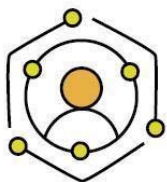# DiTEMP

Digital Transformation and Employability:

acquiring transversal competences in curricular education

O1 – Framework of Intervention

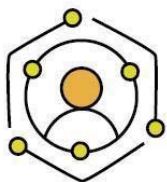*Version 7.0*

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1.0	F.Garcia; I. Ruiz; D. Taño/ULL	A	07.10.20	Overall plan for the report; chapter on surveys
2.0	C. Aleffi; S. Tomasi; G. Paviotti/ UNIMC	A	15.10.20	Adding chapter on practices analysis and framework of intervention
3.0	G.Paviotti/UNIMC	A	30.10.20	Revision of format and text organisation
4.0	F.Garcia; I. Ruiz; D. Taño/ULL N.Antonova/ULL	A C	06.11.20	2.2. Field research (students) 2.3. Desk research: practices collection 4. Framework of intervention (examples in business and economics)
5.0	M. Pastor/FUE	C	23.11.20	Overall proofreading of version 4.0 Changes made in: 2.2. Field research (companies) 2.3. Desk research: surveys and interviews 3.1 Field research: surveys and interviews 3.2 Desk research: practices collection 4 Framework of intervention
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7.0	M. Pastor/FUE	C	18.12.20	Suggested pedagogical methods. Box 7 Transversal
7.0	F.Garcia/ULL	A	22.12.20	Solved corrections from proofreading, regarding questionnaires´ analysis and business examples sections
7.0	G.Paviotti/UNIMC	A	22.12.20	Short description of teachers questionnaires development
7.0	C. Mihaela, D.Chihaia/AICU	C	22.12.20	Box 5 Education
7.0	M. Pastor/FUE	C	23.12.20	Final proofreading

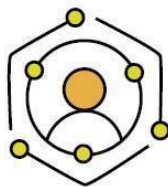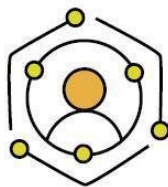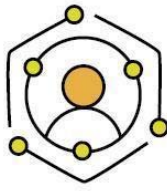**(*) A=Author; C=Contributor; REV= reviewer; EXT = external reviewer**

Table of contents

Introduction

This document summarises the work carried out in the frame of Intellectual Output 1 of the project, and it represents the DiTEMP Methodological Framework. The DiTEMP project aims at providing methods, tools and materials to university teachers to support awareness and readiness to a digital-driven market of future graduates. To better understand the background of the action, the DiTEMP consortium carried out research activities aimed at:

a) Understanding of the issue and related skills by university students and teachers, and companies in the fields addressed by the project (Business, Education, Psychology, Tourism and Cultural Heritage)
b) Understand previous practices related to teaching and digital transformation, to identify what has worked, and in which conditions.

Desk and field research activities were carried out between February and May 2020.

Following, results and implications for the project and the pedagogical approaches to adopt to support the acquisition of addressed skills are described.

This report is organised as follows:

Chapter 1 highlights the main concepts related to digital transformation and labour market changes;

Chapter 2 describes the methodology adopted by the DiTEMP consortium;

Chapter 3 reports on findings of research activities;

Chapter 4 points out the relevant conclusions for the next steps in the frame of the project by describing the preferred methodology to achieve the identified learning outcomes;

Conclusions summarise the content of the report and further recommendations for future research.

1. Digital Transformation Overview

Digital transformation is "a technology-driven continuous change process of companies and our entire society" (Ebert & Duarte, 2018), following the adoption of disruptive technologies to increase productivity, value creation and social welfare. Digital transformation shapes society at all levels: according to Norqvist (2018), it refers to "a process where humans are re-shaping the way society 'works' by ways of interpreting and understanding society, including the usage of digital technologies in everyday life" (p.2).

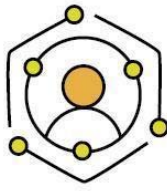The impact of digitalisation on the workforce and in the labour market is a crucial concern of States and International Organisations. The OECD (2019) estimates that some of 14% of workers face a high risk that their tasks will be automated, and another 32% will experience major changes in the tasks required in their jobs. The European Commission (Gonzalez Vazquez, I., Milasi, S., Carretero Gomez, S., Napierala, J., Robledo Bottcher, N., Jonkers, K., Goenaga, X. (eds.), Arregui Pabollet, E., Bacigalupo, M., Biagi, F., Cabrera Giraldez, M., Caena, F., Castano Munoz, J., Centeno Mediavilla, C., Edwar, 2019) also estimates that millions of jobs will be at risk of automation in next decades, of which the most exposed are those that require relatively low levels of formal education or do not involve complex social interaction. However, digital transformation in the labour market does not only affect low skilled workers, since it modifies the way of working, in addition to the type of work activities to be carried out.

To the other hand, technologies might be an opportunity for job creation. The OECD (2019) pointed out that while the process destroys jobs, it also creates them and that in the period 2006-2016, "four out of ten new jobs were created in highly digital-intensive sectors".

1.1 The labour market

Warhust and Hunt (2019) pointed out that digital transformation impacts both on work and employment since it impacts on the activity (of doing, therefore work), and the terms and conditions in which the activity takes place (relations with employers, contracts, therefore employment). Jobs as such are the combination of work and employment.

A clear example on how technology has changed jobs can be the growth of platform work. Platform work is "an employment form in which organisations or individuals use an online platform to access other organisations or individuals to solve specific problems or to provide specific services in exchange for payment" (Eurofound, 2018). The three players of the supply and demand process are the online platform, the worker and the client: the client asks for a product/service, the platform appoints the worker, and the worker accomplishes the task. Typical of platform work is the breakdown of work into tasks. Tasks of platform workers may include professional tasks (e.g. software development), transport (e.g., food delivery), household tasks (e.g., cleaning), and micro-tasks (e.g., online tagging). Following the incremental use of platform workers by consumers, a relatively new phenomenon arose at least in Western Countries – the gig economy. In short, the gig economy can be defined as a segment of the labour market characterised by flexible and temporary jobs carried out by independent contractors, or freelancers. A typical example of the gig economy is Uber, whose case has been widely studied and has led to the creation of a new concept, the 'uberisation' of work (Nurvala, 2015). On one hand, the higher flexibility and availability of temporary workers who can be called on demand supports the creation of new job opportunities; on the other hand, the same

process entails relevant social issues, such as a diminished opportunity to access permanent employment, which has to date been the backbone of social organisation, and around which the welfare state is organised.

In addition to new forms of work organisation, digital transformation also leads to job creation in traditional settings: social media managers, app designers, SEO content writers or even "influencers" are professional positions certainly born following the digital transformation. More importantly, however, digital transformation deeply impacts and changes organisational processes in all types of companies and other institutions: disruptive technologies do not only require adaptation or alignment, but also integration, or embeddedness (Bharadwaj et al., 2013; Vial, 2019), toward a Digital Business Strategy (DBS), which has been defined as "the focus on the transformation of products, processes and organizational aspects owing to new technologies" (Matt et al., 2015). The DBS, by changing the operational strategy, requires a different functional strategy, which underlines the deployment of different skills in leaders and staff.

1.2 Are digital skills enough?

Digital competence is a key concept that has emerged alongside technological development and its implications in social and economic terms. Although its components are not yet agreed upon, a comprehensive definition can be the following:
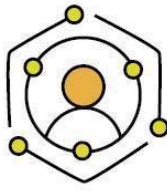
> *Digital competence is a combination of knowledge, skills and attitudes with regards to the use of technology to perform tasks, solve problems, communicate, manage information, collaborate, as well as to create and share content effectively, appropriately, securely, critically, creatively, independently and ethically[1].*

The debate over digital competence has been central in the frame of the "Skills for the 21st Century" discourse, as 'the digital' element is embedded in all spheres of life. Following research works from academic and policy field, and in the frame of the initiative "Learning and Skills for the Digital Era"[2], the European Commission published the European Digital Competence Framework for Citizens – DigComp - (last version: Carretero et al., 2017), which is today the main reference both for individuals, to self-assess skills needed in the digital era, and policymakers, to monitor citizens digital skills and support curricula development. DigComp comprises 5 dimensions

1. Competence areas identified to be part of digital competence, which are
   a. Information and data literacy
   b. Communication and collaboration
   c. Digital content creation
   d. Safety
   e. Problem-solving
2. Competence descriptors and titles that are pertinent to each area, which includes a description of 21 competences

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[1] https://digital-competence.eu/front/what-is-digital-competence/
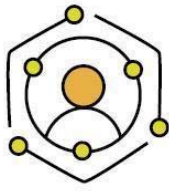[2] https://ec.europa.eu/jrc/en/research-topic/learning-and-skills

3. Proficiency levels for each competence, which are eight ranging from Foundation to Highly specialised
4. Knowledge, skills and attitudes applicable to each competence
5. Examples of use, on the applicability of the competence to different purposes.

In addition to its value as a practical tool, the DigComp approach stresses the relevance of digital competence for life, not only for work. Digital competence is also one of the eight key competences defined in the "Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning"[3]:

1. Communication in the mother tongue;
2. Communication in foreign languages;
3. Mathematical competence and basic competences in science and technology;
4. Digital competence;
5. Learning to learn;
6. Social and civic competences;
7. Sense of initiative and entrepreneurship; and
8. Cultural awareness and expression.

To deal with digital transformation is thus to deal with the complexity of an evolving socio-economic scenario that requires, in work settings, both cognitive and non-cognitive skills: as the range of contents and tasks evolves, adaptability, communication, critical thinking, creativity, entrepreneurship and readiness to learn become increasingly important (Morandini et al., 2020). For this reason, being 'digitally skilled', in terms of technical ability, is not enough, neither for finding nor for retaining a job. In order to participate in the knowledge-based workforce, individuals should develop a large set of skills which are played out within the digital world: the digital citizen should therefore be equipped with a combination of soft and hard skills, attitudes, capacities and capabilities, and, above all, be aware, responsible and proactive on own life design.

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[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32006H0962

2. Toward DiTEMP Framework of intervention: methodology

2.1 Research methodology

The research methodology was already drafted at the proposal stage, and was confirmed during the kick-off meeting. Composed on the basis of a mixed-method approach, it included field research and desk research.

2.2 Field research: surveys and interviews

In the case of the students' questionnaire, the Unified Theory of Adoption and Use of Technology (UTAUT) was used (Venkatesh et al., 2003), but introducing the extension developed by Venkatesh, Thong, and Xu (2012), adding new constructs and tailoring the model to the consumer use context. As it is well known, this new version of the model (known as UTAUT2) provides better explanations for behavioural intention and technology use than UTAUT. In our case, we adapted the original items to measure the *Intention to adapt to Digital Technologies for employment* scale, assuming that it would depend on *Performance Expectancy*; *Effort Expectancy*; *Social Influence*; *Facilitating Conditions*; *Habit* and *Opportunity*.
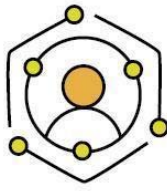
The teacher questionnaire sought to explore teachers' awareness about changes in the field, and implications of those changes for students (labour market) and education (teaching). The questionnaire was therefore focused on three dimensions: digital transformation in the subject field; in employment; in teaching and curriculum development. To allow comparison of data, the items aimed at collecting data on the 'employment' dimension were as those included in the students' questionnaire; other items were developed based on the results of desk research and literature review.

The questionnaire for companies focused on three issues: what companies consider as digital skills and competences; what gaps companies identify in relation to student/graduate digital skills and competences; and how companies consider the training provided by universities in the field of digital skills and competences. Data bases were designed in order to obtain a balance between small, medium and large companies.

