facility focused on promoting and expanding the BCO network across the EU, developing and disseminating knowledge and best practices on broadband projects, and identifying potential multipliers in the implementation of broadband plans in Europe (“Broadband Competence Offices Network - 2017 Activity Report” 2017).

At its current format the BCO network initiative provides a solid base for raising awareness about the general benefits of broadband infrastructure, providing information about available funding opportunities, and implementing the toolkit for rural areas. Through this initiative, the Commission also provides an overview of every Member State’s national broadband strategies and policies, financial instruments, major projects as well as links to publications and contact information of responsible authorities and Broadband Competence Offices (“Broadband in Member States,” n.d.). The BCO initiative, however, does not target education institutions specifically. Therefore, the Action Plan is right to call for action in raising awareness of the benefits of broadband and funding opportunities specifically for schools. On the other hand, the Plan does not specify whether the Commission would capitalise on the

5 European Investment Advisory Hub, <http://eiah.eib.org/about/index>

6 Technical assistance partnership between three partners (European Commission, EIB and EBRD), http://ec.europa.eu/regional_policy/en/funding/special-support-instruments/jaspers/

BCO network or establish a separate communication campaign for this matter, therefore the means of awareness raising are not clear yet.

Regarding the digital divide, the Action Plan acknowledges the more complex nature of this phenomenon, but it focuses the first action on addressing the basic lack of digital infrastructure. The Action Plan points out that better access to infrastructure is the necessary but not sufficient condition to further addressing other causes of the digital divide related to lack of digital and literacy skills; availability of technical and social support; and access to educators skilled in the use of information and communication technologies.

2.1.2 Educators and education institutions lack digital readiness

Lack of digital competences of Educators

The Digital Education Action Plan asserts that many educators do not have sufficient competences to support teaching with digital tools (European Commission 2018a). Evidence presented in the SWD therefore indicates high demand for pedagogical digital competences – more than half of lower secondary education teachers surveyed by the OECD specified that they need professional development in this area. Elaborating on this issue the SWD points out that specific curricula for initial teacher training in digital education are very rare. The shortage of appropriate initial and on the job teacher training therefore results in a teaching workforce that is underqualified to provide students with a digital learning experience (European Commission 2018d).

Academic literature also reflects on significant differences between optimal ICT (information and communication technology) skills needed to develop and apply digital education materials and actual knowledge that educators have in this field (Fernández-Cruz and Fernández-Díaz 2016).

In accordance with the Digital Education Action Plan, the literature emphasises the need for specific ICT modules in teachers' degree curricula. The research notes that in order to apply innovative teaching methods in classes, educators need to gain digital confidence themselves. The lack of teachers' digital competences discourages them from using digital education approaches as they are not capable to provide students with proper supervision and support (OECD 2016b; Tomczyk et al. 2017).

While many teachers already apply some level of ICT-based teaching in class, they often lack the ability to use technology in a more advanced manner, apart from gathering information or making a simple presentation. A study on teachers' use of computers and Internet inside and outside the classroom notes that the lack of educators' digital literacy might result in lower quality educational content that they use to support teaching (Hinostroza et al. 2016).

Outdated curricula and pedagogies

The literature also emphasises challenges related to more structural needs of the teaching process. One of the key issues raised by scholars is outdated curricula. Study programmes usually fall behind in responding to contemporary challenges. In order to keep up to date with a rapidly digitalising world, education institutions need to stay focused on updating curricula and expanding the number of subjects related to digital competences and applying a horizontal cross-subject approach (European Commission 2017g; Loewy 2016; Pérez-Escoda, Castro-Zubizarreta, and Fandos-Igado 2016; Picatoste, Pérez-Ortiz, and Ruesga-Benito 2017).

The OECD study emphasises that in order to apply new digitally enhanced education models, teachers do not only need to advance their digital skills, but also review their pedagogy. Technology-supported teaching requires solid pedagogic resources and a holistic understanding of how to meaningfully use technology for deeper learning. The study elaborates that new teaching models require support from policy-makers that would enable educators to access resources and understand how to use them (OECD 2016b). The JRC also points out that introducing computational thinking to education requires hands-on teacher training, so that teachers would be able to transfer their new skills to classrooms. To enable best practice sharing among teachers, the study on Developing Computational Thinking in Compulsory Education recommends policy actions on peer exchanges and community building (Joint Research Centre 2018). The messages from the joint PLA in Malta organised by the ET2020 working groups for Modernisation of Higher Education and Digital Skills and Competences also suggest improving digital competences of educators by providing training programmes supported by national authorities. These programmes could provide knowledge and practical skills in innovative teaching methods and sharing of best practices (European Commission 2017f).

Rapid growth and change in the economy pushes education systems to develop adaptive curricula and learning strategies in order to facilitate employment opportunities (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017). The entire education system - and higher education institutions in particular - are responsible for providing students with relevant and up-to-date skills so that they can successfully integrate into the labour market (FLEACĂ 2017).

Copyright issues

The digital transformation opened a plethora of opportunities for distributing educational materials online and the Action Plans calls on educators to share it freely. On the one hand, digitisation significantly contributed to enhanced provision and transfer of education materials. On the other hand, it created uncertainty for the copyright holders, as digital copies are much more prone to illegal distribution.

The study assessing the impact of the European copyright framework on digitally supported education and training practices (PPMI and DG EAC 2016) found that both copyright holders and users of copyrighted works face challenges due to low awareness about copyright as well as different national interpretations of the EU copyright rules. The study concluded that the lack of awareness and understanding of the copyright rules might have slowed down the development of innovative educational practices. The study outlined various reasons how copyright uncertainty has been limiting the shift from analogue to digital education: educators and learners face various restrictions to access copyright-protected materials; authors and right-holders have little willingness to produce high-quality open access materials; and education institutions and libraries face obstacles in distributing open materials due to low supply and underdeveloped open education debases (PPMI and DG EAC 2016).

Action 2 - SELFIE self-reflection tool & mentoring scheme for schools

Supporting the digital capacity of schools

The Digital Education Action Plan suggests an integrated approach to empowering and connecting educators. On the one hand, it points out the importance of external factors such as the right environment, infrastructure, devices and leadership support. On the other hand, it stresses that it is important to equip teachers with the right skills, curricula and educational materials that can support digital teaching models (European Commission 2018a).

The Digital Education Action Plan suggests the **SELFIE self-assessment tool** as the main policy initiative aimed at supporting the digital readiness of general and vocational schools (European Commission 2018a). The tool is based on the Digitally-Competent Educational Organisations (**DigCompOrg**) **conceptual framework** ("Promoting Effective Digital-Age Learning: A European Framework for Digitally-Competent Educational Organisations - EU Science Hub - European Commission" 2015). This initiative is aimed at "helping school communities where they stand in their use of digital technologies" ("Self-Reflection Tool for Digitally Capable Schools (SELFIE) - EU Science Hub - European Commission" 2017). The online SELFIE tool provides a snapshot of each school's strengths and weaknesses in its use of digital technologies for learning. In building this snapshot, the tool considers different dimensions such as school's strategies, teaching, learning and assessment practices, infrastructure, curricula, student experience, etc. Schools can use the main output of this tool – a SELFIE School Report – to create an Action Plan to improve the use of digital technologies for better learning. SELFIE is still in the testing and development stage, having been used by 650 schools in 14 countries. At the time of writing (June 2018), the next version is expected to become available some time later in the year ("Self-Reflection Tool for Digitally Capable Schools (SELFIE) - EU Science Hub - European Commission" 2017).

