EUROPEAN UNIVERSITY ASSOCIATION

LEARNING AND TEACHING PAPER #7

Digital skills

Where universities matter

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June 2019

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Introduction

Universities have a key role in the digital transformation of our societies, particularly in addressing the need for adequate skills. However, the present discussion about digital skills rarely makes the necessary distinction between the specific needs of different groups of learners which require different institutional approaches. This paper suggests how universities could benefit from distinguishing between these different groups and what this might mean in practice.

As the digital transformation is moving ahead, the question of digital skills has become a societal challenge: are people equipped with the right skills to make use of the new possibilities in their work and, in a larger sense, as citizens? Labour markets are changing due to automatisation. The need for mid-skilled labour has decreased while that for high-skilled labour, often university graduates, has increased over the last decades (OECD 2017, figure 3.1). However, particularly with the growth in the family of technologies referred to as artificial intelligence, the automatisation of high-level cognitive skills is already a fact in many sectors and professions (see examples about law and medicine below). Beyond automatisation, digital technologies will do more than replace jobs: they have the potential to change the way we work and interact, which is likely to create new opportunities, but also challenges. However, much of this development is unpredictable because of the wide and diverse application of digital technologies. We do not yet know how and when today's graduates will use digital tools in their future careers. For this reason, it is not sufficient to talk about 'digital skills' in broad terms. Rather, universities must understand just how diverse these skills are and how different aspects of these skills can fit the purpose of different groups of learners.

Facilitating uptake of new technologies and preparing for changing labour markets

Looking at the use of digital skills from a broadly societal perspective, we can see that while many of the key technologies for digital transformation already exist and are ready for use, they are not adopted by the people who could gain from using them. One of the major factors is the level of skills in the work force. Where workers are qualified to use digital technologies, companies are naturally much more likely to use them (Andrews, Nicoletti and Timiliotis 2018). This challenge is relevant not only for university graduates but for all levels of education.

Nevertheless, there is a socio-economic argument to be made for universities and other educational institutions to address digital skills: if graduates are familiar with new technologies, they will enable the use of these technologies in their future work, which benefits the economy in general. Moreover, innovation and use of new technologies is increasingly seen as a geopolitical challenge, where the dependence on American or Chinese technology is seen as a threat to Europe's sovereignty. If Europe has too few citizens with digital skills, particularly those that develop new technologies, it would be completely dependent on imported technologies.

Another argument for promoting digital skills, looking at the consequences for individuals, assumes that new technologies will be taken up widely in society. The consequence will be that those without the necessary skills to use the technologies of tomorrow's labour market will not be able to get a job. Generally, digitalisation has a positive effect on the labour market, creating more jobs than it destroys (Chiaccio, Petropoulos and Pichler 2018, p. 18). However, this does not mean that the jobs will remain the same. The OECD has suggested that 14% of all jobs are in danger of being automated, while 32% will potentially experience 'significant change' (OECD 2018, pp. 1-2).

Where do universities play a role?

Universities have a responsibility to ensure that graduates have the skills to make use of new technologies, and they need to prepare them for labour markets where the probability of disruption is high.

Despite their large societal remit, basic digital skills should be taught broadly through primary and secondary education, and schools have the responsibility to ensure that citizens can participate fully in society. The unique responsibility of universities lies in training the specialists who will shape the digital transformation in the future as well as those high-skilled graduates who will work in a digitally transformed society.

Specialists – but more than that

The graduates who are developing the digital solutions for tomorrow have a special responsibility. Digital technology is a tool, but the same technologies that can be used to make people's lives easier can also make them targets for commercial interests, political surveillance or political control. The tool itself is less neutral than we think. Machine learning (computers being able, for example, to recognise patterns) is dependent on the data that has been used to 'teach' those machines. A well-known example is the difficulty of using facial-recognition tools to identify women and non-white persons, clearly replicating the bias of white, male developers (European Union Agency for Fundamental Rights, 2018, p. 5). It is demonstrably highly problematic if the technologies that are going to serve an increasingly diverse society are developed by a homogenous group of experts. Social exclusion could be built into computer programmes by design (OECD, 2017a, p. 65).

