EDU-GATE

EDucational University GATeway to enhance innovative E-learning capabilities, resilience and new best practices

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Output 2

Online training curriculum to identify a learning contents, experiential knowledge and skills assessment tools: methodology of development and delivering

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Authors:

Maria Gianni (University of Macedonia), Georgios Tsaples (University of Macedonia), Jason Papathanasiou (University of Macedonia), Sofia Garane (University of Macedonia), Mariya Monova-Zheleva (Burgas Free University), Yanislav Zhelev (Burgas Free University), Alla Anohina-Naumeca, Sintija Petroviča (Rigas Tehniska Universitate), Nunzio Casalino (LUISS), Giuliana Pizzolo (LUISS), Barbara Borin (LUISS), Georgios Triantafyllou (SYMPLEXIS), Kalliopi Christopoulou (SYMPLEXIS), Massimo Olivieri (Linfa Digital), Margherita Olivieri (Linfa Digital), Donatella Fiorentino (Linfa Digital), Yuliya Arabadzhieva (European Center for Quality), Silviya Georgieva (European Center for Quality)

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1. Introduction

Academic institutions have been undergoing extensive changes during the last years that are driven by globalization, social mobility and mostly new technologies (Moran et al. 2018).These changes have only accelerated due to the COVID-19 pandemic (Tejedor et al. 2020) forcing academic institutions to come closer to the concept of the University 4.0.

The concept of University 4.0 and Education 4.0 in general can be considered the next step in education, where digital technologies and personalized data create the appropriate environment for an education that is student-centered, allowing flexible, adaptive and dynamic learning pathways (Gueye & Exposito, 2020).

As it was mentioned above, new technologies and the COVID-19 pandemic has motivated (and forced) universities to develop innovative programs that combine online and blended learning modes with the aim of streamlining and enhancing student learning (McGuinness & Fulton, 2019). However, the new methodologies and technologies do not always guarantee that the learning will improve (Jonas-Dwyer, Pospisil, 2004).

Thus, it is important to develop guidelines that will assist educators and trainers to successfully apply digitization in education curricula. The objective of the current document is to:

(1) investigate and analyze the state of the art of digitalization and innovative automation practices in the partner countries

(2) provide a context analysis of the innovation in education practices

(3) identify the needs and requirements of the target groups of the participants

(4) identify best practices in each partner country

(5) provide guidelines that would assist teachers and educators

The document is structured as follows: Section 2 is focused on a desk research for each partner's country that will illustrate the state of the art, best practices etc. The section after that is focused on analyzing the responses from the questionnaire that was developed in the context of the project. Guidelines and recommendations are discussed in the last section.

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References

Moran, S., Berckhan, S., & Clarke, A. (2018, July). A Framework to Support the Design of Digital Initiatives in Social Science Based Research. In *International Conference on Informatics and Semiotics in Organisations* (pp. 177-186). Springer, Cham.

Gueye, M., &Exposito, E. (2020, October). University 4.0: The Industry 4.0 paradigm applied to Education. In*IX Congreso Nacional de Tecnologíasen la Educación*.

Jonas-Dwyer, D., & Pospisil, R. (2004, July). The millennial effect: Implications for academic development. In*Proceedings of the 2004 annual international conference of the Higher Education Research and Development Society of Australasia (HERDSA)* (pp. 356-366).

McGuinness, C., & Fulton, C. (2019). Digital literacy in higher education: A case study of student engagement with e-tutorials using blended learning. *Journal of Information Technology Education: Innovations in Practice*, *18*, 001-028.

Tejedor, S., Cervi, L., Pérez-Escoda, A., & Jumbo, F. T. (2020). Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador. *Publications*, *8*(4), 48.

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2. Literature Review

Section 2 of the current document is divided into the following sub-sections:

(a) Enhancing digital and teaching skills and competences for the digital transformation

(b) New trends, innovative technologies and multimedia contents for the future e-learning

(c) Open access platform for academics' courses

Within each sub-section, the state of the art for each partner country is analyzed and discussed.

a. Enhancing digital and teaching skills and competences for the digital transformation

Italy

The sources that were used for the literature review were entirely online. Several specialized platforms and databases were used as well as it was conducted extensive online search by specific keywords and phrases. Additionally, specific information and statistics was collected from several national institutions` websites.

The databases that were mainly used are JSTOR, CIMEA, Academy of Management DB, Eurydice, Thomson Reuters Web of Science, MIUR ANS, CNR research institutes databases, Italian TTS Database, National Library Directory, European Data Portal, ACM Digital Library and ISCED UNESCO. Various keyword combinations were applied, some which are: "digital education" AND "Italy", "digital education" AND "universities", "university online courses" AND "Italian higher education", "flex programs" AND "blended courses". The same keywords were used both in English and Italian languages.

During the research significant information and reports regarding the HEIs, online education processes and their adaptation in higher education institutions were collected and analyzed. The publishing period of information sources was defined between 2016 and 2021. Most of them are news in online media, public reports, academic research papers and studies covering the main topics of EDU-GATE in English or in Italian languages.