The Action Plan also proposes a **mentoring scheme at national/regional level**, supported by an EU-level awareness-raising platform (European Commission 2018a). The scheme will aim to build a network for teachers and schools where they could share experiences on the use of digital technologies for teaching and learning. This network would also support the mainstreaming of digital teaching practices through peer-learning and collaboration ("Digital Education Action Plan - Education and Training - European Commission" 2018). The mentoring scheme has been inspired by the **Living School Lab project**. The project promoted a whole-school approach to ICT use, aiming to mainstream the use of technology not only in a classroom, but across the whole school. Participating schools from 12 countries were supported through peer-exchanges in regional hubs. The project presented a successful model on how to build a collaboration network for schools at national and regional level; a framework for mainstreaming school environment change through ICT; a collaborative course for school leaders and practitioners, and a plethora of freely available additional resources ("Living Schools Lab" 2014). The Commission plans to launch the mentoring scheme by 2020, as part of the Societal Challenge Programme. This programme is part of Horizon 2020 framework and presents a challenge-based approach to address the major concerns of the European citizens. This programme will also include links with the European Innovation Partnerships (EIP), part of the Innovation Union strategy⁷. ("Societal Challenges - Horizon 2020 - European Commission" 2018).

Other relevant initiatives

The recently published **European Digital Competence Framework for Educators** (DigiCompEdu) offers educators guidance in developing digital competences. The objective of this framework is to synthesise the existing national and regional efforts reflecting on educators' digital competences and provide a coherent model that could be used to assess and develop pedagogical digital competences (Redecker and Punie 2017). The DigCompEdu Framework proposes 22 elementary competences organised in 6 areas:

- *professional engagement* related to using digital technologies for communication, collaboration and professional development

⁷ Innovation Union is the EU strategy to create an innovation-friendly environment that makes it easier for great ideas to be turned into products and services ("Innovation Union - Research and Innovation - European Commission" n.d.).

- *digital resources* related to sourcing, creating and sharing digital resources
- *teaching and learning* related to managing and orchestrating the use of digital technologies in teaching and learning
- *assessment empowering learners*, related to using digital technologies to enhance inclusion, personalisation and learners' active engagement
- *facilitating learner's digital competence*, related to enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem-solving

In the area of collaboration and sharing best practices, the European Commission has been developing platforms to provide schools and educators with information and access to **Erasmus+** opportunities, as well as sharing best practices and disseminating educational materials.

For VET, the DG EMPL established a **Platform of European Associations of VET Providers** in 2015. The participants in this platform are six associations of VET providers⁸ and two decentralized agencies – Cedefop and the ETF. One of the platform's three priorities is "learning providers and the challenge of technology enhanced learning". The platform works as a community for information sharing and expert cooperation, making use of participants' experience and know-how and Cedefop's own work, as well as the efficient use of EU project outcomes. The working themes for 2017-2020 will include encouraging higher education institutions (HEIs) to share technology-enhanced learning (TEL) practices with VET practitioners; analysing cases of teachers' and trainers' further up-skilling in TEL and e-learning; reflecting on web-based learning demands, competence-based learning in TRE (technology-rich environments), new TEL-based assessment methods of learning outcomes; sharing experience on new learning tools and programmes, etc. All the gathered knowledge and information should be shared through reflection groups and practical guidelines (Cedefop 2016).

The European Commission has also established a portal to support schools in planning Erasmus+ projects - the **School Education Gateway**. One of its priorities is engaging teaching and learning in the digital age. The portal includes events, policy updates, a course catalogue for training providers, school staff mobility opportunities, and good practice examples ("School Education Gateway" 2018). This portal also hosts the **Teacher Academy**, launched to help teachers access relevant professional development activities across Europe ("Teacher Academy by School Education Gateway" 2018).

Exchange between education practitioners is also facilitated through the biggest educational network in Europe, **eTwinning** (European Commission 2018d). Financed by **Erasmus+**, this network offers teachers and other school staff members a collaboration platform for communicating, developing projects, and sharing. The platform also offers online professional development opportunities for educators. The network promotes school collaboration tools, services and support through the use of ICT ("eTwinning" 2018).

8 EFVET, EVBB, EVTA, EUCEN, EUproVET and EURASHE

DGs working on related initiatives:

DG EAC, Erasmus+

DG EMPL, Platform of European Associations of VET Providers

DG EMPL and JRC, DigiComp framework

DG RTD, Horizon2020 - the Societal Challenge Programme

Fitness for purpose of action 2

Extending the scope of the SELFIE initiative might offer education institutions a holistic approach towards integrating digital learning into school strategies, teaching, learning and assessment practices, infrastructure, curricula, and student experience. The SELFIE tool provides a user-friendly interface for the framework for Digitally-Competent Educational Organisations (DigiCompOrg) and makes it more accessible and practically applicable. The JRC study on the DigiCompOrg found that such framework is valuable for both educational organisations and policymakers. For educational organisations the framework can guide an essential self-reflection process towards integration and deployment of digital learning technologies. Policymakers can employ this framework for strategic planning of policies that encourage uptake of digital learning technologies by education institutions (Kampylis et al. 2015). If successful, the SELFIE initiative will offer a sustainable digital capacity-building approach encompassing a wide array of stakeholders – from policy makers to students.

The mentoring scheme proposed in the Action Plan suggests a collaboration network where schools and educators could exchange their experiences on the use of digital technologies for teaching and learning. While the proposed mentoring scheme would draw inspiration from the successful Living School Lab project, the coherence of such scheme with other similar initiatives might be further explored. Implementing the mentoring scheme under Horizon2020 shifts focus towards innovation policy, putting education in a wider context of smart, sustainable, and inclusive growth. As discussed above, platforms and networks such as Platform of European Associations of VET Providers or the eTwinning network already provide similar collaboration and peer-exchange opportunities for educators, therefore it is important to further analyse the potential overlaps and collaboration opportunities between the different educational networks and platforms.

Action 2 focuses on empowering structural changes in the European education sector by encouraging institutions and educators to build their own capacities to tackle challenges of the digital era. The Action Plan, however, does not reflect on more specific challenges identified in the literature review. For instance, uncertainty about copyrighted teaching and learning material still poses significant challenges for education institutions, educators and learners.

2.1.3 Scarce digital services aimed at mobile students

The Digital Education Action Plan elaborates on the importance of international student mobility in developing a highly skilled labour force. The document emphasises that studying abroad helps students cope with increasing international dimensions of the labour market and contributes to career enhancement (European Commission 2018d). The SWD stresses that digital technology can play an important role in reinforcing some of the pragmatic aspects of mobility. For instance, digital services aimed at mobile students are still scarce (European Commission 2018d), meaning that sending and receiving institutions are not able to share necessary student information between them.

The feasibility study on the digitalisation of the Diploma Supplement explored options how higher education Diploma Supplement and other student records could be digitalised. The Diploma Supplement is a transparency instrument developed jointly by the Council of Europe, the European Commission, and UNESCO-CEPES. As defined by the Commission, “the Diploma Supplement (DS) is a document accompanying a higher education diploma, providing a standardised description of the nature, level, context, content and status of the studies completed by its holder” (“Diploma Supplement - Education and Training - European Commission” 2018). In other words, it is a detailed explanation of a higher education qualification. The Diploma Supplement is an integral part of the initiatives promoting recognition of higher education across borders - the Lisbon Recognition Convention, the Bologna Process, and Europass.

The study pointed out that the Diploma Supplement remained mainly a paper document despite the fact that the majority of European higher education institutions have been already storing and processing their student records digitally. The study concluded that digitalising student records could enable education institutions to exchange student information quickly and at lower cost. The study found that if student records were digital and of the same format, it would be easier for students to present their qualifications to other education institutions and potential employers; higher education institutions could recognise and verify qualifications quicker and at lower cost; and employers could acquire correct and authentic information about job candidates. The study also asserted that student information presented through open digital credentials based on Open Badges or Blockchain infrastructure can give value to competences acquired in informal and non-formal settings, facilitating recognition of learning outcomes of lifelong learning (Pocius et al. 2017).

