



Skills for Jobs in the Digital Era

8 November 2018, Brussels

Workshop Report

Introduction

Opening the meeting, **Prof. George Metakides (President of DigEnlight)** noted that there is no shortage of studies on the issue of digital skills. National and international agencies, big tech companies, and consultancies regularly produce analyses, so it is a field that is well ploughed. While such studies tend to share basic findings, their conclusions differ. Optimists say technological progress has always brought new jobs. Pessimists opine that there are no guarantees this will continue to be the case and point to estimates that up to half of existing jobs could disappear over the next 15 years. In between are more subtle analyses, along the lines that not all jobs will be affected. The general view, therefore, is that significant change is around the corner but that our vision remains foggy.

Certain issues are clear, however. Firstly, some jobs are already disappearing. Following job losses in agriculture and manufacturing, now the service sector too is being transformed. Secondly, the new jobs that will replace them require new skills and interactions between humans and various forms of automata. Thirdly, the job skills being provided by existing institutions are not well matched to the new technologies. Many more new jobs could be created if the right skills were available. Fourthly, the archetypical model of the labour market is being replaced by new approaches, such as the 'gig economy'.

This DigEnlight Workshop aimed to contribute to this debate, focussing on three key areas: policy; supply and demand for skills; and concrete ways of harnessing technology to solve emerging problems.

Keynote Presentations

Antti Peltomäki (Deputy Director-General DG GROW, European Commission) observed that digital skills and related issues are a prime concern across the Commission. Digital technologies are disrupting industrial value chains and powering wider economic transformation, and hence are a key focus for policy-makers. It is not only the industrial world that is affected but citizens' everyday lives as well. Change is happening so quickly that policy-makers can find it difficult to keep up; hence the wide range of analyses and studies referred to by Prof. Metakides.

Many commentators emphasize the scale and urgency of the gap in digital skills. While estimates vary, the issue is clearly critical for both Europe and other regions. In today's world, digital and IT are so deeply integrated into all areas of our lives that they should no longer be treated as specialist: they are simply part of skills for everyday life. People of all ages have to prepare for the changes in working life. Most of the burden will fall on the private sector, both employers and employees, as they have the best view of what is happening. But public authorities also have a key role to play in terms of preparing the ground and it is essential that private and public sector players are well aligned.

Education and skills is primarily a competence of the Member States, but there are several areas where the EU is taking the lead. The EU's Digital Skills Action Plan, launched in early 2018, includes proposals for a digital education plan and a recommendation on key competences for lifelong learning. Another EU initiative is the European Digital Competence Framework for citizens and workers, which has the support of many private sector companies, both large and small. Structural investment funds are a key instrument. Public and private stakeholders are working together on initial sector-based pilots, in areas such as automotive, with further projects to be launched in 2019/20.

Oliver Roethig (Regional Secretary Uni Europa and Board Member of Digital Skills and Jobs Coalition) commented on the digital skills agenda from the perspective of a leading social partner.

The key challenge in digital skills is not in schooling but in the forty-plus years during which people are employed. The skills acquired during the relatively short period of formal education provided by school and university are no longer sufficient for a working life where we are likely to change careers several times. The service sector, rather than manufacturing, is already the dominant employer in Europe and is increasingly affected by skills issues. Trades unions have traditionally had their base in mid-skills jobs, many of which are rapidly disappearing. But lower level service jobs, such as cleaning, are being affected by technological change, too, as are higher skilled areas such as banking, insurance and professional services. Women are disproportionately represented in low skilled work and so at particular risk of either being displaced or further disadvantaged in terms of pay.

The Digital Skills and Jobs Coalition (DSJC) is a European initiative that brings together key stakeholders and is supported by a series of national coalitions. It has four pillars: digital skills for all; digital skills for the labour force; digital skills for ICT professionals; and digital skills in education. Aspects such as digital opportunity traineeships, which give students and recent graduates an opportunity to get hands-on training in digital fields, and EU Code Week, which helps people to take up coding, have been particularly successful. Further details are available online.¹

Given the speed of change, we can no longer afford to rely on the occasional leaps in skills as has been the case in the past. We need continuous incremental change, where skills are updated at the workplace with support from outside bodies. Essential is a company-level approach combined with a sectoral one with close cooperation of employers and trade unions. Europe is leading the way in these collaborative approaches and these efforts should be stepped up further.