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The main impacted region that was analyzed was the Italian context and some relations with neighboring countries in South-West of Europe.

The discovered reports provided common information regarding the state of digitalization in higher education institutions, identifying needs and gaps for online education due to Covid-19 restrictions.

Digital Education: computer culture and digital skills are essential requirements for an effective role and impact of HEIs services. The public and private sectors must invest to foster skills development as they are determining factors for growth, competitiveness, creation of public value, and the well-being of the country. Universities and the media should contribute to fighting all forms of digital illiteracy.

However, studying papers and reports several conclusions were obtained:

- The availability of an open access e-learning platform easy to customise for the higher education context has become critical as current HEIs' educational system is changing from a traditional to an online student-centred model, especially in small public universities, allowing professors to easily deliver courses and students to attend them without risks or travel.
- Revisit the traditional educational paradigms with a high-tech approach as clearly defined in Education 4.0 strategies.
- Need of more personalised learning tools, to allow a customized way of teaching to have a better impact on students to achieve their outcomes easily.
- Academic faculties are able to easily identify the strengths and weaknesses of the students and provide online instant feedback.
- Making e-learning available in universities and anytime with a set of e-learning tools that could promote remote and self-paced learning.
- Collaborative and engagement tools of flipped learning to improve blended learning in academic courses.

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- Prompts students to learn time management skills, organisational skills, collaborative skills, time management skills, much needed for their employment for the road ahead.
- Appropriate online and offline assessments and students more easily assessed on projects, assignments and fieldworks.
- Tools to enable the role of teachers as facilitators to improve the curricula and learning outcomes focused also on skills including problem-solving, critical thinking, creativity, people management, teamwork and collaboration, emotional intelligence, judgement and decision-making, service orientation, negotiation and cognitive flexibility.
- Higher education institutions should have modern and updated technical staff to support teachers and focus on their training to build digital skills.
- Technology built classrooms to be initiated across universities, colleges, and higher education institutions to deliver successful graduates for the digital educational systems. This could enable a technology-rich curriculum, transforming the learning approach, to better the student experience.
- Academic teachers should be really opened to using innovative tools to improve students' cognitive learning abilities. They should adapt to personalized adaptive learning techniques for a smarter learning approach to make the whole process fun and interesting.
- Lead initiatives and projects in educational innovation by designing and developing new practises, methodologies and applied technologies
- Design methodologies and evaluation mechanisms that allow learning contents designers and educators to use technologies and emerging pedagogy procedures to provide the right innovative solutions, especially for engineering programs.
- Need to build reference frameworks to guide designers during the learning contents design and implementation processes.

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In Italy for the period before the pandemic, only 51% of people aged 16-74 appeared to have at least basic digital skills, however, this percentage increased to 51% in 2020, which is still lower than the EU average of 58%.

Accordingly, in order to support the social and economic development achieved through the digital transformation of the country, the Strategy's objectives are:

- combatting the cultural digital divide affecting the Italian population through supporting real digital inclusion;
- supporting the development of e-skills throughout the higher education and training cycle;
- promoting the development of key competences for the future and increase the percentage of ICT specialists, especially in emerging technologies;
- ensuring that the entire working population has basic digital skills for the new needs and ways of working.

In the use of digital tools during lessons, there is a substantial convergence of the Italian performance with the EU average. About the use of personal devices, however, we would like to point out the lower number in the use of smartphones for educational purposes as compared to the European average.

The security rate in the use of digital technologies is also in line with the European average. According to the findings of the Ministry of Education's “Permanent Observatory for Digital Schools”; 78.34% of schools carry out educational projects for the development of digital skills, while 86.44% of schools carry out projects on digital citizenship.

However, as the Eurydice network's report Digital Education at School in Europe (September 2019) shows, the lack of a structured system of evaluation and certification of digital skills remains a critical issue, yet, common to other large European countries.

As far as teacher training is concerned, the number of Italian teachers trained in the use of digital technologies and their applications is higher than the European average. There is,

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however, a widespread need for ICT training: the Italian teachers who feel confident in using digital tools are slightly below the European average.

This data is confirmed by the "OECD TALIS 2018 Survey", from which it emerges that ICT training is one of the topics of professional development for which teachers express the strongest need (17% in Italy vs. 18% OECD average).

Also, the OECD survey Measuring Innovation in Education 2019 shows that in Italy, there is a moderate level of innovation in learning practices, slightly below the OECD average. The Italian growth rate is higher than the OECD average for the indexes relating to educational resources and IT tools, the use of ICT in teaching, and the use of active learning practices in scientific disciplines. It is important to increase the training processes for teachers, which remain more tied to traditional methodologies especially in universities.