There is a strong male dominance of students in disciplines related to Information and Communication Technologies (ICT); in 2015 only one in five new students in ICT was female (OECD, 2018a, p. 170). In terms of cultural or ethnic diversity, statistical information is more difficult to obtain, but there is evidence that there is a problem within the tech community in general concerning direct discrimination of minority groups (ATOMICO, 2018, ch. 03.2).

Universities across Europe have been active in developing policies for diversity and inclusion in the last decade or longer (EUA, forthcoming 2019). However, given that the challenges for digital specialists seem to be particularly severe, there could well be an argument for enforced action here. Not only are graduates from this field likely to have a considerable impact on the future of our societies, but more specialists will be needed, and students therefore need to be recruited from a bigger, more diverse pool. This could require targeted action from universities to reach out to more potential students. Knowledge already available about promoting inclusion and diversity in universities, shored up by leadership support as well as institution-wide awareness, are important elements of ensuring broader recruitment and retention measures (EUA, forthcoming 2019).

Leadership support can ensure a sustained, institutional engagement with diversity, but this engagement should lead to more inclusive learning environments. For example, in intra-disciplinary communication we need awareness of the differences in the kinds of questions and feedback received by male vs. female students, of the gendered character of the environment, or of other exclusionary elements and behaviours within the community. Revisiting the curriculum design in these disciplines could also be worthwhile.

Another important form of engagement is reaching out to schools to inform potential students from all backgrounds about the possibilities in ICT-related fields. This is already practiced as a means of furthering diversity in student recruitment in general. The idea that ICT is a male subject begins well before students enter university, so more recruitment diversity in this field will require cooperation beyond the walls of higher education institutions.

A call for ethics training, particularly for those digital specialists who will develop artificial intelligence, has become increasingly insistent. There are several arguments for this: firstly, artificial intelligence is so powerful that those developing it need training to understand the ethical implications of their work. Secondly, public acceptance of artificial intelligence is dependent on trust,

and the general public must be able to trust that the specialists are developing and applying the technology in an ethically defensible manner. Meaningful and practical training in ethics for digital specialists would more specifically include awareness of privacy issues, avoiding bias in data sets, ensuring accountability and explainability of choices made by machines (European Commission's High Level Group on AI, 2018). Implementing these aspects of ethical training might require inter-disciplinary learning environments, together with disciplines such as gender studies, law, philosophy or psychology.

Preparing for digitally disrupted professions

The largest group that universities need to consider are the students who are not specialising in digital fields but need preparation for societies where digital technologies will likely play a larger and qualitatively different role than today. This is not at all a homogeneous need across the student population. Some fields, particularly those related to professional studies, are already heavily disrupted, while others will remain much less affected by the digital transformation.

Among the highly disrupted fields, we already can see examples of changes in fields such as medicine and law. In medicine the possibilities of machine learning are already well developed, as there are advanced sensors to collect data and biomedical platforms to generate a large volume of data. Tools derived from data science and machine learning allow users to integrate and use these data to assist clinical decisions. Medical care can be based on collection of data from patients via self-monitoring, with increased possibilities for prevention and fewer consultations and checks in clinics and hospitals. Combining sensors, internet of things, and artificial intelligence, patients can be informed about their health via their smartphone and share the data with medical staff without needing to visit a hospital. This can be seen both as potentially intrusive as well as empowering, giving patients more control over and knowledge about their health.

It is important that medical students are prepared for a more integrated care model, knowing the possibilities, the ethical and privacy aspects of new technologies as well as their psychological aspects, linked to the individual patient's trust in technology.