The keynote presentation by Ms **Heidi Cigan (Head of Sector Digital Skills, DG CNECT, European Commission)** was not presented as Ms Cigan was unable to attend.

In discussion, it was noted that much of the expertise required was vertical (within sectors) rather than just horizontal (across sectors). Sectors such as automotive have very specific needs (e.g. security), requiring bespoke solutions (e.g. certification). Skillsets have to be 'horizontal enough' that they are applicable across a wide range of needs but with areas of specialism within them. Clearly, there is scope for collaboration between sectors with similar issues and the Commission is tracking this closely.

Asked whether skills policy should be combined with other areas of industrial policy – RDI for example – Mr Peltomäki said that digital skills were already recognised as essential to business models. The EU supports regions to build on their own economic strengths (through the Smart Specialisation Strategy, S3). The Industry 2030 Roundtable, a high level initiative, is looking at this issue further, for example how to build on the good experiences with placements in developing education-industry links.

A questioner noted that there is nothing new in the current situation: every industrial revolution has a skills wave. The focus, perhaps, should be generic because every job will have a digital component? Mr Roethig agreed. There is plenty of innovation and lighthouse-type projects: the challenge now is to mainstream them. We should devote greater effort to improving what we have, rather than always seeking to build something new. In skills terms, the lifetime is becoming ever shorter and working relationships loser. IBM has reduced its long-term planning from five to three years. It is increasingly challenging for individuals to function in such an uncertain environment.

¹ <https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition>

Panel 1 - New Jobs, New Skills: Status and Prospects

Chair: Paul Timmers (University of Oxford)

Florin Lupescu (Principal Advisor at DG CNECT, European Commission) spoke about the relevance of training and education in the digital era. In Europe, our approach to education still follows largely a conventional approach. In most cases, pupils are still taught from a blackboard or its felt pen alternative, despite the availability of digital artefacts, PCs and digital displays. The reason for this is that the politics of education has not changed. As a result, in Europe we are now fundamentally out of step with the educational demands implied by globalisation and its attendant processes. The focus of the education system needs to shift from accumulating information and knowledge, to stimulating creativity and problem-solving. A more transdisciplinary approach should also be emphasized.

Politicians must put in place the modalities for a fully digital education. How can it be that Europe has common policies on issues such as agriculture and fisheries but not for digital education, which is one of the most important issues shaping our common future? Member States have been, and remain, very protective of education policy, but we have to break through this mantra. The EU and Member States should develop a common education policy with common instruments designed to emphasize digital education.

Anders Flodstrom (Educational Director, EIT Digital) described EIT Digital's policy and actions on training and education. From a global perspective, there are many challenges. Learning has never been more ubiquitous or accessible. At the same time, learners actual and needed work competencies are less coupled to academic higher education than ever before. Meanwhile, the rate of change of professional roles and the birth-rates of new professions have never been higher.

EIT-Digital works with more than 150 industrial partners and is pioneering innovative approaches to digital skills, many of them interdisciplinary. These are offered through the EIT Digital Academy, which includes a Masters School, an Industrial Doctoral School, a Professional School, and Summer Schools. Programmes include certificated professional training programmes, and cybersecurity training for teachers (in association with Berkeley, US). Encouraging creativity in students is central to the EIT-Digital's programmes. Blended contexts are applied: learning-by-doing, learning-by-developing, etc., where the emphasis is on entrepreneurship rather than solely on skills acquisition.

Michel Servoz (Senior Advisor Robotics, European Commission) outlined challenges and opportunities for policy-makers relating to artificial intelligence (AI) and labour markets in Europe. Poor employability – due to lack of skills – is one of the main reasons for Europe's high level of long-term unemployment. For decades, Europe has been losing jobs but developments such as 3D printing, AI and robotics provide new opportunities – provided we have the right skills. On the other hand, the market for talent is worldwide and a diploma is a global currency. Hence, in Europe we face a paradox: our skills provision is organised locally but our qualifications are sought and recognised across the world. Academia has been slow to adapt but is increasingly aware of the need for change. According to a recent study by McKinsey's, half of what students learn during their first year at university will be redundant by the time they graduate.²

AI will bring major changes for labour markets in Europe. The issue is not solely that of displacement – automata replacing workers – but also humans having to work alongside robots and AI systems. There is scope for action in youth education, equipping young people with creative thinking

² Skill Shift Automation and the Future of the Workforce, McKinsey & Co. 2018.
www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce

and the ability to 'learn to learn'; improving access to and take-up of computer science in schools; and massive investment in adult education for both workers and the unemployed (mid-career schools). In the US, MIT is spending US\$1bn on an AI College which will open in 2019. Europe lags behind in terms of urgency and does not have programmes that can compete at global level. A European College on AI could be launched under the new Commission, providing sufficient budget is secured.