The lack of digital skills, both basic and advanced, results in a reduced availability and use of online services. Consequently, it is necessary to increase the resources of the school and the university system so as to make digital skills an essential element for the digital transformation of the public and private sector. In 2018/2019, there were 320 courses of study (CdS) in the ICT sector out of a total of 10,260. There are almost no training courses integrating ICT and specific areas of knowledge; there is a very low demand for Vocational Training degrees. Although the number of enrolments shows a positive trend in constant growth, the gap between graduates and the job market demand is very high. According to the estimates of the "Digital Skills Observatory" 2019; in the ICT sector there is a shortage of about 15,000 graduates. It should also be emphasized the need to encourage and support women to undertake training in the technical and ICT sectors so as to ensure inclusive and diverse development of our society.

With regard to the IT environment outside the specialist CdS, IT culture is absent from the teachings in 60% of the business CdS and 70% of the humanistic CdS. Regardless of the academic/disciplinary area of these courses, when evaluating the contents, IT area covers 7% of the courses in mathematics, physics, statistics, 3.4% of those in business, 10% of those in digital communications, and 2% of all other scientific, humanistic, and legal courses.

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At the moment the course' offer emerging from the website analysis of Italian various universities showed that although many programs were targeted to foreign students no mention officially were made by blended or full online.

Only 4 private Universities declare to adopt digital education and primarily in Italian language.

Gaps identified in the literature

There are still several immediate challenges to be met in Italy. Regulations concerning study times, social distancing on campus, new setups of classrooms and labs due to Covid-19 capacity standards, examinations and grants need to be adapted in a short time, considering the need for students to study safely. Teachers in many places still need to fine-tune their skills to take advantage of the new learning environments.

It is clear that the future of higher education needs rethinking in many ways. International and multilateral cooperation within the higher education sector and with policymakers, communities and other stakeholders will need to be increased and strengthened.

Latvia

To complete the literature review on topics considered later in Parts b., c. and d. and get the broader picture, the scope of the research was extended to all Baltic countries (Latvia, Lithuania, and Estonia) and Nordic countries (Sweden, Norway, Finland, Denmark, Iceland). An online search of information sources was performed in Google and the following databases: SpringerLink, ScienceDirect, ACM Digital Library and WILEY Online Library. The used keywords consisted of combinations of the following four groups of terms:

- geographical location: Baltic countries, Lithuania, Latvia, Estonia, Scandinavian countries, Norway, Sweden, Denmark, Nordic countries, Finland, Iceland
- education level: higher education
- scope: Digital education/learning/teaching/ programs/courses; E-learning/teaching/education/programs/courses; Online education/teaching/learning/ programs/courses

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- context:
    - For Part a.: teacher/academic staff competencies/skills
    - For Part b: Innovative/multimedia/future/advanced/smart technologies
    - For guidelines: Methodology/framework/design/development/implementation/ quality criteria

The publishing period of information sources was defined between 2017 and 2021. The type of sources was not restricted (i.e., research papers, reports, websites, news in online mass media, and others).

Summary of sources relevant to the higher education institutions in Latvia

The analysis of the current situation in Latvia shows that 42% of the Latvian population possessed low digital skills in 2019 (Fuller, 2020). Latvia's level of digital skills is one of the lowest in the EU - only 48% of people have basic digital skills (OECD, 2019; Fuller, 2020). Latvia does not have a comprehensive vision for preparing teachers for work in a digital learning environment (Spridzans & Dzerviniks, 2019; 2021). In Latvia, too generalised criteria are used to assess the digital competence of teachers under the existing legislation (Spridzans & Dzerviniks, 2019; 2021). Although digital learning goals are present in various policy plans, there is no strategy or framework for evaluating digital skills, and the educational monitoring system is also irregular (Fuller, 2020). The availability of technological solutions and the professional qualification of teachers is also essential for the successful implementation of distance learning (Kudeikina et al., 2021). One of the main shortcomings is the lack of teachers' digital skills and the inability to combine traditional teaching methods with distance studies (Centre for European Policy Studies, 2019). The need for in-service training courses exists to improve the skills and competencies of educators on the possibilities of using open-access materials, personal smart devices for learning and the preparation of the learning content appropriate for smart devices (Spridzans & Dzerviniks, 2019; 2021), as well as research shows that there is a need for the long-term monitoring of carried out development activities of digital skills (Prudņikova,

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2021). Data from the Teaching and Learning International Survey (TALIS) shows that ~77% of teachers had the "*use of ICT for learning*" included in recent professional development activities; however, only 48% felt "*well or very well prepared*" for the use of ICT in teaching, and 23% reported a high level of need for further professional development (OECD, 2020a). For teachers to be aware of their level of digital skills and competence, to motivate them to use interactive digital learning tools, develop e-courses and increase their digital competence on a more regular basis, it would be helpful to use, for example, the Digital Competence Framework for Educators.[1] (Spridzans & Dzerviniks, 2019; 2021).