2.3 Desk research: practices collection

Desk research included a collection of worldwide practices in digital transformation for further analysis and use in roadmaps. A template was designed in accordance with the project's needs, including the following sections:

- Name of the experience.
- Type and level (university master, training course, etc. Introduction of this field helped identify the same levels of studies, where the partners of the Project were going to imply the activities and use these examples as a guideline).
- Country (identification by countries was considered important for understanding differences in the methodology and approach used).
- Date of starting (the most recent projects were expected to be more useful for the Project as they reflect the newest tendencies in digital transformation).
- Additional information (e.g. number of students enrolled, level of success, etc.).
- Short description.
- Additional information (for example, webpage).

- Learning outcomes (it was important to identify learning outcomes by fields as they could be applied for the fields the Project embraces. It was also essential to find out what skills are needed to deal with digital technologies related to professional tasks).
- Pedagogical methods (this section aimed at identifying methods used as educational tools, both online and face-to-face. Moreover, it was considered helpful to learn the base of these methods, as problem based learning, work based one, etc.).

This structure embraced all aspects the project needed for design and development of learning outcomes, the definition of suitable pedagogical methods to support learning design and, finally, delivery of the methodological framework. Desk research helps with applying a roadmap for the implementation of project's activities in partners' universities.
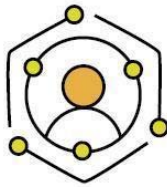
3. Findings

3.1 Field research: surveys and interviews

Field research has been conducted on three categories of stakeholders: companies, teachers, and students (see annexes). In the table below the final number of questionnaires collected from each group of stakeholders is represented. In total 582 questionnaires were collected, among them 444 from students, 103 from teachers and the remaining 35 from companies.

Table 1 – Work research sample

Country	Students	Teachers	Companies	Total
Spain	108	50	23	181
Italy	184	29	12	225
Greece	7	0	0	7
Romania	145	24	0	169
Total	**444**	**103**	**35**	**582**

Comparing the volume of the sample with the project indicators, we can conclude that the number of recollected questionnaires noticeably exceeded the planned values. Thus, students' sample is four times larger than the objective (444 versus 100). In the case of teachers, the number of collected questionnaires doubles the objective set (103 versus 45). Company responses met the project indicators (23 versus 24).

Quantitative analysis

Stakeholder comparison

We asked every stakeholder if graduates are adapted to digital skills. Only 8,3% of responding companies, 2,9% of responding teachers and 6,5% of responding students believe that graduates are very much adapted to digital skills.

On the other end of the scale, 8,4% of responding companies and 6% of students indicate that students are very little or not adapted at all.
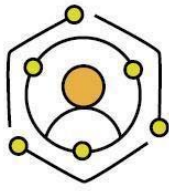
Figure 1 – Are graduates adapted to digital skills?
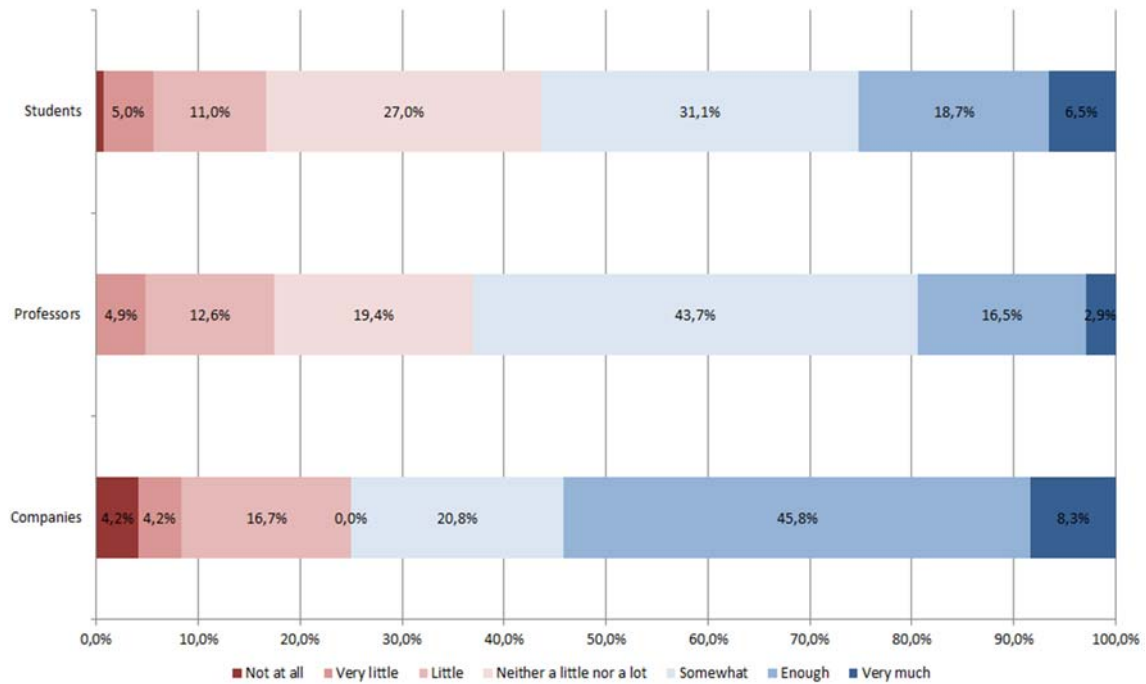
Figure 2 presents the comparison between the relevance attributed by teachers and companies to different employee skills in digital environments and the level of knowledge and ability to use them by graduates.

The most important skill for both teachers and companies is creative thinking, while social media is ranked highest for students' level of knowledge and use.

The second skill valued by teachers and companies is network and information security, which is ranked third for students' level of knowing and use by students.

On the other hand, there are certain skills related to digital marketing, such as advancing social selling, which are very important for companies and teachers but reveal low levels of knowing and use by students. The same situation is observed regarding data analysis (big data and analytics), multiplatform UX design and SEO/SEM.

Figure 2 – The importance of employee's skills
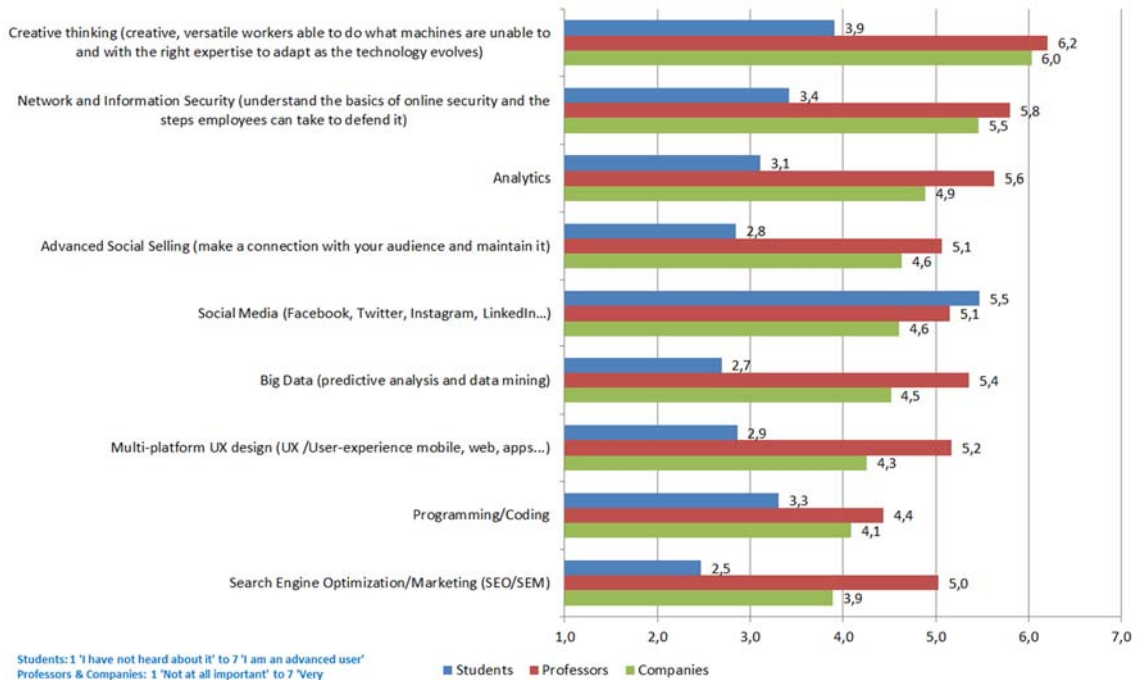
The analysis of the importance that the different skills have for employment is collected in Figure 3.

In general, there is a coincidence among all stakeholders regarding the most important digital skills for employment. Soft skills mixed with technology are at the top of the ranking. Thus, ability to work and cooperate in a digital context by using digital tools is the most valued skill. After this, we can observe:

- Ability to process and present data in more understandable forms

- Ability to use ad learn from digital resources

- Ability to find and evaluate online resources for accuracy and trustworthiness of information, manage and share in a digital context

- Ability to communicate and manage virtual interpersonal relationships by using digital tools in a digital context

It is interesting to point out that participation in social channels is not highly valued and is ranked in the lower positions of the list.

![DiTEMP - Digital Transformation & Employability logo]

Co-funded by the
Erasmus+ Programme
of the European Union
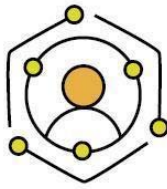
Figure 3 – The importance of digital skills for employment
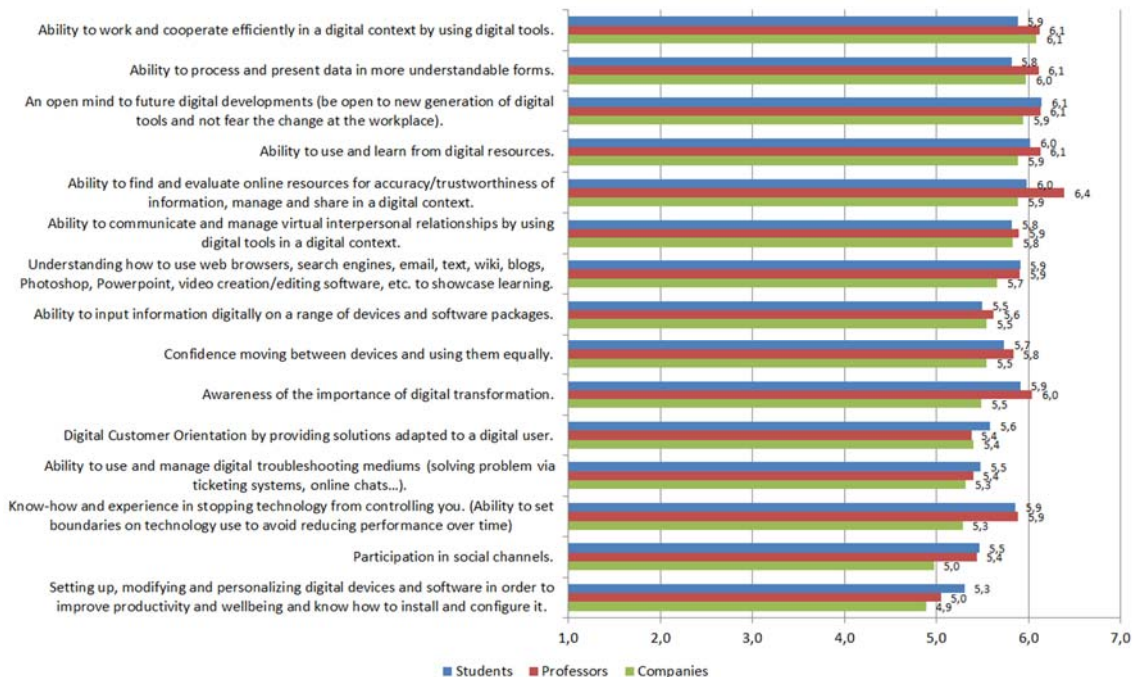
Regarding the importance of different skills for students' future employment, there are not significant differences between the different stakeholders regarding the skills addressed. However, the most important skill is:

- for companies: "ability to work and cooperate efficiently in a digital context by using digital tools";
- for teachers: "ability to find and evaluate online resources for accuracy/trustworthiness of information, manage and share in a digital context";
- For students: "an open mind to digital developments (be open to new generation of digital tools and not fear change in the workplace".