Action 3 - Digitally-Signed Qualifications

Storing and sharing qualifications online

The Action Plan proposes that the way forward should be to provide **a framework for issuing digitally-certified qualifications and validating digitally-acquired skills**. The Action Plan stresses that these qualifications should be “trusted, multilingual and could be stored in professional profiles (CVs) such as Europass”. The framework should align fully with the European Qualifications Framework for Lifelong Learning (**EQF**) and the European Classification of Skills, Competences, Qualifications and Occupations (**ESCO**).”

The Action 3 factsheet elaborates that the digitally-signed qualifications would be based on open standards and integrated into the new Europass platform. This should ensure that qualification certificates can be easily transferred from one institution to another. Holders of digitally-signed qualifications should be able to store them on the Europass platform or any other electronic site (“Digital Education Action Plan - Education and Training - European Commission” 2018).

Other relevant initiatives

The Action Plan also refers to **eIDAS regulation** (*Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on Electronic Identification and Trust Services for Electronic Transactions in the Internal Market and Repealing Directive 1999/93/EC* 2014) as one of the main enabling factors for cross-border access to digital services. The eIDAS Regulation creates a European internal market for electronic trust services - namely electronic signatures, electronic seals, time stamps, electronic delivery services and website authentication - by ensuring that they will work across borders and have the same legal status as traditional paper-based processes (Pocius et al. 2017). The strategy also notes that a **Single Digital Gateway** initiative could contribute to reducing

administrative burden for students moving abroad. The Single Digital Gateway proposes that, in the future, domestic electronic government services, including applying for a study grant from a public institution or registering a change of address, could be accessible to users from all Member States by 2020. This initiative will not, however, aim to harmonise the actual procedures, which will remain a national competence (“European Commission Press Release - Commission Takes New Steps to Enhance Compliance and Practical Functioning of the EU Single Market” 2017).

The Action Plan also asserts that the **European Student Card** and **Erasmus Without Papers** projects will be scaled-up under the **Connecting Europe Facility** and **Erasmus+** in order to enhance student identification, connect higher education institutions’ information systems, enable the exchange and verification of student information, etc (European Commission 2018a). The **European Student Card** project, **Erasmus Without Paper** project, and **EMREX** project together comprise the **European Student Card Initiative**, which is aimed at “enabling every student to easily and safely identify and register themselves at higher education institutions within the EU when moving abroad for studies, eliminating the need to complete on-site registration procedures and paper work” (“European Student Card Initiative - Educación y formación - European Commission” 2018). The European Student Card project has been focusing on the creation of a digital platform for communication between the information systems of higher education institutions in Europe (“The European Student Card Project” 2015). The Erasmus Without Paper project has been working on a network to support the electronic exchange of student data by interlinking the existing Erasmus student databases of Higher Education Institutions (HEIs) (“Erasmus Without Paper” 2018), while the EMREX project has been developing a solution for the electronic transfer of student records between higher education institutions in Europe (“Emrex – Supporting Student Mobility” 2017).

Fitness for purpose of action 3

The framework for issuing digitally-certified qualifications and validating digitally-acquired skills might provide common ground for qualification-issuing institutions on how to proceed with the digitisation efforts and contribute to interoperability of Europass services. Currently there are no established standards for common data exchange formats, security and authentication measures, potential storage and sharing options, or integration with existing student information systems and recruitment services (Pocius et al. 2017). Capitalising on already existing projects such as EMREX, Erasmus Without Papers, Blockcerts, European Student Card, or Europass platform would contribute to building the framework on already tested and widespread standards known to education institutions and practitioners. There is currently the need for support to education institutions to issue digitally signed qualifications as well as an integrated interface for storing and sharing digitally signed qualifications.

2.2 Priority 2: Developing relevant digital skills and competences for digital transformation

2.2.1 Losing competitiveness due to lack of digital skills and competences

The Digital Education Action Plan warns that Europe will lose its competitiveness if education fails to provide digital competences to Europeans of all ages. Digital Skills Index statistics from the SWD indicate that 44% of Europeans possess an insufficient level of digital skills, and 19% have no digital skills (European Commission 2018d).

According to the SWD, that lack of digital competence has a direct impact on employability – 42% of people with no digital competences in OECD are unemployed. The SWD also discusses a growing digital skills gap that eventually leads to the lower productivity of the workforce (European Commission 2018d). The Action Plan points out that more than 90% of jobs require some level of digital skills. The document therefore stresses the need to develop both basic and advanced digital skills in order to maintain an educated and highly-skilled workforce (European Commission 2018a).

The Action Plan stresses that the lack of basic digital competences required to navigate technology-rich environments limits citizens' ability to take part in learning activities, or to fully participate in the digitally driven society. In addition, the lack of more advanced digital skills creates an evident gap in the labour market. The SWD states that high-level digital skills are crucial not only for consuming technology, but also to use technology for creative and productive purposes (European Commission 2018d). The action plan therefore points out the need to enhance both digital skills and an entrepreneurial mind-set that helps people to "embrace the transformation of business through new and emerging digital technologies" (European Commission 2018a).

The OECD noted as early as 1998 that the growing application of ICT in various sectors of the economy had implications on the demand for labour. Developments in technology increase the demand for workers that not only possess good interpersonal skills but also digital competences (OECD 2016a). People who lack digital skills find it difficult to get a job and are prone to losing their competitiveness. Lack of digital competences also puts people in an unfavourable position when applying for a job (Davaki 2018; Education Journal 2014). Candidates who lack ICT skills may already face difficulties in gathering information about vacancies, as recruitment processes nowadays are largely digitalised (Valsamis et al. 2015).

Academic literature emphasises issues relating to a lack of general and advanced digital skills. The studies show that the supply of digitally competent workers is already low, and that the skills gap is expected to widen as the demand for workforce with ICT skills grows (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017; Education Journal 2014; European Commission 2017g; House of Commons Select Committee on Science and Technology 2017). The spread between the wages of digitally competent and unskilled workers is growing, as employees who are able to use ICT are seen as more productive and skilled (Kiss et al. 2017). The digital skills gap therefore polarises employment conditions and fosters inequality (Kiss et al. 2017; Valsamis et al. 2015).

Lack of general digital skills is associated with difficulties in performing seemingly easy everyday tasks. Studies show that many young people lack basic ICT skills relating to communication, privacy and problem solving (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017; Kiss et al. 2017; Pérez-Escoda, Castro-Zubizarreta, and Fandos-Igado 2016; Siddiq, Scherer, and Tondeur 2016).

Action 4 - Higher Education Hub

Creating an online platform for higher education

The Digital Education Action Plan suggests creating a **Europe-wide platform for digital higher education and enhanced cooperation**. The Action Plan suggests that this platform could be supported by Erasmus+, and could serve as a one-stop-shop for online learning, blended mobility, virtual campuses and the exchange of best practices among higher education institutions at all levels (European Commission 2018a). The Action 4 factsheet asserts that the new platform would support higher education institutions in using digital technologies and contribute to better quality and relevance of teaching and learning; facilitate

internationalisation; and support cooperation between higher education institutions in Europe (European Commission 2018a).

Fitness for purpose of the action 4

The action 4 fact sheet explains that the new platform would scale-up national and regional platforms for online learning, blended/virtual mobility, online campuses and exchange of best practice to the European level. The Action Plan, however, provides little background information on how such a platform would be constructed, and how higher education institutions would be involved in this process. Regarding the high level of autonomy in the higher education sector, there is a need to further explore the potential structure, content and added value of such a platform.