Summary of sources relevant to the higher education institutions in Baltic and Nordic countries

According to OECD (2019), Nordic countries rank at the top for ICT access and use (see Figure 1a). The situation in Baltic countries differs. Estonia, like Nordic countries, has a significant level of internet usage. In contrast, Latvia and Lithuania rank below the OECD average regarding Internet access (OECD, 2019). In terms of digitalisation, the Digital Economy and Society Index (DESI) (see Figure 1b) report ranks Denmark, Finland and Sweden at the top, closely followed by Estonia (European Commission, 2021; Nordic Council, 2021). Lithuania is a bit higher than the average EU level; Latvia is even below the average. Norway and Iceland are not included in the report since they are not EU member states. These results can also explain why the Nordic Region was better prepared for the Covid-19 pandemic since countries in this region had developed a strategy for digital education before the pandemic (Nordic Council, 2021). Currently, Estonia ranks #1 and Finland #3 in terms of education digitalisation across European countries based on the study carried out by the Centre for European Policy Studies (Information Technology Foundation for Education, 2019; Otsmaa, 2020). The history and shared identity of Estonia with the Nordic countries, especially Finland, are very strong, and Estonia received significant support from Finland after independence in the form of expertise and economic investments that helped to develop its digitalisation strategy (OECD, 2020b).

[1] Digital Competence Framework for Educators (DigCompEdu) - https://ec.europa.eu/jrc/en/digcompedu

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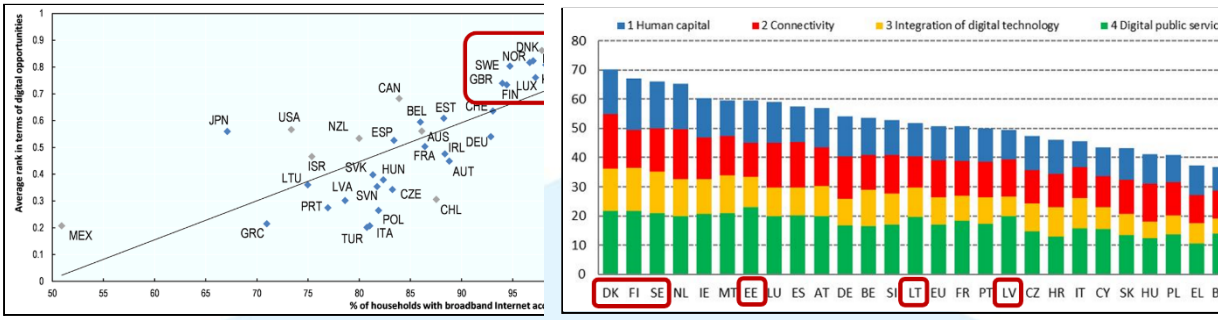
In **Lithuania**, the situation with education digitalisation is similar to Latvia. According to the results of various studies conducted in Lithuania, almost a third of educators (especially the elderly ones) had no experience with distance/remote studies before the pandemic (Bilbokaite-Skiauteriene & Bilbokaite, 2021; Miseviciene et al., 2021).



a) b)

Figure 1a) Internet usage and access to it (OECD, 2019); b) Digital Economy and Society index across the EU member states in 2021 (European Commission, 2021)

Educators lacked support from management, adequate material base, training and time to prepare for activities, as well as they had low self-confidence and motivation to participate in the distance learning actively and, for many of them, this new experience created uncertainty and tension (Bilbokaite-Skiauteriene & Bilbokaite, 2021). Several important issues were also identified, e.g., a need for increased funding to universities in creating and/or upgrading virtual environments, a need for open resources and a lack of modern teaching methods for distance studies (Centre for European Policy Studies, 2019; Spurga&Žaleniene, 2021). Improvements should also be made to the existing legislation to support the use of technologies in study models of higher education (Spurga & Žaleniene, 2021).

Estonia has become a model for digital education, and it has several solutions to fully support distance learning (Education Estonia, 2020). Therefore, switching to distance learning was never a problem in Estonia (Weale, 2020; Diplomatisches Magazin, 2021). In 1997, a Tiger Leap project was launched to provide computers and internet access for schools and vital digital training for teachers (Weale, 2020). In 2014, Estonia initiated a

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lifelong learning strategy (2014–2020) in which digital competence of citizens and a need to update digital skills continually were a priority (this also applied to teachers and students to a large extent (Mukan et al., 2019; Education Estonia, 2020; European Commission, 2020). In Estonia, each school has an IT engineer responsible for encouraging teachers to use digital technologies, disseminating good practices, organising teachers training, monitoring and analysing the results of the ICT use in the learning process (Mukan et al., 2019; Weale, 2020). In education, numerous smart solutions are widely used: digital databases and textbooks, e-learning materials, digital diaries, digital assessments and various applications (Education Estonia, 2020). Since 2013, the evaluation model for teachers' digital competence has been integrated into the professional standards of teachers (Mukan et al., 2019). Teachers are encouraged to receive certificates of international certification programs, e.g., European Computer Driving Licence or European Pedagogical ICT License (Mukan et al., 2019). Another trend in Estonia is massive open online courses (MOOCs). The number of e-courses in higher education institutions in Estonia is growing fast (Varendi et al., 2018). To support the education systems of other countries during the pandemic, Estonia shared all its digital education tools for free (https://education-nation.99math.com/) (Education Estonia, 2020). Besides, companies supported schools and universities during the pandemic by organising free webinars for educators to achieve the best possible results (Otsmaa, 2020).

