



European Training Foundation

Digital skills and competence, and digital and online learning



Written by Alessandro Brolpito, Senior Specialist in Digital Skills and Learning, ETF

The contents of this paper are the sole responsibility of the ETF
and do not necessarily reflect the views of the EU institutions.

© European Training Foundation, Turin, 2018

Reproduction is authorised provided the source is acknowledged.

*The hardest part of learning something new is not embracing new ideas,
but letting go of old ones.*

Todd Rose, 2016

PREFACE

In a globalised and fast-evolving world, digital technologies have spread rapidly, while the economy, the labour market and our societies at large are changing at an unprecedented rate.

For the economy, digital technologies are a major driver for growth, productivity, competitiveness and innovative capacity. For the labour market, digital technologies are a challenge for existing jobs, especially for those including routine tasks, and an opportunity to create new ones, mainly linked to the so-called digital economy, designing workplaces where humans increasingly interact with digital tools and artificial intelligence.

Although we cannot predict the pace of the digital transformation and innovation of society, what we do know is that employment opportunities and economic performance increasingly depend on the digital skills and competence (DSC) of citizens. We also know that today's learners expect more options for personalisation and collaboration, and better links between what they learn at work, at school and on the Internet in their lifelong learning journey.

The digital transformation is, to varying degrees, also taking place in ETF partner countries. In the reform of their VET systems, the ETF has to help partner countries reap the benefits of the opportunities offered by the digital transformation and help them address the related challenges.

This paper's ambition is to outline a commonly shared ETF position and strategic approach to DSC and digital and online learning (DOL) in vocational education and training (VET) in the ETF's partner countries. It also aims to support VET stakeholders, such as policy makers and practitioners, in partner countries and to reinforce cooperation with international development partners, primarily the European Commission's services and bodies, working on policy and practice in DSC and DOL.

Acknowledgments

The author gratefully acknowledges the reviews of this paper undertaken by ETF colleagues. Special thanks go to Helmut Zelloth for his guidance and support in all phases of the paper. Thanks are also due to Julian Stanley, Stefan Thomas, Anthony Gribben, Vincent McBride, Lida Kita, Abdelaziz Jaouani, Sabina Nari, Francesca Rosso, Ummuhan Bardak, Elizabeth Watters, Mirjam de Jong, Ulrike Damyanovic, Arjen Deij as well as Anastasia Fetsi and Xavier Matheu de Cortada. The author acknowledges the openness of all ETF colleagues who, to a different extent, have provided ideas and shared knowledge on this emerging thematic policy area.

The author is also grateful for the input provided by international experts Michael Lightfoot and Soner Yildirim.

Contents

Preface	3
Executive summary	6
Introduction	8
1. The digital transformation of the economy	9
1.1 Implications for the labour market	12
1.2 Implications for education	15
2. Policy background	18
2.1 Policy developments in the European Union	19
2.2 Policies from international organisations	22
3. Digital skills and competence	25
3.1 European frameworks for digital skills and competence	25
3.2 European Computer Driving Licence	27
4. Digital and online learning	30
4.1 Digital and online learning for innovation of pedagogy in education and training	30
4.2 EU Framework for Digitally Competent Educational Organisations (DigCompOrg)	32
4.3 Emerging trends	34
5. Implications of the digital transformation on vocational education	41
5.1 Implications on initial VET	43
5.2 Implications on continuing VET	44
5.3 Implications on infrastructure in VET	44
5.4 Implications on VET qualifications and skills	47
5.5 Implications on VET curricula	50
5.6 Implications on the continuing professional development of VET teachers and trainers	51
5.7 Implications on quality assurance for VET	52
6. Digital skills and competence and digital and online learning across the ETF's regions	53
6.1 Looking back to look ahead	53
6.2 Western Balkans and Turkey	54
6.3 Southern and Eastern Mediterranean	56
6.4 Eastern Europe	57
6.5 Central Asia	58
7. ETF position on digital skills and competence, and digital and online learning in vocational education	60
7.1 Making VET providers 'digitally competent'	61
7.2 Making digital skills and competence, and digital and online learning in VET more visible in national digital agendas	63
7.3 Promotion of digital competence as a key competence for VET	64
Acronyms	67
Bibliography	68

List of figures

Figure 1.1 Correlation between Internet penetration and economic development	9
Figure 1.2 Correlation between the four industrial revolutions and innovation	10
Figure 1.3 Distribution of US Bureau of Labour Statistic 2010 occupational employment over the probability of computerisation (2010–20), along with the share in low, medium and high probability categories	12
Figure 1.4 Adult employees experiencing technological change in the workplace in the past five years by sector – EU-28	14
Figure 1.5 The growth of MOOCs on the web	16
Figure 1.6 Types of skills needed in a modern economy.....	17
Figure 3.1 European Framework for the Digital Competence of Educators	27
Figure 3.2 ECDL programmes and modules.....	28
Figure 3.3 Mapping ECDL with DigComp digital competences	29
Figure 4.1 Digital and online learning.....	30
Figure 4.2 DigCompOrg	33
Figure 4.3 SELFIE's organisation and items.....	33
Figure 4.4 The pilot of SELFIE in figures	34
Figure 4.5 History of open education	36
Figure 4.6 MOOC and open education timeline.....	37
Figure 4.7 Mobile phone and Internet progress in developing countries	40
Figure 5.1 Participation rate in lifelong learning in some of the ETF's partner countries.	44
Figure 5.2 International Internet traffic flows – Europe and Central Asia	45
Figure 5.3 The six learning environments defined in the Schoolnet Lab	47
Figure 5.4 Complementarity between ICT and non-ICT skills at work among adult employees, 2014 – EU-28	48
Figure 5.5 Role played by professional competences for the four ICT occupation profiles in Germany.....	49
Figure 7.1 SELFIE (and DigCompOrg) key dimensions	62
Figure 7.2 ETF analytical framework to analyse progress with DSC and DOL in a country.....	63
Figure 7.3 European Framework for the Digital Competence of Educators	65

EXECUTIVE SUMMARY

This paper describes the ETF position on digital skills and competence (DSC), and digital and online learning (DOL). In its strategic approach, the paper considers the two thematic policy areas as mutually connected and useful to modernising access to and provision of vocational education and training (VET) in ETF partner countries.

The **Introduction** defines the scope, main objectives and target audience of this paper. Focusing on DSC and DOL in education and training, the target audience includes ETF specialists and country desks, VET stakeholders in ETF partner countries and ETF international development partners.

Chapter 1 briefly analyses the ongoing digital transformation of the economy and its impact on the labour market and education. The main conclusion from this analysis is that automation and digitalisation are affecting almost all jobs, but are unlikely to replace a large number of them, at least in the medium term. Over the past 200 years, employment figures have persistently increased due to the technological development, not vice versa¹. A 2016 OECD study (Arntz et al., 2016) maintains that just 9% of the jobs analysed in their research are at high risk of full automation but at least 70% of their tasks could be automated in the medium term. With respect to the impact on education, the massive open online courses (MOOCs) and open educational practices, in general, are probably the most relevant examples of how the digital transformation is affecting and innovating the education landscape in a lifelong perspective. However, in formal education, the adoption of technology has not been as rapid or intensive as expected and its perceived impact on student's proficiency remains limited or at least unclear. A possible interpretation is that good lessons require intensive teacher-student interactions and technology may distract from this valuable human engagement (OECD, 2015).

Chapter 2 briefly refers to the main policy developments at the European Union (EU) and international levels concerning DSC and DOL. Analysing the EU policies in the last two decades, there is evidence that the EU has consistently considered the digital transformation as an important source of economic growth and jobs creation. On this line, DSC and DOL policies in education have been constantly developed. Since 2006, in the EU, digital competence has been conceptualised as a key competence for lifelong learning. Subsequently, the increasing demand for DSC and DOL fostered several EU policy initiatives, of which the *Open-up Communication* (2013) and the *New Skills Agenda for Europe* (2017) are the main two pillars. However, the lack of DSC in the EU is still evident: while already today 90% of jobs require some degree of digital skills, almost half (44%) of the EU workforce has low basic digital skills, of which 22% has no digital skills at all. DSC and DOL are also increasingly the subject of European neighbourhood and enlargement policies, as well as interventions by international organisations and donors to improve access to and provision of education and training systems in developing and transition countries, including many of the ETF's partner countries. In January 2018 the European Commission launched a new digital education action plan 2018–20 that aims to undertake EU-wide cooperation initiatives (i) to scale up the digital readiness of both general and vocational schools, (ii) to develop relevant digital competences and skills for the digital transformation; and (iii) to improve education through better data analysis and foresight.

Chapter 3 provides a definition of DSC based on three main pillars: (i) digital competence as a set of basic digital skills for citizens for lifelong learning; (ii) job-specific digital skills for those involved in jobs

¹ www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2017-0051+0+DOC+XML+V0//EN

including the use and maintenance of digital tools, such as 3D printing devices; and (iii) digital skills for ICT professionals in charge of challenging and innovative digital technologies. In line with EU policy and initiatives and, in particular, with the latest recommendations on Key Competences for Lifelong Learning (January 2018), this paper recommends the use of the Digital Competence Framework for Citizens (DigComp) as a reference for the development of national DSC strategies and policies. It also recommends the adoption of the Digital Competence Framework for Educators (DigCompEdu) as a reference for the development of policies and strategies to improve the DSC of teachers and trainers.

Chapter 4 defines digital and online learning (DOL), also referred to, with e-learning, as ‘learning supported by information and communication technologies’. It connects DOL to emerging trends in education and training for the modernisation of access to and provision of education and training from a lifelong learning perspective. Particular emphasis is given to open educational practices (e.g. MOOCs and open educational resources) and to how mobile devices and computers at school can support a shift from teaching to learning and redesign the role of teachers. The chapter also underlines that the development of DSC goes hand in hand with an effective use of DOL. In line with the new European Commission’s digital education plan (January 2018), this paper recommends the adoption of the Competence Framework for Digitally Competent Organisations (DigCompOrg) and the related self-reflection tool, SELFIE, to improve the digital readiness of vocational schools.

Chapter 5 focuses on the implications of the digital transformation on VET, with specific reflections on organisational and pedagogical aspects. Research and practice suggest that DOL has two main implications: (i) for initial VET (IVET), DOL primarily affects the provision and pedagogy of VET, supporting a shift from teaching to learning and a better combining of different learning environments, while offering new opportunities for individualised and collective learning; (ii) for continuing VET (CVET), the effect of DOL is primarily to widen the access to vocational skills, for example through MOOCs and online platforms. VET systems need to re-think existing curricula, qualifications and skills to face the digital transformation and vocational schools need to become digitally competent in order to adopt DOL methods and deliver up-to-date DSC.

Chapter 6 briefly recalls previous and ongoing ETF interventions and provides information regarding progress on DSC and DOL in partner countries. Overall, there is evidence of increasing prioritisation of DSC and DOL in many partner countries. More specifically, (i) the evidence base in the Western Balkan and Turkey region is relatively strong. The so-called Berlin Process, aimed at the digitisation of economies in the area and their integration within the European Digital Single Market, triggers DSC and DOL policy reforms in VET here; (ii) the evidence base in Eastern Europe presents a rather fragmented picture. The ‘EU4Digital network’, a similar initiative to the Berlin Process, triggers DSC and DOL policy reforms in VET in Armenia, Georgia, Moldova and Ukraine; (iii) the evidence base in the Southern and Eastern Mediterranean and Central Asia regions is not strong and faces major constraints, such as very poor Internet access (high cost, low quality and slow speed), with relevant exceptions such as Israel and Kazakhstan.

Chapter 7 outlines the ETF’s position expressed in terms of four priorities and eight strategic actions. DSC and DOL are clearly indicated as transversal factors providing a ‘golden’ opportunity for forward-looking VET reform in partner countries. In order to master the manifold challenges of the digital transformation, this paper places the digital readiness of VET providers, at all levels, at the heart of its approach. It also prioritises a set of strategic policy actions to ensure a more prominent position of VET in national digital agendas and skills strategies to enable a future-fit modernisation of VET systems in partner countries.

INTRODUCTION

Why this paper – The purpose of this paper is to establish a corporate position on digital skills and competence (DSC), and the opportunities and challenges of digital and online learning (DOL) in VET with relevance to ETF partner countries. It further aims to suggest a direction for a strategic approach to these emerging policy areas and concrete actions that may be implemented by the ETF.

Target audience – The primary target audience are ETF specialists and country desks who deal with VET reform in partner countries or are engaged in the EU and international debates on these thematic areas. The secondary target group are VET stakeholders such as policy makers and social partners in ETF partner countries, as well as international development partners working on policy and practice in the field of DSC and DOL for VET.

Why now – ‘Open and innovative education and training, including by fully embracing the digital era’ is one of the six priorities in the Education and Training Agenda 2020 (ET 2020) in the EU. The new skills agenda for Europe² and the recent new digital education action plan for Europe launched in January 2018³ support the implementation of this priority.

The ETF has completed an exploratory phase to assess DSC and DOL in VET in EU candidate countries (2015–17), and it is now time to consolidate this knowledge to prepare the ground for more systemic and systematic interventions. In the near future, the ETF will come to a crossroads in terms of deciding which thematic areas of work to pursue in the light of the next mid-term perspective post-2020. DSC and DOL should be one of new priority areas to be considered.

Why in VET – In the international debate on the digitalisation of education and training, VET is often neglected; therefore, the potential of DSC and DOL in this education sector needs to be further explored. This is particularly true because of the advent of the so-called digital transformation, which affects many VET professions.

Why in the ETF’s partner countries – Globalisation and the digitisation of the economy are increasingly affecting ETF partner countries, as well as the methods and content of education and training provision. Demand for DSC is on the rise, as evidence from some national strategy documents shows, and some partner countries are already participating in the EU thematic discussions. Through DOL, especially for CVET, partner countries can provide more and better access to up-to-date VET skills.

How – This paper collects data and information on policy and practices in DSC and DOL mainly from EU and ETF partner countries. The paper is based on empirical evidence and reviews from the scientific research literature, including good examples of practices from professional journals, books and websites. The content of this paper should be read bearing in mind that the literature and practices on DSC and DOL are very broad, presenting different perspectives, and that this paper offers only a limited view of them.

Finally, this paper is a rolling document, intended to be regularly updated according to internal discussions and new knowledge and developments in this field.

² <http://ec.europa.eu/social/main.jsp?catId=1223>

³ <https://ec.europa.eu/education/sites/education/files/digital-education-action-plan.pdf>

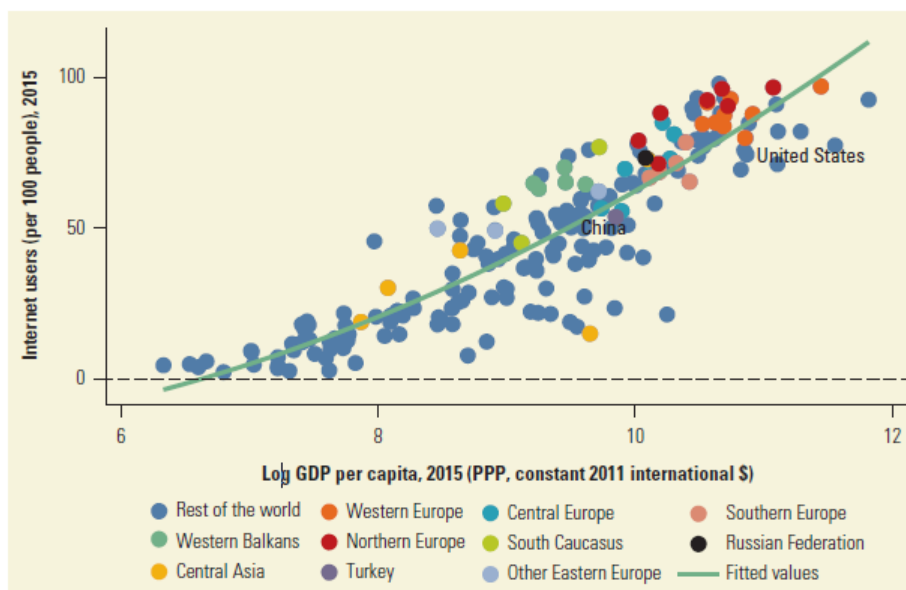
1. THE DIGITAL TRANSFORMATION OF THE ECONOMY

Information technologies have been transforming the world for centuries, starting from the large-scale production of paper (1 000 years ago) up to the present day.

A recent good example is the Internet. In March 1989, Sir Tim Berners-Lee laid out his vision⁴ for what would become the World Wide Web⁵. Some 30 years later, we live in a digital world where the Internet is rooted at the heart of our business activity and day-to-day life. In 1995, less than 1% of the population had access to the Internet. Today, around 42% of the world population has an Internet connection. Internet and mobile computing devices have also been reaching ETF partner countries faster than other technologies (World Bank, 2016).

In its recent report, *Reaping Digital Dividends* (Kelly et al., 2017), the World Bank emphasises the high correlation between Internet penetration in a country and its economic development (GDP per capita).

FIGURE 1.1 CORRELATION BETWEEN INTERNET PENETRATION AND ECONOMIC DEVELOPMENT (Kelly et al., 2017)



Source: World Development Indicators 2016.

Note: Regarding Internet use, Internet users are individuals who have used the Internet (from any location) in the past 12 months. Internet can be accessed using a computer, mobile phone, personal digital assistant, games machine, digital TV, and so forth. GDP = gross domestic product; PPP = purchasing power parity.

Figure 1.1, without suggesting a specific causal relationship, highlights a correlation between the number of Internet users and GDP per capita, which may suggest both an impact of the Internet on economic growth and the fact that richer economies are more likely to absorb Internet benefits.

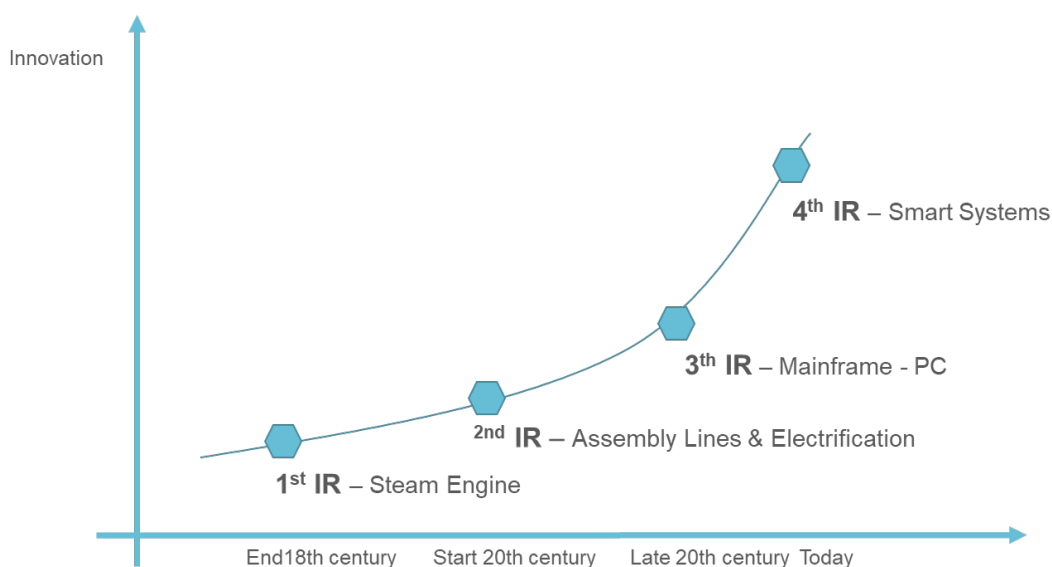
⁴ www.w3.org/History/1989/proposal.html

⁵ In this report Internet and the world-wide web are used as synonyms, although the Internet is the global computer network on which the world-wide web is used to access content over the Internet (https://en.oxforddictionaries.com/definition/world_wide_web).

Many of the ETF's partner countries are included in Figure 1.1, providing some interesting findings. For example, the graph indicates that countries in the Western Balkans have a similar Internet/GDP correlation. However, compared to other countries in the world, in the Western Balkans the number of Internet users had less impact on the GDP per capita, highlighting the fact that a wider adoption of the Internet is not a sufficient condition for economic development. Other factors, such as policies ensuring competition among businesses, the quality of education and training systems, and accountable institutions are also factors that contribute to the growth of GDP.

However, the Internet and digitisation are not the only disruptive technologies to affect the modus operandi of economy and society. Since the 18th century there have been a number of transformative events: the so-called first industrial revolution introduced steam power to mechanise the world; the second one introduced electric power to create mass production; and the third one used information technology to automate routine tasks and empower human computing capacity.

FIGURE 1.2 CORRELATION BETWEEN THE FOUR INDUSTRIAL REVOLUTIONS (IR) AND INNOVATION



Source: Brolpito, A., ETF, Presentation at the International Policy Forum 'Closing the Digital Skills Gap' organised by the British Council, Belgrade, 8 February 2017

Today, we are at the beginning of the so called fourth industrial revolution. Analysts say it will lead to a digital transformation of our economies and societies through the so-called 'smart systems', connecting and amplifying technologies such as robotic, artificial intelligence, learning machine and 3D printing.

Klaus Schwab⁶, executive chair of the World Economic Forum, refers to the fourth industrial revolution as a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society.

⁶ www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

The following list provides examples of the ever-increasing pace of technological change and capacity building towards a 'weightless' economy⁷:

- 200 years to reach 1 billion bicycles;
- 120 years to reach 1 billion cars;
- 8.5 years to reach 1 billion Facebook users;
- 5.5 years to reach 1 billion Uber rides;
- 87 days to reach 1 billion Adele views on YouTube.

EXAMPLE OF THE IMPACT OF THE DIGITAL TRANSFORMATION ON THE LOGISTICS SECTOR

How has digital transformation changed the character of the sector?

Technology is being used in the logistics sector to consolidate delivery transport flows, and to make operations more efficient. The logistics sector has started to use technologies so that it can use the data that was collected to model operations, sales patterns and transport flows more precisely, in order to improve efficiency and to cut down on costs. Automation of distribution centres¹²⁶ is also increasing demand for rapid home delivery by customers.

What digital technologies have been introduced?

In 2005, radio frequency identification (RFID) tags were introduced in a bid to make the supply chain more efficient. This technology is attached to individual items so they can be tracked whilst in transit, retailers also use these tags in order to have a better overview of the stock they currently have in their warehouses or stores. More recently, companies have looked towards utilising automation software or cloud-based networks to improve efficiency across the supply chain. A benefit of cloud-based systems is that they are cheaper to install, they fix supply-chain problems at their source and can be used by companies across networks, regardless of the locality of the user.

Currently, the logistics sector is working on introducing drones (or unmanned aerial vehicles) in order to make the delivery of goods cheaper and more efficient. For example, DHL is piloting its Parcelcopter 2.0 project, which uses drone technology to deliver time-sensitive goods (like medicine) to remote locations, quicker and more effectively than aeroplanes or ferries could achieve.¹³⁰ Similarly, Amazon is at the forefront of developments with drones and logistics that are challenging regulatory systems regarding airspace and safety.

What impact has it had on the sector?