Action 5 - Open Science Skills

Teaching, learning and assessing open science skills

The SWD stresses the importance of advanced digital skills in tertiary education and research. The Action Plan discusses open science developments as a way to develop and share these advanced skills. Open science is closely related to open education, in that it enables free access to data and research outputs, as well as broadening participation in research (European Commission 2018d).

A shift from proprietary to open science can only take place if researchers possess the necessary expertise in sharing research results and applying open research practices. Such a shift would create opportunities for open research collaboration, open data and citizens' science. In higher education, an open researcher/educator should apply openness across four different dimensions: "open learning and open research design; OER (open educational resources); co-creation of knowledge, collaboration and open publications; and implementation of open assessment practices such as peer-to-peer review and collaborative evaluation" (European Commission 2018d).

In this context, the Digital Education Action Plan asserts that it is crucial to provide training for academic staff and research students to become open educators and scientists. The Action Plan calls for action to **strengthen open science and citizen science in Europe** by piloting dedicated training, including continuous professional development courses on open science, in higher education institutions at all levels (students, researchers, educators) (European Commission 2018a).

The Action 5 fact sheet elaborates that the main objective of this action is to engage, inform, and train higher education students, teachers, researchers and staff in order to enable them to co-design and co-create programmes that tackle societal and technological challenges ("Digital Education Action Plan - Education and Training - European Commission" 2018). This action aims to support Erasmus+ projects that would develop training courses for undergraduates and further embedded training at PhD level and beyond.

Other relevant initiatives

In 2016, the Commission introduced a vision for **European Open Science Cloud (EOSC)** (European Commission 2016c) as part of the **Digital Single Market Strategy**. The main objective of the EOSC is to offer a virtual environment for researchers and science professionals with open and seamless services for the storage, management, analysis and re-use of research data that are free at the point of use. The EOSC will also gradually open up its user base to the public sector (European Commission 2018e).

The European Commission's DG for Research and Innovation also published **a report on providing researchers with the skills and competencies they need to practise Open Science** (Working Group on Education and Skills under Open Science 2017). The report defines the Open Science skills needs of researchers in order to be able to manage open data, engage with citizen science, and publish under open access. The report also proposes a European Skills and Qualifications Matrix for Open Science, pointing out the need for researcher training at all career stages ("Open Science - Research and Innovation - European Commission" 2018).

In 2018 the European Commission issued a call for proposals to explore and support citizen science under the Horizon 2020 programme ("Exploring and Supporting Citizen Science" 2018). The call describes citizen science very broadly, ranging from raising public knowledge of science, encouraging citizens to participate in the scientific process by observing, gathering and processing data, up to setting scientific agenda and co-designing and implementing science-related policies. As citizen science is a relatively new topic, the call for proposal emphasises that the question of potential of citizen science for society remains open. Under the Horizon 2020 programme the Commission is planning to fund projects that support citizen science by raising awareness and providing coordination support, as well as providing funding for hands-on citizen science activities aiming to develop new technologies and knowledge.

Fitness for purpose of the action 5

In 2012 the European Commission released a recommendation on access to and preservation of scientific information. The recommendation acknowledges that the Internet has fundamentally changed the way scientists carry out and disseminate research. The recommendation pointed out that open access to scientific research contributes to better data quality, reduces the need for research duplication and speeds up scientific progress (European Commission 2012). The report from the Mutual Learning Exercise (MLE) on Open Science concluded that Open Science can contribute to "accelerated advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation". The participants of the MLE highlighted that the Commission has a crucial role in guiding and coordinating the implementation of Open Science, including but not limited to training and development of common standards and strengthening information exchange and knowledge transfer about Open Science across European organisations.

The proposal to provide training opportunities to higher education students and trainers presents a timely and forward-looking approach contributing to the enhancement of advanced digital skills and products.

Action 6 – EU Code Week in schools

Getting more schools involved in EU Code Week

The Action Plan acknowledges that Europeans should begin acquiring digital skills at an early age, through both curricular and extracurricular activities. The document emphasises that young Europeans need to be able not only to consume digital products, but also to learn about how they are made (European University Association 2018). The action aims to encourage more primary, secondary and vocational schools to take part in EU Code Week.

Building on successful grassroots movements, the strategy proposes **scaling up EU Code Week** by collaborating with authorities in EU Member States, Code Week ambassadors, the **eTwinning** network, the **Digital Skills and Jobs Coalition** and related actions.

EU Code Week is a grass-roots movement run by volunteers, encouraging people to discover coding. The main goal of this initiative is to make programming more visible and to motivate

people to learn. The initiative also aims to “encourage more people to learn computational thinking, understand how computers work, and get different groups – teachers, engineers, business, schools, non-profit organisations – together to offer more coding opportunities for young and old” (“Europe Code Week 2018 - Europe Code Week” 2018). The Commission supports Code Week and other independent initiatives as part of its **Digital Single Market strategy** (European Commission 2015b).

Fitness for purpose of the action 6

The European Schoolnet report on computer programming and coding in European schools concluded that there is a strong rationale to integrate coding into education curricula as it helps students to understand the digitalised society and contributes to fostering other 21st century skills such as problem solving, creativity or logical thinking. There is also a growing need of ICT professionals in the labour market. The report notes that competitions and similar initiatives provide a platform for students to excel and is one of the ways to make more students interested in coding and build their confidence in pursuing IT careers. The report notes, however, that it is also important to find ways how to encourage the uptake of coding in schools and educational practices (Balanskat 2015).

The EU code week provides an inclusive approach to increase the offer of coding classes across Europe and beyond. The initiative provides a repository of resources in English and national languages, including presentations and toolkits, coding lessons for beginners, online courses for advanced learners, and guides on how to teach coding. To increase the uptake of coding in education institutions the initiative invites schools to participate in CodeWeek4all challenge encouraging to involve more than 50% of all students to coding activities.

2.2.2 Low digital literacy

The Digital Education Action Plan acknowledges that younger sections of the European population are the most vulnerable to online threats, thus it stresses the need to strengthen critical thinking and media literacy among children and young people.

With increasing numbers of pupils going online, concerns are increasing over threats such as cyberbullying, sharing personal details with strangers, exposure to content that encourages children to harm themselves, inappropriate online content and children becoming radicalised (European Commission 2018d).

The Action Plan also warns that digital technology can be misused to manipulate, radicalise and brainwash children and young people. This includes propaganda, political manipulation and even terrorist recruitment. False information or so called “fake news” is also on the rise, with almost half of young adults finding it difficult to tell whether an online story is true (European Commission 2018d). In this context, the SWD provides results from the consultation on the “Review of the 2006 Recommendation on Key Competences for Lifelong Learning” carried out in 2017. The consultation’s respondents believed that increasing media literacy might be the way to respond to digital risks and ensure that children are able to use the internet safely and responsibly (European Commission 2018d).

In accordance with the Digital Education Action Plan, the literature also discusses issues relating to the lack of digital literacy. The study on E-skills acquisition defines digital literacy as more sophisticated capabilities relating to generic skills such as perceiving, managing, analysing and synthesising information, and the ability to identify the risks and opportunities that ICT provides (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017). Digitally literate people should be able to recognise fake news, respond appropriately to cyberbullying, be aware of their digital footprint and the threat of identity theft, follow ‘netiquette’ rules,

and so on (European Commission 2016a; GARCÍA-RUIZ, RAMÍREZ-GARCÍA, and RODRÍGUEZ-ROSELL 2014; Loewy 2016). The research shows, however, that young people lack crucial awareness towards the digital materials they receive. For instance, young people struggle to identify false information or are not aware of potential online privacy issues (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017; Loewy 2016).