All stakeholders believe that the least important skill is "setting up, modifying and personalizing digital devices and software".
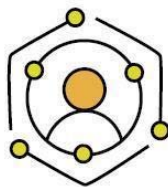
Figure 4 – The importance of skills for future employment (students' perspective)

Skill	Value
Flexibility and adaptation to change	6,2
Communication	6,2
Social skills	6,0
Critical thinking	5,9
Teamwork	5,9
Initiative and autonomy	5,9
Languages	5,8
Digital skills	5,8
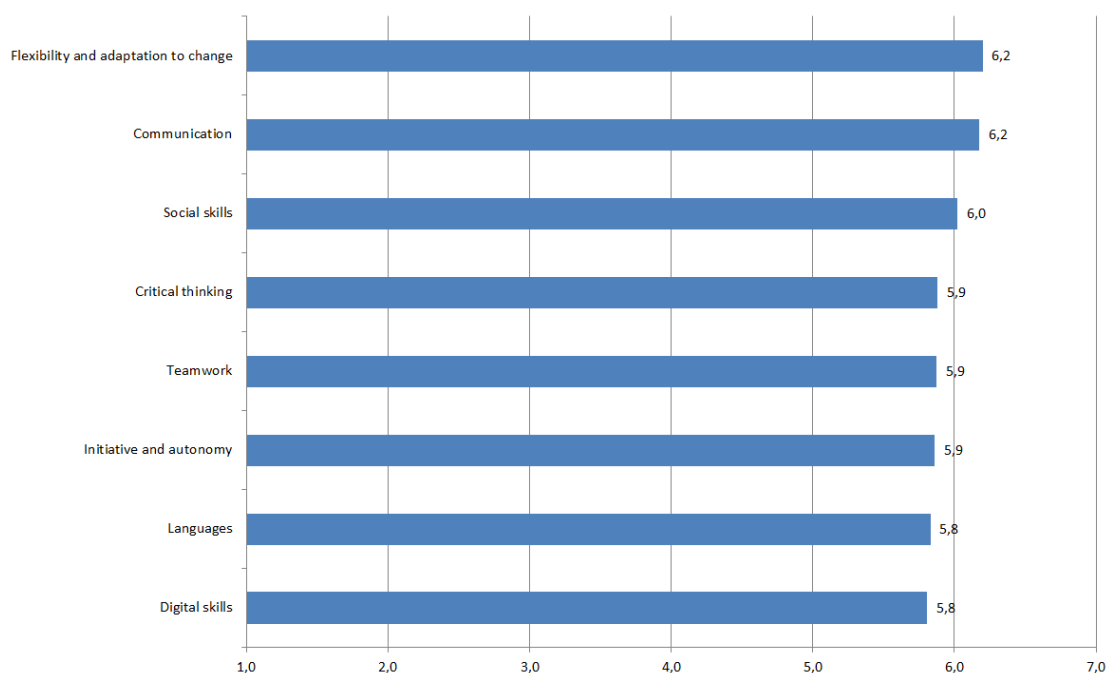
Student perspective

Figure 5 reveals that for 95% of students the main reason for keeping up to date in digital technologies is to find or progress in employment, although 15% do not believe it to be useful or necessary.

When asked what prevents them from keeping up to date in digital technologies, approximately 40% of students say they do not have access to adequate training and that the university does not provide this training.

Figure 5 - Keeping up to date in digital technologies (students' perspective)
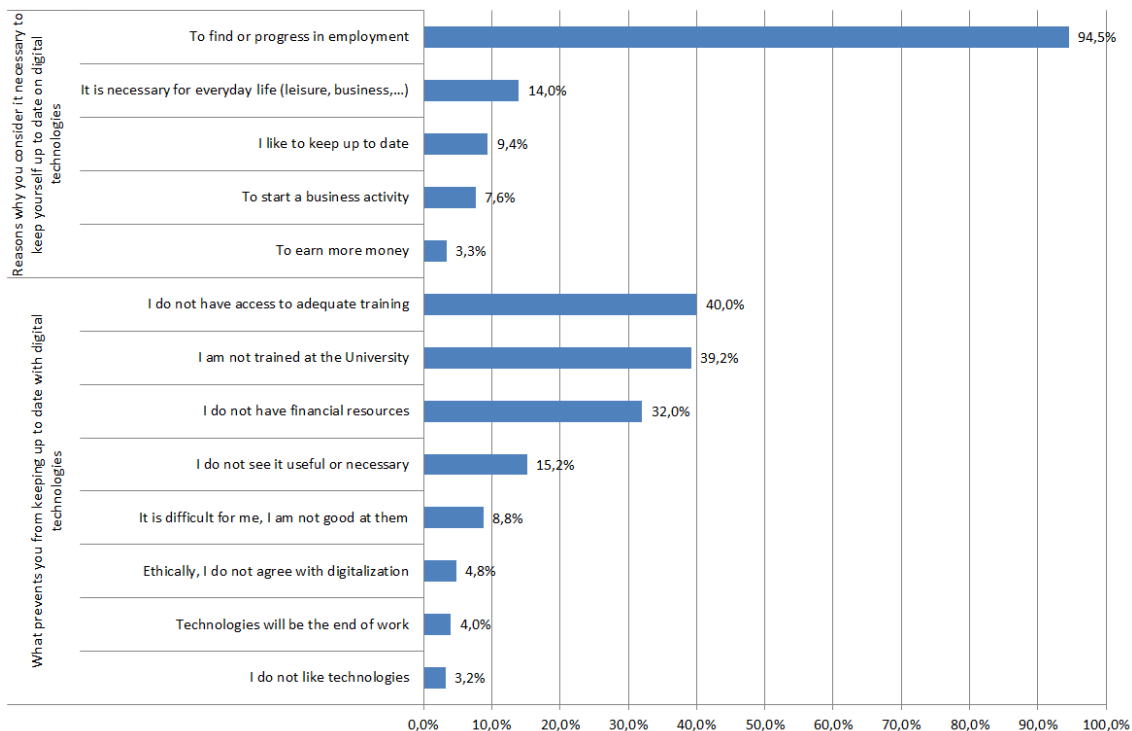
Teacher perspective

Teachers were asked about digital transformation in their field and which changes they have introduced in their teaching methods in a digital environment (Figures 6 and 7). Most teachers think that digital transformation is changing or will change teaching methods, and that it has already changed their own way of teaching in recent years.

According to the analysis, only 2% haven´t performed any changes related to digital environment. The main change introduced (73%) is the use of online resources or references. This change is obviously very basic, static, and not proactive. Changes in other aspects of teaching methods have not been widespread: project-based learning (36%), pedagogical use of social media (26%), case studies (15%), collaborative learning (11%) and the use of gamification technologies (8%). It can be concluded that there is still ample room for improvement.

Figure 6 – Digital transformation and teachers' field/teaching

Digital transformation and your field

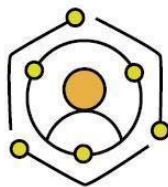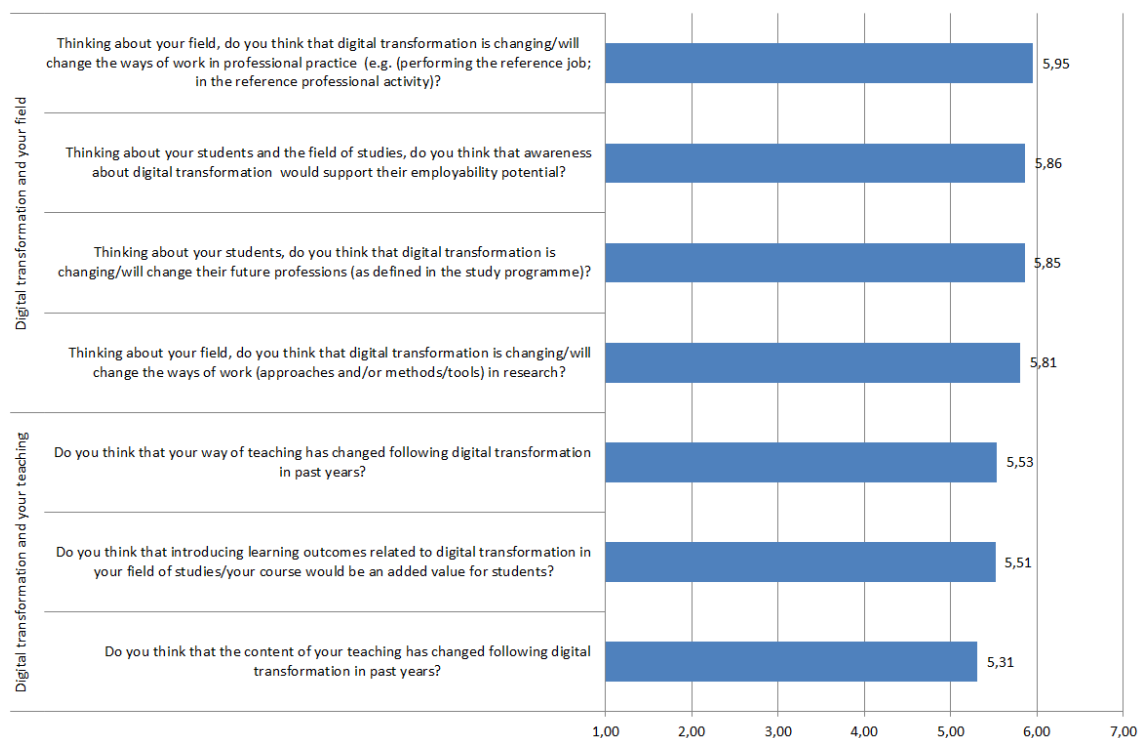| Question	Value
Thinking about your field, do you think that digital transformation is changing/will change the ways of work in professional practice (e.g. (performing the reference job; in the reference professional activity)?	5,95
Thinking about your students and the field of studies, do you think that awareness about digital transformation would support their employability potential?	5,86
Thinking about your students, do you think that digital transformation is changing/will change their future professions (as defined in the study programme)?	5,85
Thinking about your field, do you think that digital transformation is changing/will change the ways of work (approaches and/or methods/tools) in research?	5,81

Digital transformation and your teaching

Question	Value
Do you think that your way of teaching has changed following digital transformation in past years?	5,53
Do you think that introducing learning outcomes related to digital transformation in your field of studies/your course would be an added value for students?	5,51
Do you think that the content of your teaching has changed following digital transformation in past years?	5,31

(Scale: 1,00 – 7,00)

Figure 7 – Performance of changes in teaching (teachers' perspective)

| Item	Value
Use of online resources/references (including MOOCs, online courses, etc.)	73%
Project based learning based or performed through technologies	36%
Pedagogical use of social media (e.g. for collaborative learning; students assignments; etc.)	26%
Case studies on technological change in the study field	15%
Collaborative learning through Augmented Reality / Virtual Reality / Mixed Reality (e.g. use of Cospace or similar tools)	11%
Use of gamification technologies	8%
None	2%

Company perspective

When asked about the digital transformation in universities, almost 50% of responding companies do not believe that universities are committed to this process, and only 34% thinks that universities encourage students to use technology to showcase their teaching.