The digital transformation of the logistics sector has happened quite rapidly, and the sector is struggling to meet the demand in skilled workers. Technical changes in managing logistics have created a greater demand for individuals with IT skills alongside their managerial capabilities. Furthermore, these skills needs are required in a context of an 'environmental low-carbon agenda', which requires a further generic skillset of being able to manage the digital transformation of logistics in an environmentally friendly way. As a result of the new demands of the logistics sector, there is a shortage of workers who are highly-skilled enough to be able to analyse the datasets and translate the findings into solutions for the management of the supply chain. There are also concerns that people with the required digital skills might reject a career in logistics in favour of other potentially more 'exciting' sectors. Employers are also finding it difficult to upskill existing employees to the appropriate level in the timeframes needed to make effective change. Developments in logistics show that extensive IT usage is having positive outcomes, for example helping businesses to monitor their stock status, allowing for better planning and a more accurate level of stock to meet anticipated demand. Similarly, automated systems are also helping warehousing operations to move quicker and more efficiently, thus reducing costs and increasing organisational efficiency.

Source: Digital Skills for the UK Econom, January 2016, p. 44.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492889/DCMSDigitalSkillsReportJan2016.pdf

⁷ Thomas Frey, Executive Director of the Da Vinci Institute.

The digital transformation is affecting all sectors of the economy – existing industries, farms and services, the ICT industry itself and the new digital economy – transforming the way products and services are designed and delivered, and introducing new paradigms and business models (e.g. the sharing economy and the gig economy).

Increasingly, the connection of physical objects to the Internet, the so-called ‘Internet of Things’, allows the accessing and gathering of remote sensor data, plus the controlling of those objects from a distance. The combination of sensors’ data with artificial intelligence gives rise to new ‘smart systems’ and services, the implications of which are the design and production of products embedding digital technologies and the automation of the workplace.

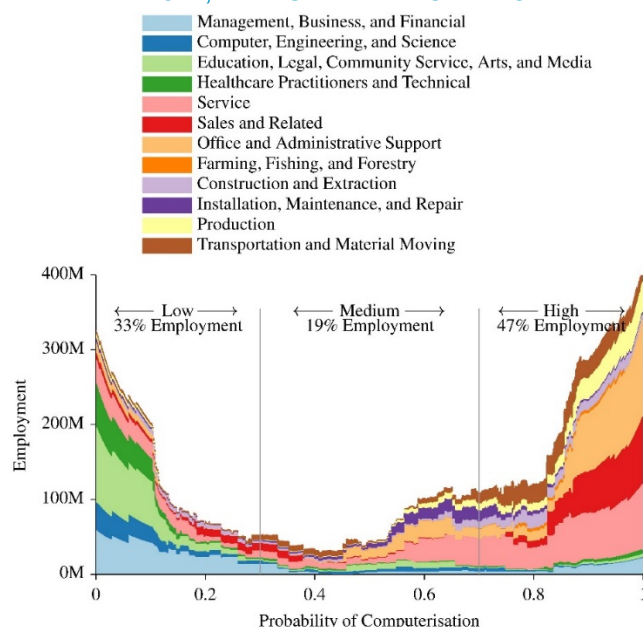
It is important to highlight that the digital transformation no longer seems to reward those who build things, but rather those who own the data and know how to connect offer and demand (e.g. Airbnb and UBER). Policy needs to understand, anticipate and respond quickly to these challenges in order to be able to support inclusive and sustainable growth, ensuring that the benefits are shared throughout society.

1.1 Implications for the labour market

Digital technology together with globalisation have had a significant effect on the nature of work of current and future jobs⁸.

A key piece of research – ‘The future of employment: how susceptible are jobs to computerisation’ (Frey and Osborne, 2017) – examined 702 occupations in the United States of America in 2010 to estimate the expected impacts of future computerisation on the labour market, distinguishing employment according to low, medium and high probability of computerisation.

FIGURE 1.3 DISTRIBUTION OF US BUREAU OF LABOUR STATISTIC 2010 OCCUPATIONAL EMPLOYMENT OVER THE PROBABILITY OF COMPUTERISATION (2010–20), ALONG WITH THE SHARE IN LOW, MEDIUM AND HIGH PROBABILITY CATEGORIES



Source: Frey and Osborne, ‘The future of employment: How susceptible are jobs to computerisation’, 2017.

⁸ www.ilo.org/global/topics/future-of-work/dialogue/lang--en/index.htm

According to their research, 47% of total US employment will be in the high-risk category in one or two decades. While computerisation has been historically confined to routine tasks involving explicit rule-based operations, normally confined to low-skill and low-wage employment, today cheap computing and data are leading to algorithms and to artificial intelligence that can replace labour in a wide range of non-routine cognitive tasks. For example, developments in machine learning (powered by algorithms based on pattern recognition) will reduce demand for labour input in tasks related to document review and translation. Only 33% of total US employment is in the low risk of computerisation category, mainly with regard to the ICT, education and health sectors, and management positions. The research estimates that this trend will not be steady. Overall, it seems to lead to increasing divisions in society, with a shrinking middle class and a high concentration of wealth and influence in the hands of a minority.

A 2016 OECD study (Arntz at al., 2016) critically reflects on the line expressed in the above-cited research, in which computerisation is directly correlated to job losses. The study argues that technological change at work is (i) a slow process; (ii) normally leads to the automation of only some tasks; and (iii) creates completely new jobs. As result, the main conclusion is that automation and digitalisation are unlikely to destroy large numbers of jobs. More specifically, the OECD study estimates that just 9% of jobs are at high risk of automation, but that at least 70% of the tasks in the jobs analysed could be automated.

In the EU the demand for digital technology professionals has grown by 4% annually over the last 10 years, and the European Commission estimates that there will be a shortage of 756°000 ICT professionals by 2020⁹. The Commission also highlights that today 90% of jobs require some kind of digital skills, while almost half (44%) of the EU workforce has low basic digital skills, of which 22% has no digital skills at all¹⁰. As result, the latter group are at risk of unemployment, poverty and social exclusion and reskilling and upskilling of low and medium occupations is a priority to prevent a polarisation of the labour market and the so-called digital divide.

To better predict the impact of digital technology on the labour market, it is also useful to analyse some trends from the recent past. The Cedefop's European skills and jobs survey¹¹ provides evidence that across the 28 EU Member States, 43% of adult employees have seen the technologies they use in the workplace changing in the past five years, making some people's jobs vulnerable to automation, and 47% have seen changes in working methods or practices¹². Overall, some occupations are changing faster than others as shown in Figure 1.4.

For example, 57% of adult employees in ICT have seen changes in their jobs during the past five years compared to 27% of those in accommodation and catering.

The main conclusion from this analysis confirm the OCED's analysis 2016 OECD (Arntz at al., 2016), with the automation and digitalisation affecting almost all jobs but unlikely replacing a large numbers of them. As with previous major technological advances, as a result of current changes some jobs will

⁹ A new skills agenda for Europe working together to strengthen human capital, employability and competitiveness, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0381>

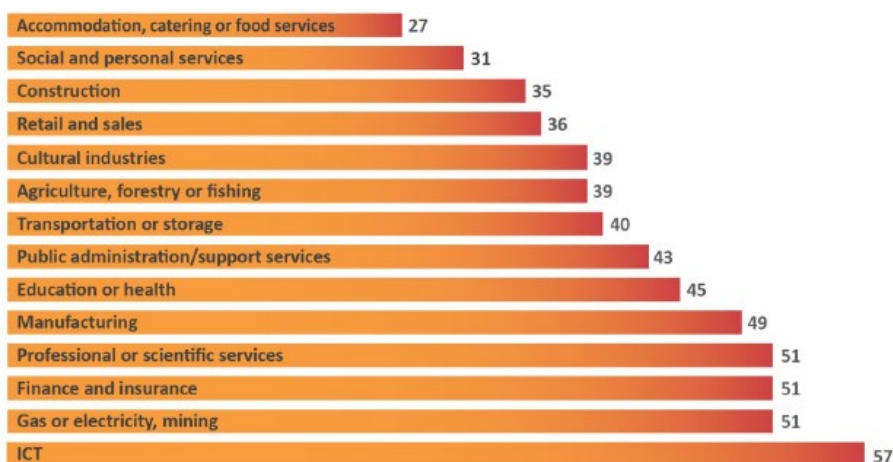
¹⁰ https://ec.europa.eu/education/initiatives/european-education-area/digital-education-action-plan_en

¹¹ Carried out in 2014, the survey collected information on how the skills of about 49 000 adult workers (aged 24–65) across the EU matched the needs of their jobs, www.cedefop.europa.eu/en/events-and-projects/projects/european-skills-and-jobs-esj-survey

¹² www.cedefop.europa.eu/en/publications-and-resources/publications/9121

disappear, others will be replaced, new jobs will be created, many jobs and industries will be transformed and new businesses and markets will emerge¹³.

FIGURE 1.4 ADULT EMPLOYEES EXPERIENCING TECHNOLOGICAL CHANGE IN THE WORKPLACE IN THE PAST FIVE YEARS BY SECTOR – EU-28



Source: Cedefop European skills and jobs survey.

Over the past 200 years, employment figures have persistently increased (and in many cases the quality of employment improved) due to technological development, not vice versa¹⁴. Even this time, job creation may compensate jobs substitution: the McKinsey Global Institute’s 2011 survey of 4 800 SMEs found that the Internet created 2.6 jobs for each job lost to technology-related efficiencies¹⁵.

Key challenges for the future seem to be the danger of polarisation in the labour market and upholding labour standards for most of the jobs created in advanced economies. In the sharing and gig economies, workers in flourishing ‘e-companies’, such as the Uber’s drivers, are classified as independent contractors and continue to experience low salaries and have few rights or protections, such as insurance, medical cover, social security or paid vacations. Other key challenges are demographic changes (with life expectancy rising by about two years every decade)¹⁶ and the lack of engagement of women in ICT occupations in advanced economies (e.g. less than 20% of ICT professionals are women in the EU)¹⁷. Another challenge heightened by the digital transformation is globalisation: with the development of ICT it is increasingly possible for products/services to be produced/delivered through a supply chain spread across the world, thus, in turn, affecting which skills are in demand and in what locations. As a result, citizen need to be accompanied and protected in this journey through active market policies and policies ensuring that citizens receive an adequate level of social protection, inclusion and a fair redistribution of benefits.

In recent years, ETF partner countries have experienced extensive changes in their labour markets¹⁸. Transition countries have experienced severe labour market shocks, due in large part to the transition from a state-owned or subsidised centralised economy to a market economy, which has made labour market skills in some areas redundant and others, such as DSC, lacking. For example, according to a recent ETF study in Ukraine, in the period 2014–20 employment is expected to grow only modestly,

¹³ See European Commission, ‘A concept paper on digitisation, employability and inclusiveness: The role of Europe’, 2017, http://ec.europa.eu/newsroom/document.cfm?doc_id=44515

¹⁴ www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2017-0051+0+DOC+XML+V0//EN

¹⁵ www.mckinsey.com/industries/high-tech/our-insights/internet-matters

¹⁶ www.weforum.org/agenda/2018/05/the-4-emerging-truths-of-the-4IR-job-market/

¹⁷ <https://ec.europa.eu/education/sites/education/files/factsheet-digital-education-action-plan.pdf>

¹⁸ ETF position paper on anticipating and matching demand and supply of skills in ETF partner countries (internal document)

by 0.8%; however, the IT sector is forecast to grow by 22.5% (Bardak et al., 2016). Among the ETF's partner countries, developing countries are marginally more affected by the digital transformation. Their economies are mainly based on agriculture and non-agricultural informal activities, including micro and small enterprises that provide a wide range of precarious, low-skilled and vulnerable jobs where the demand for DSC is still limited.

1.2 Implications for education

In the 19th century, the primary and secondary education and training system was created to prepare the workforce for the 'new' world of manual and clerical work in the cities. In the 20th century, the education system focused on training good factory workers and their managers, inspired by the principles of Taylorism, to support the second industrial revolution.

In the 21st century, national education systems need to provide everyone with access to lifelong learning so that they can acquire the fast-changing skills and competence requested by an increasingly digital and globalised world. The World Economic Forum, in its report 'The future of jobs'¹⁹ estimates that 65% of children entering primary school today will ultimately end up working in completely new types of job that don't yet exist.

The introduction of education management information systems to support schools' administration has probably been the first major achievement in the digital transformation of education and training facilities.

Following this, digital technology has been used to improve the accessibility and provision of education, in particular at the university level, offering new instruments and solutions for innovative pedagogies and distance learning. Based on the concept of distance education, the massive open online courses (MOOCs) are probably the most relevant example of how the digital transformation is affecting the education landscape. The consensus is that the online course 'Connectivism and Connective Knowledge' led by George Siemens (Athabasca University) and Stephen Downes (National Research Council)²⁰ in 2008 was the first MOOC ever. Subsequently, MOOCs have emerged based on a variety of platforms, mainly across the US, Europe and, more recently, also the Arab States, South America and Asia (Oliver, 2016). They generally represent a further evolution of the concept of open education, and offer courses of study over the Internet for free or at limited cost for a very large number of people. MOOCs often include open educational resources²¹, a forum and online tools for a regular tutor – and/or self-assessment of progress.

Currently, everyday millions of people and students around the world access MOOCs²² through learning management systems (e.g. Coursera, www.coursera.org/), anytime, no matter where they live in the world. As a result, MOOCs are undoubtedly a possible world-wide answer to the Universal Declaration of Human Rights, Article 26.1 ('Everyone has the right to education') and related Sustainable Development Goal No 4²³, as well as to modern education systems' need to provide efficient and quality learning that lasts a lifetime, although in practice it has been revealed that the

¹⁹ <http://reports.weforum.org/future-of-jobs-2016/>

²⁰ https://oerknowledgecloud.org/sites/oerknowledgecloud.org/files/Connective_Knowledge-19May2012.pdf

²¹ The term open educational resources was coined at UNESCO's 2002 Forum on Open Courseware and designates 'teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work'.

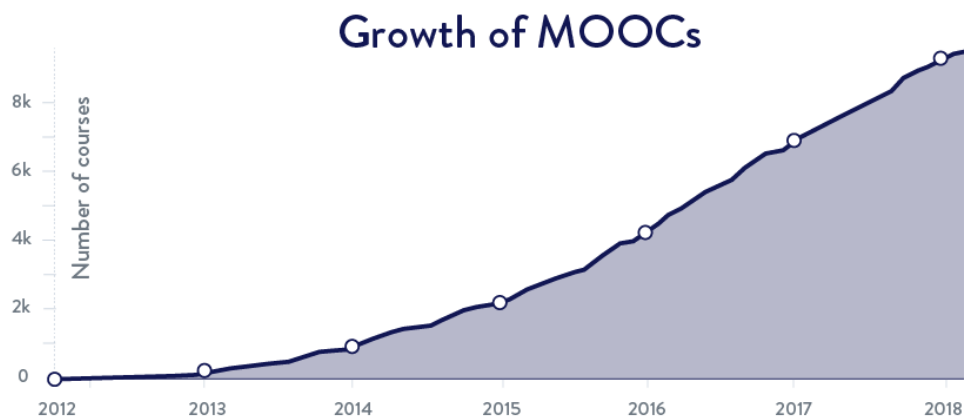
²² www.class-central.com/report/moocs-stats-and-trends-2017/

²³ <https://en.unesco.org/education2030-sdg4/targets>

quality of MOOCs and related learning experiences can vary considerably (Moore and Kearsley, 2011).

FIGURE 1.5 THE GROWTH OF MOOCs ON THE WEB

CLASS CENTRAL



By the Numbers: MOOCs in 2017

Source: www.class-central.com/report/moocs-stats-and-trends-2017/

Examples of MOOC platforms include: Coursera, Edx, FUN, FutureLearn, Iversity, Rwaq, Veduca and XuetangX (Music, 2016). The number of registered users has increased to an estimated 81 million students in 2017²², up from 58 million in 2016, 35 million in 2015 and an estimated 16–18 million in 2014 (Shah, 2015; Music, 2016).

The digital transformation, to a different extent, has also affected primary and secondary schooling, with implications for the infrastructure, curricula and pedagogy, offering also assistive technology²⁴ for people with a disability or specific learning disorder, thus supporting inclusion and equity²⁵.

Today, teachers are increasingly experimenting with digital pedagogies, or using them as part of their curricula (e.g. the flipped classroom). More frequently, teachers use digital tools and pedagogical software to prepare and present lessons, improve teacher-learner interactions, and, for example, to regularly assess the progress of students (formative assessment).

However, the adoption of DOL in schools has been not as rapid or intensive as expected, and its impact on students' proficiency seem to remain limited, or at least unclear. A possible interpretation is that good lessons require intensive teacher-student interactions and technology may distract from this valuable human engagement (OECD, 2015). Research and practice have identified teachers' lack of digital competence and educational organisations' lack of digital readiness as key issues. As result, the capacity of education, and in particular of schools and teachers, to exploit new technologies and to develop their own roles in relation to these opportunities seem to be the main challenges facing modern education systems.

Focusing on the learners' implications of the digital transformation, the Cedefop's European skills and jobs survey²⁶ shows that to keep up with the digital economy, simply improving digital literacy is not

²⁴ www.webopedia.com/TERM/A/assistive_technology.html

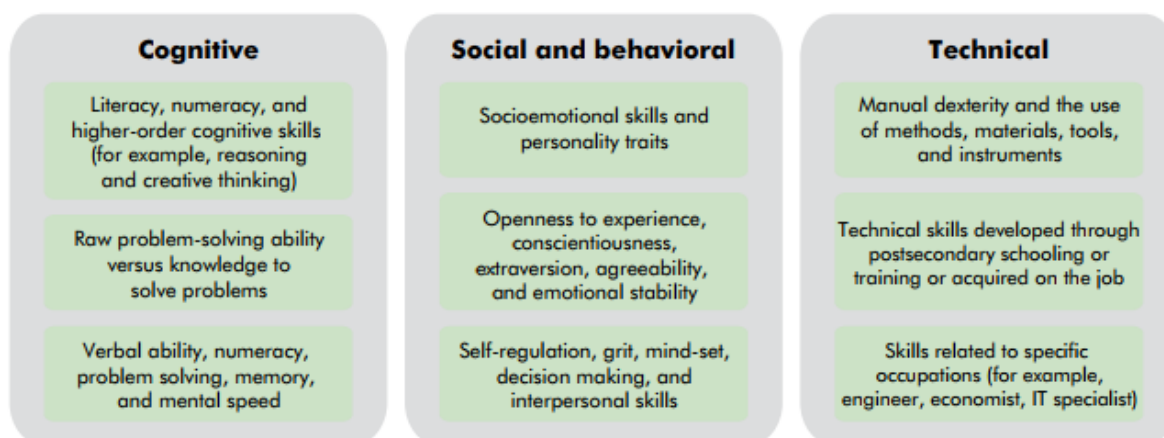
²⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52010DC0636>

²⁶ www.cedefop.europa.eu/en/publications-and-resources/publications/9121

enough. More specifically, the survey shows that adults in jobs requiring at least moderate-level ICT skills, on top of technical job-specific skills, also require a healthy mix of cognitive and socio-behavioural skills. Jobs requiring advanced ICT skills depend heavily on people being able to solve problems, and to learn, adapt and apply new methods and technologies, as well as having in-depth technical knowledge.

Overall, the World Bank identifies the following types of skills as necessary for modern economies (World Bank, 2016).

FIGURE 1.6 TYPES OF SKILLS NEEDED IN A MODERN ECONOMY



Source: WDR 2016 team, adapted from Pierre, Sanchez Puerta, and Valerio 2014.

Note: IT = information technology.

The implications of the digital transformation on education and training systems will be further analysed in Chapter 5 with specific reflections on VET.

2. POLICY BACKGROUND

The past 30 years have witnessed a steady expansion of digital skills and educational technology policy making around the world, with technology-enhanced learning often presented by researchers and policy makers as an essential modernising tool for education to sustain economic growth and competitiveness. What is notable during this period is the remarkable similarity in the policy agendas throughout the world, even though they have been enacted in different countries operating in very different contexts, resulting in what Zhao et al. (2006) have described at page 674 as ‘a techno-centric, utopian and economic driven mind-set’.

However, there are relevant examples of education policy inspired by a more human perspective, taking into consideration that education and training policy reforms are complex, take time and can't simply be seen as a fast-responding process to meet economic needs. This is the case, for example, in Finland, whose education system is praised for equity and high quality the world over and which is clearly shaped by a non-market-driven approach (Sahlberg, 2014).

A comparative analysis of policies for the use of digital technologies in education (Kozma, 2008) identifies four common objectives:

- to support economic growth;
- to promote social development;
- to support education reform;
- to support education management.

The OECD highlights that education policy reforms should provide a vision and support the development of an environment in which digital technologies can increase students' proficiency, enhance access to and the quality of schooling, and improve the effectiveness of governance (OECD, 2015).

As a result, education policy reforms must go beyond the need to broaden the ICT infrastructure, and define favourable conditions for an effective use of DOL. They also need to empower the teachers and trainers, as well as the institutions and governance structures of education systems (World Bank, 2016). For example, education and training policies also have to overcome the various challenges introduced by the use of technology in education, such the provision of safe Internet connectivity to educational organisations and the delivery of continuing professional development to teachers and trainers with regard to the pedagogical use of digital technologies (OECD, 2015).

THE CASE OF FINLAND: PERSONALISATION OF TEACHING AND LEARNING IS KEY TO SUCCESS

The Finnish education system is internationally indicated as a model that ensures good levels of achievement in learners (OECD PISA indicators – for Finnish 15-year-olds in literacy and mathematical and scientific literacy), and which also shows little variation in learners' performance within individual schools and between schools in different parts of the country.

Finland bases its success on principles of equity, flexibility in terms of lifelong learning, schools having autonomy and responsibility, high-quality teacher education, formative evaluation, and support for children with learning difficulties. Rather than being economically driven, Finland's curriculum aims to prepare learners for the future, fostering students' self-confidence, while it has a strong emphasis on participative approaches and communal methods of studying, with students making connections between the subject they learn and the knowledge they need for their own lives and futures. Although several non-technological innovation factors contribute to the success of the Finnish education system, DOL is also a primary ingredient to support, for example, the personalisation of teaching and learning methods. Today, almost half of Finnish 16-year-olds, when they leave compulsory education, have had some sort of special education, personalised help, or individual guidance during their time in school (Sahlberg, 2014).

2.1 Policy developments in the European Union

Since 2006, digital competence has been one of the eight key competences for lifelong learning²⁷ for EU citizens. In January 2018, a set of recommendations for improving digital competence was published²⁸, extending its definition to cover coding and cybersecurity. These recommendations also introduce the concept of digital citizenship, drawing attention to the vulnerability of personal data and cybersecurity threats. They also cover media literacy and related risks, such as fake news, cyberbullying and radicalisation, against which awareness-raising and mitigation actions are necessary.

In 2010, the Europe 2020 strategy²⁹ defined the EU agenda for creating the conditions to enable smart, sustainable and inclusive growth. Since May 2015, the Digital Single Market strategy³⁰ has been one of the political priorities and drivers of the Europe 2020 strategy, aiming to create growth, boost productivity and promote innovation, advocating an EU-wide digital economic transformation³¹.