Academics also analyse the phenomenon of “digital natives” (children born in the digital era) and its relation to digital literacy. “Digital natives” are said to be more familiar with technology than any other previous generation. Scholars, however, argue that the name “digital natives” does not mean this generation possesses better digital literacy skills such as critical thinking (Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017; Loewy 2016). Nowadays, young people are quick to simply consume ICT but find it difficult to use it in a critical and creative manner (European Commission 2017g). Being born in the digital age does not itself provide children with technological supremacy, as digital literacy must be consistently cultivated with the help of formal and non-formal education institutions (Aesaert and van Braak 2015; Alvárez-Flores, Núñez-Gómez, and Rodríguez Crespo 2017).

The literature also emphasises the importance of teaching digital citizenship practices in schools. The new model of 21st-century citizenship demands deeper technical knowledge and critical thinking skills for young people to be able to properly engage in democratic processes (Owen, Doom, and Riddle 2016). An important insight made in the literature is the lack of “netiquette” (European Commission 2016a). Research has shown that primary school students face difficulties in communicating online in a socially acceptable and understandable way (Aesaert and van Braak 2015).

Action 7 - Cybersecurity in Education

Raising awareness of teachers and students

To tackle the challenges for online safety and cyber-hygiene the Digital Education Action Plan suggests an **EU-wide awareness-raising campaign** targeting educators, parents and learners to foster online safety, cyber hygiene and media literacy. The Action Plan also recommends a **cyber-security teaching initiative** that would be built on the Digital Competence Framework for Citizens.

The awareness campaign called **#SaferInternet4EU** has already been launched in February 2018 and will run throughout the year. The campaign will cover a wide range of topics such as critical thinking, media literacy and digital skills necessary to identify and combat fake news; cyber hygiene and risks brought by online technologies. The campaign will host a European contest to reward high quality resources and inspiring initiatives pursuing Better Internet for Kids objectives. An online safety MOOC has also been launched under this campaign. This 6.5 weeks course aims to provide teachers with tools to tackle fake news in the classroom and beyond, as well as provides tips on how to address issues such as online abuse, cyberbullying, sextortion, hate speech, radicalisation and online relationships.

In 2019 and 2020 the Action Plan anticipates a **blended course on cyber-security** targeting educators at primary and secondary level. The course is planned to roll out in 20 different locations in Europe.

Fitness for purpose of action 7

The awareness raising campaign is part of the European Strategy to Make the Internet a Better Place for Children (referred to as **Better Internet for Kids**). The strategy was adopted in 2012 and over the years the Commission’s activities have comprised of awareness raising, fighting illegal content, filtering and content labelling. The initiative contributed to discussing the civil society and child online safety issues and creating a database of

information related to the use of new technologies by young people ("From a Safer Internet to a Better Internet for Kids" 2018).

At the current stage the Better Internet for Kids programme maintains a **Better Internet for Kids (BIK) online service platform** that functions as one-stop-shop to share resources, services and practices between national providers of the services, and provide information and services to individual users ("Better Internet for Kids - Timeline" 2018). European Schoolnet (EUN) manages the BIK programme on behalf of the European Commission and coordinates the Insafe network of awareness centres, helplines and youth panels, in partnership with INHOPE (the International Association of Internet Hotlines), dedicated to the removal of illegal online content. These combined strands are commonly referred to as Safer Internet Centres (SICs), operating in 30 European countries in the drive to keep children and young people safe online. Safer Internet Centres function as focal points in each country providing services to children and young people, parents, carers, teachers, educators and other professionals in the children's workforce ("Better Internet for Kids Annual Report 2016-17" 2017).

While the BIK initiative focuses on young people and does not directly address wider challenges posed by the lack of digital literacy, the European Commission established an expert group on media literacy that worked to identify and document best practices of media literacy, facilitate networking between stakeholders and explore synergies between EU policies. Recently⁹ the Commission released a communication with an Action Plan and self-regulatory tools to tackle the spread and impact of online disinformation in Europe. This communication aims to improve transparency of information production, diversity and credibility of information and inclusive solutions with broad stakeholder involvement ("Communication - Tackling Online Disinformation: A European Approach" 2018).

The #SaferInternet4EU awareness raising campaign supports an already established infrastructure of safer internet services across the EU and presents a timely solution for a pressing issue. The initiative caters to the need to raise awareness about the internet threats and provide resources that help to increase media literacy. The blended course on cyber-security is a practical follow-up activity that will potentially provide educators with useful tools to further increase media literacy of young people.

DGs working on media and digital literacy:

DG CNECT, Media Convergence and Social Media (Unit I.4); Learning, Multilingualism, and Accessibility (Unit G.3)

2.2.3 Gender gap

The Digital Education Action Plan recognises lack of interest among girls to pursue studies in ICT (information and communication technology) or STEM (science, technology, engineering and mathematics) as a clear problem leading to lost opportunities and risks contributing to gender inequality (European Commission 2018a). The SWD discusses several factors potentially leading young women to lose interest in the field already at a secondary school age. The document names lack of information campaigns about potential career in ICT as one of the main reasons why girls do not develop this interest for further studies. A perception of ICT as a male-dominant field also adds to the list of factors resulting in women being underrepresented in ICT professions (European Commission 2018d).

Recent studies show that females are poorly represented in ICT sector. From an early age fewer girls tend to choose careers in ICT sphere due to various reasons among which

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stereotypes play a huge role (Aesaert and van Braak 2015; Davaki 2018; Education Journal 2016). Gender stereotyping related to women's ICT savvy stops them from active ICT usage at young age and prevents from pursuing STEM (science, technology, engineering, mathematics) field degrees at university resulting in female underrepresentation in ICT sector (Davaki 2018; Education Journal 2016; European Commission 2016b). Even after entering the ICT sector, females find it difficult to stay as their participation in ICT labour market decreases with age, recent study on digital gender gap has shown (Davaki 2018). Davaki argues that stereotyping and drawing boundaries between 'feminine' and 'masculine' occupations should be viewed with particular caution and should not be supported (Davaki 2018). The PLA on tackling digital skills gap suggests that various volunteering initiatives that help to improve children's digital skills could be tailored specifically for girls. Ad hoc training courses could not only offer computing activities, but also invite successful female mentors that are in ICT careers to share their experience and encourage girls to choose the ICT sector (Davaki 2018; European Commission 2017g).

Action 8 - Training in digital and entrepreneurial skills for girls

Addressing the gender gap in digital and entrepreneurship sectors

To increase female participation in ICT and STEM careers, the Digital Education Action Plan suggests that the Commission will support measures to further decrease the gender gap in the technology and entrepreneurial sector by promoting digital and entrepreneurial competences among girls; mobilise stakeholders (companies, NGOs) to equip girls with digital skills and inspirational models, **building on the Digital Competence Framework for Citizens and the Entrepreneurship Competence Framework** (European Commission 2018a).

The Action 8 factsheet elaborates that 20,000 girls in primary and secondary would participate in a series of workshops on digital and entrepreneurial skills throughout Europe over the upcoming three years. The workshops would be run in close cooperation with partners from business, research and education. The fact sheet also asserts that role models with careers and studies in technology, entrepreneurship and innovation would also contribute to the workshops and share their experience.

Other relevant initiatives

To promote participation of women in the digital sector, the Commissioner in charge of Digital Economy and Society outlined a three-action strategy. The actions focus on three areas: challenging stereotypes; promoting digital skills in education; and advocating for more women entrepreneurs. Under the education topic, the strategy suggests to scale up the **EU code week**, give a special prize for women and girls at the **Digital Skills Awards 2017** organised by Digital Skills and Jobs Coalition and celebrate **Girls in ICT Day**¹⁰ that aims to empower and encourage girls and young women to consider careers in the growing STEM/IT sector ("Women in Digital" 2018).