Diagnosis is another key task where machines play a major role. It is well known that computers are able to diagnose skin cancer with great precision, or that they can recognise patterns (when analysing x-ray images, for instance). Use of machines for care and diagnosis also opens the door to telemedicine and personalised medicine on a scale that is qualitatively different from what we see today. Medical practitioners already work closely with machines that perform these kinds of tasks. The precision of machines and their ability to manage large amounts of data allow them to make better estimations than their human counterparts and thus support doctors and health care practitioners in making informed decisions. However, the uptake of 'e-health' is hampered by a lack of skills among health practitioners (European Commission, 2018a and Science Business, 2018). So again, new technology skills are required from health professionals just as they are from all those working in environments disrupted by technology.

The legal field is another example of disruption. Much of legal practice requires knowledge of highly codified pieces of information, legal texts and their usage . Today, part of this can be done through machines. For example, machines can retrieve relevant cases and continuously learn which cases could be relevant for a particular problem. Machines can also learn to write contracts by 'reading' very large numbers of existing documents and learning how to produce a similar document, for example, a contract between entities from two different countries.

Much of the routine legal work, traditionally among the daily tasks of entry-level legal jobs, is highly likely to be automatised. With regard to managing legal processes, drafting contracts or performing due diligence, this is already in place. In more advanced roles, machines will be able to predict the decisions of judges based on prior court rulings, even estimating the likely interpretations of individual judges. There are already examples of administrative decisions taken by machines in the public sector, so in order to contest these decisions, it is necessary that lawyers understand how automated decisions are taken. In this way, digital technologies in the legal disciplines have an impact on the work of practitioners, automising some functions and helping to give the best legal advice.

Preparing for the unknown

While the changes in these highly disrupted fields are challenging –and more fields than medicine and law are affected –the bigger challenge might lie with university students in fields less connected to one particular profession. For most university graduates, it can be difficult to predict what sectors they will go to and what kind of tasks they will perform. The general advantages of digital technologies for retrieving and managing information, both text and data, can be used in a plethora of different situations, from customer relation management to text analysis. The uptake will be dependent on the knowledge about the scope and limits of technology and on the imagination of those who apply it to their specific work situation.

One way that universities are meeting this challenge is to change the content of their teaching (including lifelong learning), adding new study programmes and new curricula, including data literacy. This can include common courses in basic digital literacy for all students. They are also creating new learning environments supporting the understanding of digital technologies (Meyer-Guckel, Klier, Kirchherr and Winde, 2019, p. 5). In the context of digital skills, there is a direct connection between the digital learning environment and the skills attained, which goes beyond adding digital skills to the curriculum by including the digital provision of this curriculum. In terms of the concrete physical learning environment, this can include spaces for problem-based learning where interdisciplinary student teams can work together; it can also mean using platforms with online material for pure online or blended learning.

These reforms in European higher education provide non-

specialists with knowledge about digital technologies. For example, the rising popularity of problem-based learning points to one of the methods that can expose non-specialists to digital skills. According to the EUA Trends 2018 study, almost all universities (87% of respondents) found that introducing problem-based learning was useful in enhancing learning and teaching (Gaebel and Zhang, 2018, p. 55). Looking deeper into concrete examples of enhancing digital skills through this kind of learning, the recently published EUA study on the role of universities in innovation ecosystems sees provision of digital skills as one of the main elements in promoting entrepreneurial and management skills (Reichert, 2019, p. 22). For example, interdisciplinary groups of students working on specific problems can bring students from computer science together with students from other fields to combine their knowledge. Thus, knowledge from the social sciences can cross-fertilise with knowledge about digital technologies. There are also examples of ICT-specific modules that particularly motivated students can take as an add-on to their main field (Reichert, 2019, pp. 22-32).

As digital technologies become ubiquitous across academic fields and different sectors of society, it is fair to assume that in many cases where problem-based learning is used, there is some type of exposure to digital technologies for non-specialist students. Importantly, through problem-based learning, ICT specialists can also be exposed to ethical and legal aspects of the use of technology such as privacy concerns, or gender or other bias.