The EU vision on the use of digital technologies in education and training is expressed in the following communications of the European Commission:

- *Rethinking Education: investing in skills for better socio-economic outcomes (2012)*³²: This links the need for a 'world-class VET system' and the opportunity offered by the use of ICT;
- *Opening up Education: innovative teaching and learning for all through new technologies and open educational resources (2013)*³³: This identifies technology and open educational resources as opportunities to reshape EU education. It underscores the importance of developing self-

²⁷ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006H0962>

²⁸ <https://ec.europa.eu/education/sites/education/files/recommendation-key-competences-lifelong-learning.pdf>

²⁹ <http://eur-lex.europa.eu/legal-content/IT/ALL/?uri=CELEX:52010DC2020>

³⁰ <https://ec.europa.eu/digital-single-market/en/digital-single-market>

³¹ Eurobarometer survey 2017, 'Attitudes towards the impact of digitisation and automation on daily life', <https://ec.europa.eu/digital-single-market/en/news/attitudes-towards-impact-digitisation-and-automation-daily-life>

³² <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2012:0669:FIN>

³³ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013DC0654>

assessment tools for learners, teachers and educational organisations and it calls for actions at EU and national level to improve education systems' capacity to:

- help learning institutions, teachers and learners acquire digital skills and learning methods;
- support the development and availability of open educational resources;
- connect classrooms to the Internet and deploy digital devices and content.

In line with the above communications, the education and training strategy for the period 2010–20³⁴ (ET 2020) promotes initiatives to achieve the economic, social and educational goals requested by the Europe 2020 strategy, setting 'open and innovative education and training, including fully embracing the digital era' as one of its six priorities for education and training.

Since 2014, as part of the ET 2020 strategy, the European Commission's working group on Digital and Online Learning (DOL, 2014–15) and the subsequent working group on Digital Skills and Competence (DSC, 2016–18) have been responsible for supporting policy actions aimed at the digital innovation of education in the EU, contributing to the development of the following tools:

- European reference frameworks and related tools to support the development of DSC for citizens (DigComp³⁵ 2.1), teachers (DigCompEdu³⁶) and educational organisations (DigCompOrg³⁷);
- models for educational providers to produce and include digital content, including open educational resources for massive open online courses (MOOCs);
- models for educational providers to provide quality assured open and digitally-innovative learning environments;

As a formal member of both working groups, the ETF has contributed to the thematic discussions and supported the involvement of candidate countries.

Focusing on VET, EU cooperation was explicitly referred in Article 128 of the Treaty of Rome in 1957³⁸, and, subsequently, mentioned in the Treaty of Lisbon which calls for the Union to implement 'a vocational training policy'³⁹. Since 2002, this policy has evolved under the framework of the Copenhagen Process, being further enhanced by the 2010 Bruges Communiqué. The latter policy frameworks also refer to digital literacy and the use of information and communication technologies (ICT) in education as a means 'to maximise access to training and to promote active learning, as well as to develop new methods in both work- and school-based VET'⁴⁰. Specifically for candidate countries, in 2015 the Riga Conclusions⁴¹ defined five medium-term deliverables for the period 2015–20, including to 'further strengthen key competences in VET curricula and provide more effective

³⁴ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM:ef0016>

³⁵ <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use>

³⁶ <https://ec.europa.eu/jrc/en/digcompedu>

³⁷ <https://ec.europa.eu/jrc/en/digcomporg/framework>

³⁸ Treaty of Rome setting-up the European Economic Community in 1957, Article 128: 'The Council shall, acting on a proposal from the Commission and after consulting the Economic and Social Committee, *lay down general principles for implementing a common vocational training policy* capable of contributing to the harmonious development both of the national economies and of the common market.'

³⁹ Treaty on the Functioning of the European Union, Article 166: 'The *Union shall implement a vocational training policy* which shall support and supplement the action of the Member States, while fully respecting the responsibility of the Member States for the content and organisation of vocational training.'

⁴⁰ http://europa.eu/rapid/press-release_IP-10-1673_en.htm, p. 14

⁴¹ Built on the achievements of the Copenhagen Declaration (2002) and reaffirmed in the Communiqués of Maastricht (2004), Helsinki (2006), Bordeaux (2008) and Bruges (2010), http://ec.europa.eu/dgs/education_culture/repository/education/policy/vocational-policy/doc/2015-riga-conclusions_en.pdf

opportunities to acquire or develop those skills through IVET and CVET’, thus covering digital competence.

In June 2016, the New Skills Agenda for Europe⁴² reaffirmed the need for digital skills, and in particular for ‘digitally smart people’, who are not only able to operate digital technologies, but can also innovate and provide leadership in terms of their use. Among other initiatives, the new skills agenda launched the Digital Skills and Jobs Coalition⁴³ to mobilise companies, not-for profit organisations, educational providers, social partners and Member States in Europe to work together to tackle the lack of digital skills in Europe. The Coalition also encourages Member States to develop national digital skills strategies aimed at training more digital experts and offering more reskilling and upskilling solutions to the labour force and citizens in general. After its launch early in 2017, 18 National Coalitions were established, with a total of 300 members, and activities have been implemented which have involved more than 7 million EU citizens⁴⁴.

In July 2017, the European Commission also launched the multilingual database, ‘European Classification of Skills, Competences, Occupations and Qualifications’⁴⁵ to support the dialogue between European employment services (EURES) and the education sector, and as a reference for job-specific skills, job search and job matching algorithms.

In October 2017, the European Council called for EU Member States’ training and education systems to be ‘fit for the digital age’⁴⁶.

In November 2017, at the Gothenburg Summit, the European Parliament, the Council and the Commission announced the European Pillar of Social Rights, which reaffirmed the right to high-quality and inclusive education, training and life-long learning. In relation to this, the Communication ‘Strengthening European Identity through Education and Culture’⁴⁷ sets out a vision for a European Education Area and announced a dedicated Digital Education Action Plan for the period 2018–20. As a result, in January 2018, the European Commission launched a new Digital Education Action Plan⁴⁸, covering three priorities: (i) making better use of digital technology for teaching and learning; (ii) developing relevant digital competences and skills for the digital transformation; and (iii) improving education through better data analysis and foresight. The plan sets out 11 actions, including one that intends to scale up the self-reflection tool SELFIE for the use of one million teachers, trainers and learners in the EU and the Western Balkans⁴⁹. The new European Commission’s working group DELTA (Digital Education Learning, Teaching and Assessment 2018–20) will start in September 2018 and will play a key role in the implementation of the new digital education action plan.

⁴² <http://ec.europa.eu/social/main.jsp?catId=1223>

⁴³ <https://ec.europa.eu/digital-single-market/en/news/digital-skills-and-jobs-coalition-nutshell>

⁴⁴ ETF, Francaea Crestani’s mission report, ‘Digital Skills and Jobs Coalition’ Annual Conference, 7 December 2017 (internal document)

⁴⁵ <https://ec.europa.eu/esco/portal/home>

⁴⁶ EUCO 14/17: European Council conclusions of 19 October 2017, www.consilium.europa.eu/media/21620/19-euco-final-conclusions-en.pdf.

⁴⁷ COM(2017) 673: Strengthening European Identity through Education and Culture https://ec.europa.eu/commission/sites/beta-political/files/communication-strengthening-european-identity-education-culture_en.pdf

⁴⁸ <https://ec.europa.eu/education/sites/education/files/digital-education-action-plan.pdf>

⁴⁹ https://ec.europa.eu/education/initiatives/european-education-area/digital-education-action-plan_en

It is worth noticing that DSC and DOL are also increasingly the subject of European neighbourhood and enlargement policy initiatives to sustain the digital economy in the EU's neighbouring countries and to aid their accession to the Digital Single Market (DSM). For example, as part of the Eastern Partnership platform, the 'EU4Digital network' involves Armenia, Azerbaijan, Georgia, Moldova, Ukraine and Belarus, and aims to develop national digital skills strategies and sustain the creation of national coalitions on DSC⁵⁰. Similarly, the European Commission's Communication on 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans'⁵¹ (February 2018) called on the EU's Enlargement Policy to further support the digital agenda in the region.

KEY INITIATIVES RELEVANT TO DSC AND DOL POLICIES LAUNCHED BY THE EUROPEAN COMMISSION IN JANUARY 2018 TO HELP BUILD INCLUSIVE, COHESIVE SOCIETIES

Key Competences for Lifelong Learning

- Proposal for a Recommendation on Key Competences for Lifelong Learning
- Annex to the Proposal for a Recommendation on Key Competences for Lifelong Learning
- Commission Staff Working Document on Key Competences for Lifelong Learning
- Factsheet on Key Competences for Lifelong Learning

Digital Education

- Digital Education Action Plan
- Commission Staff Working Document on the Digital Education Action Plan
- Factsheet on the Digital Education Action Plan

Common Values, Inclusive Education, and the European Dimension of Teaching

- Proposal for a Council Recommendation on Promoting Common Values, Inclusive Education, and the European Dimension of Teaching
- Commission Staff Working Document on Promoting Common Values, Inclusive Education, and the European Dimension of Teaching
- Factsheet on Promoting Common Values, Inclusive Education, and the European Dimension of Teaching
- European Commission Press Release: New Measures to Boost Key Competences and Digital Skills, as well as the European Dimension of Education

Source: http://ec.europa.eu/education/news/european-commission-adopts-key-education-initiatives-for-inclusive-cohesive-societies_en

2.2 Policies from international organisations

The ETF works with several international and national (non-)governmental organisations that provide policy advice, research and analysis, as well as technical assistance in policy development and the implementation of education, training and labour market systems in partner countries, increasingly focusing on digital technologies in education and training, and the development of digital skills and competence. These organisations include UNESCO, the OECD, the World Bank, national

⁵⁰ http://collections.internetmemory.org/haeu/20160313172652/http://eeas.europa.eu/eastern/platforms/docs/hdm-action-plan-2016-2017_en.pdf

⁵¹ https://ec.europa.eu/commission/sites/beta-political/files/six-flagship-initiatives-support-transformation-western-balkans_en.pdf

organisations for international cooperation (e.g. GIZ⁵², AICS⁵³, CFI⁵⁴, BS⁵⁵), and third sector bodies (e.g. NGOs).

- **The United Nations Organisation for Education, Science and Culture (UNESCO)**⁵⁶

In 2012 UNESCO, in the Paris Declaration⁵⁷, provided a de facto internationally accepted definition of open educational resources (OERs). This marked a historic moment in the growing movement for OERs, calling on governments worldwide to formulate policy initiatives geared towards openly licensing publicly funded educational materials, and undertaking the development of massive open online courses (MOOCs) and online platforms.

In 2016 UNESCO developed a new strategy for technical and vocational education and training (TVET) 2016–21⁵⁸, where digital skills and digital technologies are indicated as means to support the transition to green economies and sustainable societies. Finally, in relation to digital literacy, the UNESCO Institute of Statistics commissioned the University of Hong Kong to develop a global reference framework on digital literacy skills⁵⁹ to support Sustainable Development Goal 4, 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' by 2030⁶⁰.

- **The Organisation for Economic Cooperation and Development (OECD)**⁶¹

The OECD is an authoritative source of information on the state of education, policies and practices, around the world, including international analysis on the impact of ICT⁶² policy on education. For example, based on results from PISA 2012, the OECD analysed the use of ICT in relation to students' socio-economic status, gender and geographic location (OECD, 2015). The report highlights that in general no appreciable improvements in students' achievement in reading, mathematics or science have been traced in OECD countries that invest heavily in ICT for education. In addition, the report considers technology of little help in bridging the digital divide between advantaged and disadvantaged students. According to the OECD, students with a difficult socio-economic background easily slip into a 'bad use' of ICT (e.g. using it only for games and social media). Research and practice suggest that cognitive processes, pedagogy and computer science need to be better connected in order for DOL to have a more positive impact on students' achievement.

- **The World Bank**⁶³

The World Bank is a worldwide actor operating in many ETF partner countries, exploring issues related to the use of digital technologies to improve education and training in developing countries. While fighting extreme poverty and promoting shared prosperity in these countries, the World Bank believes that using digital technologies in education, and in particular the Internet,

⁵² Deutsche Gesellschaft für Internationale Zusammenarbeit, www.giz.de/en/html/about_giz.html

⁵³ Italian Agency for Cooperation and Development, www.aics.gov.it/

⁵⁴ L'agence française de coopération medias, www.cfi.fr/en

⁵⁵ The British Council, www.britishcouncil.org/organisation

⁵⁶ The United Nations Organisation for Education, Science and Culture (UNESCO) www.unesco.org/new/en/unesco/about-us/

⁵⁷ www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/what-is-the-paris-oe-declaration/

⁵⁸ <http://unesdoc.unesco.org/images/0024/002452/245239e.pdf>

⁵⁹ <http://gaml.cite.hku.hk/>

⁶⁰ <https://unstats.un.org/sdgs/metadata/>

⁶¹ Organisation for Economic Cooperation and Development (OECD), www.oecd.org/about/

⁶² In this paper referred to as DOL.

⁶³ The World Bank, www.worldbank.org/en/about

can support improvements in learning outcomes at a modest cost, where, for example, teacher training is unlikely see rapid improvement (Kelly et al., 2017).

- **National (non-)governmental development cooperation organisations**

Several national organisation for international cooperation in the EU are also active in ETF partner countries in the area of DSC and DOL policy for education and training. For example, in the Western Balkans the British Council has developed a 'strategic framework' for narrowing the digital divide in the region, proposing an active collaboration between governments, IT companies and education institutions to champion the role of young people's digital skills in the economic transformation of the region.

The so-called third sector (NGOs) is also increasingly active in the field of policy on digital skills and technologies in education in VET. For example, in 2015, the Swiss Agency for Development and Cooperation, in collaboration with the Government of Albania, developed the 'Skills for Jobs' report⁶⁴ that includes data and information regarding progress in the use of digital technologies in VET in Albania.

⁶⁴ <http://idmalbania.org/wp-content/uploads/2016/05/JobSkills-EN-web.pdf>

3. DIGITAL SKILLS AND COMPETENCE

Research and practice suggest different definitions and classifications of digital skills and competence (DSC). An emerging classification in the EU identifies three main categories of DSC for learners/citizens.

- **Digital competence:** also referred to as digital literacy, encompasses a set of basic digital skills, covering information and data literacy, online communication and collaboration, digital content creation, safety and problem solving⁶⁵. Digital competence⁶⁶ is about the ability to apply those digital skills (knowledge and attitude) in a confident, critical and responsible way in a defined context (e.g. education). Since 2006, digital competence is one of the eight key competences in the EU for lifelong learning.
- **Job-specific digital skills:** a set of specific digital skills for those involved in jobs including the use and maintenance of digital tools such as 3D printers, CAD software and robots.
- **Digital skills for ICT professionals:** a set of advanced, highly specialised, digital skills for those involved in the ICT occupations, for example programmers and cyber security experts who are expected not only to use but also challenge and innovate existing information and communication technologies and create new solutions.

3.1 European frameworks for digital skills and competence

As part of the ET 2020 strategy, and on behalf of the Directorate-General for Education, Youth, Sport and Culture, the Joint Research Centre (JRC) developed two reference frameworks to support a coherent conceptualisation and development of DSC among EU Member States.

TABLE 3.1 EUROPEAN FRAMEWORKS FOR DSC FOR LEARNERS, TEACHERS AND EDUCATIONAL ORGANISATIONS

EU framework and tools	Target group	What
Digital Competence Framework for Citizens (DigComp 2.1) Self-assessment tool and guidelines under development with the JRC	All citizens	<ul style="list-style-type: none"> ■ Conceptualisation of digital competence for citizens with respect to lifelong learning (21 competences grouped in 5 areas); ■ Progression model based on 8 proficiency levels
Digital Competence Framework for Educators (DigCompEdu) Self-assessment tool and guidelines under development with the JRC	Teachers and trainers	<ul style="list-style-type: none"> ■ Conceptualisation of digital competence for educators (22 competences grouped in 6 areas) ■ Progression model based on 6 proficiency levels

For both frameworks, each competence has a descriptor, with examples of activities and digital technologies; it also include a series of proficiency levels (six for educators and eight for citizens) that can be used to design individual progression models; not everyone should target the highest level of proficiency, perhaps not even for one competence, and certainly not for all. For example, depending on the role, subject, education level, etc., a teacher could self-evaluate their own strengths and

⁶⁵ For example, using computers and mobile computing devices to retrieve, assess, store, produce, present and exchange information; communicating and participating in collaborative virtual networks; the confident and critical use of social media and the Internet in general.

⁶⁶ Competence is formally defined by Cedefop as the ‘ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development’ (p. 20), www.cedefop.europa.eu/it/publications-and-resources/publications/4117

weaknesses, target the most relevant competence(s), suitable proficiency level(s) and register for the relevant professional development initiatives.

Digital Competence Framework for Citizens

Building on the definition of DSC as a key competence for lifelong learning (December 2006) and the progress made by previous international and national initiatives, the JRC published the first version of DigComp in 2013. In May 2017, the DigComp 2.1 (the current version) expanded the initial three-proficiency level to a more fine-grained eight-proficiency level.

DigComp clusters basic DSC into five competence areas, including 21 competences evaluated over eight proficiency levels, described in terms of learning outcomes and including examples of use.

TABLE 3.2 DIGCOMP COMPETENCE AREAS

Digital competence area	Description
1. Information and data literacy	To articulate information needs. To search for and access data, information and content in digital environments, and to navigate between them. To create and update personal search strategies
2. Communication and collaboration	To interact through a variety of digital technologies and to understand the appropriate digital communication means for a given context.
3. Digital content creation	To create and edit digital content in different formats, to express oneself through digital means.
4. Safety	To protect devices and digital content, and to understand risks and threats present in digital environments. To know about safety and security measures and to have due regard for reliability and privacy.
5. Problem solving	To identify technical problems when operating devices and using digital environments, and to solve them (from troubleshooting to solving more complex problems).

Source: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use>

DigComp enjoys broad recognition⁶⁷ and acceptance across Europe and beyond. It provides a vision for DSC as part of a ‘common curriculum’ that includes and connects with other transversal and more complex skills such as ‘problem solving’. In 2018 the JRC published also a guide including a broad range of existing practices and challenges with the use of DigComp in all forms of education that could inspire and support our partner countries in the adoption of DigComp as a reference to develop DSC of citizens⁶⁸.

Digital Competence Framework for Educators

Today, teachers and trainers are asked to support a shift from teaching to learning, create digital resources including open educational resources, use digital technologies for professional development and themselves play new roles in relation to these changes.

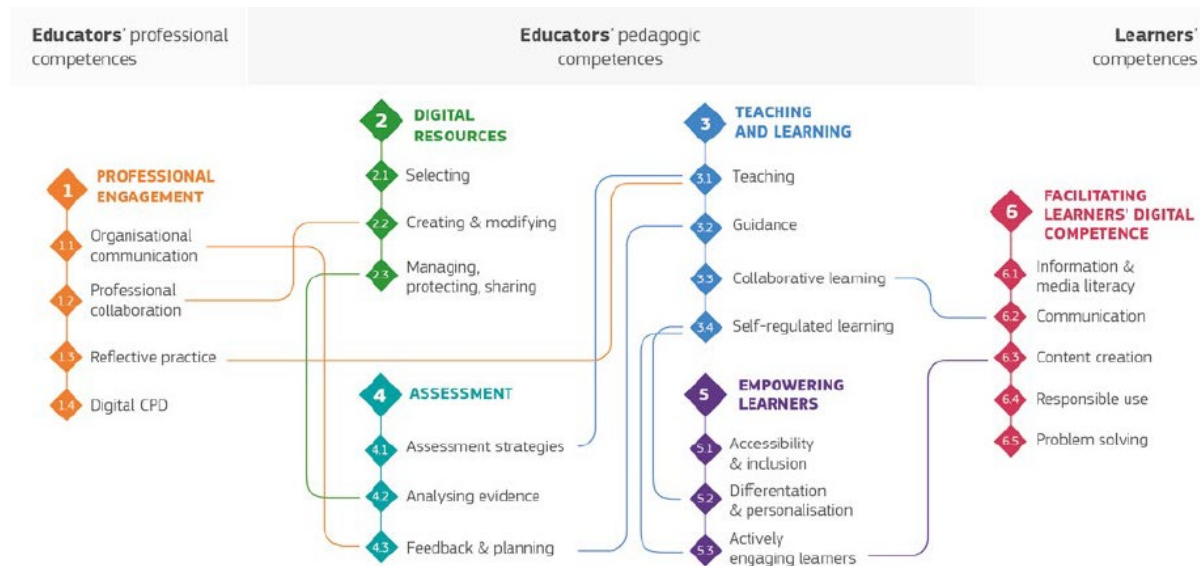
In 2017, The JRC delivered the first European Framework for the Digital Competence of Educators (DigCompEdu)⁶⁹ as shown below.

⁶⁷ The Annex 1 lists the main use of DigComp in the EU, <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-action-get-inspired-make-it-happen-user-guide-european-digital-competence-framework>

⁶⁸ <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-action-get-inspired-make-it-happen-user-guide-european-digital-competence-framework>

⁶⁹ <https://ec.europa.eu/jrc/en/digcompedu>

FIGURE 3.1 EUROPEAN FRAMEWORK FOR THE DIGITAL COMPETENCE OF EDUCATORS



Source: https://ec.europa.eu/jrc/sites/jrcsh/files/digcompedu_overview_-_english.pdf

The DigCompEdu Framework aims to capture and describe educator-specific digital competences by identifying 22 competences organised in six areas, including a six-level (A1... C1) progression model to help educators assess and develop their digital competence.

3.2 European Computer Driving Licence

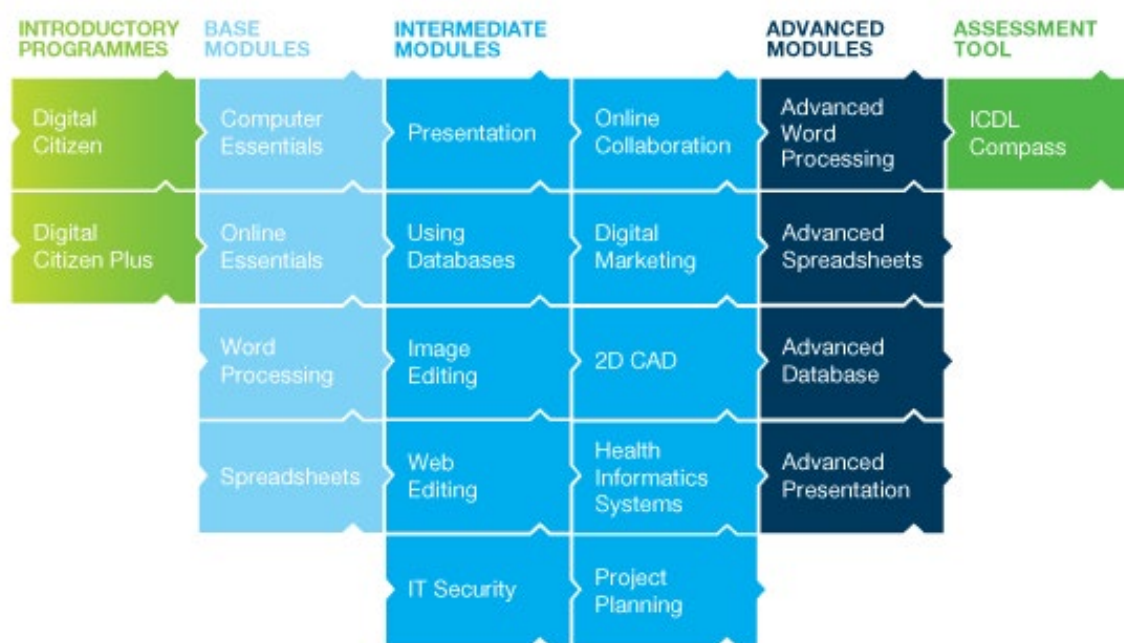
From the perspective of establishing common reference frameworks for DSC, the European Computer Driving Licence (ECDL)⁷⁰ is one of the first and is still one of the most successful global initiatives.