Fitness of purpose of action 8

While the foreseen workshops may contribute to engaging more girls to be interested in ICT, the Action Plan does not provide sufficient information on how the workshops would be organised and what countries and education institutions would be involved, and what funding programme would provide resources for this action.

10 Initiative of International Telecommunication Union (ITU) ("Girls in ICT Day" n.d.).

DGs working on encouraging women's participation in the tech sector:

DG CNECT

2.3 Priority 3: Improving education systems through better data analysis and foresight

2.3.1 Lack of coherent cross-European data on progress of digital education

The Digital Education Action Plan draws attention to a lack of coherent cross-European data on progress of digital education. The Action Plan notes an increasing need to gather deeper insights on what impact digital technology brings to learning experience and learning outcomes (European Commission 2018d). Such data could be used to improve education systems through evidence-based policy-making.

Action 9. Launch of a reference study on mainstreaming ICT use in education ***Monitoring progress and informing policy***

The Action Plan calls to “build evidence on the uptake of ICT and digital skills in schools, by **publishing a reference study assessing progress in mainstreaming ICT in education**”. The study should cover availability and usage of ICT infrastructure and digital tools and levels of digital skills (European Commission 2018a).

The SWD refers to European Commission’s **survey on ICT in Education (ESSIE)** and OECD’s **Programme for International Student Assessment (PISA)** as primary sources of such information.

The SWD points out, however, that the Commission conducted the last comprehensive **survey on ICT in Education (ESSIE)** in 2011. The survey report provides a detailed benchmarking on access, use and attitudes to ICT in schools in 31 European countries (European Commission et al. 2013). The Action Plan asserts that the survey will be updated in 2018 (it will be called **ESSIE2**), aiming to assess progress and impact of ICT use in schools and provide estimates on how much it would cost to equip and connect all EU primary and secondary classrooms (“Digital Education Action Plan - Education and Training - European Commission” 2018). The survey will cover primary, lower secondary, upper secondary and upper secondary vocational schools in 31 countries (EU28, Norway, Iceland and Turkey). Acknowledging this effort, the SWD calls for further action in ensuring that such data is collected sustainably and continuously for all educational sectors.

The **OECD** has been leading international data collection activities on education with its flagship **Programme for International Student Assessment (PISA)**. This programme is a triennial survey testing knowledge and skills of 15-year-old students in 72 countries. PISA aims to assess to what extent students who are at the end of their compulsory education have acquired skills and knowledge necessary for participation in modern society. The survey assesses core school subjects – science, reading, and mathematics. It also assesses proficiency in an innovative domain, for instance, in 2015 it was collaborative problem solving. PISA assessment not only determines whether students are able to reproduce knowledge, but also whether they can apply this knowledge in unfamiliar settings by extrapolating from what they have learned (OECD 2018).

In 2015 **OECD published a comprehensive comparative report** analysing “digital skills that students have acquired, and learning environments designed to develop these skills” (OECD 2015). This report, based on PISA 2012 data, provided the “first-of-its-kind

internationally comparative analysis” on student access to computers, their use of computers, and learning outcomes. This report presented ground breaking results stating that countries that have invested heavily in ICT for education did not demonstrate any significant increase in PISA results for reading, mathematics, or science. Digital skills were assessed through practical exercises requiring students to use mouse and keyboard to navigate texts, find information, or create charts.

Fitness for purpose of the action 9

The Digital Education Action Plan suggests that the Commission will update its own survey on the use of digital technologies in school education **ESSIE2** and work with the OECD to **develop a new module in PISA focusing specifically on the use of technology in education**. The fact that the latest comprehensive datasets on digital education are based on 2011 and 2012 data calls for more coordinated and sustainable data collection and analysis activities. The Commission’s survey will provide estimates on how much it would cost to connect and equip all the primary and secondary classrooms in the EU as well as provide guidance on connected classrooms. The updated and revised PISA questionnaire on the use of ICT would form the basis for developing a pedagogical framework exploring how the use of ICT in learning can be linked to measurable cognitive outcomes. Collaborative effort between the Commission and the OECD may provide a new rich perspective on how technology can augment education.

The strategic framework for European cooperation in education and training (ET 2020) set up seven **benchmark indicators**¹¹ for monitoring progress towards the set of ET 2020 strategic objectives. While these benchmarks are not concrete targets for Member States to achieve by 2020, the Council Conclusions invite Member States “to consider, on the basis of national priorities and whilst taking account of changing economic circumstances, how and to what extent they can contribute to the collective achievement of the European benchmarks through national actions” (Council of the European Union 2009). The Education and Training Monitor (European Commission 2017e) assesses these benchmarks annually. The Digital Education Action Plan considers exploring relevance and feasibility of proposing **new Council benchmarks for digital competences and entrepreneurship** (European Commission 2018a).

With evident relevance of digital skills and competences, the Action Plan provides a very timely suggestion for exploring new benchmarks by the end of the strategic planning cycle. Setting digital competences as a priority at strategic level would enable to focus more efforts on establishing funding programmes and monitoring progress towards achieving sufficient levels of digital skills.

Action 10. Launch artificial intelligence and learning analytics pilots in education

The Action Plan’s SWD separates data use in education into two parts – *learning analytics* aiming to improve learning and teaching practices, and use of *big data* that aims to generate deeper insights for policy and decision-making (European Commission 2018d).

The SWD explains various benefits that the new data analysis techniques can bring, together with inherent challenges. The document explains that both subjects, big data for policy making and learning analytics, could bring significant added value to education. The SWD argues that current monitoring of education systems is based on longitudinal studies suffering from so called data collection lag. Such studies are not able to provide up-to-date information

11 The indicators are in the fields of early leaving from education and training; tertiary education attainment; early childhood education and care; employment rate of recent graduates; low achievement in reading, mathematics and science.

on trends and changes in education. Big data and learning analytics¹² might provide tools to identify which learning and teaching techniques work in general, or contribute to building personalised learning approaches (European Commission 2018a).

Academic literature suggests that the most popular scheme for enhancing education with the aid of big data is learning analytics. As contemporary society is driven by large amount of data, different forms of analytics seem to exist. Scholars emphasise that analytics “is not a one-size-fits-all endeavour” but rather “goal-directed practice” (van Barneveld, Arnold E., and Campbell 2012). Hence, academic literature supposes learning analytics should be an ad hoc tool providing learner-centred information gathering and analysing as educational purposes highly differ from those of business or other fields (van Barneveld, Arnold E., and Campbell 2012).

Scholars notice that large data stocks already exist as many colleges and universities partly organise their learning process by the aid of technologies. Systematically collected data on various learning difficulties helps to indicate students facing serious obstacles. In this manner, educational institutions are informed about issues on time and can provide appropriate intervention. Data gathering based monitoring can help to prevent students from early school or higher education leaving. Educational institutions can benefit from learning analytics in developing evidence-based strategies thus optimising management costs (Elias 2011). Collected data can serve as tool to form responsive decision making and implement effective policies (van Barneveld, Arnold E., and Campbell 2012). The Commission’s study on Big Data for monitoring educational systems explored how big data developments might transform monitoring of educational systems and affect evidence-based policy-making. The study confirmed that consistently captured individual level real-time data could be aggregated and used for monitoring at the education system level. The study also noted that while individual student data can present vast opportunities for personalised learning, it also poses great privacy or bias risks (Berendt et al. 2017). Another study on learning analytics in education pointed out that this new monitoring technique poses ethical issues that must be addressed before putting learning analytics into practice. Biometrics, location tracking, social media and other evolving technologies generates huge volumes of data going beyond mere academic performance. Concerned about privacy, learners may be reluctant to share their data for research and analysis. Issues of data ownership also come into play as it is often unclear who the data belong to – an individual, an institution, or an outside company that the data collection tools (Reyes 2015). Developments in the learning analytics field could be possibly seen in the next 10-30 years. Before that, Europe needs to develop a “robust infrastructure methodological framework enabling data collection and data analysis, and regulatory frameworks for privacy and governance of big data for education and skills” (Berendt et al. 2017). The Digital Education Action Plan notes that learning analytics is still at its infancy, therefore more experiments are needed to determine the real risks and opportunities. Following on this note the document calls for **artificial intelligence and learning analytics pilots** that could explore specific problems and improve implementation and monitoring of education policy (European Commission 2018a).