In this same line of opinion, 83% felt that universities should develop more online classes and workshops to enhance learning in the classroom, and 86% think that a digital skills module should be mandatory for all students, no matter what field of studies.

Regarding students and graduates, while 63% of companies think that they are aware of the importance of digital transformation, only 34% believe that Generation Z graduates have the digital skills needed by business.

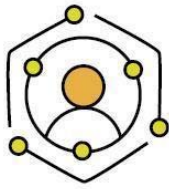**Figure 8 – Company perspective of the digital transformation process in universities**
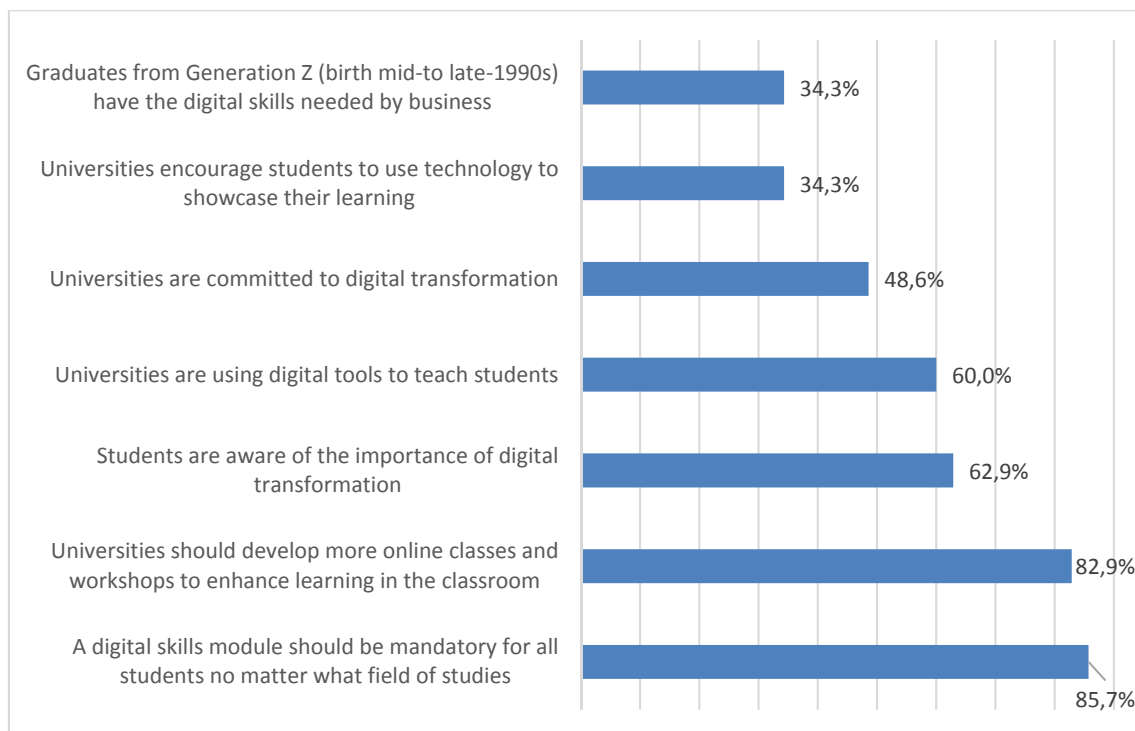
Qualitative analysis

Teachers' perspective

Several open questions were included in the teachers' questionnaires asking them about the effects of digital transformation in their field, both from the perspective of the teaching process and the job market.

Most teachers consider that students must be familiar with digital technologies in order to study and work more effectively. Such competences are viewed as "academic evolution" and a great competitive advantage. They also recognize the need for teachers to have a minimum level of digital competence. These issues are especially important now, during the Covid19 pandemic.
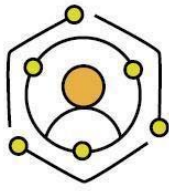
A SWOT-analysis of digital transformation from the teachers' perspective is presented below.

Figure 8 - SWOT-analysis of digital transformation (teachers' perspective)

Strengths	Weaknesses
- Better monitoring of student learning /evaluation - Developing awareness and skills - Better time management - Adapting to new trends both in the job market and in life itself - Access to an extremely rich online bibliography - Flexibility allowed by the use of technology - Paper bureaucracy can be abandoned	- Difficulty in evaluating this type of learning outcomes - Physical presence is essential, DX is only justified in a subordinate and complementary way - Lack of personal computers - Low-speed internet connection - Lack of communication with teachers - Lack of technology in universities - Lack of training for teachers - Lack of digital skills in students
Opportunities	**Threats**
- Collaborative work through projects - Professional updating, adaptation to the new environment - Platforms or other devices that can be used in the classroom - Professional development (both for teachers and students) - Adaptation to various situations (such as the current Covid19 pandemic) - Possibility to create intuitive support when the explanations are not enough - Saving time and expenses (transportation when it comes to meetings, research)	- The costs of a digital learning programme can be high - Permanent updating can require support - Lack of equipment at the universities - Need for teachers to stay updated - Monitoring and motivating student participation can be a problem - The 'abandonment' of traditional education can affect the didactic relationship, socialization aspects, and teamwork

Teachers were also asked to answer how their field of studies and their students are affected by digital transformation. Among the positive aspects we found that teachers use online platforms for lessons, for monitoring virtual internships, for students´ job searches. DX provides access to bibliographic sources and to systematic search and analysis of information of practical value. It also eliminates distance and saves time and transportation expenses when it comes to meetings. All teachers agreed that paper bureaucracy will be abandoned, and that the use of digital resources will allow for better monitoring of student learning. The integration of these resources in the teaching-learning process stimulates class development and allows for a closer connection with the capacities and interests of the new generations of digital students.

Nevertheless, teachers indicated several drawbacks of DX. The most important one is that, in their opinion, DX completely blocks the communication process needed for the development of emotional intelligence, thus creating individual imbalance. The "abandonment" of traditional education irreparably affects the didactic relationship, socialization process, and teamwork. Didactic communication is an inter-human communication. It involves immediate collective and

individual feedback that directs the content, style, and verbal and nonverbal language of teaching-learning that the online environment will never provide. Another difficulty is that teaching and assessment methods need to be adapted to digital reality. Also, more training for teachers is needed. Students' lack of digital skills is identified as another obstacle.

The opportunities of applying DX to specific fields are presented below.

- **Psychology:** online surveys; web-based assessment and intervention models; online psychological counselling; education of healthy behaviours online; monitoring with the help of digital technology of behaviours.

- **Archaeology:** the definition of absolute dating of artefacts; the determination of origin of manufactured articles; the description of production technologies and traces of use; the development of strategies for the conservation of archaeological heritage through a more systematic application of non-destructive investigation technologies; territorial diagnostics to assess the presence and quality of buried structures and the nature of the soil; processing and comparison of collected data for decision-making.

- **Tourism:** tourist enhancement of cities' historical heritage; cultural marketing sector (for example, museum services, public communication - before, during and after the visit).

- **Philology**: opportunity for linguistic learning.

- **Geography**: use of Geographic Information Systems and Technologies, cartography, etc.

- **Education**: although some (few) teachers think that these students don´t particularly need these skills; others (most) consider them to be essential. The use of ICT as a means to intervene in the teaching-learning process is essential, from the planning phase to the implementation of didactic methodology in the classroom, student motivation, and innovation to improve educational quality.
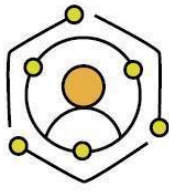
Companies' perspective

Companies and universities

Most companies consider collaboration as a key factor for helping universities to provide and develop digital skills and competences. The collaboration can be organised in different ways:

- Periodic meetings

- Organising practical training and workshops for students and teachers

- Shared activities, projects, co-realization of courses

- In-company internships.

Several respondents proposed integration of companies into the study process through lectures, sharing real cases, and mentoring activities by business professionals. Firms also consider it would be helpful to provide free software for the development of some digital skills, and they refer to the need of heavy government investment in education to update teachers' knowledge and technical means.

Nevertheless, several companies do not see how they can help universities, and one of the reasons is that they don't believe it would benefit them directly.

Companies and students

Most companies see two ways to help students acquire and develop digital skills and competences: internships and training. Internships should include the use of the digital tools implemented in the company, exposure to the digitalization of a company's activities and first-hand knowledge of the business reality. Training activities embrace free workshops or seminars, training courses and informing students about the most popular applications during testimonials and classroom cases.

All companies agreed that recent graduates do not have enough experience in the use of digital work tools (administrative, HR, data analysis), and that they lack knowledge of basic programming, the use of social networks in a professional way, and even of basic Office package skills.

Companies feel that students lack the experience and practical knowledge needed by the job market and call out for increased integration of practical training in their learning process. A possible solution could be mandatory internships and the renovation of learning methods based on creative thinking and gamification applying digital technologies. In their opinion, universities should offer seminars taught by professionals, not by professors, that can give a realistic vision of the work world.

## 3.2   Desk research: practices collection

Sample

Practices collection was carried out between March and April 2020. The analysis took place in May 2020.

The partners identified and described 26 practices from 22 different countries with the following geographical distribution: most of them carried out in Italy (13), followed by the United Kingdom (8), Spain (6) and Germany (5). The other countries involved with a lower number of practices were: Estonia, Costa Rica, Poland, Belgium, Ireland, Greece, Malta, Romania, Austria, Denmark, Lithuania, France, Finland, United States of America, Russia, Croatia, Slovenia, Hungary.

The most recent projects were launched in 2020, some of which are still active, while the oldest one dates back to 2014. Many of them are activated annually or refer to the current academic year.

Projects were implemented within undergraduate and graduate programmes offered by Universities, but also within training programmes geared to adult learners. 79% of the practices identifies were funded with European projects. With respect to the level and type of education addressed by practices identified, 40% (11) aimed at **tertiary education**, involving undergraduate and master students. 23% (6) are aimed at **adult education** and another 23% (6) practices are addressed to **postgraduate students** from different disciplines. The remaining practices are addressed to vocational education and training (VET), teacher training, and the general public.
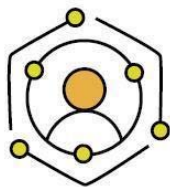
Topics

Regarding the topics addressed, some common themes have been found.

13 practices deal with **transversal issues.** In general, each project offers digital skills learning and development opportunities in order to lead businesses/universities in an innovative way (Digital Skills Accelerator, Digital Generation, The University of Edinburgh Digital Skills Framework, Digital Business Strategy). In particular, the D-Transform project tries to raise the awareness of European universities on the importance of e-educational, a strategic tool useful to be pedagogically more effective, more cost-effective, more attractive and able to meet the needs of the professional world. Some of them lead students to acquire competencies as a project manager and to know technologies needed to become future professionals (MADIM, DIGITA). In doing so, students have the opportunity to actively learn by meeting experts, peers and tutors who share their experiences (eLene4work, Liquid Junior). In other cases, these courses are aimed at managers, professionals and consultants in order to compete in the global digital economy (International Executive MBA, Institute of Coding). Others focus on complex challenges related to digital transformation and frontier technologies (MDT, MSC in Digital Transformation Management & Leadership).