Fiona Fanning (Director of European Affairs, Certiport, Pearson VUE) focused on the role of certification within the digital skills agenda. Future skills needs will continue to evolve in the face of the exponential growth and disruption enabled by technology. We need to ensure not only that we provide the next generation with the specific skills necessary but also that we have the systems in place to facilitate and value the constant acquisition of skills at all levels.

As other speakers had noted, the fast pace of change represents a challenge to formal education systems. At present, only 25% of students are taught by teachers who are digitally confident. We need to set our educators up to succeed by ensuring that digital is integrated into teacher training at all levels and is used as an enabler of learning in all subjects; in other words, education becomes digital by default. Secondly, how we learn, when we learn and where we learn also needs to evolve. We should no longer think of education as being through monolithic, three-year degrees. There should be more emphasis on 'just in time' learning: smaller units of learning acquired through informal and non-formal channels and even formal channels on an ongoing basis.

Thirdly, appropriate mechanisms need to be put in place to recognise and valorise learning in all forms. These systems must be flexible so they endure and are resilient in the changing context. They should provide recognition for all types of learning – non-formal and formal – and facilitate mobility and portability of recognition in Europe. Much good work is already underway at policy level.

Andrea Parola (General Manager, European eSkills Assoc) presented the eSkills Association's view on the future of work and job skills. Reiterating the message from other speakers, he noted that the majority of today's school pupils will do jobs that do not yet exist. Meanwhile, globalisation means that jobs are being simultaneously displaced and created, but not necessarily in the same place. We are using educational approaches developed in the 19th century and teachers trained in the 20th century to educate students for the 21st century: this model needs to change, and quickly.

The economy is changing rapidly: in the automotive sector, for example, more than 90% of RDI is related to software. Workers continually need to be trained and retrained, and we should see skills as a safeguard for both workers and employers. EEA is working closely with the EC in areas such as competence frameworks and IT professionalism. The DSJC is an important initiative but it needs to be brought closer to funding initiatives such as ESF.

Discussion

Europe needs ambidextrous organisations that are creative as well as innovative. We have the capacities to do this but do not bring them together well. The European education market remains highly fragmented: different term times, degree regulations, etc.

Asked why creativity was not yet on the political agenda, Mr Lupescu said that it lacked champions who were able to fight for it at national level. While agreeing with the need to make education digital, an industry participant emphasized the need for collaboration. Pilot projects should be established where industry and public bodies work together, identify missing skills and future skill needs, and chart a path towards them.

Digital skills shortages are particularly acute in traditional industries, such as energy. In some cases, there are few workers left that understand legacy systems. As a consequence, the knowledge of existing workers is being re-evaluated and valued more highly.

Why is academia in Europe lagging behind? Partly it is because the organisational structures are not conducive to quick adaptation. It can take five years for a university to change its curricula. The McKinsey report provides important insights. Universities are only interested in students up to graduation. There is tremendous scope for post-graduation updates that enable graduates to top up their skills throughout their careers. Companies are not blameless either: they need to take greater responsibility for upskilling and reskilling workers rather than making them redundant, which is very expensive for individuals, companies and the state. We need proper ecosystems for education.

The importance of standardisation and European frameworks was broadly acknowledged. At present we have 28 certification systems to deal with, which is cumbersome and a barrier to competences being recognised between Member States. Although the EU has had some success in this area, more could be done and there is nothing to stop Member States collaborating separately outside of European frameworks, where they wish to do so.

Initiatives designed to encourage young people to take up coding have shown the potential for bottom-up initiatives in incentivising people to follow digital careers. Skills have to be driven by the professional communities concerned, such as nurses and lawyers, so as to get their buy-in and support: imposing from the outside will not work.