Problem-based learning is a very appealing way to expose non-specialist students to digital technologies, but there are certain conditions that can make it difficult to implement. Interdisciplinary programmes might be particularly difficult to set up where universities have little autonomy to design and accredit their own programmes. Mostly, national strategies for higher education have been helpful in introducing learning and teaching reforms all over Europe (Gaebel and Zhang, 2019, p. 22).

However, it would also be necessary to see if there are major obstacles to introducing the specific kind of interdisciplinary courses that can expose students from different fields to digital technologies. We do know that problem-based learning requires higher staff-student ratios in order to meet the need for in-depth coaching and working with relatively small groups. While online learning can potentially reach larger groups of students, including lifelong learners (which is a topic too broad for this paper),[1] it is both expensive to produce and lacking in the exposure to practical learning that small interdisciplinary face-to-face student groups have. For this reason, there is a significant cost element in making full use of these methods. Indeed, many of the concrete examples of this kind of programme aim at smaller groups of particularly motivated students.

There still remains the challenge of reconciling the future needs of students with the learning tools that we have at our disposal, the resources required, and regulatory boundaries, particularly for students that have unpredictable and diverse career trajectories. Teachers need training so that they are prepared for learning environments where non-specialists are exposed to digital skills, through problem-based learning for instance, or other kinds of team-based exercises.

Learning analytics might prove a useful tool. Learning analytics uses data on learning to make predictions; for example, it can predict how likely students are to achieve specific learning outcomes after having participated in different learning activities. Applying machine learning, for example, to large quantities of student data can give more precise information about which types of learning can best equip students with digital skills.

At present, the implementation of learning analytics in Europe is by no means systematic, and the exact capacity of these technologies is not clear, particularly regarding the potential ethical and legal limits in terms of privacy of the students.[2] However, given the different needs of students and the multiplicity of ways in which they are exposed to digital technologies, learning analytics has already shown potential to become an important tool for universities. It can serve to personalise learning and enhance learning environments.

Conclusion

There is a very real and urgent need to prepare students for a future where digital technologies are disrupting all sectors of society, even if we consider just the potential of existing technologies, not counting new disruptive innovation. However, an undifferentiated call for 'digital skills' is not doing justice to the needs of students. The use of digital technologies will impact some fields of study more than others, and different technologies will be relevant for different groups of students. For this reason, there is a need for much more precision in public discourse about digital skills, and there is a need for universities to take a differentiated approach, where they can apply policies that are fit for various user groups: for the specialists who will shape tomorrow's technologies, for those whose fields are already disrupted, and for those whose exact needs cannot yet be predicted.

The author would like to thank Professor Damien Gruson, Cliniques universitaires Saint-Luc (UCL), Belgium, and Professor Malcolm Langford, University of Oslo, Norway, for their comments and advice.

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Endnotes

1 The University of Helsinki, Finland, made headlines recently by offering an artificial intelligence MOOC to support broad information and reflection about the topic.
2 For more information, see https://sheilaproject.eu/

EUROPEAN UNIVERSITY ASSOCIATION

The European University Association (EUA) is the representative organisation of universities and national rectors' conferences in 48 European countries. EUA plays a crucial role in the Bologna Process and in influencing EU policies on higher education, research and innovation. Thanks to its interaction with a range of other European and international organisations, EUA ensures that the voice of European universities is heard wherever decisions are being taken that will impact their activities.

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This paper is one of a series of reports specifically focused on learning and teaching. It is designed to gather the knowledge and experiences of experts on the topic from across Europe. EUA's activities in learning and teaching aim at enhancing the quality and relevance of higher education provision, underline the importance of learning and teaching as a core mission and advocate for learning and teaching activities to be geared towards student learning and success.

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