Two projects are focused on **Tourism and Cultural Heritage** in two different ways: one provides the appropriate background for the development of digitally-enhanced art events and tangible or intangible cultural heritage experiences (AR & VR for the education in cultural heritage), the other aims to prepare future cultural heritage professionals with transferable and transversal competences (EUHeritage).

Four projects that address **Communication and Business Management** are designed to train professionals in innovation skills (new strategies and business models) using the main tools offered by digital technologies in business management (CHEDTEB, MIT, UNINETTUNO, DIGITAL BUSINESS LEADERSHIP PROGRAM).
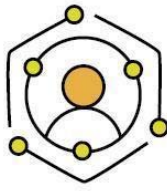
Three others are strongly focused on **ICT and digital skills**: the aim is to provide courses on digital competences development (Get Digital, POWERUDIGITAL) and also to integrate ICTs into the education system (ITedu).

In general, all projects have in common the aim of giving a complete overview of existing new technologies, of providing the necessary tools to understand these technologies and to know how to use and exploit them in every field of action.

Learning outcomes

The learning outcomes of the projects can be summarized in 4 main categories:

- **Fundamentals in all disciplines:** banking and economic fundamentals; humanities, sociological, economic, psychological, juridical, linguistic and artistic areas; basic skills in maths, technology and science.
- **Soft skills:** social/inter-personal skills (communication, civic and social responsibility, team work, conflict management, negotiation); personal/intra-personal skills (leadership and decision-making, self-evaluation, adaptability and flexibility); methodological skills (learn to learn, analytical skills, creativity and innovation, problem solving).

- **Business management skills:** project management tools, value proposition design, business strategy development.
- **Digital skills:** digital transformation, artificial intelligence, evaluation and management of digital content, copyright and licences, digital safety and security, web-marketing, open data/big data.
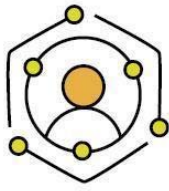
Pedagogical methods

The main pedagogical methods used are divided into online and offline, individual and in group work:

- online (virtual classrooms, e-learning platforms, MOOCs, webinars, online workshops)
- offline (frontal lessons, lectures, stages, labs)
- individual
- groupwork (collaborative learning, development teams, role plays, group discussion, think-pair-share)

Both through online or F2F, the educational tools that the projects apply are mainly:

- self-learning
- project-based learning
- work-based learning (real word missions, peer to peer discussion)
- experiential learning (stage, internships, in-company training)
- problem based learning (consultation with experts, guest speakers and site visits)
- active learning (workshop, distance learning, working groups, stage/project and final report)
- blended learning (any combined form online-offline)

Other tools used to facilitate learning have also been identified: game jams and game storming, gamification, hackathons.

4. Framework of intervention

This section aims at providing lines of work to ensure that digital transformation can be embedded in regular courses.

By analysing collected data, it appears clear that digital transformation is played out so far by focusing on digital skills: as a matter of fact, out of 26 practices that we have described 23 are focused on digital skills more than on digital transformation of the labour market and student awareness about the issue (which is the aim of the project). In particular, 23 practices address transversal digital skills, and 3 focus on field-specific digital skills (arts and cultural heritage; business and veterinary, but the latter is focused on digital skills for veterinary).

Learning outcomes

The vital point is therefore to pinpoint the link between the digital skills needed for the labour market and the implications of digital transformation for the market.

For this, the proposed learning outcomes to add to modules/courses/curricula are the following

1. Learners are able to compare, assess and identify the appropriate technology for the professional task
2. Learners are able to identify the skills needed to manage digital technologies related to professional tasks
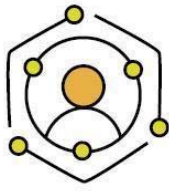
Suggested pedagogical methods

Most of the practices are based on self-learning, it means that they reported about MOOCs, online courses, etc. offered to a broad range of audiences (adult learners, teachers, etc.), not necessarily to higher education students.

Considering only those practices presenting curricula and courses involving methods other than self-learning, suggested pedagogical methods may be classified as:

- project-based learning
- work-based learning
- experiential learning (from field visits to labs)

Although there is an ample literature related to the development of digital skills, student awareness about digital transformation's impact on the labour market has not yet been studied. In this context, the DiTEMP Framework of Reference builds upon the literature of effective learning through experiential methods (which also include dialogue with labour market).

Experiential learning is widely intended as the process of learning through experience, which includes the willingness to be actively involved in the experience, the reflection on the experience, the possession by the learner of analytical skills to conceptualise the experience; and decision making and problem-solving skills to use the new ideas gained for the experience. In Kolb's cycle terms, the four stages of the process of learning through experience are concrete

experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984).

Methods inspired by experiential learning that are usually primarily considered

- Problem-based learning: used since the 60s in Medical Education (Barrows, 1996), is based on the presentation of a complex real-world, open-ended problem to students, who, through reflection and reasoning, propose their own solution. It is considered one of the most flexible and effective teaching methods, and is built upon an established series of steps, starting with the presentation of the problem, and ending with the assessment. Examples on how to design a PBL pathway:
  o The University of Maastricht – the 7-jumps
  o The Erasmus University Rotterdam – the seven steps guide
- Project-based learning: project-based learning is also built on the idea of working in groups in real-world contexts, but with a different approach, as students tackle problems during the implementation of a project. Interesting resources include
  o The teaching guide to project-based learning at the Boston University
  o The teaching guide to project-based learning at the New South Wales Government Education website
- Work-based learning is an educational strategy that provides students with real-life experiences. Traditional work-based learning includes internships, traineeships, and apprenticeship, but can also include service learning, field trips, entrepreneurial experiences, etc.

Many other learning methods, or didactic techniques, can also be useful to stimulate reflection about digital transformation in the labour market, such as for example:
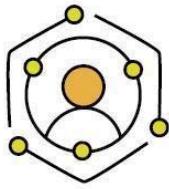
- case studies
- workshops about the practical use of digital skills in work settings
- courses, seminars and workshops on new software and their application in specific fields (e.g. arts; museums).
- labs
- etc.

In experiential learning of any kind, and in the learning process in general, the reflection moment is always the most important: it is a guided process regularly applied to teaching.

To stimulate reflection on digital transformation and the labour market, a specific question should be added about the potential 'step forward' that digital transformation can represent for the case/field addressed. Once a limited number of scenarios have been identified, learners should be stimulated by asking '**would I be ready for that?**'

Techniques that can be used to this purpose can be:

- Brainstorming, as initial positioning within the task and/or debriefing (by using tools like 'sticky notes', e.g., Ideaflip; Linoit). Brainstorming activities can be managed in both asynchronous (students can be encouraged to collect and organize their ideas to be archived and used in a second step) and synchronous channels (students can be motivated to give their opinion and express their ideas during a class by using an online poll/survey tools whose data can be easily and quickly shared and commented with all the participants;

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- Peer assessment, either individual or group-based, as a peer validation and reflection process after the task accomplishment, and potential building of a reference rubric (in this case, collaborative tools such as online forum or wiki can be helpful);
- Feedback, as teacher follow-up actions that would enable students to capitalize (feedforward) lessons learnt from individual/group/collective feedback about specific artefacts in their progress (activities to be completed and that can pass through sequential feedback steps in order to be optimized). Inputs in this direction can be offered through different multimedia formats (e.g., video or audio input);
- e-Portfolio, as an integrated tool to collect, select and share both significant student/practitioner's artefacts and the reflection papers/notes about their effectiveness and meaningfulness for their own learning process. Virtual environments like Mahara let users structure their portfolio and be part of a community; the social aspect contributes to enhancing the reflection process by taking part in discussion forums in dedicated groups (e.g. class groups and/or disciplinary interest-driven groups) and/or leaving comments on peers' portfolios (e.g. asking for clarification, adding suggestions, proposing a different perspective, etc.).

The DiTEMP intervention on teachers should therefore be focused on learning design for stimulating students' meaning-making and awareness on the implications of digital transformation for the labour market, and life. This action should be embedded in the regular educational activity and should foster links within the classroom, with other university experiences, and with the world.

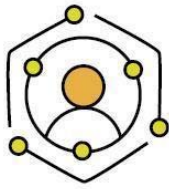In the following boxes, some examples of how learning outcomes can be achieved in practice are presented.

Box 1 – Business and Economics: digital videos for delivering business models

Each year, students from University of La Laguna's Accounting and Finance Degree present their business models for evaluation by teachers and entrepreneurs. The best projects are presented at the annual Entrepreneurial Talent Fair held in May at the Faculty of Economics, Business and Tourism.

During the 2018-2019 academic year these students used digital videos to better explain their business models. Previously, a specialist in digital transformation was invited to introduce and explain this digital tool. A technical workshop was organised for the management of specific software related to the visual communication of projects. The creation process of a digital video for this purpose was also explained For example, a very useful technique for recording a video is Chroma Key, which helps remove a background ('green screen' tool) and replace it with a photo, diagram, video, etc. you need.

The students worked in teams on an innovative proposal that could solve a previously identified need. These projects were later presented through digital communication tools. Students worked on their own personal business models in order to make them evolve into potential future prototypes, which had to be tested in practice outside the classroom.

A total of 115 university students participated in this initiative developing 21 innovative projects. In the testing phase, a video was made to present the idea and receive feedback

from people, both known and unknown. This testing was meant to allow for reorientation of the models. Each team later created a final two-minute presentation video of their projects, geared to capture the attention of their target-public.

As a result, students learned to work with audio-visual tools. At the same time, students acquired knowledge on a series of technological competencies that are increasingly demanded in the labour market.

Box 2 – Business and Economics: pre-enrolment activities

Another example of how learning outcomes in digital transformation can be achieved in practice in the area of Business refers to the same digital tool but used by pre-university students. At the end of the academic year participating students must elaborate and present business ideas to solve previously identified problems.

This project ("IDÉALO": https://fg.ull.es/empleo/idealo/) is designed to promote entrepreneurial culture in youth. This initiative, supported by the employment unit at the General Foundation of the University of La Laguna (FGULL), to stimulate the entrepreneurial spirit in the classroom, through the development of innovative business projects which are later presented through digital tools.

The project revolves around a training program for teachers on how to develop projects directly in the classroom through digital tools integrated into a virtual classroom. The teachers' practice is supervised and supported by the FGULL technical team, who offers specific advice when necessary.

At the end of the project each team prepares a video to present their project to the public. Some examples of these videos can be consulted on the above mentioned webpage. It is important to highlight that the project's target group is pre-university students who will begin Business studies in the future and already have partly developed competences in this area.

Box 3 – Cultural Heritage – how Wikipedia can be useful to understand change in a sector

This project was designed by prof. Pierluigi Feliciati from the Department of Education, Cultural Heritage and Tourism of the University of Macerata (UNIMC). It started after the 2016 earthquake in central Italy with the aim to engage and create awareness among heritage communities from the small villages hit by this natural disaster, namely those people from the same community who recognise the value of their cultural heritage and care about its valorisation and transmission to future generations. The Web, and more specifically Wikipedia, is, in this project, an important tool for improving the visibility and promotion of the cultural heritage and of the territorial assets of a place, as a well-written item may increase the tourism attractiveness of "minor" destinations (Hinnosaar et al., 2017). Wikipedia can be considered as a digital ecosystem where people can apply and increase their information literacy by taking part in bottom-up collaborative initiatives for the creation of new items in
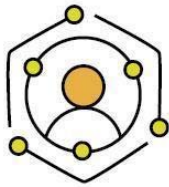
the encyclopaedia. The broader objective is to create new knowledge based on sources, which can contribute to the implementation of a collective intelligence.