Panel 2 - Up- and Re-skilling: Innovative Approaches

Chair: Jacques Bus (Secretary-General, DigEnlight)

Kostas Axaroglou (Dean, Alba Business School) described Alba's approach to up- and re-skilling. Alba is a Graduate Business School offering academic and professional education programmes. The Alba Executive Development has pursued programme innovation with emphasis in employability through reskilling and upskilling in the era of digitalisation. Programmes are offered through the Alba Digital Academy, which aims to support managers in becoming continuous learners. Alba offers training at a variety of levels across a learning canvas, from basic entry-level introductions to advanced technical and leadership programmes. Under one such Alba learning initiative, young STEM (Science, Technology, Engineering, Mathematics) graduates are coached in digital competences, with the best achieving a software testing qualification.

Universities in collaboration with companies (forming a 'learning ecosystem') have to think in terms of 'digital social responsibility' (DSR), empowering young talents with the mindset, behaviours, technical skills and know-how to become employable and successful in the digital era. Such initiatives have not just to provide added value for the learner but also to instil values. The aim is to develop the next generation of experts and game changers who are equipped with technical expertise as well as the competences and soft skills necessary to make a difference. It requires an agile learning mindset, and an emphasis on ethics and meritocracy, social responsibility and solidarity.

Magda Rosenmöller (EIT Health and IESE Business School, Barcelona) leads EIT Health's activities on training and skills. Studies such as the Hospital of the Future project (undertaken by IESE and Accenture) emphasize that, like all modern organisations, a hospital is a function of its knowledge base. Digital transformation will be crucial to the future of healthcare, opening the way to more personalised care and allowing patients to take a bigger role in managing their care and condition. The study

identified fourteen recommendations.³ Based on these, EIT-H is now looking at future management needs. It aims to understand the role of the future healthcare manager in the EU; to develop competence frameworks, as well as means to validate those competences.

MTiH is a new masters (MSc) programme in Technological Innovation in Health offering a transdisciplinary and holistic approach. Degrees are offered at various centres across Europe, each of which is certified by the EIT-H, regardless of the institution's reputation, so as to ensure common recognition of the qualification. Other initiatives being pursued by EIT Health include: Starship, which brings together masters students from high potential regions; CRISH, a teaching programme that involves patients; and GENIE, the global educators' network for healthcare innovation.

Simone Vitiello (Open Evidence) described STEM4youth, a Horizon 2020 project concerned with innovative ways to make science education and scientific careers attractive to young people.⁴ STEM4youth analysed the labour market for STEM skills, aiming to understand the factors influencing demand and supply. In 2015, STEM accounted for 9% of the total employment in the EU, equivalent to 19.9 million jobs, and STEM-based industry employed about one-third of the EU active population. STEM employment increased by 5% from 2011-2015, a trend that is forecast to continue. On the supply side, there were 5.3 million STEM students in the EU in 2014, of which 31% were female (evidence of continuing gender bias, especially in engineering and computer science). STEM students accounted for about 27% of all students in tertiary education.

STEM employment drivers include replacement demand; trends in key STEM sectors, such as energy, construction, automotive and biotech; and cross-sectoral issues.

Patrick Hartigan (InnoEnergy) proposed a new interpretation of the term 'blended learning'. The concept of blended learning has been around for a decade or more, with much of the focus being on full-time learners in higher education settings. It is equally applicable to continuous professional development (CPD), but approaches here are still evolving.

A true 'blended' approach to learning requires us to go much further than is currently common practice. As well as the blending of online and face-to-face learning, it requires the blending of technology and business; the blending of digitalisation with specific user communities; and the blending of stakeholder perspectives. Data is the glue that holds everything together: it enables innovation and allows stakeholders to contextualise the opportunity for their specific circumstances.

Digital transformation is now driving the need for blended CPD education across many industry sectors. One example is the 'Internet of Energy Bootcamp', developed by InnoEnergy, a Knowledge and Innovation Community of the EIT. Not only course delivery methods, but delegates' backgrounds and course content are also blended around the common theme of deriving valuable business information from real-world datasets. The result is efficiently delivered learning that prepares delegates from electricity utilities and energy supply companies for the digitalisation challenges facing their sector.