Other relevant initiatives

Learning analytics has been already high on **DG Connect** agenda. The DG has been implementing a set of pilot projects exploring plausible futures for learning analytics and educational data mining. For instance, the Learning Analytics Community Exchange (LACE) project was aiming to bring together the key European players in learning analytics and

12 Learning Analytics is “the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environment in which it occurs” (Reyes 2015)

educational data mining to explore emerging best practices in the field. (“LACE - Learning Analytics Community Exchange” 2016). The LEA's BOX project took a more practical perspective on making educational assessment and appraisal more goal-oriented, proactive, and beneficial for students as well as on enabling formative support to teachers and other educational stakeholders. The project developed a learning analytics toolbox for educators to perform competence-centred, multi-source learning analysis. (“LEA’s BOX” 2014). The PELARS project developed real technologies that integrate learning analytics tools for practice-based STEM learning in real-world learning environments to teachers and learners understand what is happening when people practice Science Technology Engineering and MATH (STEM) (“PELARS Project” 2016).

Erasmus+ has also been financing learning analytics projects. The SHEILA project will build a policy development framework that will help universities to become more mature users and custodians of digital data about their students (“SHEILA Project” 2018). The STELA project will apply the learning analytics approach to enhance a successful transition from secondary to higher education (“STELA Project” 2018).

While discussing data policies and digital learning, DG Connect also stresses the importance of security, privacy and ethics in using student data for learning analytics purposes (“Policies for Educational Data Mining and Learning Analytics: One Day Briefing and Workshop” 2018).

DGs working on learning analytics:

DG CNECT

DG EAC

Fitness for purpose of the action 10

Learning analytics meant to help tackle academic issues still need further exploration and testing to function properly. The literature suggests that learning analytics tools should be better integrated into educational processes (Elias 2011). It is important to develop data sets which would be easily employed by students, educators and researchers in order to achieve the greatest outcomes learning analytics can provide. Artificial intelligence and learning analytics pilots are therefore a timely and forward-looking initiative that might contribute to more accurate real-time forecasts of skills needs and training.

While exploring the technical application of learning analytics has already been on the Commission’s agenda, the JRC study on learning analytics (JRC 2017) pointed out that in order to enable practical implementation of learning analytics there is a need for a common European strategic vision. The study found that over the last five years the learning analytics developed very quickly leaving education policies behind. The study calls for action that would “align the educators, researchers, developers and policymakers so that learning analytics are used to drive work in Europe’s priority areas for education and training” (JRC 2017).

Action 11. Initiate strategic foresight on key trends arising from digital transformation for the future of education systems.

To initiate strategic foresight in education the Action Plan proposes to release **a series of policy, research and guidance papers analysing the impact and potential of digital technologies in education**. The papers should set the scene and allow a non-expert audience to understand key trends in education and training help in designing policies and strategies to address upcoming trends and needs.

The Action Plan also proposes to organise an **EU-wide education hackathon** that would engage stakeholders from different education and training institutions in an annual contest, taking place simultaneously over 48 hours in Europe.

Fitness for purpose of Action 11

The foresight concept has been developed and used by the European Foresight team which is a part of scientific action 'ERA (European Research Area) policy mixes, joint programming and foresight'. Foresight encompasses systematic considerations of future science and technology development aiming to identify future economic, environmental and societal change (Joint Research Centre 2009). Foresight is described as "future-intelligence-gathering and medium-to-long-term vision-building process aimed at present-day decisions" (Joint Research Centre 2005). Foresight enables various stakeholders to think and discuss potential future visions in order to shape future using different policy instruments. Foresight can be an additional approach complementing traditional policy tools (Joint Research Centre 2009).

The general foresight concept is rather well-developed, however it is important to emphasise that this approach is not commonly used in education field. Foresight techniques are more frequently employed in domains of environment, security, health, food and nutrition, migration, demography, etc. (European Commission 2016h, 2017h). The Action Plan's proposal to initiate strategic foresight therefore fills the gap in current foresight activities. The Action plan, however, does not specify the nature of the papers, whether they would be merely research papers, or Commission's communications.

Data hackathons, also known as data dives, are "intense events where teams of data scientists, computer programmers, graphic and interface designers and project managers try to creatively tackle data problems and prototype data analytics products". In 2017 the European Commission organised a European Big Data Hackathon that aimed to find big-data driven solutions to statistical data problems, identify best of class European data scientists, promote partnerships with the research community and the private sector and produce innovative products and tools (*What Is a Hackathon?* - CROS - European Commission n.d.). Hackathons can be an innovative way to find creative solutions that could be further applied to support policy-making.

3 BLIND-SPOTS OF THE ACTION PLAN AND RECOMMENDATIONS FOR POLICY RESPONSE

This section provides a summary of potential “blind spots” in the field of digital skills and competences that are not addressed by the Action Plan and other existing initiatives at EU level. Based on identified policy gaps we outline areas for potential policy responses.

The need for stronger policy support to education institutions

The Action Plan stresses the need for more digitally competent educators and education institutions. The document outlines the complex nature of these issues explaining that educators do not possess sufficient knowledge to apply and develop digital education materials, while training to prepare educators for the digital era is also not sufficient. The literature emphasises that full integration of digital teaching and learning practices into the education processes requires a plethora of structural changes. Currently many education institutions still rely on outdated curricula failing to provide digital guidance to both educators and learners. Technology-supported teaching requires hands-on teacher training so they can access digital resources and understand how to use them.

The Action Plan suggests solutions for education institutions and educators to pro-actively build their own capacities. This action is mainly based on the assumption that education institutions can create effective digitisation strategies if they know what their strengths and weaknesses are. For instance, the SELFIE initiative implies that the snapshot report would encourage different education stakeholders to collaborate and improve collectively, while the mentoring scheme relies on peer-learning. Action 2 focuses on empowering structural changes in the European education sector by encouraging institutions and educators to build their own capacities to tackle challenges of the digital era.

While focusing on the bottom-up initiatives, the action plan lacks a more strategic view on how to support policy-makers in the Member States. The literature review emphasises that peer-exchanges and community building may not be enough and education institutions need stronger support from the national authorities to update curricula and provide more relevant initial and on-the-job teacher training. Additionally, it is important to distinguish among the specific challenges for different levels of education and training, based on their level of autonomy from and relationship with the labour market. The support from policy actors is particularly important in general education schools, where the autonomy is low.

- While the EU countries are responsible for reforming their own education systems, the CULT Committee could recommend that the Commission further supports the EU Member States through strengthening evidence base for reform. For the next programming period, the Committee on Culture and Education could suggest that the Commission sets digital education benchmarks for different levels of education. While the issue of new benchmarks has been already included in the Digital Education Action Plan under the topic of coherent cross-European data on progress of digital education, it is crucial to emphasise the role of EU benchmarks in driving policy reforms and discussing best practices.

Raising awareness about copyright of education materials

The new copyright regulation proposal released in 2016 suggests a new exception on “illustration for teaching aims to provide full legal certainty for the use of protected content in digitally-supported and online teaching activities, including across borders” (European Commission 2016e). The current 2001 edition of the InfoSoc Directive does not anticipate

digital use copyright exceptions in the area of education (“Questions and Answers on the Modernisation of EU Copyright Rules for the Digital Age” 2016).