There is no policy for teachers' education in terms of digital competence in Finland, and universities have a high degree of autonomy in designing their curriculum (Lisborg et al., 2021). In 2016, career tracking was introduced in universities to improve study quality, and, in 2018, amendments were proposed to the higher education law to enable the provision of modules as continuous professional development (Jansons & Rivza, 2019). However, overall regulatory frameworks mainly focus on education digitalisation in primary and secondary schools; therefore, digital learning formats (e.g., MOOCs) are not widely accepted in universities. This explains a relatively lower score for institutions in digital learning (Centre for European Policy Studies, 2019). Several projects have been undertaken to promote digitalisation in learning environments, mobile learning and the use of digital materials (Anthony et al., 2019). However, despite the development of digital materials and online

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training, there is not enough evidence of how widely such training is accepted by universities (Centre for European Policy Studies, 2019).

In **Denmark**, the use of ICT in higher education was already at the centre of the political agenda in 2007 (Tømte et al., 2019). Digital technologies were first included in the teachers' education curriculum in 1991 (Lisborg et al., 2021). From 2020, the description of digital competence in the teachers' education curriculum consists of practical skills, productive, creative, and critical competencies (Lisborg et al., 2021). The technical, social, and critical understanding of technologies is mandatory in pedagogy studies (Lisborg et al., 2021). General demand for teachers also exists to develop further digital learning skills (Lisborg et al., 2021).

Norway has worked towards the digitalisation of higher education for several years; however, universities have experienced less governmental influence in terms of digitalisation processes than, e.g., Denmark (Tømte et al., 2019; Blikstad-Balas et al., 2022). In Norway, digital competency has been considered a basic educational competence since 2006 and is integrated into all subjects and levels of teachers' education (Ottestad et al., 2014; Lisborg et al., 2021; Blikstad-Balas et al., 2022). Future educators acquire digital competencies related to using specific digital technologies, didactical digital experiences and thematic digital competencies addressing source awareness, data privacy, copyright, learning through gaming, and others. (Almås et al., 2021). Even though distance learning has a prominent role in national policy initiatives (Laterza et al., 2020; Tømte et al., 2020), Norwegian teachers were also not prepared to switch to remote studies, despite good technological infrastructure and the importance of digital competence in subjects (Almås et al., 2021; Blikstad-Balas et al., 2022). However, they were moderately prepared to use various digital tools and willing to make online learning work for themselves and their students (Blikstad-Balas et al., 2022).

Sweden is at the forefront of technological developments also in the context of higher education (Barman et al., 2019; Centre for European Policy Studies, 2019). Sweden also has a long tradition of distance learning (Barman et al., 2019) to reach students that live in remote areas and people at different stages of their lives and careers (Tømte et al., 2020).

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Also, the growth of MOOCs was observed during the pandemic (Laterza et al., 2020). However, there is not an overall strategy for the digitalisation of higher education (Tømte et al., 2020). Digital skills are integrated into the curriculum as a nationwide learning outcome for primary and secondary schools to strengthen digital competence, information literacy, and critical thinking ability (European Commission, 2020). Higher Education Ordinance that regulates teachers' education only describes the national purpose and structure but not the content of the curriculum; therefore, the need for teachers to acquire digital competence is less explicit (Lisborg et al., 2021).

In **Iceland**, universities are working on implementing the digitalisation of higher education (The ad hoc group on digitalisation in recognition, 2020). Iceland is higher than the OECD average when it comes to the digital devices available to schools, but teachers' technical and pedagogical skills to integrate technologies are pretty low (OECD, 2020c; 2021). In Iceland, 46% of teachers had "*use of ICT for teaching*" included in their formal education or training; however, only 26% were "*well-prepared for the use of ICT for teaching*" (OECD, 2020d; 2021). The additional funding to universities is given to address shortages in teacher qualifications (OECD, 2021). A new 10-year policy, "Innovative Iceland", launched in 2019, aims to prepare the country for technological changes and related economic and societal challenges. The government Action Plan for the Fourth Industrial Revolution includes adult learning among its main pillars (Government of Iceland, 2019). The plan entails three broad objectives: a simplified system of continuing education, improving the information on learning, and strengthening the links between adult learning and the education system through developing skills assessments schemes (OECD, 2021).

The gaps identified or major conclusions

Analysis of the existing situation in Latvia, Baltic (Estonia, Lithuania) and Nordic regions (Finland, Denmark, Norway, Sweden and Iceland) in terms of digitalisation of higher education allows concluding that digitalisation level and enhancement of digital skills and competencies of teachers differ a lot. All countries could be divided into two groups:

1. countries with less developed digitalisation and low-level digital skills (Latvia and Lithuania);

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2. countries with a high degree of digitalisation at all levels of education (Estonia and Nordic countries).