From 2018 to 2019, in the context of two Erasmus+ projects coordinated by UNIMC, The Wine Lab and FOODBIZ, students and some agri-food companies took part to several Wikipedia laboratories for place branding and for the promotion of local food and wine. Existing items were improved, and new items were created by the students, also in different languages, based on the historical sources provided by the companies. UNIMC students worked together divided in groups and supported by the professor and by tutors. Several Wikivoyage guides have been elaborated as well as new Wikipedia items related to tourism. Students learned how to use and edit Wikipedia and experienced how to write quality contents for an encyclopaedia. They reflected on the right use of words and language, in order to provide complete information, accessible for all. They also learned to value the quality of sources used and developed competences in the research of information.
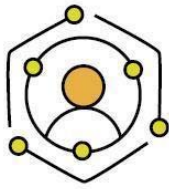
Alongside the development of digital skills, the students had the opportunity to understand relations between sectors (e.g. cultural heritage and tourism), which led to discussion about the evolution of the labour market through digital transformation, and future new roles for cultural heritage graduates.

Box 4 - Education

Since 2016, the Department for Student Services and Alumni Affairs from AICU-IASI is courses for all students in order to develop their transversal skills. One of the courses - "Training for students in digitalization"- takes place at least twice a semester. The training is open to all students from the University willing to learn how to employ different tools useful for their activities as students and during their free time. The training is focused on searching tools, time management tools and collaborative platforms.

The Master in Educational Policies and Management developed at AICU's Faculty of Psychology and Educational Sciences has included a subject related to technology in the formal curriculum: Development of Educational Virtual Environments. The courses and seminars taught for this subject are covering the following topics: e-learning platforms, MOOCs, collaborative platforms, CMS (content management systems), photo / image editing, online security. Students enrolled in this Master are mainly teachers working in the pre-university level (kindergarden, primary school, gymnasium and high school).

In May 2020, during the state of emergency in Romania because of the COVID-19 pandemy, the Department for Student Services and Alumni Affairs organized a series of video podcasts on topics that were related to students' needs and also useful advice for them in order to adapt easily to the social distancing situation. One of the video podcasts that was transmitted for all students was "How to efficiently use technology for learning".

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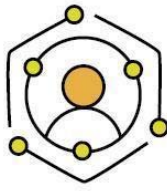of the European Union

Box 5 – Psychology

The introduction of ICT in teaching, as evidenced by numerous studies, affects the profound cognitive-planning structures of teachers, engaging them in the conjugation of disciplinary, methodological and technological knowledge. The challenge, also in Higher Education, is the development of "integrated training environments" and "knowledge creation" communities, capable of relating information processes (scientific-disciplinary organization of knowledge and hard skills) knowledge processes (input, exploration, production and soft skills) in order to favour meaningful learning processes.

It is a question of finding procedures aimed at reconciling the two prevailing models that characterize university education, referable, one, to the "metaphor of acquisition" - "learning consists in becoming the owner of something" (for example, knowledge, concepts , ability) - and the other to the "metaphor of participation" - learning consists in "becoming a skilled participant in well-defined and recurrent forms of human activity (practice, discourse, advanced culture)". Within this perspective, it was carried out in the academic year 2015-16 the Project "ITEDU - Integrating Technology in Higher Education", coordinated by Professor Marina De Rossi from the Applied Psychology Department, which involved a group of university teachers from various scientific areas and 1450 students of courses designed in blended form implementing integration of ICT through tools of the MOODLE platform.
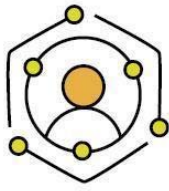
Box 6 – Tourism: use of case-studies in agri-tourism

During the first semester of the 2020-2021 academic Year. a cross-cultural learning experience, based on a descriptive case study methodology, has begun with students from the University of Macerata's Master in place branding and rural development and students from the School Business at the JAMK University of Applied Sciences in Finland. The theme of the exchange is sustainable tourism related to local food and wine resources. An introduction about place branding, sustainability, sustainable tourism and rural development will guide the students from a theoretical perspective. Students have been provided with learning materials, such as relevant papers, websites, methodological papers and guidelines ("how to..."). Students, divided in groups, will attend the presentation of 3 case studies from each country/region by stakeholders/companies involved in sustainable tourism at local level (3 cases from Marche Region; 3 cases from Finland). In parallel, they will attend programmed theoretical lectures. They will then be asked to investigate the case studies provided through desk and field research, by collecting information on the web and by interviewing the actors involved. As a deliverable, they will apply the triple layered business model canvas tool (Joyce & Paquin, 2016) which not only considers the economic dimension, but also the social and environmental dimensions of sustainability.

During this place-based and project-based learning experience, students will particularly focus on the analysis of the business models' social dimension. To the dimensions taken from the model, additional items require students to study the case in longitudinal way, and explore modifications to the company/service depending from digital transformation. Students should therefore reflect on the impact of digital transformation on a real case. Further, as the designed

process includes the activation of peer assessment among students, digital transformation will be re-discussed: students will be stimulated to reflect about the change in production, services, functions, and the labour market.

Box 7 – Transversal: online internships

e-Start: online internship programme for undergraduates and graduates

FUE's e-Start programme allows students to carry out online internships by participating - in group mode - in real projects that are proposed by collaborating companies and co-tutored by company professionals and teachers.

It is a practical training model perfectly aligned with current labour market trends in which work, training and professional interactions are carried out increasingly in virtual and digital environments.
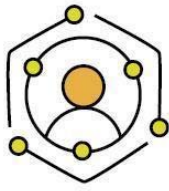
In particular, e-Start promotes collaborative and autonomous learning, facilitates peer-to-peer knowledge through the resolution of real cases with the support of a tutor-mentor; allows students to assume a leading role in their learning process; brings into play skills and competencies that enable meaningful learning; allows the student to become familiar with the use of virtual learning and work environments.

The programme's methodology is structured in five phases: 1) the university defines the objectives and the duration of the online practice, as well as the competences that participating students must acquire; 2) FUE is in charge of bringing companies on-board to offer relevant projects in line with the criteria defined by the HEI; 3) the university validates the suitability of the projects proposed by the companies, ensuring their complete adaptation to the educational content of the Bachelor's or Master's degree curriculum; 4) students are assigned to develop each project, which FUE monitors from start to finish; 5) the internship is certified, with the consequent granting of academic credits, based on the business tutor's final report and the academic tutor's final evaluation.

The development of the program, as in any face-to-face practice, revolves around four essential roles: 1) the business tutor, who is responsible for the internship project and must supervise the student's activities by means of follow-up sessions and tutorials on a weekly or biweekly basis, using the virtual means available on the platform - videoconferences, chats, messaging, etc.; 2) the academic tutor, who is responsible for the academic monitoring and evaluation of the internship based on periodic follow-up sessions and tutorials and on reports presented by the business tutor and the student; 3) the student, who takes on the responsibility of carrying out the internship under the established terms and meeting the objectives proposed in the assigned project, always with the support of his/her tutor; 4) FUE, which is responsible for the e-Start internship platform and ensures compliance with the commitments taken on by the business and academic tutors for the correct development of online internships.

All of this is carried out on the e-Start platform which provides the communication, monitoring, recording and evaluation tools needed by students and tutors.

Since 2011, 18.157 students from 66 undergraduate and graduate programmes from 15 universities and business schools have participated in 4.587 projects proposed by 3.350 collaborating companies and institutions.

The programme may be applied to all areas of study: Arts and Humanities, Science, Social and Legal Sciences, Life and Health Sciences, Engineering and Architecture. Since e-Start was launched, and in relation to the specific study areas addressed in DiTemp, the programme has been carried out within: 1 Bachellor Degree in Psychology; 1 Bachellor Degree in Business Administration; 44 Master Degrees in the field of Business; 7 Master Degrees in the field of Education.
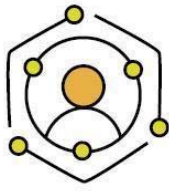
Conclusions

The DiTEMP project explores the pedagogical approaches that teachers in different fields may adopt to support student employability in a fast-changing, digitally-driven labour market. The first set of activities of the project included desk and field research to identify the present situation of key players involved (teachers, students and companies) with regard to digital transformation and the previous practices in the field.

Analysis of crossed data highlighted that digital transformation of the labour market, although linked to digital skills, implies the need for a wider action geared to help learners understand the links between study, tasks, and the implication of technology on the tasks carried out in the professional world.
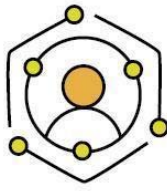
Therefore, proposed learning outcomes for the educational project activities (O4), and accordingly the teacher training (O3), focus on (1) the ability to compare, assess and identify appropriate technologies for professional tasks, and (2) the ability to identify skills needed to manage digital technologies related to the professional task.

Pedagogical methods suggested are consequently experiential. However, the experience should be followed by reflection, which allows the learner to make sense of the experience, gain awareness and understanding of the world of work, and position his/herself within the labour market.
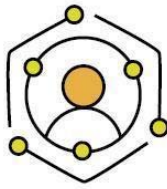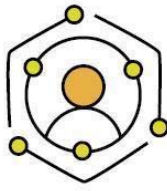
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ANNEX I: STUDENTS´QUESTIONNAIRE

Presentation

A group of European Higher Education institutions are participating in a project aimed at analyzing some trends related to the future of employment. We thank you for your collaboration by answering the following questionnaire, which will not take you more than 10 minutes. Your answers will be held in strict confidentiality and will be used only for the purposes of this study. The results will be reported in aggregate form only, and cannot be identified individually.

Q1. Of the following skills, how important do you think each one is for your future employment? [Scale from 1 Not at all important to 7 Very important]
- Flexibility and adaptation to change
- Initiative and autonomy
- Digital skills
- Social skills
- Languages
- Teamwork
- Communication
- Critical thinking

Digital transformation is a technology-driven continuous change process of companies and the entire society, it is about adopting disruptive technologies to increase productivity, value creation, and social welfare. To adapt to this process, it is necessary to develop "digital skills", both in the fields of work, as in leisure and communication. Digital skills can be defined as a set of knowledge, abilities, attitudes and strategies that are required for the use of digital media and information and communication technologies.

Q2. Of the following employee skills, which do you know about or have used?
[Scale: I have not heard about it, I have heard, I know, I have used it, I am an advanced user (I configure / program it)]

Social Media (Facebook, Twitter, Instagram, LinkedIn…)
Search Engine Optimization/Marketing (SEO/SEM)
Analytics (Application of statistics, computer programming, and operations research in order to quantify and gain insight to the meanings of data)
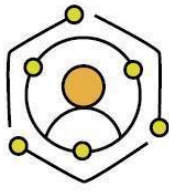Big Data (predictive analysis and data mining)
Advanced Social Selling (make a connection with your audience and maintain it)
Multi-platform UX design (UX /User-experience mobile, web, apps...)
Network and Information Security (understand the basics of online security and the steps employees can take to defend it)
Creative thinking (creative, versatile workers able to do what machines are unable to and with the right expertise to adapt as the technology evolves)
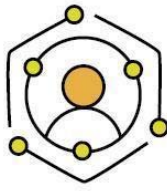Programming/Coding

Q3. In your opinion, how important are the following digital skills for your future employment? [Scale: 1 Nothing important to 7 Very important, NS / NC]

- Ability to input information digitally on a range of devices and software packages.
- Ability to process and present data in more understandable forms.
- Confidence moving between devices and using them equally.
- Ability to use and manage digital troubleshooting mediums (solving problem via ticketing systems, online chats…).
- Setting up, modifying and personalizing digital devices and software in order to improve productivity and wellbeing and know how to install and configure it.
- Participation in social channels.
- Understanding how to use web browsers, search engines, email, text, wiki, blogs, Photoshop, Powerpoint, video creation/editing software, etc. to showcase learning.
- Ability to find and evaluate online resources for accuracy/trustworthiness of information, manage and share in a digital context.
- Ability to communicate and manage virtual interpersonal relationships by using digital tools in a digital context.
- Ability to work and cooperate efficiently in a digital context by using digital tools.
- An open mind to future digital developments (be open to new generation of digital tools and not fear the change at the workplace).
- Ability to use and learn from digital resources.
- Digital Customer Orientation by providing solutions adapted to a digital user.
- Awareness of the importance of digital transformation.
- Know-how and experience in stopping technology from controlling you. (Ability to set boundaries on technology use to avoid reducing performance over time)

Q4. In general, how prepared do you consider yourself to be in digital skills??