In 1995, the Council of European Professional Informatics Societies created a task force to examine how to raise the levels of digital literacy throughout Europe, and the new certification process was launched as the ECDL in Sweden in August 1996. By the end of the decade the number of candidates in Europe exceeded one million and its success attracted interest from all over the world, with it subsequently becoming known as the International Computer Driving Licence (ICDL). A milestone was reached in 1999 when UNESCO, through its Cairo office, signed an agreement with the ECDL Foundation to become the national operator for several Arab States. Shortly afterwards, the IC DL was launched in the North American and Asian markets.

Currently, the ECDL is the world's leading computer skills certification process, offering flexible programmes that including basic, intermediate and advanced modules, relevant for many VET occupations.

⁷⁰ <http://ecd.org/>

FIGURE 3.2 ECDL PROGRAMMES AND MODULES



Source: <http://ecdl.org/>

To date, more than 14 million people have engaged with the ECDL programme through a network of over 24 000 ECDL accredited test centres in over 100 countries, including several partner countries⁷¹. For example, in Montenegro an EU project⁷² established the ECDL standard level as a reference for basic digital skills and competence for all teachers, and the ECDL advanced level as a reference for ICT teachers.

⁷¹ <http://ecdl.org/about-ecd> |

⁷² www.ecdlfor.me/

There is a substantial overlap between DigComp and ECDL modules, contributing to the development of the same DSC areas.

FIGURE 3.3 MAPPING ECDL WITH DIGCOMP DIGITAL COMPETENCES

DigComp Area	DigComp Competences	ECDL Modules
Information and Data Literacy	Browsing, searching and filtering data, information and digital content Evaluating data, information and digital content Managing data, information and digital content	Computer Essentials Information Literacy
Communication and Collaboration	Interacting through digital technologies Sharing through digital technologies Engaging in citizenship through digital technologies Collaborating through digital technologies Netiquette Managing digital identity	Online Essentials Online Collaboration ICT in Education
Digital Content Creation	Developing digital content Integrating and re-elaborating digital content Copyright and licences Programming	Word Processing Spreadsheets Presentation Using Databases Advanced Word Processing Advanced Spreadsheets Web Editing Image Editing Project Planning 2D CAD Advanced Database Advanced Presentation
Safety	Protecting devices Protecting personal data and privacy Protecting health and well-being Protecting the environment	IT Security
Problem Solving	Solving technical problems Identifying needs and technological responses Creatively using digital technologies Identifying digital competence gaps	Computing ICT Troubleshooting* <small>* Coming in 2017</small>

Source: <http://ecd1.org/policy-publications/ecd1-and-digcomp>

4. DIGITAL AND ONLINE LEARNING

Among policy makers and practitioners, there is a broad recognition that the use of ICT in education can improve both the internal efficiency, and the external economic and social efficiency of education and training. The ubiquity of digital devices and the Internet offers new opportunities to apply personalised teaching and learning strategies based on a student-centred approach.

At the same time, research and practice show a widespread and fundamental lack of clarity about the use of ICT in education – in terms of its concept, definition, purpose, implementation and prerequisites. For example, there is uncertainty over the extent to which students' engagement with technology may harm their involvement with school or feelings of belonging.

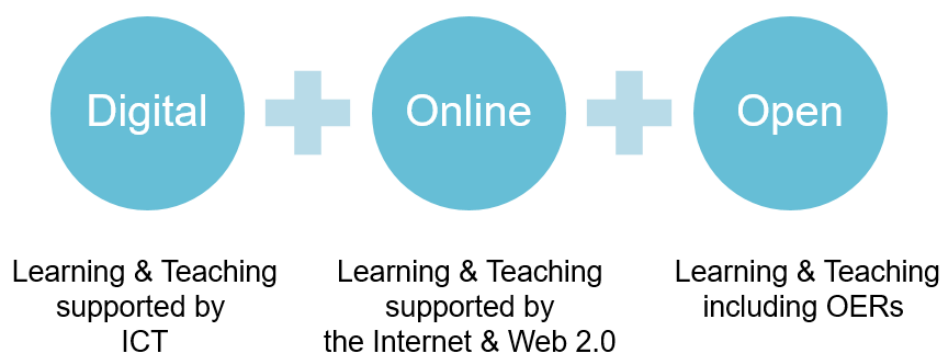
Research and literature often use the term *e-learning* when referring to the use of ICT in education. This is defined by Cedefop as 'Learning supported by information and communication technologies (ICT)'⁷³.

In 2014, within the ET 2020 framework, the European Commission introduced the broader term 'digital and online learning' (DOL) to emphasise the two main components of today's 'e-learning'.

- **Digital learning:** a form of teaching and learning supported by ICT. It encompasses multiple formats and hybrid methods, including the use of software installed locally;
- **Online learning:** today's prevalent form of distance learning (Demiray and İşman, 2001), imparted mainly via the Internet, incorporating social media and web 2.0 services for a collaborative and personalised learning experience, anywhere and at any time via desktop and mobile computing devices. It can also involve the use of Open educational resources.

In this paper 'digital and online learning' (DOL), 'e-learning' and 'digital learning' are considered synonyms.

FIGURE 4.1 DIGITAL AND ONLINE LEARNING



Source: Brolpito, A., ETF, Presentation at ETF Webinar, 18 November 2015.

4.1 Digital and online learning for innovation of pedagogy in education and training

Classically, the word pedagogy refers to a process of 'leading out' – whereby a teacher guides and leads a learner to new knowledge and skills – as distinct from one that is 'pushing in' knowledge and competencies. However, pedagogy remains in most cases, characterised by standardisation,

⁷³ www.cedefop.europa.eu/en/publications-and-resources/publications/4064

discipline, conformity and a rigid scheduling of the learners' time in accordance with the subject disciplines that make up a curriculum. In this model, students have to be in the same room at the same time using a common approach and strategy.

Researchers and pathfinders in education are constantly exploring new forms of teaching, learning and assessment that can help improve learners' proficiency. DOL seems to be a step change in innovating and individualising pedagogy for learners, including those with disabilities, and in providing solutions for an education journey that starts at birth and is expected to last a lifetime.

By using DOL, teachers and learners can also develop their DSC and their soft skills⁷⁴ through participatory learning methodologies based on connectivist and constructivist learning theory⁷⁵. When effectively integrated, DOL can provide students, teachers and trainers with engaging opportunities to find and utilise multimedia information, and to apply academic and vocational skills to solving real-work problems/situations that could be connected, simulated, or expressed as virtual reality in schools.

The Open University – a veteran of distance learning – in its fifth report, *Innovating pedagogy*⁷⁶, proposes 10 new forms of teaching, learning and assessment in which DOL is clearly an enabler and mainstreamer.

Teachers' awareness of and interest in the potential of a pedagogical use of ICT (DOL) is on the rise. The European Schoolnet's survey of the use of ICT in European Schools reported that Europe's teachers have high aspirations to improve their own understanding of ICT, and that the majority of European teachers engage in personal learning related to ICT (European Schoolnet, 2013). Further, the survey shows that the teachers who are more confident about ICT make greater use of it in teaching and learning, even in those schools that are poorly equipped. Similar trends appeared in a recent ETF survey on continuing professional development in VET in the Western Balkans and Turkey, where ICT skills for teaching was reported as one of the most common professional development activities⁷⁷.

DOL also introduces new challenges and risks⁷⁸. For example, a challenge for DOL as a form of distance learning relates to identity, namely who is actually performing, for example, an online course assessment⁷⁹. Fingerprint technologies and face or retina recognition software are increasingly used in education, but this is still at an early stage and with a limited regulation.

A change in the direction of establishing a digitally innovative pedagogy that is both sustainable and scalable requires strong 'analogical' components. Firstly, it requires 'digitally competent and ready' educational organisations that are able to provide, for example, an adequate ICT infrastructure and a leadership that allows the use of, and experimentation with, DOL. Secondly, it needs digitally competent teachers and trainers who are confident users of digital tools, such as smartboards, and know how to implement group work, personalise learning and blend traditional and innovative pedagogy through DOL.

Last but not least, digitally innovative pedagogy requires that education policy and institutions create an enabling context in which DOL is for everyone, and where it can flourish by ensuring system-wide

⁷⁴ Problem-solving, critical thinking, teamwork, creativity

⁷⁵ <http://er.dut.ac.za/handle/123456789/69>

⁷⁶ www.open.ac.uk/blogs/innovating/

⁷⁷ ETF internal document

⁷⁸ Data privacy/protection, cyber bullying, harassment, disturbing online content

⁷⁹ Are learners performing the assigned work? Are they who they say they are? Are they gaining any undue advantage?

good governance and oversight of quality, while promoting the necessary education reforms and investments.

Finally, it is worth recalling that DOL is an opportunity to develop, and not a precondition for, innovative pedagogy. For example, although Finland has defined access to the Internet at broadband speeds as a legal right and pursues a universal access policy, it does not show a particularly high use of technology in the classroom, although its education system is famous for being innovative and a top performer (Sahlberg, 2014).

TECHNOLOGY IN THE CLASSROOM: SAVIOUR OR BUST?

'We won't see a big payoff from technology unless we make big investments in teacher quality, change our standards for student performance, make the right sort of investments in curriculum development, change the way we do testing and examinations, and integrate all this with the right sort of investments in technology. This is a systems problem and it won't be solved until we get the system right.'

Mark Tucker, www.ncee.org/2015/09/tuckers-lens-technology-in-the-classroom-savior-or-bust/

4.2 EU Framework for Digitally Competent Educational Organisations (DigCompOrg)

At the EU level, as part of the ET 2020 strategy, in 2015 the Joint Research Centre, in collaboration with the European Commission's working groups on DOL (2014–15) and DSC (2016–18), has developed a framework for Digitally Competent Educational Organisations (DigCompOrg)⁸⁰. Based on existing national and international frameworks, DigCompOrg provides a comprehensive and generic reference framework that reflects on key aspects of the process of systematically integrating digital learning into educational organisations⁸¹.

TABLE 4.1 EUROPEAN FRAMEWORKS FOR DIGITALLY COMPETENT ORGANISATIONS

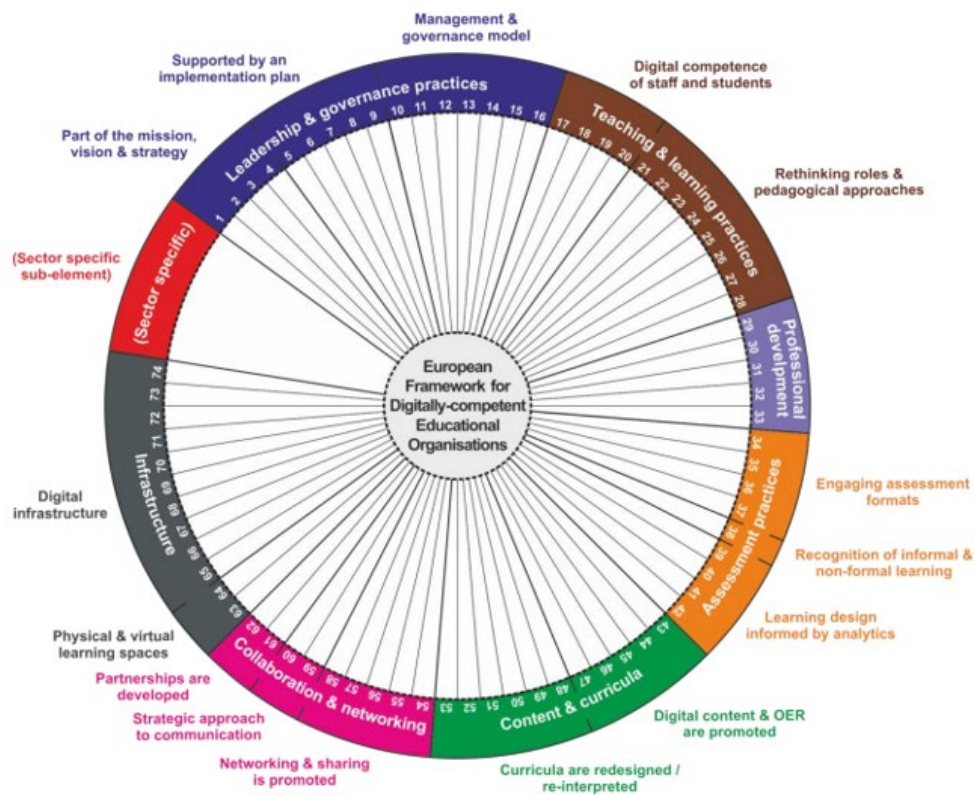
EU framework and tools	Target	What
Digital Competence Framework for educational organisations (DigCompOrg) Self-reflection tool SELFIE	Educational organisations	<ul style="list-style-type: none"> ■ Conceptualisation of digitally competent organisations (DigCompOrg – 74 descriptors grouped in 7 areas) ■ Self-reflection tool SELFIE

DigCompOrg is based on seven cross-cutting elements, including 15 sub-elements based on 74 descriptors. It also includes an 'undefined' thematic area that could be used to define sub-elements and related descriptors to fit a specific educational sector.

⁸⁰ <https://ec.europa.eu/jrc/en/digcomporg/framework>

⁸¹ DigCompOrg is not intended to address the full range of administrative and management information systems that may be in use within the organisation.

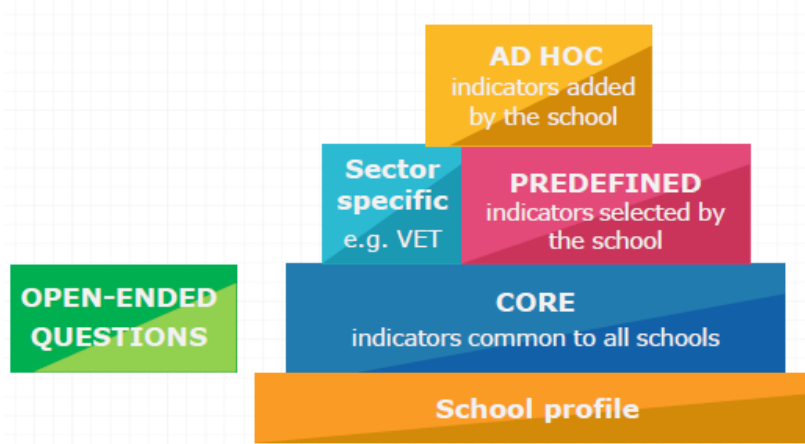
FIGURE 4.2 DIGCOMPORG



Source: <https://ec.europa.eu/jrc/en/digcomporg/framework>

The related self-reflection tool SELFIE⁸² includes some 30 items covering all the cross-cutting elements in DigCompOrg. It is formulated as a series of distinct questions for teachers, school leaders and students to collect evidence on the availability and use of digital technologies in teaching and learning.

FIGURE 4.3 SELFIE'S ORGANISATION AND ITEMS



Source: European Commission's website, https://ec.europa.eu/education/news/20171002-selfie-schools-making-most-digital-technologies_en

⁸² <http://selfie.jrc.ec.europa.eu>

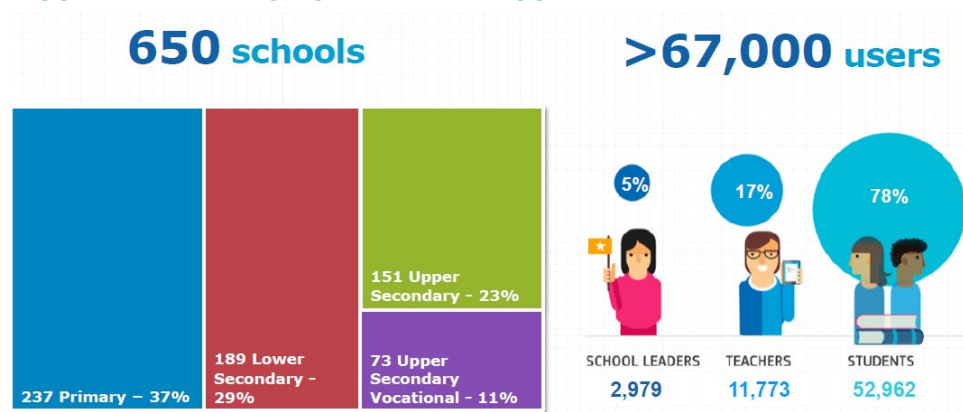
Questions for school leaders focus mainly on strategies/policies at school level related to the use of digital technologies. The questions for teachers are intended to mainly capture teaching practices, while those for students are to primarily identify experiences and learning practices related to the use of digital technologies. This reflects the fact that a digitally competent educational organisation relies on both organisational factors (such as leadership and infrastructure) and the practices of teachers and trainers.

As a result, SELFIE allows a school to take a snapshot of its status in terms of using digital technologies (DOL). Answers are anonymous and gathered in a school report that includes statistics and charts, indicating strengths, weaknesses and areas for improvement. SELFIE's outcomes are intended to foster a dialogue and reflective process within the school, among school leaders, teachers and students, around potential areas for improvement, while deepening a collective engagement by looking at both organisational factors (e.g. infrastructure and governance) and individual responsibilities (e.g. teaching and learning practices).

At a higher level, aggregated SELFIE outcomes could foster education policy dialogue⁸³.

In 2017, SELFIE was piloted in 650 schools in 14 countries, including Serbia, Georgia and Russia (UNESCO schools only), involving more than 67 000 users (school leaders, teachers and students).

FIGURE 4.4 THE PILOT OF SELFIE IN FIGURES



Source: Kamylylis, P., JRC, presentation at the workshop on SELFIE in Seville, January 2018.

SELFIE will be launched in the second half of 2018. It will be made available to schools across Europe and in the Western Balkan and Turkey region, in all EU languages, through a website that will incorporate a mentoring scheme to help schools improve their use of technology in education and training, including tools to support peer-to-peer exchanges.

4.3 Emerging trends

Nowadays, innovations in pedagogy take into account principles such as:

- the shift from teaching to learning;
- a student-centred approach;
- the construction of the learning environment;
- active learning and learning strategies;
- self-organised and self-directed learning;

⁸³ https://ec.europa.eu/education/news/20171002-selfie-schools-making-most-digital-technologies_en

- an authentic situated learning environment;
- concepts of modelling (problem-oriented learning)
- interactive and collaborative learning;
- cross-cultural communication.

From a teaching perspective, the Internet and computers can, for example, help teachers and trainers to:

- select and present learning content;
- moderate and facilitate group working;
- support the implementation of learning strategies;
- assess and evaluate progress of learners;
- orient themselves in learning communities;

The next paragraphs provide some examples of how computers, the Internet and, in general, DOL can implement innovative pedagogies based on the above principles.

4.3.1 Open educational practices

A milestone on the path to open education was the adoption of the Cape Town Open Education Declaration in 2007, pointing to technologies that facilitate (i) collaborative and flexible learning, (ii) peer sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues, and (iii) new approaches to assessment, accreditation and collaborative learning⁸⁴.

The Paris Declaration and the European Commission's communication *Opening up Education* (2013)⁸⁵ assigned to open education practices a strategic role in the development and innovation of education and training in Europe and the rest of the World.

OPEN EDUCATIONAL RESOURCES

Open educational resources are any type of educational materials that are in the public domain or are introduced with an open licence. The nature of these open materials means that anyone can legally and freely copy, use, adapt and re-share them. They range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation.

UNESCO's Paris Declaration, www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/

UNESCO believes that universal access to high-quality education is key to the building of peace, sustainable social and economic development, and intercultural dialogue. Open educational resources provide a strategic opportunity to improve the quality of education as well as facilitate policy dialogue, knowledge sharing and capacity building.

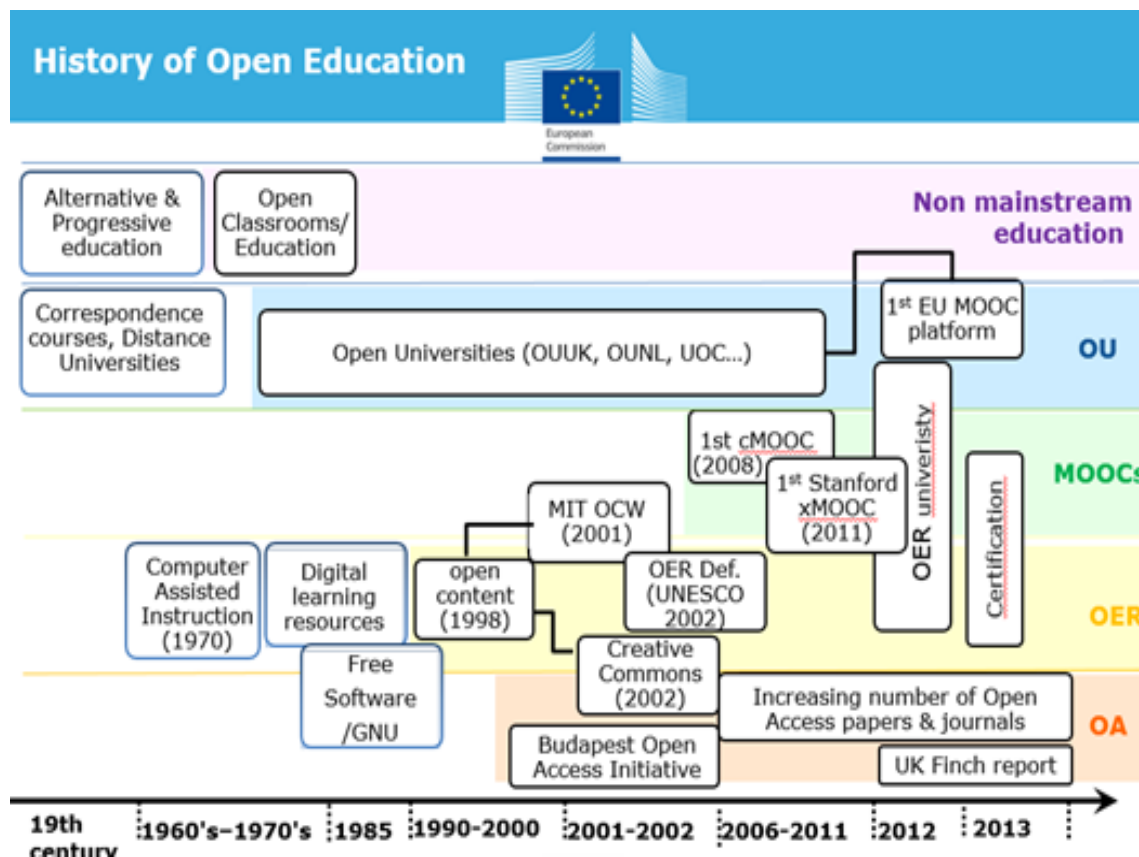
Since the rise of the open software movement, openness has become a key feature of our societies in many fields, such as science and innovation, and a key dimension of strategic foresight (Vincent-Lacrin, 2016). Today, the concept of open education already has a long record. Research and practice reveal that open education has its origin in higher education with the so-called open universities. Initially, open education was an off-line and paper-based as a form of distance education.