Theo Mensen of ePortfolio for All (NL) was unable to attend. In Mr Mensen's absence, the presentation was summarized briefly by Jacques Bus. StudyBits aims to support the international mobility of students and professionals by developing more efficient and trustworthy procedures. Blockchain offers opportunities for better, faster and more efficient student services across a number of scenarios. One is to make credits and learning outcomes more transparent and trustworthy. Badges,

³ <https://media.iese.edu/research/pdfs/ST-0388-E.pdf>

⁴ <http://www.stem4youth.eu/>

secured by blockchain, are proposed as a means of certifying skills. Working demonstrations, known as Open Badges, have been set up.

In essence, this is a novel perspective on the previous discussions regarding certification. An open system, based on blockchain, may overcome the established hurdles but could also introduce new issues and risks. Certificators would need to be validated, otherwise anyone could create an open badge. These are very early developments that should be kept under review.

Discussion

Reflecting on the presentations, it was observed that previously professionals had been managing their career paths. Now, in a market where freelance working is becoming more dominant, they are having to manage their learning paths as well.

The situation varies across Europe. In Greece, for example, STEM unemployment is relatively high due to the economic circumstances and the lack of specialist employers.

The labour market in health will continue to grow, so here it is an issue of reskilling rather than replacement. New technology provides scope to automate some functions, such as radiography examinations, freeing highly-trained professionals for other tasks. Digital technologies also present opportunities to address the shortage of medical professionals in less-developed regions by training surgeons, doctors and community health professionals.

The opportunities in health are boundless, but we should not lose sight of the human dimension. Patients can feel alienated if the technology is seen to take over. There are generational differences here, with millennials expecting a different approach to healthcare than older generations: they tend to be more comfortable dealing with health apps but also less cautious about big data and privacy issues. When used appropriately, new technologies could free up time for a more human-centred approach to healthcare, allowing patients and their families to be more closely involved.

Mr Vitiello observed that although universities adapt their courses to reflect the need for hard skills, they are less responsive in relation to soft skills, such as communication. We need STEM students to acquire other skills and for students in non-STEM disciplines to acquire STEM skills. Computing is increasingly important in life sciences, for example. Bringing more women into STEM will also help cultural change. A broad body of evidence now shows that diverse groups are more productive: we have to use full human capital potential.

Asked about the potential of the blended learning approach, Mr Hartigan stressed that content was just as important as delivery. Blended learning allows managers to contextualise the nature of the opportunity within their specific sector. It is an attempt to tap into organisations through competitive drivers, alerting senior and middle management to the opportunities and then using the available datasets to enable innovation. In doing so, it also highlights the need for broader perspectives, such as lawyers, ethicists and privacy specialists.

Panel 3: New Generation e-Learning Tools for Career Development

Chair: Obhi Chatterjee (Head of Sector - Learning Technologies, European Commission)

Stefan Dietze (GESIS, Leibniz Inst. For the Social Sciences) discussed use of the Web as a platform for informal and everyday learning. With informal everyday online learning (as opposed to education) it is the activity rather the resource that makes the difference. In other words, how a resource is used,

rather than which resource is used. The concept of learning analytics has emerged to understand learning behaviour, especially in informal settings.

AFEL, a Horizon 2020 project, is studying learning within social web environments.⁵ Learning efficiently on the web means finding reliable and relevant information for a particular topic or learning need. User knowledge gain/state can be predicted from user behaviour during search missions, in particular browsing behaviour and querying. There is a need to support learners/users to find information efficiently (“learning to learn”). Work is ongoing to investigate resource features as additional signals and to turn such models into actual applications.

Aaron Wagener (Co-founder, MXC Foundation gGmbH) argued that IoT is essential to the future of AI. Blockchain is a key technology here but it needs to be used as a tool, not a purpose as has been the case up to now. Relevance, integration, and reward will be keys to driving take-up of blockchain technologies. Education is a major hurdle and start-ups such as MXC have a key role to play in enabling developers to broaden their skills in IoT, AI and related technologies.

MXC is taking IoT to the people by designing tools to make IoT relevant to people’s lives. Its initial focus is on smart cities, providing tools and apps to power the data revolution. We need kinaesthetic learning (‘learning by participating’), where citizens take an active role and the data networks are owned and operated by citizens, who use them and receive rewards.