- Not at all
- Very little
- Little
- Neither a little nor a lot
- Some
- Enough
- A lot

Q5. How important do you think it is for future job seekers to be adapted to the digital transformation?
- Not at all important
- Very little importance
- Little importance
- Neither little nor very important
- Of some importance
- Quite important
- Very important

Q6. How often do you carry out or have you carried out activities to keep up with digital skills? [Frequency: Constantly, once a month, once a term, once a year, less frequently, never]
- Self-study
- Online courses
- Face-to-face courses
- Courses included in subjects

Q7. In the subjects you have studied so far in the university, to what degree do you think digital skills have been taught?

- Not at all
- Very little
- Little
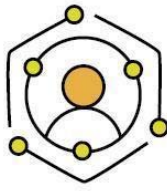- Neither a little nor or a lot
- Some
- Enough
- A lot

Q8. Who encourages or drives you to keep up with your digital skills?
[Scale: Nothing, Very little, Little, Neither a little nor a lot, Some, Enough, A lot]
- Professors
- Family
- Friends
- Others

Q9. Reasons why you consider it necessary to keep yourself up to date on digital technologies [multiple response, maximum 2]
- To find or progress in employment
- To earn more money
- To start a business activity
- I like to keep up to date
- It is necessary for everyday life (leisure, business,…)

Q10. What prevents you from keeping up to date with digital technologies
[multiple response, maximum 2]
- I don't see it useful or necessary
- I don't like technologies
- Ethically, I do not agree with digitalization
- It is difficult for me, I am not good at them
- I don't have financial resources
- I do not have access to adequate training
- I am not trained at the University
- Technologies will be the end of work

Q11. Regarding your intentions to advance in the use of digital technologies.
Please indicate your level of agreement with the following statements (1 = strongly disagree, 7 = strongly agree)
BI1. I intend to continue training in digital technologies in the future to adapt to the requirements for employment.
BI2. I will always try to keep up with new technologies to be a technologically competent professional.
BI3. I plan to continue adapting to the digital transformation that is changing employment.

Q12. What is your opinion about the importance of digital technologies for employment? Please indicate your level of agreement with the following statements (1=strongly disagree, 7=strongly agree)

PE1. Being adapted to the digital transformation will improve my competitiveness in the labor market.
PE2. Improving my digital skills will help me find the job I want.
PE3. The use of digital technologies increases my employment opportunities.

EE1. My interaction with technology has always been pleasant and understandable.
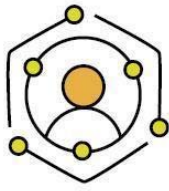EE2. I find that technologies are easy to use.
EE3. It is easy for me to acquire skills in the use of digital technologies.

SI1. My close family members think I should prepare to use digital technologies.
SI 2. My friends and acquaintances suggest and encourage me to be up to date on digital technologies.
SI 3. People whose opinions I value agree that digital technologies dominate.

Q13. Regarding the use you make of digital technologies. Please indicate your level of agreement with the following statements (1=strongly disagree, 7=strongly agree)

FC1. I have the necessary resources to continue advancing in the knowledge and use of digital technologies.
FC2. I have the knowledge to use digital technologies.
FC3. I can get help from other people when I have difficulty using or advancing in the knowledge of digital technologies.

HM1. Using digital technologies is fun for me.
HM2. Using digital technologies is enjoyable and I like it.
HM3. Using digital technologies is very entertaining.

HT1. The use of digital technologies has become a habit for me.
HT2. I consider myself addicted to the use of digital technologies.
HT3 I need to use digital technologies regularly.

Q14. What is your opinion about digital technologies? Please indicate your level of agreement with the following statements (1=strongly disagree, 7=strongly agree)

PA1. Digital technologies have more advantages than disadvantages.
PA2. Digital technologies improve work, leisure and communication.
PA3. I believe that the future goes through the development of digital technologies.
PI1. I consider myself a person with technological skills.
PI2. I am always looking for new tools and new technologies.
PI3. I receive information about developments in digital technologies.

OP1. Having digital skills is a clear opportunity to access employment in the future
OP2 There are many employment opportunities for people who have knowledge in digital technologies.
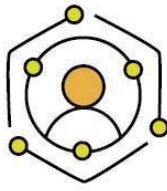OP3 The best and most stable jobs will be for the best technologically prepared.

Details of classification

Age: _____

Gender

- Female
- Male

Level of studies in progress at the university

- Undergraduate (Bachelor Degree)
     Please, indicate year: 1st year / 2nd year / 3rd year / 4th year
- Graduate (Master Degree)
- Postgraduate (PhD: other postgraduate courses)
- Other (please specify)

Area of current studies

- Psychology
- Cultural Heritage & Tourism
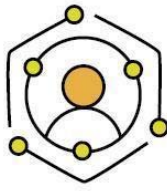- Business
- Education

University

- University of La Laguna
- Universita Degli Studi Di Padova
- Universita Degli Studi Di Macerata
- Universitatea Alexandru Ioan Cuza Din Iasi
- Other:

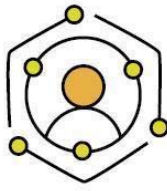Do you have experience in a professional environment?
- Yes
- No

If yes:
- Internship
- Job contract
- Freelancer

ANNEX II: FIRMS´QUESTIONNAIRE

Are recent graduates ready to work in a digital environment? Do they have the required digital skills and competences?

These are the questions that we want to answer in DiTemp, a project funded by the European Commission in which a consortium of universities and institutions will address the impact that digital transformation may have on graduate employability in the coming years.

We thank you for your collaboration in answering the following questionnaire, which will not take you more than 10 minutes. Your answers will be held in strict confidentiality and will be used only for the purposes of this study. The results will be reported in aggregate form only, and cannot be identified individually.

Email address:

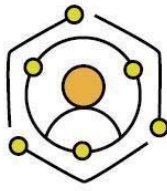**Company name:**

1. **Company size:**
   - o   1-20
   - o   21-250
   - o   251-500
   - o   +500

2. **Company Sector:**
   - o   Agriculture
   - o   Commerce
   - o   Finance and Banking
   - o   Industry (including Construction)
   - o   Public Administration
   - o   Services for Business
   - o   Services for People
   - o   Logistics/Transportation
   - o   IT
   - o   Energy
   - o   Health

o Education

o Tourism & Hospitality

o Other_____

3. How would you define Digital Skills and Competences? _____

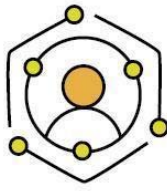**4. Is your Company ready and adapted to digital transformation?**

o Yes

o No

o We are almost there

5. Does your company provide the tools, training and environment needed to become a digital employee?

o Yes

o No

6. Regarding your company and industry select 3 employee skills you consider to be most relevant in a digital environment:

◊ Social Media (Facebook, Twitter, Instagram, LinkedIn…)

◊ Search Engine Optimization/Marketing (SEO/SEM)

◊ Analytics (Application of statistics, computer programming, and operations research in order to quantify and gain insight to the meanings of data)

◊ Big Data (predictive analysis and data mining)

◊ Advanced Social Selling (make a connection with your audience and maintain it)

◊ Multi-platform UX design (UX /User-experience) mobile, web, apps...)

◊ Network and Information Security (understand the basics of online security and the steps employees can take to defend it)

◊ Creative thinking (creative, versatile workers able to do what machines are unable to and with the right expertise to adapt as the technology evolves)

◊ Programming/Coding

◊ Other:_____
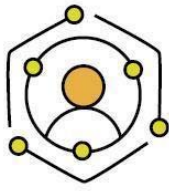
7. **Are you currently recruiting recent graduates?**

   o YES

   o NO

8. **If yes, to what extent do you think that they are adapted to digital skills??**

[Not at all / Very little / little / neither a little nor a lot / something / enough / A lot]

9. **In your opinion, how important are the following digital skills for recent graduates:**
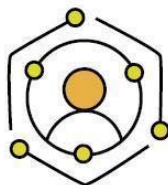
1. Ability to input information digitally on a range of devices and software packages

2. Ability to process and present data in more understandable forms

3. Confidence moving between devices and using them equally

4. Ability to use and manage digital troubleshooting mediums (solving problem via ticketing systems, online chat…)

5. Setting up, modifying and personalizing digital devices and software in order to improve productivity and wellbeing and know how to install and configure it.

6. Participation in social channels

7. Understanding how to use web browsers, search engines, email, text, wiki, blogs, Photoshop, Powerpoint, video creation/editing software, etc. to showcase learning.

8. Ability to find and evaluate online resources for accuracy/trustworthiness of information, manage and share in a digital context

9. Ability to communicate and manage virtual interpersonal relationships by using digital tools in a digital context

10. Ability to work and cooperate efficiently in a digital context by using digital tools.

11. An open mind to future digital developments (be open to new generation of digital tools and not fear the change at the workplace)

12. Ability to use and learn from digital resources

13. Digital Customer Orientation by providing solutions adapted to a digital user

14. Awareness of the importance of digital transformation.

15. Know-how and experience in stopping technology from controlling you. (Ability to set boundaries on technology use to avoid reduce performance over time)

10. In your opinion, do universities provide the training needed by students/graduates to cover company needs in relation to digital skills? Why?

11. Do you agree or disagree with the following statements?

- Universities are using digital tools to teach students
- Universities are committed to digital transformation
- Students are aware of the importance of digital transformation
- Universities should develop more online classes and workshops to enhance learning in the classroom
- Universities encourage students to use technology to showcase their learning
- A digital skills module should be mandatory for all students no matter what field of studies
- Graduates from Generation Z (birth mid-to late-1990s) have the digital skills needed by business

12. How can companies help universities to provide and develop digital skills and competences?

13. How can companies help students to acquire and develop digital skills and competences?

14. What are the deficiencies of digital skills you have found in recent graduates?

15. If you have any additional comments or suggestions regarding digital skills and graduate employability, please feel free to share them with us.
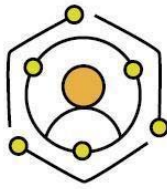
**ANNEX III: TEACHERS´QUESTIONNAIRE**

Are recent graduates ready to work in a digital environment? Do they have the required digital skills and competences?
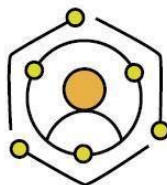
These are the questions that we want to answer in DiTemp, a project funded by the European Commission in which a consortium of universities and institutions will address the impact that digital transformation may have on graduate employability in the coming years.