⁸⁴ Cape Town Open Education Declaration 2007, www.capetowndeclaration.org/

⁸⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013DC0654>

It progressively evolved towards online courses, such as MOOCs, across all education levels and types.

FIGURE 4.5 HISTORY OF OPEN EDUCATION



Source: JRC's slide presented at the European Commission's Working Group on Digital Skills and Competence in 2016.

Open educational resources

At the heart of DOL are the so-called open educational resources (OERs). Browsing the web, it is possible to find public repositories of OERs that anyone can access, use and modify for free, anywhere and anytime. At the school level, open educational practices can involve a group of teachers or students participating in the online peer creation of OERs or repurposing a set of existing OERs for a specific learning context.

Creative Commons⁸⁶ is a non-profit organisation that grants world-wide de facto commonly accepted standard copyright licences that mark digital resources as OERs (with a so-called open licence). Everyone from individual creators and large companies to governmental institutions can use Creative Commons to grant copyright permissions to their work, which can then be copied, distributed, edited, remixed and built upon, all within the boundaries of copyright law.

Massive open online courses – MOOCs

In addition to traditional course materials, such as readings and problem sets, many MOOCs provide interactive tools, for example forums and serious games, to support peer interactions among students and exchanges with teachers. In spite of the term 'open', MOOCs can be free or for-profit, with copyrighted, public or even open resources as part of the course materials. In addition, the 'massive'

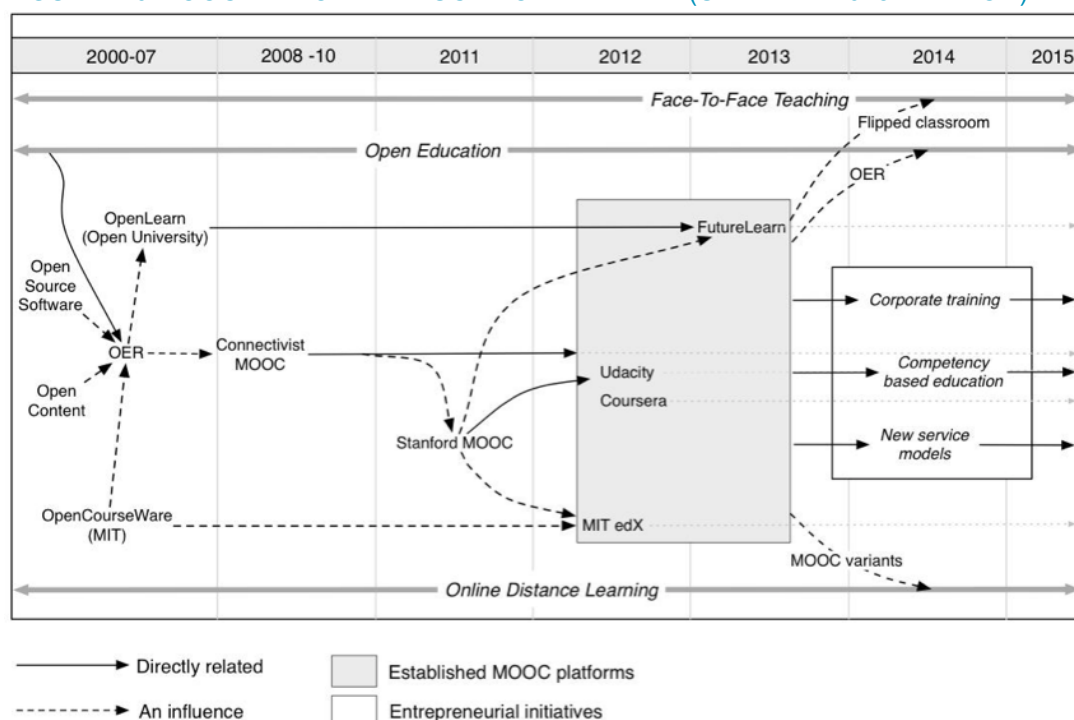
⁸⁶ <https://creativecommons.org/>

term could easily be questionable, as MOOCs increasingly come to be seen as for ‘small’ group of learners. For example, while the Stanford’s Artificial Intelligence MOOC in 2011 attracted more than 160 000 participants, today’s MOOCs may attract as few as 100 students. In any event, there is no right number, and this phenomenon is clearly influencing the level of interactions between learners and between learners and teachers. Currently, there are different variations within MOOCs. At the extremes there are:

- cMOOCs – characterised by peer learning and constructivism, where the materials are, for example, co-developed in projects by groups of learners (rather than being pre-selected), and feed further editions of the course (as a real open educational resource);
- xMOOCs – traditional online courses, truly massive and mainly based on individual learning, using pre-selected resources, with limited interactions (e.g. discussion fora), and standard self-test tools.

Today, the most distinguished MOOC platforms are still in the US, although relevant initiatives are increasingly emerging in Europe and Asia⁸⁷. The majority of MOOCs are powered by the open source learning management systems such as Moodle ⁸⁸and EdX⁸⁹, which are increasingly evolving to include quality standards and more sophisticated tools for implementing personalised learning experiences.

FIGURE 4.6 MOOC AND OPEN EDUCATION TIMELINE (UPDATED 2015 VERSION)



Source: https://en.wikipedia.org/wiki/Massive_open_online_course

⁸⁷ https://en.wikipedia.org/wiki/Massive_open_online_course

⁸⁸ <https://moodle.org/?lang=en>

⁸⁹ www.edx.org/

4.3.2 The flipped classroom

In 1993 Alison King in her article 'From Sage on the Stage to Guide on the Side' had already highlighted the importance of using class time for the construction of meaning rather than information transmission (King, 1993). In 1997, Harvard professor Eric Mazur further developed King's work, introducing the concept of peer relearning (Mazur, 1997). Finally, in 2000 Lage, Platt and Treglia introduced the concept of the flipped classroom in their paper 'Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment', while explaining the results of their research at college level (Lage et al., 2000).

Today, although a common international methodology for the flipped classroom does not yet exist, there is increasing interest in the use of this concept in education and training, as testified by research, practice and publications. World-wide, many teachers and trainers are experimenting with the core idea of flipping the traditional instructional approach, with instruction that used to occur in classroom being accessed at home, in advance of the class, through self-directed and collaborative web-based learning. For example, students at home could watch teacher-created videos, use various media for advancing concepts and engage in collaborative peer learning.

Wide availability, cost reductions and the simplification of video making and distribution are making the flipped classroom and, in general, digital pedagogy increasingly accessible and of interest in developing and transition countries.

4.3.3 Social media

Learning is increasingly occurring outside schools and social media can offer a range of learning opportunities through people accessing expert advice, encountering challenges, and defending their own opinions or amending them in the face of different ideas.

A recent research on the use of social media in VET courses in Australia highlights, for example, that students seem more willing to ask questions online than face-to-face although they seem to have little understanding of the privacy setting and other risks related to the use of social media⁹⁰, such as inaccurate information, fake news and biased comments.

In many partner countries teachers, trainers or even groups of students have created ad-hoc (open or closed) groups in Facebook to share experiences and make connections, linking these with teaching resources. For example in Montenegro, a recent piece of research on DOL in VET revealed that most vocational schools have created Facebook profiles, as this is the most convenient means of communicating with students⁹¹. As is typical in innovative digital pedagogies, educators on social media have multiple roles that differ from those found in the classroom (e.g. filtering resources and engaging and 'protecting' students).

YouTube, a video-sharing platform, can be used to share webinars, recorded lectures and presentations by industry experts. It can also be used by students to demonstrate, for example, the completion of an assignment.

Twitter can be a valuable world-wide source of information and intelligence. Students can use Twitter to improve their practice in the promotion of services or products related to their study or follow high-level experts.

⁹⁰ www.ncver.edu.au/publications/publications/all-publications/social-media-in-vet-courses-good-practice-guide#

⁹¹ [www.etf.europa.eu/webatt.nsf/0/50D44E906AAF770DC125822D004B107E/\\$file/Digital%20factsheet_M%E2%80%8Dontenegro.pdf](http://www.etf.europa.eu/webatt.nsf/0/50D44E906AAF770DC125822D004B107E/$file/Digital%20factsheet_M%E2%80%8Dontenegro.pdf)

Less used than Facebook and YouTube, Blogs can be used when, for example, students need to reflect on and share personal views of lessons or experiences in the workplace. A limit to its use is the need for higher levels of writing skills.

In conclusion, even though the honeymoon between social media and education is over, social media continue to offer a number of benefits for teaching and learning.

4.3.4 ePortfolios

The ePortfolio represents an extension of the portfolio concept for the digital age, and is a new pattern for timely, authentic, (vocationally) specific forms of formative assessment. The concept of a portfolio of work is familiar from the art and design sector, where, traditionally a visual artist has been able to demonstrate their skills, talents and creative flair through presenting a portfolio of work to a potential client or employer.

Nowadays, a vocational student, for example, can gather a collection of artefacts that is representative of his/her achievements, which could be in the form of photographs, videos, audio recordings or testimonials, together with the regular forms of assessment evidence such as transcripts. Since the ePortfolio is a 'live' resource it is constantly evolving and tutors are able to add comments on its content and development, enabling the ePortfolio to be both a formative and summative assessment tool.

The ePortfolio includes several features of DOL, providing a space where learners can be guided towards new knowledge and skills through investigations and web-quests, moderated and facilitated by online teachers and trainers whose assessments and feedback become part of the learning process, and where the learners themselves can interact and provide peer-to-peer feedback⁹².

Although, there is minimal documented evidence of the use of ePortfolios in VET, their practice can support a shift from standard common summative tests to individual formative assessment. Several of the best performing education systems have based their education policy reform on this principle. For example, the Finnish education system, which is considered, according to several international scientific performance indicators such as PISA, a strong 'performer', has reduced the use of formal and summative student testing to a necessary minimum (Sahlberg, 2014, p. 33).

Several open source ePortfolio platforms exist including Mahara⁹³ and Moodle⁸⁸ (a learning management system that includes ePortfolio functionality).

4.3.5 Bring your own device

As mobile technology becomes more affordable and available in many countries, educational organisations are increasingly considering the establishment of 'bring your own device' (BYOD) schemes, which encourage students to bring their own laptop or tablet device to school to be used as a digital learning tool.

However, BYOD policies and practices need to be accompanied by guidelines for the use of personal devices on school grounds that all learners must agree to and comply with. Some schools call these General Guidelines, while others refer to an Acceptable Use Policy⁹⁴.

Many EU countries are also piloting a BYOD policy. For example, in Germany a pilot of the project 'Start in die nächste Generation' (Start into the next generation) has recently taken place. The pilot

⁹² www.jisc.ac.uk/guides/e-portfolios

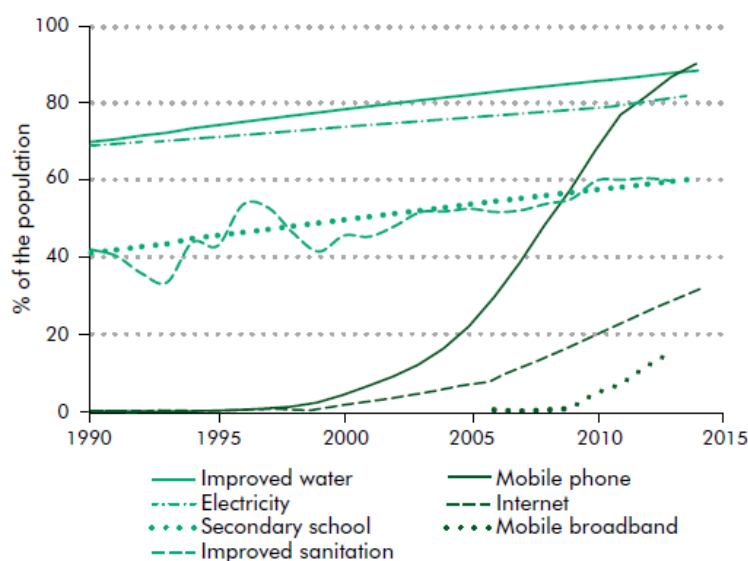
⁹³ <https://mahara.org/view/view.php?id=2>

⁹⁴ An example: www.ourict.co.uk/school-byod-policy-sample/

has been run in six schools (out of 40 applicants) for the past two years. Given the preliminary good outcomes⁹⁵, the pilot has been extended and scaled up to 50 schools. An evaluation of the project by the University of Hamburg is nearing completion.

In many developing countries, including the ETF's partner countries, in spite of chronic problems related to hardware rapidly becoming out of date and needing expensive maintenance, so far it is rare to find any positive reference to the BYOD policy. All too often the fear of student distraction/loss of class control, and the lack of confidence is such that many teachers and trainers expressly forbid the use of students' own devices – mobile phones, tablets, and laptops – in the classrooms or workshops. Notable exceptions exist: for example, Simon Majstorov, a teacher at the Vocational School Kole Nedelkovski-Veles in the former Yugoslav Republic of Macedonia, who, from being a sceptic about students utilising their own handheld electronic devices, is now a passionate advocate of the use of smartphones in class⁹⁶.

FIGURE 4.7 MOBILE PHONE AND INTERNET PROGRESS IN DEVELOPING COUNTRIES



Source: World Bank digital dividends overview 2016, www.worldbank.org/en/publication/wdr2016

⁹⁵ https://ec.europa.eu/education/sites/education/files/2016-pla-bring-your-own-device_en.pdf

⁹⁶ www.etf.europa.eu/web.nsf/pages/DOL_Macedonia_factsheet

5. IMPLICATIONS OF THE DIGITAL TRANSFORMATION ON VOCATIONAL EDUCATION

The assumption that the digital transformation will make work more complex⁹⁷ and involve a change to the role of labour in the workplace (Frey and Osborne, 2017), as employees' tasks have to change to deal with 'irregular objects'⁹⁸ and the assistance of, and interfacing with, technology is required, prompts deep reflections on the future nature and role of vocational education and training (VET).

VET is one of the four key education and training sectors, together with schools, higher education and adult learning. VET plays a key role in the lifelong learning continuum by providing young people with the initial qualifications they need for a smooth transition into the labour market, as well as offering adults opportunities to continuously upskill and reskill throughout their professional career. VET is also central to patterns of employment and social inclusion, aiming to respond to the needs of the economy but also to develop people's skills in terms of personal development and active citizenship, especially for disadvantaged groups.

The recent Cedefop projects 'Digitalisation and the future of work'⁹⁹ and 'Changing nature and role of vocational education and training (VET) in Europe'¹⁰⁰, analysed the drivers and impact of the digital transformation on work and employment, informing policy regarding the future of VET in the EU. The related papers identifies 'ensuring that the system can be responsive to the changes resulting from technological change with respect to both mitigating the impact of skills obsolescence and ensuring that the demand for new skills in new jobs is met' and 'ensuring that those employed in vocational schools possess the technical knowledge and have access to the latest technologies so that the teaching they deliver is relevant to the needs of industry' as main challenges for VET in facing the digital transformation (Cedefop, 2018, p.106). With the aim of establishing a policy response until 2030, the paper highlights the role of skills anticipation and the need for reconfiguring the ties between industry and VET as key for the future of the sector. In addition, VET needs to balance *stability* with a certain degree of *flexibility*, with the latter allowing for a fast response to labour market developments and to rapid innovation cycles. In the meantime, VET has to continue to prepare young people for the labour market, while, at the same time, improving the offer for upskilling and reskilling to the adult population, taking advantage of the opportunities offered by the digital transformation to improve access to and provision of skills.

⁹⁷ Increasingly including knowledge-intensive and interactive tasks, which rely on the social and creative intelligence of workers, www.bibb.de/veroeffentlichungen/en/bwp/show/8488

⁹⁸ Frey and Osborne (2017) make reference to the processing and handling of inconsistent objects which cannot be easily recognised or read by a machine and in general terms work in an unstructured environment that is subject to frequent change.

⁹⁹ www.cedefop.europa.eu/it/events-and-projects/projects/digitalisation-and-future-work

¹⁰⁰ www.cedefop.europa.eu/it/events-and-projects/projects/changing-nature-and-role-vocational-education-and-training-vet-europe

A PRACTICAL DEFINITION OF VET¹⁰¹

Vocational education and training (VET), rather than forming a well-defined sector and body of institutions, can be described as a policy area dealing with the organised provision of opportunities for the development of labour-market-relevant skills for all. This includes in particular:

- institutional VET programmes (IVET), regulated by national authorities, typically leading to nationally recognised qualifications, at several levels:
 - basic VET provision, leading to qualifications at EQF 2 and 3 (below upper secondary level);
 - upper secondary VET programmes (EQF 4), either in apprenticeship form (dual-system) or school based, possibly with a work-based component (upper secondary level with vocational orientation);
 - post-secondary VET programmes (EQF 5 and higher), either formally included in the tertiary education system or not (post-secondary);
- CVET opportunities, often non-institutional, in the form of in-company training, opportunities for upskilling and re-qualification and continuing professional development organised by public authorities, sectoral and trade organisations or commercial vendors, with different levels of regulation and certification.

Individual Member States are also analysing the implications of the digital transformation of the workplace on VET programmes (qualifications and skills) and how DOL can improve VET access and provision. For example, in Germany under the Federal Government's Digital Agenda, the Federal Ministry of Education and Research and the Federal Institute for Vocational Education and Training (BIBB) recently launched several initiatives under the umbrella of 'Vocational Education and Training 4.0 (VET 4.0)'. Among others, the initiatives 'Skills for the digital workplace of tomorrow'¹⁰² and 'Digitalisation in Inter-Company Vocational Training Centres and Competence Centres' aims to: (i) analyse a set of occupations (covering a set of simple, qualified and highly qualified occupations) to investigate how the digital transformation impacts upon workplaces (the correlation between human task requirements and the use of digital technologies) in terms of work processes, activity profiles and qualification requirements; (ii) identify changes in skills; and (iii) develop relevant recommendations for action. The results of this research will form part of a set of guidelines and assistance for the reform of IVET (public and private formal vocational schools) and CVET (in- and inter-company vocational training centres) in Germany.

Partner countries have diverse VET system models (as in the rest of the world), at various stages of development and affected in different ways by digital technologies. Although VET policy implementation is often weak and not always a priority in education, in some of the partner countries the efficiency and innovativeness of VET are becoming more prominent aims in the policy agenda, with DOL being part of the response to challenges such as skills mismatch, defunding and the attractiveness of VET.

While DSCs are needed at all levels and are rapidly evolving, research suggests that DOL has two main implications.

- For **IVET**, DOL primarily affects the provision and pedagogy, supporting a shift from teaching to learning, better combining different learning environments and offering new opportunities for individualised and collective learning.

¹⁰¹ Advisory Committee on Vocational Training (ACVT), 'A shared vision on the future of vocational education and training (VET) and European cooperation in VET beyond 2020' (internal document)

¹⁰² www.bibb.de/en/49603.php

- For **CVET**, DOL is primarily affecting and widening the access to relevant and quality skills development solutions, for example through MOOCs and online platforms.

Overall, VET appears to go in and out of fashion over time. In many countries, VET is evolving, expanding and diversifying, with VET increasingly delivered by institutions outside the traditional VET upper secondary sector, such as higher-level institutions (EQF 5 and above), companies and sectors. A better provision of DSC and an effective adoption of DOL could increase the attractiveness of VET to both students and employers and reduce the skills mismatch and skills obsolescence accentuated by the rapid innovation cycle imposed by the digital transformation.

5.1 Implications on initial VET

Compared to general education, the development of vocational competence and performance requires a combination of general and theoretical knowledge together with practical skills and workplace 'situated' knowledge – and both to be applied in specific contexts, or, more broadly, for the labour market (Rauner, 2007).

In the classroom, with the role of teachers changing, DOL can support teachers adopting innovative pedagogies¹⁰³. For example, the theory of social constructivism implies that students learn best when they can co-build knowledge derived from different sources – only one of which might be a teacher. Today, it is no longer possible, nor is it necessary or desirable, for a teacher to be the fount of all knowledge and the centre of attention in a classroom. Increasingly there have been policy initiatives to encourage teachers to blend innovative pedagogy (inquiry- and project-based) with DOL in their teaching practice, and to give students greater responsibility for, and a more active role in, their own learning.

Especially in countries where a form of dual VET system is in place, the integration of theory and practice is obtained by combining school-based education (e.g. developing academic and vocational skills and knowledge) and workplace training (e.g. developing an appropriate attitude, team working habits and self-reliance). Already in 2005, a European Commission's study identified the use of DOL in education and training as a means to better connect school-based and work-based learning environments¹⁰⁴. For example, vocational students or their tutors can gather a collection of artefacts that are representative of their authentic and situated achievements at the workplace – these could be photographs, videos, audio recordings or testimonials. A recent online course on the use of ICT in VET education¹⁰⁵ provides several concrete examples of ways in which using pedagogical software and mobile computing devices can support, once back in the classroom, richer, evidence-based reflections on the experience gained at the workplace (e.g. what happened, what options, what wrongs) and how this information could tailor the individual learning experience. Such techniques are particularly effective in VET dual systems (where a considerable part of the learning time is spent in the workplace), but they can also be used for internships/traineeships.

In addition, because the digital transformation of jobs is increasingly embedding digital technologies in many aspects of workplace tasks, real work is becoming more 'virtual', and the simulated work based learning at school an increasingly genuine work experience. This is the case for example in the automotive sector (jobs affected by the digital transformation) and for the web sector (jobs created by the digital transformation) where tasks are mainly undertaken using digital devices and/or in front of a computer.

¹⁰³ The relation between ICT and innovative pedagogies is explored and described with examples in Chapter 5.

¹⁰⁴ http://edz.bib.uni-mannheim.de/daten/edz-b/gdbk/05/ict_in_vocational_en.pdf

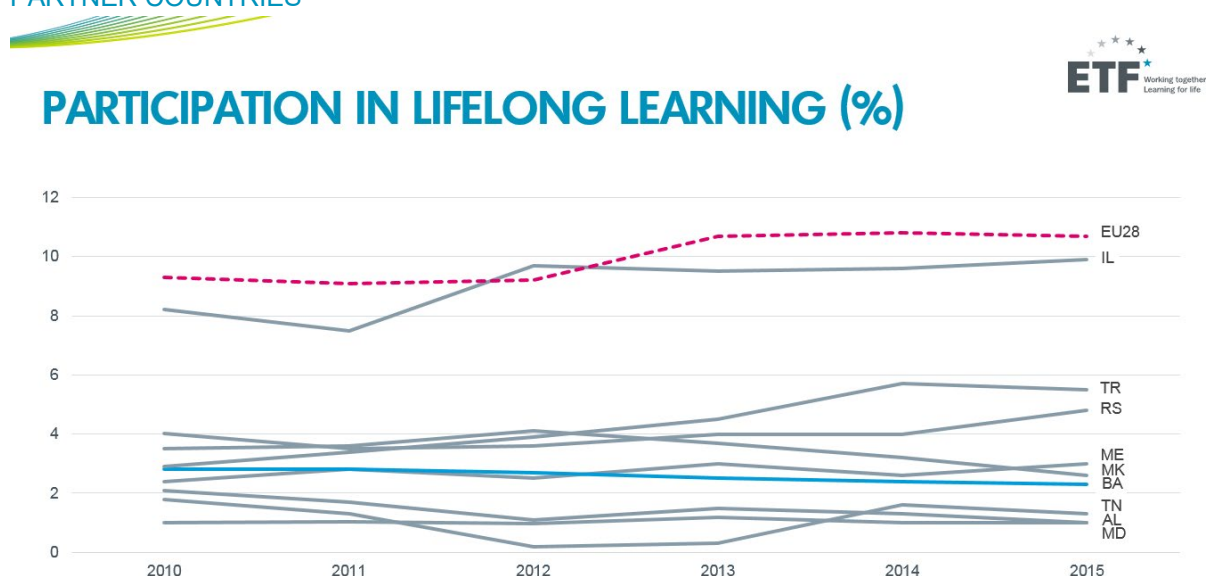
¹⁰⁵ Future Learn platform: www.futurelearn.com/courses/blended-learning-getting-started

Furthermore, the advent of virtual and augmented reality and the availability of cheap computing and data also allow the simulation of ‘non-digital’ jobs or even of a large part of a company process, for example when companies are not able to offer enough real workplace experience close to the school. This technique is already used, for instance, in a number of Western Balkan and Eastern European countries through the concept of ‘virtual firms’, mainly in economy, tourism and business administration vocational schools.