The research results allow concluding that the provision of sufficient digital skills for academic staff is an essential factor in the digital age. In Latvia, remote studies can be considered as an innovation, and technological solutions in education will continue to grow, and, thus, it is essential also to develop a proper legislative framework (Kudeikina et al., 2021). Currently, development activities of digital skills are not monitored in the long term (Prudņikova, 2021), and it is not clear whether the courses offered to teachers have changed the learning process. In Latvia, existing regulations include too vague and generalised criteria to assess the digital competence of teachers (Spridzans & Dzerviniks, 2019; Fuller, 2020). Overall, a positive trend can be observed for the growth of digital skills among academic staff since the beginning of the Covid-19 pandemic. Competences in using learning management platforms, providing distance learning and conducting online lectures have increased (Spridzans & Dzerviniks, 2021). Although, educators still feel uncomfortable during online lessons due to psychological concerns, low self-confidence about their IT competence in using online tools, and others. (Spridzans & Dzerviniks, 2021). Considering the rapid development of technologies, activities for developing digital competence should occur more regularly, criteria for assessment of competence should be unified, and educators should be encouraged to take part in online digital competence development courses (Spridzans & Dzerviniks, 2019). During the development of teacher digital competence, particular attention should be paid to pedagogy and technology interaction and integration aspects to prepare highly interactive and meaningful learning content (Spridzans & Dzerviniks, 2021).

References

Almås A.G., Bueie A.A., Aagaar, T. (2021). From digital competence to Professional Digital Competence: Student teachers' experiences of and reflections on how teacher education prepares them for working life. Nordic Journal of Comparative and International Education, Vol. 5 No.4, pp.70–85.

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Anthony S., Guðmundsdóttir, A.G., Kuokkanen, M., Sandell, S., Skoglöf, M., Størset, H., Valgeirsdóttir, H. (2019). Basic digital skills for adults in the Nordic countries. Available at http://norden.diva-portal.org/smash/get/diva2:1426282/FULLTEXT01.pdf

Barman L., McGrath C., Stöhr C. (2019). Higher Education; For Free, For Everyone, For Real? Massive Open Online Courses (MOOCs) and the Responsible University: History and Enacting Rationalities for MOOC Initiatives at Three Swedish Universities. The Responsible University, pp. 117-143.

Bilbokaite-Skiauteriene I., Bilbokaite R. (2021). The challenges of distance learning during the COVID-19 pandemic: the context of Lithuanian pre-school teachers' opinions. Society. Integration. Education, Volume V, pp. 41-52.

Blikstad-Balas M., Roe A., Dalland C.P., Klette K. (2022). Homeschooling in Norway During the Pandemic-Digital Learning with Unequal Access to Qualified Help at Home and Unequal Learning Opportunities Provided by the School. Primary and Secondary Education During Covid-19, pp.177-201.

Central Statistical Bureau. (2020). Desmit gados interneta pieejamība mājsaimniecībās pieaugusi par 30 %. (in Latvian). Available at https://stat.gov.lv/lv/statistikas-temas/informacijas-tehn/interneta-lietosana/preses-relizes/2182-iedzivotaju-interneta

Centre for European Policy Studies (2019). Index of Readiness for Digital Lifelong Learning: Changing How Europeans Upgrade Their Skills. Available at https://www.ceps.eu/wp-content/uploads/2019/11/Index-of-Readiness-for-Digital-Lifelong-Learning.pdf

DiplomatischesMagazin (2021). Digital tutoring made in Estonia. Available at https://www.diplomatisches-magazin.de/en/article/digitale-nachhilfe-made-in-estland/

Education Estonia (2020). How did Estonia become a new role model in digital education? Available at https://www.educationestonia.org/how-did-estonia-become-a-new-role-model-in-digital-education/

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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

European Commission (2020). Innovation & Digitalization. A report of the ET 2020 Working Group on Vocational Education and Training (VET). Luxembourg: Publications Office of the European Union.

European Commission (2021). Questions and Answers: Digital Economy and Society Index (DESI) 2021. Available at https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_5483

FITech (n.d.). For teachers. Available at https://fitech.io/en/about-fitech/for-teachers/

Fuller A. (2020). Increasing Digital Skills Levels: an Education or a Training matter? A Comparative Policy Analysis of Estonia and Latvia. Available at https://www.researchgate.net/publication/343254944_Increasing_Digital_Skills_Levels_an_Education_or_a_

Training_matter_A_Comparative_Policy_Analysis_of_Estonia_and_Latvia

Government of Iceland (2019). Iceland and the fourth industrial revolution. Available at https://www.government.is/library/01-Ministries/Prime-Ministrers-Office/Fjorda-idnbyltingin-skyrsla-enska_HQ.pdf

Huhtanen A. (2020). How to get started with online teaching? Six steps from zero to online. Available at https://fitech.io/en/how-to-get-started-with-online-teaching-six-steps-from-zero-to-online/

Information Technology Foundation for Education (2019). Estonia no. 1 in Europe for digital learning in first-ever ranking on EU digital skills. Available at https://www.hitsa.ee/about-us/news/estonia-no-1-for-digital-learning

Jansons E., Rivza B. (2019). Awaiting Industry 4.0: Transformation of Tertiary Education in the Baltic Countries and Finland. Research For Rural Development, Vol. 2, pp. 146-152.