Xavier Letizia (SIVCO Belgium) showcased a number of practical examples of digital channels being used to support capacity building and life-long learning. Among these examples, he mentioned that SIVCO was recently awarded by DG Human Resources a Framework Contract, namely TRAINUSERS III, which allows for services for development of eLearning courses to be used by the European Parliament, DGs, agencies and other pertinent European institutions.

For more than ten years, SIVCO has successfully developed high-end projects initiated by the European Commission with an extensive positive social and economic impact. With unique skills and extensive expertise in software development and internationally competitive experts, SIVCO has implemented more than 25 European IT projects, with direct benefits to millions of EU citizens. The BTrain project implemented by SIVCO at DG TAXUD has several components, including the development of the Taxedu Portal (<https://europa.eu/taxedu/>), aiming to educate European citizens about tax and how it affects their lives. Further eContent developments were also uploaded on the portal, like micro-learning clips, eLearning courses and the Taxlandia application (an interactive educational game for students throughout the European Union, aimed at raising awareness on taxation processes), all of these being made available to the wider public.

eLearning has reached the mainstream and there are now many successful examples across a variety of channels and devices. Other case studies include: learning nuggets for immigration officers; immersive environments for laboratory training and nuclear power plant design; and educational games. Experience shows the importance of the ‘4Cs’ in creating value in e-content: collaboration, creativity, critical thinking, and communication. Videos of the examples were presented at a side screen during the workshop.

Bruno Koninckx (KnowledgeFlow i.o) highlighted a novel approach to making knowledge more usable within the workplace. Users, especially younger generations, are turning away from traditional e-learning approaches: they are looking to learn ‘on the fly’ or ‘just in time’, acquiring knowledge at the moment they need it.

⁵ See <http://www.afel-project.eu/>

KnowledgeFlow is a knowledge management platform that makes knowledge more accessible and usable by structuring it. Knowledge is presented as a series of microlearnings that are directly relevant to the user's needs and circumstances. The interface is highly intuitive (knowledge is displayed on the screen in blocks) and users are able to use natural language queries if they wish. The extensive in-built analytics support continuous testing and 'learning by testing' (learning moments with immediate feedback). Retailers have used KnowledgeFlow to answer customers' queries and industrial companies have used it to equip operators to perform complex tasks. The solution is platform agnostic and enables on-demand and formal learning to be combined effectively.

Knowledge sharing among employees, facilitated by solutions such as KnowledgeFlow, empowers and motivates staff and helps businesses be more competitive.

Greg Alpar (Open University, The Netherlands) explained that future jobs will need mathematics and mathematical learning skills but current education does not prepare students for that job market. In a study released earlier this year, the World Economic Forum noted: "there is an urgent need to address the impact of new technologies on labour markets through **upgraded education** policies aimed at rapidly raising education and skills levels of individuals of all ages, particularly with regard to both **STEM** (science, technology, engineering and mathematics) and non-cognitive soft skills (e.g. **communication or collaboration**), enabling people to leverage their uniquely human capabilities."⁶

The same report presented detailed results from a worldwide study into the changing job market between 2018 and 2022. In Western Europe, the top five skills that are expected to play an increasingly important role are: creativity, analytical thinking, learning strategies, technology design and programming, and complex problem-solving. Real mathematics and its applications play a crucial role in at least three of these (analytical thinking, technology design and programming, and complex problem-solving), while creativity and learning strategies are a crucial part of mathematics. A more interdisciplinary approach is needed.

Open Maths is a new approach to teaching mathematics that teaches students not only the idea of real mathematics, but also other important skills. The course, which is being offered at two universities in the Netherlands, aims at changing the image that students have about mathematics and about themselves with regard to maths. It is a blended course, comprising a mixture of online and classroom learning.

Conclusions

The workshop addressed many important issues relevant to the digital skills debate.

It is clear that the situation is more complicated and deep-rooted than the much-publicised skills gap. Aspects highlighted include:

- **The ever increasing pace of change:** Globalisation, technological progress and demographic change have major implications for the future of work. The development of AI, Big Data and analytics, automation and robotics is leading to the so-called Fourth Industrial Revolution. The effects on employment and the job market creates much uncertainty, in particular for lower-educated workers. The majority of today's school pupils will do jobs that do not yet exist. Half of what students learn during their first year at university will be redundant by the time they graduate. If even large companies are reducing their long-term planning horizon to three years, how are individuals expected to cope?