5.2 Implications on continuing VET

The above referred implications of DOL applies also on CVET, for example on training provided by companies/public-private providers for upskilling and re-qualifying employed and unemployed people. In a lifelong learning perspective, DOL can also be a key mechanism for raising access to and participation in CVET, which is still low and underdeveloped in many countries.

FIGURE 5.1 PARTICIPATION RATE IN LIFELONG LEARNING IN SOME OF THE ETF'S PARTNER COUNTRIES



Source: ETF, presentation at Torino Process conference, June 2017.

More specifically, DOL – implemented as a distance learning – can be particularly useful in CVET for (i) settings in which a large group of adults need to be trained; (ii) solutions for adults in remote areas with limited access to face-to-face training; and (iii) self-learning initiatives of individuals. For example, in the Western Balkans in addition to the traditional in-company training centres there are local and international ICT companies (e.g. Cisco® and Microsoft®) that use DOL to deliver trainings on DSC for their products, providing formal certificates of participation/achievement which are increasingly recognised by the private and public sector.

5.3 Implications on infrastructure in VET

In many ETF partner countries, a steady increase in Internet broadband investment and capacity¹⁰⁶ is progressively bringing, to various extents, more reliable and affordable Internet connectivity to educational organisations, offering new opportunities for the use of digital tools in classrooms and laboratories. Among the ETF's partner countries, those in Central Asia, with the exception of

¹⁰⁶ Through technologies such as ground, satellite and high altitude Internet lines.

Kazakhstan, have the lowest international bandwidth and average connection speeds (World Bank, 2016).

FIGURE 5.2 INTERNATIONAL INTERNET TRAFFIC FLOWS – EUROPE AND CENTRAL ASIA (GBIT/S)



Source: www.telegeography.com/, World Bank report, p. 55.

Concerning computers at schools, some partner countries have adopted a ‘one-to-one computer’ policy, aimed at distributing free computers and reaching a ratio of one computer per student in schools. There are many good reasons for this policy. Firstly, a 1:1 policy directly addresses the digital divide, leading to a degree of democratisation and universality of technology in education. Secondly, such policies should improve the school’s DOL capacity. Thirdly, especially for VET, when learners enter the workplace to take up apprenticeships/traineeships or when they are at home they can better connect to the different learning environments using their own computer. Where such policies are not affordable, the increasing number of mobile computing devices (e.g. smartphones and tablets) and mobile network providers (allowing cheaper and better performing Internet services) offer new opportunities for the adoption of bring your own device (BYOD) policies.

THE FATIH PROJECT IN TURKEY: AN EXAMPLE OF A 1:1 POLICY

In 2010, the Turkish Government launched a new education project called FATIH (as in ‘the conqueror’, referring to one of the most influential Ottoman Sultans, Mehmet II). The main goal of the project is to provide interactive whiteboards for all basic education classrooms (Grades 1–8) and tablet PCs for all students, starting from Grade 5, as well as interactive whiteboards for all high school classrooms. In terms of numbers, the project has supplied more than 10 million tablet PCs and 800 000 interactive whiteboards in 40 000 schools, as well as installing 1.25 million data sockets in classrooms, and has provided in-service training for 680 000 teachers nationwide.

Currently, a total of 169 684 tablet PCs have been distributed to vocational school students (in Grade 9) in three types of school: vocational and technical Anatolia high schools, vocational and technical training centres, and multi-curriculum high schools. In addition:

- 84 263 interactive whiteboards have been installed in 57 014 classrooms and ICT laboratories;
- establishing an Internet infrastructure for 1 081 schools has been completed;
- system rooms and uninterruptible power supplies (UPS) have been installed in 1 081 schools;
- 177 773 data sockets have been provided in 1 081 schools;
- 3 210 multi-function printers have been distributed to 3 091 schools;
- 200 schools have received fibre-optic cabling for 6 000 classrooms;
- 101 339 tablet PCs have been provided for teachers.

The increasing availability of the Internet and computers in schools has introduced several challenges for VET infrastructure and logistics. Firstly, Internet connectivity through landlines and Wi-Fi needs computer rooms and access points distributed throughout all learning environments. Secondly, many vocational schools/training centres in partner countries do not have net-safe policies (also referred to as an Acceptable Usage Policy¹⁰⁷) in respect of openness and access to the Internet. Thirdly, ICT equipment and software in partner countries’ vocational schools often come from donors and maintaining them remains a challenge. For example, a recent ETF case study on DOL in VET in Serbia¹⁰⁸ highlighted that establishing a reliable and regular funding mechanism for the maintenance, renewal and upgrading of the existing equipment for DOL was difficult for all of the institutions visited, where in most cases a single computer science teacher was responsible for maintenance and troubleshooting.

Once a school is connected to the Internet, DOL for innovative teaching and learning methods also requires good wireless, Ethernet and power connectivity, as well as the creation of an open and flexible learning environment¹⁰⁹. Experiments in this area are not new. In the UK there have been reflections on schools’ design for more than 20 years. Today, Finland is designing schools where walls are coming down to eliminate barriers between subjects and age ranges, offering open spaces for ‘phenomenon-based’ learning. Vocational schools can autonomously select a topic, such as the digital transformation of the workplace, and learners can look at it from very different perspectives, and from the vantage points of a variety of subjects, such as mathematics, DSC and enterprise skills¹¹⁰.

¹⁰⁷ An Acceptable Usage Policy is a document that outlines a set of rules to be followed by users or customers of a set of computing resources, which could be a computer network, website or large computer system. The document clearly states what the user is and is not allowed to do with these resources (www.techopedia.com/definition/2471/acceptable-use-policy-aup).

¹⁰⁸ [www.etf.europa.eu/webatt.nsf/0/DC024C02AA9B9384C12580280043A0B6/\\$file/DOL%20in%20VET%20in%20Serbia.pdf](http://www.etf.europa.eu/webatt.nsf/0/DC024C02AA9B9384C12580280043A0B6/$file/DOL%20in%20VET%20in%20Serbia.pdf)

¹⁰⁹ www.eun.org/resources/detail?publicationID=1

¹¹⁰ www.weforum.org/agenda/2017/10/why-finland-is-tearing-down-walls-in-schools/

Another example is the 'Future Classroom Lab' developed by European Schoolnet, which includes six learning zones.

FIGURE 5.3 THE SIX LEARNING ENVIRONMENTS DEFINED IN THE SCHOOLNET LAB

Learning Zones



Source: <http://fcl.eun.org/it/about>

5.4 Implications on VET qualifications and skills

The OCED's Skills Strategy¹¹¹ suggests a shift of focus away from human capital measured in years of formal education towards the skills people acquire and develop over their lifetimes. This is particularly true for digital skills, as the digital transformation of work and society, the ubiquity of the Internet and the increasing availability of cheap computing devices imply that digital skills are often developed outside the formal education context, for example at the workplace and over the Internet.

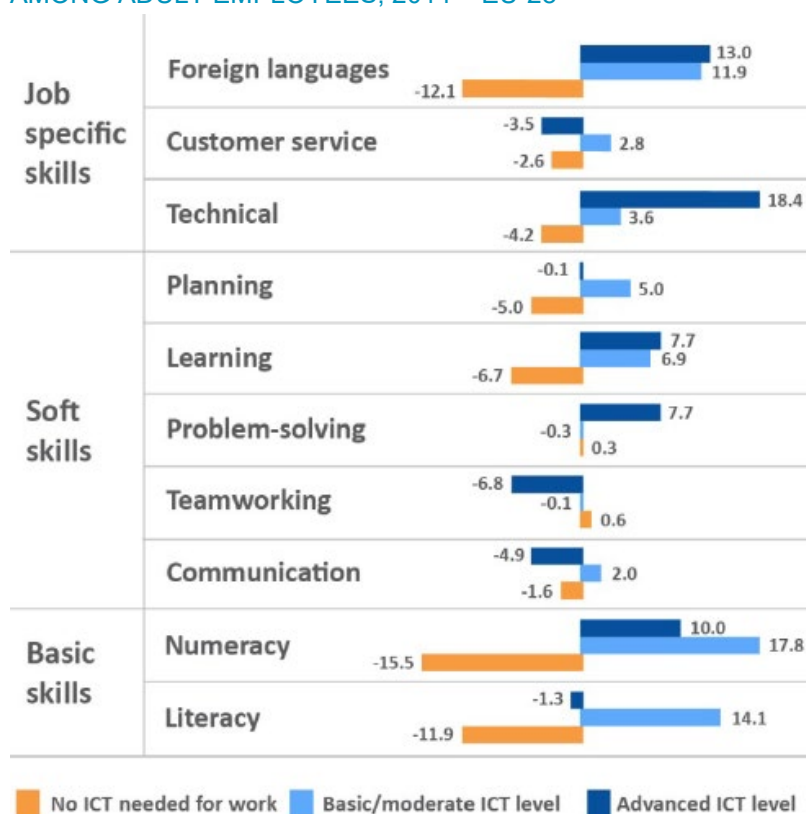
On the one hand, this means that formal VET qualifications need to include the up-to-date job-specific digital skills and competencies, with both work-based and digital and online learning key for their development. On the other hands, this also means that the more widespread and easier validation of digital skills and competence would make them more recognisable and transferrable across companies and borders, thus improving employability and mobility.

Because the introduction of digital technologies affects the individual's role and their ability to carry out increasingly complex tasks in the workplace, the digital transformation also has an impact on digitally complementary skills and competence. A recent piece of research by Cedefop¹¹² highlights that with the greater availability of ICT in workplaces comes an increasing need for soft skills and competence (e.g. planning, personal adaptability and screening/filtering abilities) to carry out the necessary tasks. For example, the research says that the job of an average worker which relies on basic digital skills has an 18% higher chance that numerical skills are also important, relative to that of a comparable worker who does not need ICT skills to do their job.

¹¹¹ www.oecd.org/edu/47769000.pdf

¹¹² www.cedefop.europa.eu/en/events-and-projects/projects/european-skills-and-jobs-esj-survey

FIGURE 5.4 COMPLEMENTARITY BETWEEN ICT AND NON-ICT SKILLS AT WORK AMONG ADULT EMPLOYEES, 2014 – EU-28



Source: Cedefop, The European Skills and Jobs Survey, www.cedefop.europa.eu/en/events-and-projects/projects/european-skills-and-jobs-esj-survey

Specific attention needs to be given to ICT professional qualifications, skills and competence, which, due to the digital transformation, are demanded by many economic areas, far beyond the ICT sector. A recent BIBB study¹¹³ analysed skills and competence needs for five IT occupation profiles (IT system integration, IT applications development, IT and telecommunications system electronic technician, IT system support specialist and IT officer) in Germany¹¹⁴.

The study confirms the need for all five profiles to include a mix of digital and non-digital skills and competence, indicating IT security (e.g. data security and availability, data integrity and data protection including legal aspects) as an emerging topic not sufficiently covered in existing VET qualifications.

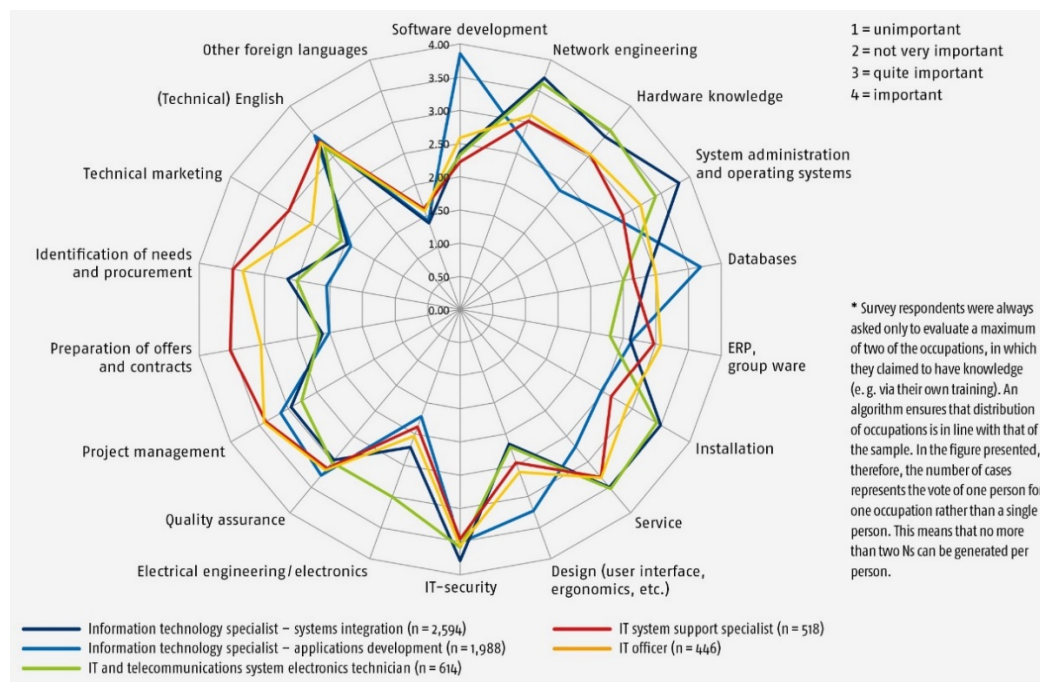
Focusing on the applications development profile, the study highlights the need for a shift away from teaching specific software programming languages to a focus on the foundations of programming, and leaving until later the learning of specific programming languages in a situationally-related way. This is an emerging requirement, for example, in terms of the advent of the so-called Internet of things¹¹⁵ and the need to programme all kind of devices with ad-hoc programming languages that often are learnt in the workplace.

¹¹³ www.bibb.de/veroeffentlichungen/en/bwp/show/8488, p. 14

¹¹⁴ www.bibb.de/veroeffentlichungen/en/bwp/show/8488

¹¹⁵ In simple terms, the Internet of Things is the network of 'smart devices' that can be connected through the Internet to cloud systems and can exchange data. Each smart device is uniquely identifiable through its embedded computing system.

FIGURE 5.5 ROLE PLAYED BY PROFESSIONAL COMPETENCES FOR THE FOUR ICT OCCUPATION PROFILES IN GERMANY



Source: www.bibb.de/veroeffentlichungen/en/bwp/show/8488, p.10.

The digital transformation also offers new solutions for accessing skills and building new digital learners' records and credentialing systems that can capture, recognise and validate all forms of learning (formal, informal and non-formal), covering personal interests, peer relationships and achievements in academic, civic, professional or career-relevant areas. An emerging technology for digital credentials is the *open badge*. This can be used as a visual token of the achievement of micro-credentials that can be grouped into digital repositories (e.g. blockchain¹¹⁶) to form and extend traditional macro-credential systems (Oliver, 2016). Open badges can also better represent the individual's learning achievements than a traditional record (e.g. Europass CV) as they can represent a constantly evolving picture of a person's lifetime learning, extensible and adaptable to the changing education and training marketplace (Ifenthaler et al., 2016). However, the quality and transparency of accreditation of digital and online learning institutions and micro credentials remain the main challenges for wider adoption. More research and transnational standards are necessary.

Along these lines, in January 2018 the European Commission launched an initiative for the development of a framework for issuing digitally-certified qualifications as part of the digital education action plan 2018–20¹¹⁷. Remarkable also are the ongoing international initiatives for a global qualifications framework, also referred to as a fourth generation of qualifications frameworks, the focus of which is on credentials and the inclusion of 21st-century skills.

Most of the ETF's partner countries are developing and implementing national qualifications frameworks (NQFs) as an integral part of their national qualifications systems. Possible needs and implications of digital transformation could be: (i) the ease of widespread accreditation for digital and

¹¹⁶ A blockchain is a distributed ledger that allows information to be recorded and shared by a community. In this community, each member maintains his or her own copy of the information and all members must validate any updates collectively. Entries are permanent, transparent, and searchable, which makes it possible for community members to view transaction histories in their entirety. Each update is a new 'block' added to the end of a 'chain'. A protocol manages how new edits or entries are initiated, validated, recorded, and distributed (<https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/blockchain-education>).

¹¹⁷ <https://ec.europa.eu/education/sites/education/files/digital-education-action-plan.pdf>

online learning institutions; (ii) the assessment, recognition, validation and accreditation of non-formal DSC; and (iii) the re-modularisation of qualifications to better fit the pace of formal learning courses that include DOL elements and improve the flexibility and response of curricula to new content and practices emerging in the workplace.

5.5 Implications on VET curricula

VET cannot respond to the digital transformation without changing its curricula¹¹⁸ at all levels. More specifically, the advent of DSC and DOL affects VET curricula design and development in the following components.

- **Content:** This includes continuing the widening of national VET curricula's content to include digital competence as a key competence for lifelong learning. Digital competence could be combined in a course covering other key competences, such as entrepreneurship, and other 21st-century skills, thus providing the new transversal competences/skills requested by the labour market. In addition, for VET programmes preparing candidates for jobs affected by the digital transformation, which means already almost all of today's jobs, there is an increasing need to cover job-specific digital skills. Tools such as the ESCO database¹¹⁹ and sectoral cooperation could be key to identify necessary job-specific digital skills. Overall, it is necessary to strike a balance between broad-based education, including key competences, and occupation-specific skills. Specific attention and investment should be reserved for the content of ICT professional curricula, which are key to sustaining the digital transformation and whose courses are already today unfit, both qualitatively and quantitatively, to meet the labour market demand in many countries, for example in the EU.
- **Delivery:** Teaching and learning should increasingly blend traditional and DOL methods to support innovative pedagogy, e.g. by augmenting group work in classrooms and in the workplace, simulating job processes and workplaces through virtual-reality and simulation tools. DOL could also foster an active role for learners (e.g. through methods such as the 'flipped classroom') and the implementation of flexible modular pathways (personalisation and of the learning experience), thus supporting the inclusion of special needs groups.
- **Assessment:** This involves supporting a change of paradigm from summative to formative assessment through the regular use of electronic textbooks and related online resources, e-Portfolios and, in general, learning analytics tools in order to undertake qualitative and quantitative regular reviews of learners' progress and inform teachers' and trainers' individualised learning strategies.

¹¹⁸ In simple terms, a curriculum is a written plan for learning consisting of (a set of) learning goal(s), one or more learning and teaching activities (delivery), and content organized and assessed in a way consistent with the goals and activities.

¹¹⁹ European Skills, Competences, Qualifications and Occupations, <https://ec.europa.eu/esco/portal/alphabeticalBrowser>

CURRICULA REVIEW FOR HIGH-TECH OCCUPATIONS OF THE AUTOMOBILE INDUSTRY IN GERMANY¹²⁰

A recent BIBB project, in cooperation with the Volkswagen Academy, analysed changes in tasks, procedures and requirement profiles for skilled workers (e.g. operational maintainer) as a result of the digital transformation.

- **Key changes for the professional maintainer:** For the maintenance of automated systems, IT applications (interfaced with sensors, collecting and analysing data) play an ever greater role, with procedures shifting from cyclical to continual operations while plants remain active. Repair and maintenance do not necessarily need to be performed on site. IT-assisted troubleshooting and error diagnosis are at the heart of the maintainer's tasks, with a significant shift from metal to digital system maintenance components.
- **Existing VET curricula analysis:** The hard skills requested have their foundations in the understanding of IT-based systems, the handling of systematic error diagnoses, problem-solving strategies and anticipatory action-taking. Soft skills, including self-direction and autonomy are also in demand.
- **Matching of training vs. occupational profile:** A mismatch has been identified in terms of hard skills (such as a lack of skills in relation to network technology, robots and bus systems) and soft skills (e.g. in problem solving).
- **Recommendations from the project:** A more holistic approach is necessary for understanding a high-tech system which encompasses interoperability between mechanical, electrical and information components sub-systems, with a shift from an inductive to a deductive approach. Also recommended is the use of tablets, e-books and web-based training, together with mobile computing devices linked to social media, as required by the workplace of today and in the future.

5.6 Implications on the continuing professional development of VET teachers and trainers

Education is increasingly challenged to exploit new technologies to implement innovative learning strategies, for example, by increasing learner engagement, saving cost or deepening learning. Yet, in the majority of partner countries, a minimum set of DSCs is not a formal prerequisite for teaching in VET. As a result, continuing professional development (CPD) is essential to improve the digital competence of teachers and to facilitate a more regular use of new technologies in teaching and learning.

CPD initiatives for DSC can be designed to enhance specific digital skills, for example in using a smartboard. Increasingly, CPD in partner countries offers initiatives focusing on the pedagogical use of ICT and open educational resources.

In many of our partner countries where teacher training is unlikely to improve rapidly, research and practice indicate that DOL may also be an opportunity to improve the efficiency of CPD at modest cost (World Bank, 2016, p. 33). DOL brings to CPD the power of the Internet and digital tools, offering easy and affordable, often free, platforms for networking, peer-learning and online collaboration. In particular, this seems to offer a good opportunity for VET, where CPD needs to target heterogeneous groups of teachers and trainers operating in diverse contexts, including teachers at school, and trainers/workers in the workplace or in training centres. The use of DOL in VET for CPD can bring together and support cooperation between distant parties or allow large-scale CPD programmes through virtual communities and online events that can act as agents for change or transmitters of professional development (Imants, 2003). For example, in the Western Balkan and Turkey region there are already a number of virtual platforms associated with professional development for VET

¹²⁰ www.bibb.de/veroeffentlichungen/en/bwp/show/8488, p. 15

teachers and trainers. In some cases, national VET agencies or relevant ministries manage virtual platforms mainly for information purposes. Other virtual platforms are more informal and used by teachers and trainers to describe the activities of particular projects or focus on a specific VET sector/subject.

5.7 Implications on quality assurance for VET

Future-facing quality assurance mechanisms may need to be devised and implemented to embrace digital learning and open educational resources for VET in partner countries. The adoption of the formal frameworks for DSC and DOL, like the ones introduced in Chapters 3 and 4, could sustain this review process, providing standards and criteria for monitoring and evaluating the progress and quality of learners', teachers' and trainers' DSC. Similarly, the national adoption of the framework for digitally competent organisations introduced in Chapter 4 (DigCompOrg) could also provide standards and criteria for monitoring and evaluating the quality of digital learning in vocational schools and training centres.