Despite the plans to modernise rules on digital use of copyrighted materials in education, the issues related to low awareness and legal uncertainty remain. The study on the European copyright framework (PPMI and DG EAC 2016) identified the lack of national and European support services that could facilitate better awareness and understanding of copyright in education. While open-license education material is becoming more popular across Europe, a significant number of educators are not aware of available licensing solutions available at their education institutions. At the same time learners are also more likely to have a passive attitude when they are not sure about the copyright status of online materials.

In May 2018 the Council of the EU agreed on the negotiating mandate for the new InfoSoc directive, stating that “a new mandatory exception or limitation is necessary to ensure that educational establishments benefit from full legal certainty when using works or other subject-matter in digital teaching activities, including online and across borders (Council of the European Union 2018). While the potential amendment could contribute to better accessibility of digital learning content, it calls for more information and support measures that could address low awareness and passive attitude towards copyright of digital works used in education.

- Providing information and support on copyright to education institutions, educators and students should be one of the priorities of the Commission after the new InfoSoc directive comes into force. The Committee on Culture and Education may recommend the Commission to develop an awareness raising campaign and an online information platform that would help education stakeholders to overcome copyright uncertainty and make full use of online education materials.

Acknowledging the complexity of education qualification arrangements

The Action Plan proposes to provide a framework for issuing digitally-certified qualifications and validating digitally-acquired skills.

While the framework could significantly contribute to increase the transparency of qualifications, it is crucial to embrace the complexity of existing arrangements of qualification transparency and recognition. For instance, the Europass initiative comprises five different documents. While Curriculum Vitae and Language Passport help citizens to present their skills, are freely accessible and can be edited by any user, the Europass Mobility records, Certificate Supplement, and Diploma Supplement are issued by education institutions. Moreover, the Diploma Supplement is part of a wider joint initiative developed by the Council of Europe, the European Commission, and UNESCO-CEPES.

Regarding digitisation of student records and qualification certificates, education institutions are also at varying stages of progress – some of the institutions already participate in digital student information exchange projects while many still print diplomas and transcripts on paper. Transition from paper to digitally signed qualification certificates and implementation of common data storage and transfer standards are likely to pose significant financial and administrative costs to education institutions. The follow-up on the action 3 may further explore how to motivate education institutions and other issuers of qualifications to take-up the new technical developments, also taking into account the high level of autonomy of higher education institutions.

- Considering the high complexity of education governance arrangements across the EU and European Higher Education Area, the CULT Committee could recommend that the Commission initiates a discussion on the potential governance model for the framework of digitally certified qualifications in order to divide responsibilities between

institutions and organisations that would be responsible for the development, implementation, and monitoring of such framework.

- Building common data exchange and storage standards and templates should remain a priority while developing the framework for issuing digitally-certified qualifications and validating digitally-acquired skills. It is crucially important to provide clear guidelines as well as financial and peer support mechanisms to education institutions in order to facilitate successful transition from paper-based to digitally certified qualifications.

Further exploring the purpose and added value of the higher education hub

The Action Plan suggests that a Europe-wide platform for digital higher education and enhanced cooperation would support higher education institutions in using digital technologies and contribute to better quality and relevance of teaching and learning; facilitate internationalisation; and support cooperation among higher education institutions in Europe.

The European University Association (EUA) published a response paper inviting the European Commission to share more details on the proposed platform and other planned measures ("EUA Responds to Digital Education Action Plan" 2018). In the paper, the EUA stressed that the added value of the prospective Europe-wide platform should be better defined. The association expressed its interest in being consulted and actively contributing to development of the platform. The paper concluded that it is very important to develop this initiative in close cooperation with the sector, ensuring its participation and ownership (European University Association 2018).

The European Trade Union Committee for Education (ETUCE) also expressed its interest in "seeing how this EU platform will be implemented as not much information is available" (ETUCE and Blower 2018). The ETUCE position paper notes that it is important to guarantee the quality assurance and source transparency of the prospective platform content. In accordance with the European University Association, the ETUCE paper asserts that such a platform should be built in consultation and cooperation with EU social partners in education.

- The responses from the main potential higher education hub's stakeholders indicate the need to further explore the added value of such platform. The Committee on Culture and Education could suggest that the Commission facilitates further discussions with the higher education sector on how to build a useful tool for peer-exchange and collaboration.
- The Committee on Culture and Education could recommend that the Commission explores the suggested platform's synergies with already existing initiatives that encourage cooperation between European higher education institutions, namely the Erasmus+ programme. As Erasmus+ programme already includes a number of networking activities, including strategic improvement of the professional skills of staff, organisational capacity building, and creating transnational cooperative partnerships with organisations from other countries, the higher education platform may capitalise on the Erasmus+ activities.

Elaborating on measures to increase female participation in ICT and STEM careers

To increase female participation in ICT and STEM careers, the Digital Education Action Plan suggests that the Commission will support measures to further decrease the gender gap in the technology and entrepreneurial sector by promoting digital and entrepreneurial competences among girls; mobilise stakeholders (companies, NGOs) to equip girls with digital skills and inspirational models.

While the Action Plan outlines specific issues related to gender gap in ICT, it only provides an abstract view on how to encourage more girls to take up ICT careers. The Action Plan anticipates that the Commission would support a series of workshops for girls on digital and entrepreneurial skills throughout Europe.

- The CULT Committee could recommend that the Commission develops a clear roadmap on how to facilitate specific objectives related to increasing female participation in ICT and STEM careers outlined in the Digital Education Action Plan. The Committee on Culture and Education may recommend the Commission to provide strategic policy framework for the planned actions (workshops and stakeholder inclusion mechanisms) by establishing a clear link with specific policy programmes and financial support mechanisms that would enable to set specific goals and monitor progress.
- In addition to currently proposed series of ad-hoc actions, the Committee on Culture and Education may recommend the Commission to further explore synergies with already established grassroots platforms such as the EU Code Week. Such platforms could be used as a powerful tool to raise awareness among schools, educators, companies and NGOs about gender stereotypes and build their capacities to provide a more diverse set of inspirational models for children and young adults.

Developing a strategic vision for learning analytics

In 2017 the JRC published a study on “The Implications and Opportunities of Learning Analytics for European Educational Policy” (JRC 2017) to gather evidence on the use and processes of implementing learning analytics in education. The study found that even though there have already been significant developments on the technical applications on learning analytics, there is a need to further build the evidence base on practice and successful implementation. The study also found that most of the existing projects and tools tended to focus on the supply side (data models, tools, and prototypes), dedicating significantly less work on the demand side – how can learning analytics support the assessment, teaching and learning needs of schools, educators and students.

These findings call for more research and experimentation in the learning analytics area, and the Digital Education Action Plan’s suggestion to carry out more artificial intelligence and learning analytics pilots is a timely consideration. The JRC’s study noted, however, that work on learning analytics needs to establish better links with the overall EU education and training policy framework.

- The CULT Committee could recommend the Commission follows the action plan on learning analytics suggested by the JRC (JRC 2017) which asserts to 1) define the role and policy priorities for learning analytics in the context of the education and training policy in close collaboration with education stakeholders; 2) in line with education and training policy priorities, develop a learning analytics roadmap that would support the development of tools and practices; 3) identify organisations and individuals who would be responsible for coordinating the learning analytics roadmap coordination and stakeholder cooperation at EU and national level.

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This study aims to provide Members of the European Parliament's Committee on Culture and Education with information, analysis and recommendations on digital skills in the 21st century and an adequate EU policy response to contemporary challenges as set out in the Digital Education Action Plan and accompanying Staff Working Document. Based on literature review and policy mapping, the study identifies potential blind spots in the field of digital skills and competences that are not addressed by the Action Plan and other existing initiatives at EU level.

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