Joshi M.S. (2021). Holistic design of online degree programmes in higher education – a case study from Finland. International Journal of Educational Management. https://doi.org/10.1108/IJEM-12-2020-0588

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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

Kazaine I. (2017). Evaluating the Quality of E-learning Material. Proceedings of the 11th International Scientific and Practical Conference "Environment. Technology. Resources", Rezekne, Latvia, Vol. II, pp.74-77

Kudeikina I., Zīvarts J., Mihailovs I.J. (2021). The Challenges of Higher Education in the Context of Remote Studies: Legal Regulation and Practice. Society. Integration. Education, Volume 1, pp.374-383.

Laterza V., Tømte C, Pinheiro R. (2020). Digital transformations with "Nordic characteristics"? Latest trends in the digitalisation of teaching and learning in Nordic higher education. Nordic Journal of Digital Literacy, Vol. 15, pp.225-233.

LatvijasStudentuapvienība. (2020). Par attālinātāmstudijām Covid-19 krīzeslaikā. Aptaujasrezultātuapkopojums (in Latvian). Available at https://www.lsa.lv/wp-content/uploads/2020/04/Par-attalinatam-studijam-Covid-19-krizes-laika.pdf

Lisborg S., Händel V.D., Schrøder V., Rehder M.M. (2021). Digital competences in Nordic teacher education: an expanding agenda. Nordic Journal of Comparative and International Education, Vol. 5 No. 4, pp. 53–69.

Miseviciene R., Rimavicius V., Makackas D. (2021). Transition to Online Education: Research of Video Teaching Challenges During Covid 19 Pandemic. Society. Integration. Education, Vol. V, pp. 170-178.

Mukan N., Noskova M., Zinchuk I. (2019). Teachers' Digital Competence Development: Estonian State Policy in the Field. Comparative Professional Pedagogy, Vol. 9 No. 1, pp. 26-32.

Nordic Council (2021). The Nordic Region can and should play a leading role in Europe's digital development. Available at https://www.norden.org/en/news/nordic-region-can-and-should-play-leading-role-europes-digital-development

OECD (2019). How's Life in the Digital Age?: Opportunities and Risks of the Digital Transformation for People's Well-being, OECD Publishing, Paris.

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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

OECD (2020a), OECD Skills Strategy Implementation Guidance for Latvia: Developing Latvia's Education Development Guidelines 2021-2027, OECD Skills Studies, OECD Publishing, Paris.

OECD (2020b). Case Study: The Estonian Education Information System (EHIS). Strengthening the Governance of Skills Systems: Lessons from Six OECD Countries, OECD Publishing, Paris.

OECD (2020c). Teachers' Training and Use of Information and Communications Technology in the Face of the COVID-19 crisis. Teaching in Focus, No. 35, OECD Publishing, Paris.

OECD (2020d). School education during COVID-19: Were teachers and students ready? Iceland. Available at https://www.oecd.org/education/Iceland-coronavirus-education-country-note.pdf

OECD (2021). OECD Economic Surveys: Iceland 2021, OECD Publishing, Paris.

Otsmaa S. (2020). Estonia offers its digital education solutions for free to support other countries. Available at https://www.hm.ee/en/news/estonia-offers-its-digital-education-solutions-free-support-other-countries

OttestadG., Kelentrić M., Guðmundsdóttir G. (2014). Professional Digital Competence in Teacher Education. Nordic Journal of Digital Literacy, Vol. 9, pp.243-249.

Prudņikova I. (2021). Digital Skills for Educators and Parents in the Context of High - Quality Education. Society. Integration. Education, Vol. 1, pp.185-194.

Skvorcovs A., and Graurs I. (2018). Improving the quality of distance learning courses in Latvia. Proccedings of the 10th International Conference on Education and New Learning Technologies (EDULEARN18), July 2-4, 2018, Palma, Spain. pp. 4733-4740

Smidt H. (2020). Policy paper "Boosting the digital transition through lifelong learning": Nordic Initiatives. Available at https://nordicengineers.org/wp-content/uploads/2020/09/ane-nordiclll-policypaper-220920.pdf

Spridzans M., Dzerviniks J. (2019). Pedagogu digitālās kompetences pilnveides aktualitāte (in Latvian). Society. Integration. Education, Vol. V, pp. 513-524.

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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

Spridzans M., Dzerviniks J. (2021). Impact of Covid-19 on Border Guards Training in Latvia, Lithuania, Estonia and Finland. Society. Integration. Education, Volume V, pp. 209-220.