The main challenge introduced by DOL remains the use of open methods, including open educational resources. The recent JRC publication *State of the Art Review of Quality Issues Related to Open Educational Resources (OER)*¹²¹ indicates the involvement of several actors at each step of the OER lifecycle (creation, use and reuse, repurposing and the modification of resources) as one of the major challenges. Quality assurance leans towards formal processes and procedures related to quality standards (underlying principles, criteria and indicators) that actually tend to inhibit a broader use of OERs in IVET. The paper also emphasises the lack of a widely accepted set of quality criteria for OERs and acknowledges the emergence of new 'federated' quality methods and tools based on peer assistance and social ranking systems.

¹²¹ <http://publications.jrc.ec.europa.eu/repository/handle/JRC88304>

6. DIGITAL SKILLS AND COMPETENCE, AND DIGITAL AND ONLINE LEARNING ACROSS THE ETF'S REGIONS

The ETF's partner countries are exposed to the opportunities and challenges brought about by the digital transformation, and are increasingly turning to digital technologies for new ways and mechanisms to modernise and optimise learning and teaching. For example, some partner countries are looking at the Internet and open educational practices as a means to (i) tackle the chronic limited capacity of education and training systems to deliver relevant and quality skills; (ii) overcome 'stand-alone' donors and international organisation provisions; and (iii) facilitate sharing and scaling-up good practice and knowledge among teachers and trainers.

Overall, some partner countries are already advanced in the digital transformation of VET and have the capacity to proceed further (e.g. Israel), others have bold aspirations but still have only a limited capacity (e.g. Serbia and Ukraine), while others, the majority, are still at an early stage, demonstrating some policy ambition but limited evidence of practice. In general, the culture of classroom control in many partner countries is so deeply engrained in education and training systems that teachers, and, indeed, many students are unwilling, and often unable to shift the power relationship within a learning contract so that pupils cease to be passive consumers of teachers' and trainers' lessons but, rather, are prepared to act themselves to move their learning forward.

From 2015, the ETF re-started support of some partner countries in DSC and DOL through holistic initiatives, warning against the long-standing 'worst practice' belief that buying ICT equipment for schools and training centres on a massive scale 'for induction' actually fosters change in teaching and learning practices. Unfortunately, available evidence says this is not the case.

This chapter briefly outlines ETF initiatives from the past and provides some examples of recent developments on DSC and DOL in partner countries clustered by ETF regions.

6.1 Looking back to look ahead

The first ETF initiative to support distant, yet still not digital, learning in partner countries dates back to 1999 with the publication of a Programme Compendium on the Multi-country Programme for Distance Education¹²². As part of the Phare programme, this involved 13 countries, including Albania, the former Yugoslav Republic of Macedonia, and Bosnia and Herzegovina and aimed to (i) establish an infrastructure of national and regional open and distance learning centres; (ii) support cooperation among participant countries; and (iii) promote the use of open and distance learning in the reform and innovation of post-secondary education and training.

In 2006, the ETF published a survey on e-learning initiatives in South Eastern Europe, aiming to provide evidence of e-learning practices and promote reforms in the education and training sector that include e-learning¹²².

In 2008, the ETF undertook a comparative analysis of e-learning initiatives for teachers and trainers in the Mediterranean region, as part of the MEDA-ETE (Education and Training for Employment) programme. It included a teacher training blended programme on the use of e-learning methods for teaching and training¹²².

¹²² Paper copy available in the ETF's archive.

Since 2015, the ETF has been regularly working on DSC and DOL in partner countries, mainly in the Western Balkan and Turkey region, joining the EU policy dialogue as a member of the two European Commission's working groups on DOL (2014–15) and DSC (2016–18) introduced in Chapter 2.

6.2 Western Balkans and Turkey

The evidence base on progress on DSC and DOL in the Western Balkan and Turkey region is relatively strong, with several initiatives undertaken in the region by the EU, international donors and the ETF, in addition to several forward-looking national initiatives.

The Instrument for Pre-accession Assistance (IPA)¹²³ and, specifically for education, the Western Balkans platform¹²⁴ are the main EU tools to support reforms in the region. As an example, the so-called Berlin Process involves six countries in the Western Balkan region promoting cooperation to create a digital economic area in the region and facilitate its subsequent integration within the European Digital Single Market.

The evidence base includes several ETF initiatives.

- Since 2015, as part of the Riga Conclusions, the ETF has been monitoring progress in key competences, including digital competence, in VET in candidate countries.
- In 2016, the ETF published a case study that analysed DOL practices in eight vocational schools in Serbia (see the key findings in the box below), providing evidence of enthusiasm and commitment, albeit constrained by limited means.
- In recent years, the ETF has undertaken several initiatives to improve the volume, relevance and effectiveness of CPD for DSC and foster the use of DOL in innovative CPD programmes for vocational teachers and trainers in the region, more specifically:
 - in 2015 the ETF launched a survey to obtain evidence on the volume, quality and impact of CPD initiatives¹²⁵ in seven countries¹²⁶, highlighting that more than 50% of respondents reported that they needed CPD to learn more about new technologies in the workplace;
 - in recent years the ETF has provided funds and expertise to implement a set of demonstration projects that aimed to (i) promote the use of the ePortfolio in VET in Serbia; (ii) launch a Moodle platform for CPD initiatives in the former Yugoslav Republic of Macedonia¹²⁷; and (iii) support the development of professional virtual networks (e.g. at national, vocational sector and international levels) of teachers and trainers as a means to support peer-to-peer development of DSC, open educational resources and other professional competences.
- In 2018, five factsheets are being published highlighting policy initiatives to improve the DSC of VET students and teachers as well as a number of good practices in the use of DOL in IVET and CVET in candidate countries¹²⁸.
- The last decade has also witnessed several national policy initiatives. For example, in Turkey in August 2016 the Board of Education approved a new curriculum for a 'Computer Science Course' for all high school students, including VET. This course is mandatory and designed for application in the first two years of secondary education. Unlike the previous course on ICT, which was primarily aimed at providing students with basic digital skills, the new course is placing

¹²³ https://ec.europa.eu/neighbourhood-enlargement/instruments/overview_en

¹²⁴ https://ec.europa.eu/education/policy/international-cooperation/western-balkans_en

¹²⁵ ETF internal resource

¹²⁶ Albania, Bosnia and Herzegovina, former Yugoslav Republic of Macedonia, Kosovo, Montenegro, Serbia, Turkey

¹²⁷ ETF internal resources

¹²⁸ Example for Turkey: www.etf.europa.eu/en/publications-and-resources/publications/digital-skills-and-online-learning-turkey

programming skills and computational thinking skills at the heart of the new curriculum, thus providing a broader and more comprehensive set of DSCs. Focusing on the Western Balkans, Serbia seems to be the most ambitious country. In its annual national strategy for developing the economy's IT sector, Serbia has adopted a bold action plan for 2018 which includes specific measures to improve the digital readiness of educational organisations¹²⁹ and the introduction of electronic textbooks.

- Donor and ETF initiatives, especially when combined with EU programmes, have proved to be effective in improving policy and practice in the region. Nonetheless, they are apparently still insufficient in terms of allowing countries to autonomously lead DSC and DOL policy implementation.

A CASE STUDY ON DOL IN VET IN SERBIA¹³⁰

This case study aimed to identify relevant policies and practices for digital and online learning (DOL) in IVET. The objective of the study was to (i) gather information on and analyse DOL provision in IVET; and (ii) provide a set of recommendations. The data-gathering component of this research consisted of field visits to eight secondary vocational schools in major cities in Serbia, selected on the basis of their good practice in respect of DOL. The analysis was structured around the six cross-cutting elements of the European Framework for Digitally Competent Educational Organisations¹³¹.

Key findings

- In all of the schools visited, ICT development and DOL are often referred to as key, and all the school principals acknowledged their responsibilities in this regard. Unfortunately, this evident commitment was not so visible in the accompanying school documentation.
- From the perspective of current technological infrastructure, the majority of the schools visited were equipped to meet most of the teachers' needs.
- The issue of individual outdated workstations in computer laboratories was, to some extent, mitigated through implicit, or emergent, BYOD policies for students.
- As there are currently no explicit network security policies in the vocational schools visited, in most cases this issue was resolved pragmatically by simply 'locking down' and restricting network access.
- Because the schools selected for this case study have been recognised as places promoting valuable and innovative practice, some of the findings were somewhat surprising. Most of the teachers and principals interviewed had a rather limited vision, that is, of using ICT to perform familiar tasks in a 'better', more 'digital' way. Only a few teachers expressed any ambition to use DOL for innovative pedagogies. In practice, in most of the schools visited, ICT and DOL were essentially seen as productivity tools that serve to reinforce a status quo in which teachers do 'more of the same, only electronically', with existing curricula, rather than using the technology to innovate how teachers teach and learners learn.

System-level policy recommendations

- A national DOL strategy should be developed in relation to VET, together with practical guidelines for schools, including a governance model defining clear roles and responsibilities, objectives, support infrastructure and resources.
- A set of minimum digital skills and DOL competences that VET teachers are required to have should be established. Digital competence should be acknowledged as key and systematically supported by CPD.
- Schools need to be provided with better network administration support and clear network security and integrity policy guidelines.
- A series of pilot studies should explore the scope for online curriculum delivery for youth and adult learners, thus covering IVET and CVET from a lifelong learning perspective

School-level recommendations

- DOL should be embedded in school development plans, and schools should adopt monitoring and self-evaluation measures to review the progress of implementation.
- All teachers should receive greater and appropriate support and guidance for developing their own digital skills. CPD programmes should include functional training in basic information and communication technology (ICT) skills and efficient operation of the learning management system, as well as covering new pedagogy.
- Schools should be responsible for adopting modern network policies aimed at ensuring learners' safety and data integrity on the Internet.

¹²⁹ www.media.srbija.gov.rs/medeng/documents/it-action-plan2018.pdf

¹³⁰ www.etf.europa.eu/en/publications-and-resources/publications/digital-and-online-learning-vocational-education-and

¹³¹ <https://ec.europa.eu/jrc/en/digcomporg/framework>

6.3 Southern and Eastern Mediterranean

The evidence base on progress in DSC and DOL in the Southern and Eastern Mediterranean is not strong and the region faces major constraints on key drivers such as the Internet (Kelly et al., 2017).

As mentioned earlier in this chapter, in 2008 the ETF promoted a survey on e-learning initiatives in the region which highlighted that many countries in North Africa and the Middle East were lagging behind in making DOL commonplace in schools and in the provision of DSC. Recommendations were made to improve public-private partnership and encourage ICT companies to offer DSC courses (e.g. on specific digital tools and software), thus offering better options for employment, as well as further education and training solutions.

EU and international cooperation initiatives in the region mainly aim to improve dialogue and the development of civil society in the region. For example, the Union for the Mediterranean¹³² is an intergovernmental organisation that supports policy dialogue among the 28 EU Member States and 15 countries from the Southern and Eastern shores of the Mediterranean. Although the Union for the Mediterranean promotes region-wide cooperation projects and initiatives to address employability and economic growth, including the development of the digital economy, there is no major evidence of related initiatives for the development of DSC and DOL in VET in the region.

However, the countries of the Middle East and North Africa want to improve their education and training systems in order to modernise national economies that often remain based on natural resources, state-owned enterprises and small family businesses working in arts and crafts and other types of manual labour. In this context several countries in the region have recognised the potential of technology in education and the need for reform strategies and action plans to promote the integration of DSC and DOL within VET.

This is the case in Morocco, where DSC are included in the VET Reform Strategy 2021 as one of the key competences (p. 33)¹³³. Algeria includes among its priority actions of the Development Plan for VET the ‘continuation of digitisation and networks creation among the VET institutes’ and the ‘implementation of distance learning’¹³⁴. Tunisia in its policy orientation document for VET 2018 also includes a specific objective on the use of innovative pedagogical methods, talking of the need to ‘adopt pedagogical approaches and the use of new technologies in VET’ and to ‘disseminate data, documents and practice to facilitate exchange through the use of ICT’¹³⁵. The Palestinian Authority, with support from the Belgian Development Cooperation, undertook in 2014–15 a piece of research on DOL that aimed to provide policy advice to the Ministry of Education and Higher Education for improving and advancing DOL resources and practices for teachers, students and families¹³⁶. It delivered a comprehensive set of policy papers, covering bottom-up, school-led initiatives, digital resources, mobile learning, CPD initiatives and 21st-century skills. At the same time, Israel, although not representative of the region, continues to be a role model, with heavy investment in research and development¹³⁷, and strong policy and practice to sustain the use of technology in education and the provision of quality DSC.

Difficulties are encountered by many countries in the region when moving to policy implementation. This may be due, inter alia, to the lack of public-private sector partnership and the fact that key digital

¹³² <http://ufmsecretariat.org/who-we-are/>

¹³³ www.fcs.ma/wp-content/uploads/2016/05/Strate%CC%81gie-Nationale-Formation-FR.pdf

¹³⁴ www.premier-ministre.gov.dz/ressources/front/files/pdf/politiques/formation-professionnelle.pdf

¹³⁵ www.emploi.gov.tn/fileadmin/user_upload/Formation_Professionnelle/PDF/Reforme_FP_Tunisie-Fr.pdf

¹³⁶ www.enabel.be/sites/default/files/policy_paper_2_on_digital_educational_resources_december_2015.pdf

¹³⁷ www.weforum.org/agenda/2017/05/tiny-israel-is-a-tech-titan-these-5-charts-explain-its-startup-success/

technologies, such as broadband, remains underdeveloped and thus lag behind in terms of prices, penetration and content¹³⁸.

THE CASE OF THE ORT NETWORK IN ISRAEL¹³⁹

Since 1949, the ORT network has been Israel's leading education network responsible for research, planning, development, and for designing and building innovative schools and programmes for education including in science and technology education, called iSTEAM, covering DSC and 21st-century skills. The network uses the Israeli consolidated project-based learning method supported by DOL tools, including:

- personal websites for teachers and students;
- learning and management system and eBooks;
- teaching and learning using online collaboration platforms;
- mobile learning using smartphones;
- social media.

Currently, the network covers iSTEAM programmes including aerospace and aviation, precision agriculture, bio-medical engineering, cybersecurity, robotics and nanotechnology, delivered through their successful consolidated project-based learning methods. The ORT network counts some 2 150 educational institutions, including VET, catering to some 100 000 students in 52 locations in Israel.

6.4 Eastern Europe

The evidence base on progress on in DSC and DOL in EE paints a fragmented picture, with increasing national and international initiatives.

The Eastern Partnership Multilateral Platforms¹⁴⁰ is the main EU cooperation instrument to promote DSC and DOL policy reform in the region, involving EU institutions, some EU Member States and six partner countries. More specifically, under Platform 2 'Economic integration and convergence with EU policies', the EU4Digital network, chaired by DG Communications Networks, Content and Technology, adopted an action plan¹⁴¹ aiming at developing digital skills in Armenia, Georgia, Moldova and Ukraine, including actions to (i) measure and forecast national digital skills gaps and define priority actions; and (ii) create national coalitions in partner countries, using the EU's Grand Coalition model. The EU4Digital network aims to sustain the harmonisation of the digital markets of the partner countries involved, with a view to creating a pan-European digital market.

The ETF is also implementing initiatives in Georgia and Ukraine for the promotion of national curricula standards in which digital and entrepreneurship competence are key competences for lifelong learning, supporting peer learning between stakeholders from both countries. To this end, DigComp (see Chapter 3) and the framework for entrepreneurship competence 'EntreComp'¹⁴² are the main reference models used by the ETF.

¹³⁸ www.worldbank.org/en/region/mena/publication/broadband-networks-in-mna

¹³⁹ <http://en.ort.org.il/>

¹⁴⁰

http://collections.internetmemory.org/haeu/content/20160313172652/http://eeas.europa.eu/eastern/platforms/index_en.htm

¹⁴¹

http://collections.internetmemory.org/haeu/20160313172652/http://eeas.europa.eu/eastern/platforms/docs/hdm-action-plan-2016-2017_en.pdf

¹⁴² <https://ec.europa.eu/jrc/en/entrecomp>

ETF INITIATIVE FOR A NEW UKRAINIAN SCHOOL CONCEPT

Set against the provisions of the 2017 Law on Education, the education reform action plan 2017–19, and the 2017 SME Strategy, the ETF supports a competence-based education reform promoting the integration of digital competence and entrepreneurship as key competences skills for lifelong learning into the education curricula through the use of the EU reference frameworks DigComp and EntreComp. Activities include:

- supporting the design of learning-outcome- based standards, curricula and teacher training materials;
- training of trainers at in-service teacher training institutes in all 25 regions through the application of EntreComp and DigComp.

6.5 Central Asia

Evidence for progress in DSC and DOL here is not strong, and this region faces major constraints in terms of the Internet. Central Asia, as is the case in many countries in Africa, pays some of the highest prices in the world for Internet access while receiving very poor service, with mobile speeds in certain remote regions barely sufficient for basic Internet operations (e.g. mailing). This is due to several factors. Primarily, the absence of a close relationship between countries in the region, for example between Tajikistan and Uzbekistan, hampers schemes to improve regional connectivity. As a result, the proportion of individuals using the Internet ranges from a high of 55% in Kazakhstan and 44% in Uzbekistan to 28% in the Kyrgyz Republic, 17% in Tajikistan, and just 12% in Turkmenistan (Kelly et al., 2017) and this is clearly negatively affecting the potential of DOL in the region.

Despite very different socio-economic realities, over recent years all Central Asian countries have placed a strong emphasis on education and, to different extent, VET reform, and dedicated important budgetary resources to these.

The Central Asia Education Platform¹⁴³ is the main EU cooperation instrument for strengthening national and regional collaboration and peer learning in education sector reforms for VET and higher education between the EU and five countries¹⁴⁴ in Central Asia. The ETF actively participates in the Platform's policy dialogue on VET, which is mainly focused on more traditional VET challenges such as quality assurance, accreditation systems and CPD.

However, there are a number of EU co-funded transnational and national initiatives to sustain DSC and DOL in the Central Asian region. For example, since 2000 the Trans-Eurasia Information Network¹⁴⁵ (TEIN) has connected research and education communities across Europe and Asia and aims to support DOL in the region.

At national level, in January 2018, the Ministry of Education and Science of the Republic of Kazakhstan presented an ambitious mid-term agenda to introduce DSC and increase the use of DOL in the country that includes: (i) a review of national standard curricula at all grades (1–11 grade) to include DSC; (ii) the provision of advanced training courses for 2 500 computer science teachers in 2018; (iii) the launch of five new IT specialisation training programmes; (iv) the organisation of short-term courses on digital literacy for unemployed and self-employed citizens; (v) establishing

¹⁴³ www.caep-project.org/

¹⁴⁴ Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

¹⁴⁵ https://ec.europa.eu/europeaid/regions/asia/tein-3_en

16 competence centres for IT technologies in the country; and (vi) continuing the development of digital resources for teaching and learning¹⁴⁶.

Overall, policy and practice in relation to DSC and DOL in VET in Central Asia remains underdeveloped. One of the major obstacles is the general aversion of governments to the use of the Internet, which is still perceived as a disruptive factor for the fragile democracies in the region¹⁴⁷.

ETF ONLINE EVENT TO SUPPORT CPD IN VET IN TAJIKISTAN – A PROMISING CASE

Access to and provision of high-quality continuing professional development (CPD) for VET teachers and trainers in Tajikistan is still challenging. Resource constraints and outdated content are the major obstacles. The ETF launched an initiative in 2014 which aimed to set-up a set of communities of practice for CPD in the major cities of Tajikistan.

The communities of practice have been implemented as regular informal face-to-face meetings involving groups of school directors and employers to discuss and review their professional and institutional practices with the purpose of considering how they can be improved and updated.

In June 2016 in Khorog/GBAO, the ETF, in close collaboration with the School of Professional and Continuing Education of the University of Central Asia¹⁴⁸ and the Ministry of Labour, Migration and Employment of Tajikistan, organised a webinar connecting communities of practice from the cities of Dushanbe, Qurghantepa, Rasht, Kurghontepa, Kulob and Sughd.

The webinar was pioneering in its aim, and, ultimately, in spite of significant technical constraints and thanks to a meticulous preparation, it could be regarded as a success, with just a few and marginal technical glitches.

However, the use of DOL for modern and viable CPD programmes in Tajikistan is still at the early stages of a long journey, and the ETF webinar was a first successful step in this direction. It was also an ambitious concept in terms of using digital technologies to deliver a range of aims, including enhanced outreach, strengthened demand-driven and peer-learning programmes and improved cost efficiency.

¹⁴⁶ Ministry of Education and Science of the Republic of Kazakhstan, Presentation of the Human Capital Development agenda, Astana, January 2018

¹⁴⁷ www.worldbank.org/en/region/eca/publication/digital-dividends-in-eca

¹⁴⁸ www.akdn.org/our-agencies/university-of-central-asia/campus-development

7. ETF POSITION ON DIGITAL SKILLS AND COMPETENCE, AND DIGITAL AND ONLINE LEARNING IN VOCATIONAL EDUCATION

We do not know what the impact of digitalisation on the economies and labour markets will be, nor can we predict the pace of change. What we do know is that for an increasing number of citizens, digital skills are becoming central to interacting, working and learning in today's society. We also know that today's students expect more personalisation and collaboration, and better links between what they learn at work, at school and online in their lifelong learning experience.

In this context, VET systems have to acknowledge these changes and re-define themselves. The future of VET also needs to rely on forward-looking DSC and DOL policies and strategies, and on educational organisations, in particular VET providers, who, therefore, have to become 'digitally competent' in order to provide more flexible access to and relevant provision of VET programmes.

Adapting current education and training provision to DOL and DSC requires awareness, commitment, time and investment (e.g., the buy-in of policy makers and school managers) as well as investment in infrastructure and professional development, in a context where technologies and skills demand are rapidly changing. VET stakeholders in partner countries are seriously challenged due to limited resources, weak institutions and lack of information on current and future skills needs.

However, there is a 'golden' opportunity for VET reforms in partner countries to improve access and provision through increased use of technology in education (DOL) and making graduates more employable through digital skills (DSC).

This paper is focused on VET and claims that DSC and DOL are important pillars for the modernisation of VET systems in a lifelong learning perspective. It draws on the experience of current and previous ETF actions in the fields.

This paper promotes a strategic approach based on four priorities and eight strategic actions that take into account the new European Commission's digital education action plan¹⁴⁹ and a set of EU reference frameworks and tools for DSC and DOL (DigComp, DigCompEdu and DigCompOrg). These frameworks should be considered as reference tools as opposed to 'prescriptors' for policy makers and practitioners. They are applicable also within the context of ETF partner countries, as demonstrated by recent initiatives in Serbia, Bosnia and Herzegovina, Ukraine and Georgia.

Three out of the four strategic priorities cover actions for ETF partner countries and one strategic priority covers ETF activities linked to EU and international policy dialogue (see Table 7.1). These strategic actions need to go hand-in-hand with other VET modernisation initiatives and thematic policy areas. This includes, for example, links to qualifications and skills development, work-based learning, entrepreneurship and the CPD of teachers and trainers.

Without prejudice to the other ETF's regions, the recent European Commission's communication on 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans'¹⁵⁰

¹⁴⁹ <https://ec.europa.eu/education/sites/education/files/digital-education-action-plan.pdf>

¹⁵⁰ https://eeas.europa.eu/headquarters/headquarters-homepage/39711/credible-enlargement-perspective-and-enhanced-eu-engagement-western-balkans_en

(February 2018) and the new European Commission’s digital education action plan (January 2018) suggest that the ETF should focus on the Western Balkans in the short and medium term.