We thank you for your collaboration in answering the following questionnaire, which will not take you more than 10 minutes. Your answers will be held in strict confidentiality and will be used only for the purposes of this study. The results will be reported in aggregate form only, and cannot be identified individually.
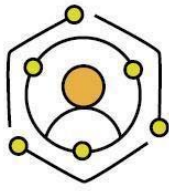
Country				
University				
Level of education concerned	Undergraduate (first level; Bachelor degree - EQF6)	Graduate (degree level; Master degree - EQF7)	Post-grad (PhD; other post-graduate courses - EQF8)	Other (please specify)
Degree (Title of the degree in national language)	*[short answer/text possible]*			
Course (Title of the course taught in national language)	*[short answer/text possible]*			

Introduction

Digital transformation is a technology-driven continuous change process of companies and the entire society, it is about adopting disruptive technologies to increase productivity, value creation, and social welfare: it entails transformation of business, organisational activities, processes, required competences, and it impacts across society at several levels, from the individual to the collective perspective.

The following questions refer to the impact of digital transformation in field teaching in higher education: you will be asked to reflect and share your opinion about the implication of digital transformation in your daily work (both research and pedagogy), and implications for students' employment prospects.

Digital transformation and your field

1. Thinking about your field, do you think that digital transformation is changing/will change the ways of work (approaches and/or methods/tools) in research?	*Please rate on the following scale where 1 = not at all; 7 = very*						
	1	2	3	4	5	6	7

2. Thinking about your field, do you think that digital transformation is changing/will change the ways of work in professional practice (e.g. (performing the reference job; in the reference professional activity)?	*Please rate on the following scale where 1 = not at all; 7 = very*						
	1	2	3	4	5	6	7

3. Thinking about your students, do you think that digital transformation is changing/will change their future professions (as defined in the study programme)?	*Please rate on the following scale where 1 = not at all; 7 = very*						
	1	2	3	4	5	6	7

4. Thinking about your students and the field of studies, do you think that awareness about digital transformation would support their employability potential?	*Please rate on the following scale where 1 = not at all; 7 = very*						
	1	2	3	4	5	6	7

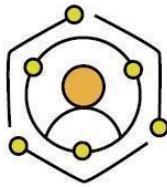| 5. Can you please explain more in detail how your field of studies and/or your students are (or are not) affected by digital transformation?	*long answer possible*
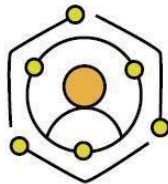
Digital transformation and employment							
6. Thinking about your field, indicate the relevance of the following employee skills in a digital environment	*. Please rate on the following scale where 1 = not at all; 7 = very*						
Social Media (Facebook, Twitter, Instagram, LinkedIn…)	1	2	3	4	5	6	7
Search Engine Optimization/Marketing (SEO/SEM)	1	2	3	4	5	6	7
Analytics (Application of statistics, computer programming, and operations research in order to quantify and gain insight to the meanings of data)	1	2	3	4	5	6	7
Big Data (predictive analysis and data mining)	1	2	3	4	5	6	7
Advanced Social Selling (make a connection with your audience and maintain it)	1	2	3	4	5	6	7
Multi-platform UX design (UX /User-experience mobile, web, apps…)	1	2	3	4	5	6	7
Network and Information Security (understand the basics of online security and the steps employees can take to defend it)	1	2	3	4	5	6	7
Creative thinking (creative, versatile workers able to do what machines are unable to and with the right expertise to adapt as technology evolves)	1	2	3	4	5	6	7
Programming/Coding	1	2	3	4	5	6	7
7. Thinking about your field, to what extent do you think that graduates who finish their studies have adapted to digital skills?	*Please rate on the following scale where 1 = not at all; 7 = a lot*						
	1	2	3	4	5	6	7
8. In your opinion, how important are the following digital skills for newly graduates in your field	*Please rate on the following scale where 1 = not at all important; 7 = very important*						
Ability to input information digitally on a range of devices and software packages.	1	2	3	4	5	6	7
Ability to process and present data in more understandable forms.	1	2	3	4	5	6	7
Confidence moving between devices and using them equally.	1	2	3	4	5	6	7
Ability to use and manage digital troubleshooting mediums (solving problems via ticketing systems, online chats…).	1	2	3	4	5	6	7
Setting up, modifying and personalizing digital devices and software in order to improve productivity and wellbeing and know how to install and configure it.	1	2	3	4	5	6	7
Participation in social channels.	1	2	3	4	5	6	7
Understanding how to use web browsers, search engines, email, text, wiki, blogs, Photoshop, Power Point, video creation/editing software, etc. to showcase learning.	1	2	3	4	5	6	7
Ability to find and evaluate online resources for accuracy/trustworthiness of information, manage and share in a digital context.	1	2	3	4	5	6	7
Ability to communicate and manage virtual interpersonal relationships by using digital tools in a digital context.	1	2	3	4	5	6	7
Ability to work and cooperate efficiently in a digital context by using digital tools.	1	2	3	4	5	6	7

DiTEMP
DIGITAL TRANSFORMATION & EMPLOYABILITY

Co-funded by the
Erasmus+ Programme
of the European Union

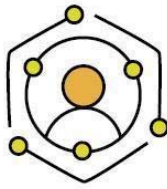|							
An open mind to future digital developments (be open to new generation of digital tools and not fear the change at the workplace).	1	2	3	4	5	6	7
Ability to use and learn from digital resources.	1	2	3	4	5	6	7
Digital Customer Orientation by providing solutions adapted to a digital user.	1	2	3	4	5	6	7
Awareness of the importance of digital transformation.	1	2	3	4	5	6	7
Know-how and experience in stopping technology from controlling you. (Ability to set boundaries on technology use to avoid reducing performance over time)	1	2	3	4	5	6	7

Digital transformation and your teaching

9. Do you think that the content of your teaching has changed following digital transformation in past years?	Please rate on the following scale where 1 = not at all; 7 = a lot						
	1	2	3	4	5	6	7
10. Do you think that your way of teaching has changed following digital transformation in past years?	Please rate on the following scale where 1 = not at all; 7 = a lot						
	1	2	3	4	5	6	7
11. Which changes have you performed in your teaching, if any?	Please tick max three choices						
	□ Use of online resources/references (including MOOCs, online courses, etc.) □ Use of gamification technologies □ Project based learning based or performed through technologies □ Case studies on technological change in the study field □ Collaborative learning through Augmented Reality / Virtual Reality / Mixed Reality (e.g. use of Cospace or similar tools) □ Pedagogical use of social media (e.g. for collaborative learning; students' assignments; etc.) □ Other □ None						
12. Can you explain more in detail your points about content and/or teaching methods related to digital transformation?	long answer possible						

Introducing digital transformation in the curriculum

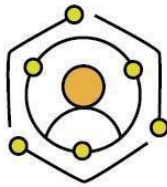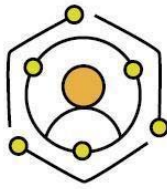|							
13. Do you think that introducing learning outcomes related to digital transformation in your field of studies/your course would be an added value for students?	Please rate on the following scale where 1 = not at all; 7 = a lot						
	1	2	3	4	5	6	7
14. Please explain your answer to the previous questions, by highlighting opportunities/strengths/potential bottlenecks in the process of including learning outcomes about digital transformation in the study programme.	[Long answer/text possible]						

ANNEX IV: LIST OF PRACTICES

Title of the practice	Institution	Web link
CHEDTEB	European Project	https://www.chedteb.eu/
DIGITAL SKILLS ACCELERATOR PROJECT	European Project	https://www.digitalskillsaccelerator.eu/
The University of Edinburgh Digital Skills Framework	University of Edinburgh (UK)	https://www.digitalskills.ed.ac.uk/about-the-framework/
EUHeritage	European Project	http://www.euheritage.eu/
DigitalCulture-Improving the Digital Competences and Social Inclusion of Adults in Creative Industries	European Project	https://digiculture.eu/it/
DI&F	Catholic University "Sacro Cuore" (IT)	https://offertaformativa.unicatt.it/master-digital-innovation-fintech-la-trasformazione-destinatari-e-profilo-professionale#structure
eLene4work	European Project	http://elene4life.eu/
DIGITA	University of Naples (IT	http://www.digita.unina.it/it/progetto-digita-2019/

Master in digital transformation - MDT	Dortmund University of Applied Sciences and Arts (DE)	https://www2.daad.de/deutschland/studienangebote/international-programmes/en/detail/4879/#tab_overview
International Executive MBA	University of Bologna (IT)	https://www.bbs.unibo.it/hp/master-executive/international-executive-mba-2/?utm_source=google&utm_medium=cpc&utm_content=iemba&gclid=CjwKCAiAsIDxBRAsEiwAV76N8yjp3CwtTD0EblJKSXLnXcqTv0k6wqXVY3slO5v3kfGSTF231VyqDBoC6GYQAvD_BwE#presentazione
Msc in digital transformation management & leadership	ESCP Business School (FR)	https://www.escpeurope.eu/programmes/specialised-masters-MScs/MSc-in-digital-transformation-management-and-leadership
Digital Business Leadership Programme	Columbia Business School (USA)	https://eruditus.gsb.columbia.edu/dblp/?utm_source=Google&utm_medium=cpc&utm_campaign=B-0000_ROW_GG_SE_DBLP_Jun_20_Non-Brand&utm_content=Non-Brand&utm_term=%2Bdigital%20%2Btransformation%20%2Buniversity&gclid=Cj0KCQiA04XxBRD5ARIsAGFygj_GC23-EgpUuXLnUvabfCWQRxTwHhdqnIxoaACkMPaIxTvqJUpW61gaAsJ7EALw_wcB
Digital Business Strategy	Luiss University (IT)	https://businessschool.luiss.it/digital-business-strategy-belluno/partner/

SOFTVETS	European Project	http://www.softvets.eu/
D-Transform	European Project	https://www.dtransform.eu/
MADIM	University of Milan (IT)	https://maunimib.unimib.it/
POWERUDIGITAL	European Project	www.powerudigital.com
AR & VR FOR THE EDUCATION IN CULTURAL HERITAGE	European Project	https://www.erasmuspluska1.eu/ar-vr-for-the-education-at-cultural-heritage/?fbclid=IwAR2RXjXSXstDrfIrt07aHZ44ooNe8Ts_9ILM8a9677WFoLlDf22OGHAaZrE
ITedu	University of Padova (IT)	http://www.padovauniversitypress.it/publications/9788869381157
Get Digital	University of Westmister (UK)	https://www.westminster.ac.uk/current-students/studies/study-skills-and-training/digital-skills
Digital Competition School	Escuela de competencia digital (ES)	https://escuelacompetenciadigital.com/
International Telematic University UNINETTUNO bachelor	UNINETTUNO University (IT)	https://www.uninettunouniversity.net/en/indirizzo-istituzioni-pubbliche-e-media-digitali.aspx?faculty=&degree=238&idindirizzo=78&mode=cs
Digital Generation	Digital Generation Tech (Russia)	https://digitalgeneration.tech/

Institute of Coding	Institute of Coding (UK)	https://instituteofcoding.org/
BBVA Liquid Junior - FUE	Fundación Universidad-Empresa (ES)	https://www.talentoteca.es/becas-fue/cambio-tecnologico/ https://www.uah.es/es/estudios/Formacion-Superior-en-Cambio-Tecnologico-e-Innovacion/
DIGITA 2019 (Digital Transformation and Industry Innovation Academy)	University Federico II, Naples (IT)	http://www.digita.unina.it/progetto-digita-2019/