⁶ *The Future of Jobs Report, 2018*. The World Economic Forum

- **The decoupling of labour market skills and formal education:** In this fast-changing world, the competences required in the job market, both current and prospective, are less coupled to academic higher education than ever before. One of the reasons for this is Europe's fragmented education system. Universities are slow to adapt to new demands in the labour market, especially in transdisciplinary approaches and soft skills. The qualifications they provide are not portable between Member States and there is no 'after sales' service for graduates. Added to this is the lack of political will to build a true pan-European education system.
- **Learning as part of the portfolio career:** In a market where freelance working is becoming more dominant, professionals are having to manage not just their career paths but their learning paths as well. The market for talent is global and a European qualification system can be a passport to lucrative jobs elsewhere.
- **Learning in the 21st century:** As the WEF report highlights, the top skills required for the future are those based on creativity and adaptability rather than pure technical expertise. Creative and trans-disciplinary thinking, in particular, are essential skills and nurturing these is key to people's ability to 'learn to learn'. We can no longer afford to rely on the occasional leaps in skills, as we have done in the past, and must create an ecosystem for continuous learning.

This fast pace of change represents a challenge to formal education systems, learners, companies, and policy-makers. It is clear there is no 'one size fits all' solution: individual sectors, groups, and labour markets will require their own solutions. Key recommendations suggested by the workshop are:

- **Make education digital by default,** with learners of all ages able to learn ICT and then use ICT to learn. Creativity should be a foundational aspect, equipping people not with facts but with the ability to 'learn to learn'.
- **Ensure education is inter- or transdisciplinary.** Students, in both STEM subjects and non-STEM subjects, should have a learning environment that crosses boundaries rather than being confined to traditional silos. STEM students need better awareness of social aspects (such as ethics of AI, algorithms and privacy) as well as soft skills like communication and problem solving. Non-STEM students need at least basic competence in STEM disciplines so as to be able to understand the fast-paced world of innovation around them. Approaches such as the Open Mathematics initiative and transdisciplinary degrees can help bridge this gap.
- **Explore new approaches to blended learning:** While e-learning has reached the mainstream, we are still only at the beginning of the curve in terms of understanding what blended learning has to offer. Its use should be applied beyond full-time higher education in areas such as part-time learning and continuous professional development. New modalities are emerging which need to be explored and evaluated. These include:
 - Learning-by-doing
 - Learning-by-developing
 - Learning-on-the-fly or 'just-in-time learning'
 - Learning-by-participating
 - Learning-by-testing.
- **Invest in upskilling and reskilling:** Skills are a safeguard for both workers and employers: we have to value them more. A massive investment in upskilling and reskilling is needed so as to improve the employability of European workers across all levels of the labour market. Actions should include: mid-career schools where workers can top-up their knowledge or learn new

skills; on-the-job training, delivered using blended learning approaches; and schemes to retrain mature workers and the unemployed in new fields.

- **Develop systems to recognise and valorise learning:** New forms of learning require a step-change in our approach to recognition and certification. Appropriate mechanisms need to be put in place to recognise and valorise learning in all its forms. These systems must be flexible, reliable and secure; provide recognition for all types of learning (formal, non-formal, blended); and facilitate mobility and portability in Europe. Potential approaches range from Europe-wide certification approaches, to open systems based on new technologies such as blockchain.
- **Collaborate for a new era of digital social responsibility:** To navigate their portfolio careers tomorrow's workers and entrepreneurs will need both technical expertise and soft skills and competences, such as communication and collaboration. Public and private sectors have to work together to empower young people with the mindset, behaviours, technical skills, social awareness and know-how to become employable and successful in the digital era. This calls for new, innovative collaborations that bring together companies, academia, public authorities and social partners.
- **Towards joint European policies for education and skills:** Nurturing its human capital is one of the greatest challenges facing Europe in the Fourth Industrial Revolution. Yet at present the EU Member States have no common policy on education, in general, and digital skills in particular. This must change if we are to be as agile and adaptable as the new globalised world demands. If no European policy can be agreed, then certain Member States should at least move forward with joint policies that could provide the foundations for future evolution.