TABLE 7.1 ETF PRIORITIES, STRATEGIC ACTIONS AND TOOLS

ETF priorities	ETF strategic actions	Tools
Making VET providers digitally competent	Support the analysis of the digital readiness of VET providers Support the digital competence development of VET providers	For VET providers: DigCompOrg and the self-reflection tool SELFIE Capacity building through peer learning and other soft mechanism (e.g. e-Platform/Forum)
Making DSC and DOL in VET more visible in national digital agendas	Support the establishment of (or foster existing) digital skills strategies Conduct analyses of the state of play and potential impact of digitalisation on skills and VET provision	EU platforms and related tools National coalitions on digital skills and competence ETF analytical frameworks for VET
Promoting digital competence as a key competence for VET	Promote DSC in CPD for VET teachers and trainers Promote DSC in curricula for VET students and adult learners	DigCompEdu DigComp
Contributing to the EU and international policy dialogue on DSC and DOL	Continued structured cooperation with DG Education, Youth, Sport and Culture and DG Employment, Social Affairs and Inclusion Continued cooperation with the JRC	ET 2020 Thematic Working Group on DSC and DOL ETF-JRC possible partnership agreement

7.1 Making VET providers ‘digitally competent’

At the centre of the ETF’s approach is the VET provider (initial, post-secondary and CVET), who needs to become ‘digitally competent’ so that the necessary digital capacity for the key elements of the VET system can be fully developed.

As the awareness and commitment of VET providers is a pre-condition for the potential digital transformation of VET and for ‘making better use of digital technology for teaching and learning’¹⁵¹, analysing the digital readiness of VET providers and supporting their capacity to become ‘digitally competent’ should be the top priority action for ETF interventions. Although VET providers are mostly public and private schools and continuing training providers, companies and intermediary organisations are also playing an increasing role and should be considered.

Focusing on the VET providers, in close cooperation with the relevant ministries and institutions in charge of VET and digital innovation, the ETF effects a strategic entry into the key elements already mentioned, such as leadership, teaching, quality assurance and learning practices, depending on the country needs and context.

Working with VET providers on improving their digital readiness also offers the opportunity of a ‘quick-win’. No specific ETF tool needs to be developed at this stage as the EU Competence Framework for Digitally Competent Organisations (DigCompOrg) and its self-reflection tool, SELFIE, provide a universal framework that can also be easily applied in the short term to all partner countries that are interested in the digitalisation of education and training.

¹⁵¹ Priority 1 (of three) of the European Commission’s new digital education action plan

Proposed ETF actions

- **Support the analysis of the digital readiness of VET providers** in selected partner countries by promoting the use of the self-reflection tool, SELFIE, which looks at strategies and practices related to dimensions such as Leadership and Governance Practices (see Figure 7.1).

Following preparatory work in 2018, the ETF could apply SELFIE in priority countries, in particular in candidate and Eastern Partnership countries. This would also raise the awareness and understanding of policy makers concerning the value and scope of the digital transformation.

Taking into account the lessons learnt from the 2017 pilot of SELFIE in Serbia, such an initiative would have the potential to trigger further actions and multiple effects, for example:

- strengthening the commitment and ownership of key organisations to foster digitalisation in VET through the bottom-up and participative approach of the self-reflection method;
 - providing baseline information and data for policy makers and school managers to inform future actions and to monitor progress in the field (e.g. Riga monitoring);
 - improving the thematic country intelligence of the ETF and feeding into standard ETF products, such as factsheets on DOL/DSC in VET in partner countries and policy briefings;
 - knock-on effects for future ETF policy advice and capacity building, where appropriate and feasible.
- **Support the digital competence development of VET providers** through soft mechanisms, including peer learning and peer review (in the country and abroad), and through promoting tools such as the development of Digital School Improvement Plans in selected partner countries. The ETF may also consider undertaking a feasibility assessment of establishing an ETF platform/forum on 'digitally competent VET providers' (2019/20) and the launch of such a forum (2020/21). One of its main functions could be to complement the self-assessment exercise, sharing lessons learnt and building a cross-country community of digitally advanced and interested VET providers, as a lever for modernising the VET system.

FIGURE 7.1 SELFIE (AND DIGCOMPORG) KEY DIMENSIONS



Source: JRC, presentation at the workshop on SELFIE in Seville, January 2018.

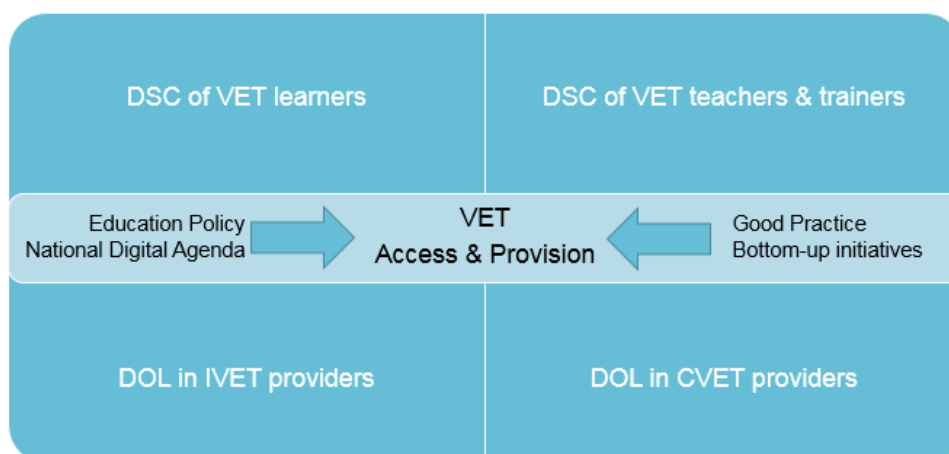
7.2 Making digital skills and competence, and digital and online learning in VET more visible in national digital agendas

Increasingly partner countries are developing National Agendas for Digitalisation and there is a risk that DSC and DOL in VET are neglected or fall too short. The ETF's task could be to support a limited number of priority countries (i.e. in the Eastern Partnership region) in the policy dialogue process at national level to foster the development of DSC and DOL in VET and/or to exchange knowledge and develop expertise at cross-country level.

Proposed ETF actions

- **Support the establishment of (or foster existing) digital skills strategies** and facilitate policy dialogue mechanisms at national level that effectively link the overall digital agenda of a country with DSC and DOL in VET dimension; for example supporting the formation of national digital skills and job coalitions, or promoting the idea of a national working group or sub-group on digital skills strategy, i.e. an expert advisory committee on DSC and DOL in VET, or through policy advice and sharing EU/international good practices. A recent opportunity emerged within the Eastern Partnership platform with the network EU4Digital as well as in the Berlin Process in the Western Balkans, to which the ETF could be connected and play an important role regarding VET.
- **Analyse progress of DSC and DOL policy and practice in relation to VET** and the potential impact of digitalisation on skills and VET provision in any countries that express interest in such a study. This analysis could build on and further develop existing ETF analytical frameworks for DSC and DOL in VET recently used in candidate countries. This would provide an opportunity for multidisciplinary work across thematic fields, including the ongoing ETF interdisciplinary activity on the future of work/skills.

FIGURE 7.2 ETF ANALYTICAL FRAMEWORK TO ANALYSE PROGRESS WITH DSC AND DOL IN A COUNTRY



Findings from such a study could feed into the above policy dialogue and also serve the future Torino Process rounds in terms of capturing baseline data/indicators for progress monitoring on the digital readiness of a VET system.

Two indexes for DOL have already been identified in cooperation with the ETF's Torino Process team, and in particular with the stats team.

TABLE 7.2 INDEXES FOR DOL

Index	Description
Number (share) of vocational schools connected to the Internet (y/n) + Is it broadband? (y/n)	1+1 quantitative indicators to measure DOL capacity of vocational schools, ETF data gathering
Existence of policy/law/action plan for DOL (y/n) + Are progress monitored and evaluated? (y/n)	Qualitative indicators showing interest and progress with DOL, ETF data gathering In line with this paper on DSC and DOL, the EU frameworks DigCompOrg and the related tool, SELFIE, shall be used/proposed for specific country analysis as a reference/ benchmark

7.3 Promotion of digital competence as a key competence for VET

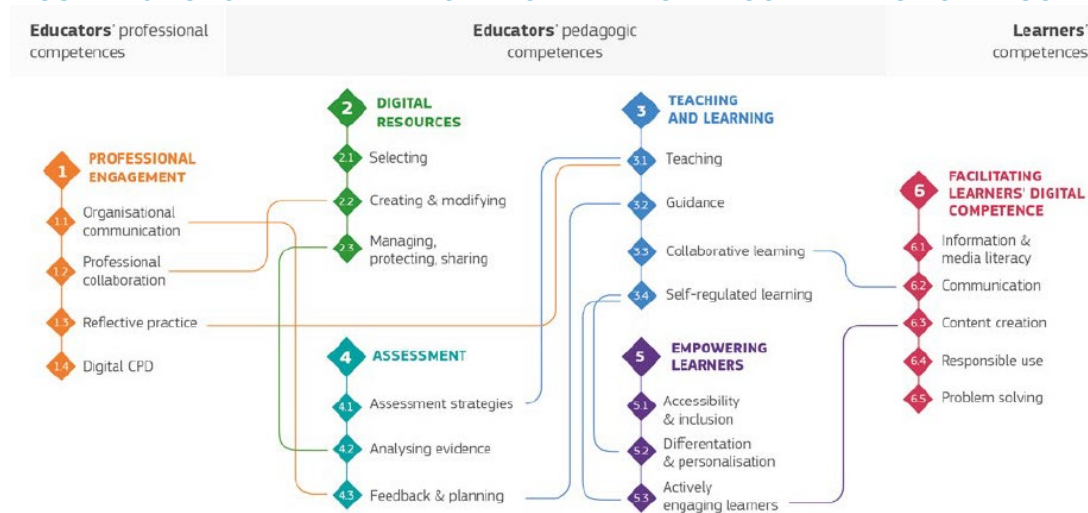
Complementary to the proposed priority action concerning VET providers' digital competence, the ETF should focus on promoting digital competence as a key competence in VET. Priority should be given to VET teachers and trainers, and also to VET learners.

Options for ETF actions

- Promote DSC in CPD for VET teachers and trainers:** The digital readiness of VET providers relies to a large extent on teachers and trainers – it is widely known that teachers are the most important factor contributing to learning outcomes and achievement. Teachers often also act as role models for the proper and critical use of digital technology in the learning process. On the other hand, teachers themselves need to learn and catch up with the latest developments in order to improve their competences.

The ETF entry point is CPD of teachers and trainers, although initial teacher training also plays a key role, but this is currently out of our mandate. The instrument that could be applied in this area is the 'European framework for the digital competence of educators' (DigCompEdu). A set of countries could pilot DigCompEdu (22 competences grouped into six areas and six proficiency levels) with a number of VET teachers/trainers, after the self-reflection of VET providers (SELFIE) was completed. This would allow exploring the teacher dimension in a more detailed fashion, for example regarding the pedagogical use of digital technology or empowering the learner in the process of becoming digitally competent.

FIGURE 7.3 EUROPEAN FRAMEWORK FOR THE DIGITAL COMPETENCE OF EDUCATORS



Source: https://ec.europa.eu/jrc/sites/jrcsh/files/digcompedu_overview_-_english.pdf

- Promote DSC in curricula for VET students and adult learners:** Basic as well as job-specific digital skills are becoming an increasingly important element of the overall skills sets of VET learners with a view to ensuring their employability. VET curricula, at all levels, need to be revisited and updated to ensure that such competences are properly included in students' learning outcomes.

 - An ETF action could envisage a VET curriculum review in selected countries to provide policy recommendations to ministries and agencies. Such recommendations would help partner countries to adopt and anchor digital competence in national VET curricula.
 - As part of such review, the ETF could promote the EU Digital Competence Framework for Citizens (DigComp)¹⁵² to facilitate the further conceptualisation of digital competence in VET curricula. Lessons learnt from ETF activities on national education standards in Ukraine, Georgia, and Bosnia and Herzegovina should be taken into account.
 - Co-working the digital and entrepreneurship key competences is important to promote an 'integrated learning outcomes' approach for the two competence areas for a digital economy in selected countries (building on the lessons learnt from the ETF pilot on training of trainers in Ukraine).
 - Last but not least, the ETF could explore the more difficult terrain of job-specific digital skills, working with a selected partner country on the design and adoption of job-specific digital skills (and related proficiency levels) for a set of VET occupational standards.
- Contribute to the EU and international policy dialogue on DSC and DOL:** At the heart of the ETF strategy on DSC and DOL are EU policies, frameworks and tools, in the development of which the ETF has contributed its expertise. While making use of these EU tools in partner countries where appropriate, the ETF should continue to actively contribute to the EU's internal policy development. In concrete terms this means:

 - structured cooperation with DG Education, Youth, Sport and Culture through participation in the new round of the thematic working group DELTA (Digital Education Learning, Teaching and Assessment 2018–20), focusing on VET and supporting the involvement of candidate countries;
 - systematic partnership with the Joint Research Centre of the Commission on the further development and implementation of various self-assessment tools (e.g. SELFIE 2.0, focus on VET items, self-assessment tools for DigComp, DigCompEdu and other tools supporting

¹⁵² The ETF is collaborating with the Joint Research Centre on the development of a self-assessment tool for citizens (forthcoming).

human capital development with relevance to VET). A possible partnership agreement could be explored (e.g. Memorandum of Understanding);

- connecting with the Eurydice network's initiative for the development of a report and comparative analysis on digital education covering 38 countries (based on 20–25 indicators)¹⁵³.

¹⁵³ https://eacea.ec.europa.eu/national-policies/eurydice/home_en

ACRONYMS

BYOD	Bring your own device
Cedefop	European Centre for the Development of Vocational Training
CPD	Continuing professional development
CVET	Continuing vocational education and training
DG	Directorate-General
DigComp	Digital Competence Framework for Citizens
DigCompEdu	Digital Competence Framework for Educators
DigCompOrg	Digital Competence Framework for Educational Organisations
DOL	Digital and online learning (also referred to as e-learning)
DSC	Digital skills and competence
EC	European Commission
ECDL	European Computer Driving Licence
EQF	European Qualifications Framework
ESCO	European Skills, Competences, Qualifications and Occupations
ET 2020	Education and Training Agenda 2020
ETF	European Training Foundation
EU	European Union
GDP	Gross domestic product
ICDL	International Computer Driving Licence
ICT	Information and communication technology
IT	Information technology
IVET	Initial vocational education and training
JRC	Joint Research Centre
MOOCs	Massive open online courses
NGOs	Non-governmental organisations
OECD	Organisation for Economic Cooperation and Development
OERs	Open educational resources
PISA	Programme for International Student Assessment (OECD)
US	United States (of America)
VET	Vocational education and training

BIBLIOGRAPHY

Ananiadou, K. and Claro M., '21st Century Skills and Competences for New Millennium Learners in OECD Countries', *OECD Education Working Papers*, No 41, OECD Publishing, Paris, 2009. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/218525261154>

Arntz, M., Gregory, T. and Zierahn, U., 'The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis', *OECD Social, Employment and Migration Working Papers*, No 189, OECD Publishing, Paris, 2016. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/5jlz9h56dvq7-en>

Bardak U., Rosso, F., Kuusela, T. and Mereuta, C., European Training Foundation, 'Anticipation of current and future skill needs in an era of digital revolution: The examples of skills forecast in Ukraine and policy foresight for skills in South East Europe', in Larsen, C., Rand, S., Schmid, A., Holopainen, P., Jokikaarre, P., Kuusela, K. and Alapuranen, N. (eds), *Digital (r)evolution and its effects on labour: Opportunities and challenges for regional and local labour market monitoring*, Rainer Hampp Verlag, Munchen Mering, 2016, pp. 317–362.

Bhuasiri, W. et al., 'Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty', *Computers & Education*, Vol. 58, No 2, 2012, pp. 843–55.

Burke, J.W. (ed.), *Competency based education and training*, Psychology Press, UK, 1989.

Cedefop, *The changing nature and role of vocational education and training in Europe, Volume 3: The responsiveness of European VET systems to external change (1995–2015)*, Cedefop research paper, No 67, Publications Office of the European Union, Luxembourg, 2018. Last accessed 27 September 2018 at: <http://data.europa.eu/doi/10.2801/621137>

Demiray, U. and İşman, A., 'History of distance education', *Sakarya Üniversitesi Eğitim Fakültesi Dergisi* 1, 2001.

Ehlers, U.-D. and Conole, G., 'Open educational practices: Unleashing the power of OER', UNESCO Workshop on OER in Namibia, 2010.

European Schoolnet, *Survey of schools: ICT in education. Benchmarking access, use and attitudes to technology in Europe's schools. Executive summary*, 2013. Last accessed 27 September 2018 at: www.eun.org/c/document_library/get_file?uuid=9be81a75-c868-4558-a777-862ecc8162a4&groupId=43887

Fields, E., 'Making visible new learning: Professional development with open digital badge pathways', *Partnership: The Canadian Journal of Library and Information Practice and Research*, Vol. 10, No 1, 2015.

Frey, C.B. and Osborne, M.A., 'The future of employment: How susceptible are jobs to computerisation?', *Technological Forecasting and Social Change*, Vol. 114, 2017, pp. 254–80.

Goldin, C.D. and Katz, L.F., *The race between education and technology*, Cambridge, MA, Harvard University Press, 2009.

Hajkowicz, S.A. et al. 'Tomorrow's digitally enabled workforce: Megatrends and scenarios for jobs and employment in Australia over the coming twenty years', *Australian Policy Online*, 2016.

Hilton, J.L. III, Johnson, A., Stein, J. and Wiley, D., 'The four R's of openness and ALMS analysis: Frameworks for open educational resources', *All Faculty Publications*, Vol. 822, 2010. Last accessed 27 September 2018 at: <http://scholarsarchive.byu.edu/facpub/822>

Ifenthaler, D., Bellin-Mularski, N. and Mah, D. (eds), *Foundation of digital badges and micro-credentials: Demonstrating and recognizing knowledge and competencies*, Switzerland, Springer, 2016.

Imants, J., 'Two basic mechanisms for organisational learning in schools', *European Journal of Teacher Education*, Vol. 26, No 3, 2003, pp. 293–311. Last accessed 27 September 2018 at: <https://doi.org/10.1080/0261976032000128157A>

Jung, I. and Jung, I., *Quality assurance in distance education and e-learning: Challenges and solutions from Asia*, Sage Publications Pvt. Ltd, New Delhi, 2013.

Kaplan, A.M. and Haenlein, M., 'Higher education and the digital revolution: About MOOC, SPOCs, social media, and the Cookie Monster', *Business Horizons*, Vol. 59, No 4, 2016, pp. 441–50.

Kelly, T., Liaplina, A., Tan, S.W. and Winkler, H., *Reaping digital dividends: Leveraging the internet for development in Europe and Central Asia*, Washington, DC, World Bank, 2017. Last accessed 27 September 2018 at: <https://doi.org/10.1596/978-1-4648-1025-1>

King, A., 'From sage on the stage to guide on the side', *College Teaching*, Vol. 41, No 1, 1993, pp. 30–35.

Kozma, R.B., 'Comparative analysis of policies for ICT in education', in Voogt, J. and Knezek, G. (eds), *International Handbook of Information Technology in Primary and Secondary Education*, Springer, USA, 2008, pp. 1083–96.

Lage, M.J., Platt, G.J. and Treglia, M., 'Inverting the classroom: A gateway to creating an inclusive learning environment', *The Journal of Economic Education*, 31.1, 2000, pp. 30–43.

Mazur, E., *Peer instruction: A user's manual series in educational innovation*, Prentice Hall, Upper Saddle River, NJ, 1997.

Moore, M.G. and Kearsley, G., *Distance education: A systems view of online learning*, Cengage Learning, Boston, MA, 2011.

Music, A., 'Massive open online courses (MOOCs): Trends and future perspectives', Background paper #2, OECD Centre for Educational Research and Innovation and Laureate International Universities international seminar 'Opening higher education: What the future might bring', Berlin, Germany, 8–9 December 2016.

National Commission on Teaching and America's Future, *Induction into learning communities*, National Commission on Teaching and America's Future, Washington, DC, 2005.

New Media Consortium, *The NMC Horizon Report Europe: 2014*, Schools Edition, 2014.

OECD, *Inspired by technology, driven by pedagogy: A systemic approach to technology-based school innovations*, Educational Research and Innovation, OECD Publishing, Paris, 2010. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/9789264094437-en>

OECD, *Students, computers and learning: Making the connection*, PISA, OECD Publishing, Paris, 2015. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/9789264239555-en>

OECD, *Getting skills right: Assessing and anticipating changing skill needs*, OECD Publishing, Paris, 2016. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/9789264252073-en>

OECD and Peña-López, I., *The OECD handbook for innovative learning environments*, OECD Publishing, Paris, 2017.

Oliver, B., *Better 21C credentials: Evaluating the promise, perils and disruptive potential of digital credentials*, Deakin University, Victoria, 2016.

Orr, D., Rimini, M. and van Damme, D., *Open educational resources: A catalyst for innovation*, Educational Research and Innovation, OECD Publishing, Paris, 2015. Last accessed 27 September 2018 at: <http://dx.doi.org/10.1787/9789264247543-en>

Rauner, F., 'Practical Knowledge and Occupational Competence', *European Journal of Vocational Training*, 40.1, 2007, pp. 52–66.

Rose, T., *The end of average: How to succeed in a world that values sameness*, Penguin UK, 2016.

Sahlberg, P., *Finnish lessons 2.0: What can the world learn from educational change in Finland?*, Teachers College Press, New York, 2014.

Schwarz, H., Conein, S. and Tutschner, H., 'Modernisation of the IT occupations in the age of 4.0', *VET Trends 2018*, BWP Special Edition, Bonn, 2017, pp. 10–14. Last accessed 27 September 2018 at: www.bibb.de/veroeffentlichungen/de/bwp/show/8488

Shah, D., 'By the numbers: MOOCs in 2015' [online], *2015 MOOC Roundup Series*, 21 December 2015. Last accessed 27 September 2018 at: www.class-central.com/report/moocs-2015-stats/

Vincent-Lancrin, S., 'Open higher education: What are we talking about?' Background paper #1, OECD Centre for Educational Research and Innovation and Laureate International Universities international seminar 'Opening higher education: What the future might bring', Berlin, Germany, 8–9 December 2016.

World Bank, *World development report 2016: Digital dividends overview*, World development report, Washington, D.C., World Bank Group, 2016. Last accessed 27 September 2018 at: <http://documents.worldbank.org/curated/en/961621467994698644/World-development-report-2016-digital-dividends-overview>

Zhao, Y., Lei, J. and Conway, P.F., 'Global perspective on political definitions of e-learning: Commonalities and differences in national educational technology strategy discourses', in Weiss, J. et al. (eds), *The international handbook of virtual learning environments*, Springer, The Netherlands, 2006, pp. 673–97.

Website
www.etf.europa.eu

Twitter
[@etfeuropa](https://twitter.com/etfeuropa)

Facebook
facebook.com/etfeuropa

YouTube
www.youtube.com/user/etfeuropa

Instagram
instagram.com/etfeuropa/

LinkedIn
linkedin.com/company/european-training-foundation

E-mail
info@etf.europa.eu



European Training Foundation