Spurga S., Žaleniene I. (2021) The Changing Role of Universities in Lithuanian Society. In: van't Land H., Corcoran A., Iancu DC. (eds) The Promise of Higher Education, pp. 227-232.

The ad hoc group on digitalisation in recognition (2020). Digitalisation in recognition. Available at https://norric.org/wp-content/uploads/NCM-Report-on-Digitalization-in-Recognition.pdf

Tømte C.E., Fossland T., Aamodt P.O., Degn L. (2019). Digitalisation in higher education: mapping institutional approaches for teaching and learning, Quality in Higher Education, Vol. 25 No. 1, pp. 98-114.

Tømte C.E., Laterza V., Pinheiro R.T., Avramovic A. (2020). Is there a Scandinavian model for MOOCs? Understanding the MOOC phenomenon in Denmark, Norway, and Sweden. Nordic Journal of Digital Literacy, Vol. 15 No. 4, pp. 234-245.

Varendi M., Villems A., Pilt L., Plank T., Kusmin M. (2018). Quality management of e-courses – process, supporting development of digital culture in higher education. Estonian case. Available at https://www.eua.eu/resources/publications/785:quality-management-of-e-courses-process,-supporting-development-of-digital-culture-in-higher-education-estonian-case.html

Weale (2020). Lessons from Estonia: why it excels at digital learning during Covid. Available at https://www.theguardian.com/world/2020/oct/30/lessons-from-estonia-why-excels-digital-learning-during-covid

Bulgaria

The sources that were used for the literature review were entirely online. Several specialized platforms and databases were used as well as it was conducted extensive online search by specific keywords and phrases. Additionally, specific information and statistics was collected from several national institutions` websites.

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The databases that were mainly used are Eurydice and Cedefop. Various keyword combinations were applied, some which are: “digital education” AND “Bulgaria”, “digital courses” AND “universities”, “university online courses”, “digitalization” AND “Bulgarian higher education”, “blended programs” AND “higher education”. The same keywords were used both in English and Bulgarian languages.

During the research significant information and reports regarding the digitalization processes and adaptation in primary and secondary education were also found. They were not included in the list of resources and considered. Few academic research papers and studies were found on the topic and they were primarily in Bulgarian language.

From the sources that were gathered several conclusions were made:

- Teachers and professors need to improve their digital skills – this will help them to better use the software programs and also, it will help them to conduct their classes in more effective and efficient way.
- Although most of the students at universities are computer-literate they need a guide and/or training to be able to better use the software programs and platforms used by their university
- There is a need to improve knowledge on how to adapt and modify courses` content in order to better suit the specifics of the digital education
- There is need to gain skills on how to interact and communicate in online classes in order to better engage students and teach more effectively

The region that was assigned was Eastern Europe, however only few sources in English were found. The reports found provided generic information regarding the state of education and identified the need for digitalization due to Covid-19 restrictions. Additionally, due to the sufficient literature that was found for Bulgaria, the literature review is focused on Bulgarian national level.

One of the sources used to collect information in the countries in Eastern Europe is “Education and Training Monitor 2020” Country Analysis Report published by European

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Commission. The report provides brief overview of the educational systems in all levels and their digitalization in all EU countries.

The main findings from the conducted review could be summarized as follows:

- In the country, there are some distance programs (mainly master's programs). For them usually, the training sessions are online, but the final examinations are in face-2-face or blended modality;
- There is no regulation for the recognition and validation of knowledge and skills obtained through pure online courses such as MOOC courses;
- It is necessary to develop appropriate technological infrastructure (modern technologies and contemporary online pedagogies).

Greece

For the desktop review, an online search was performed in the databases of Google scholar, scopus and elsevier using the keywords "digital education" AND "higher education" (along with alternatives such as "universities") OR "online courses" OR "online programs" AND "GREECE". Interestingly, all the papers and reports that were found were focused on digital education in primary and secondary education in Greece, while no significant material was found on digital education in universities.

However, studying the papers and reports on primary and secondary education, one important need was identified and that was the lack of digital skills. In Greece for the period before the pandemic, only 51% of people aged 16-74 appeared to have at least basic digital skills, however, this percentage increased to 51% in 2020, which is still lower than the EU average of 58% (Perifanou & Economides, 2021).

According to Eurostat in 2019, 6& of Greeks 16 to 74 reported that they have attended an online course in the last 3 months compared to the EU average of 8%

Consequently, in the case of Greece two important needs were identified:

- Increase basic digital skills for teachers and professors

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- Increase the available digital material/better advertise available online courses/make continuous education part of business career.

The lack of papers and reports on digital education in Greek universities was not accompanied by a similar lack of offered courses. After a desktop research it was revealed that many universities and higher education institutions in Greece offer online courses thus revealing that digital education has penetrated the Greek Tertiary level. The figure below illustrates the Universities and the number of courses that they offer.

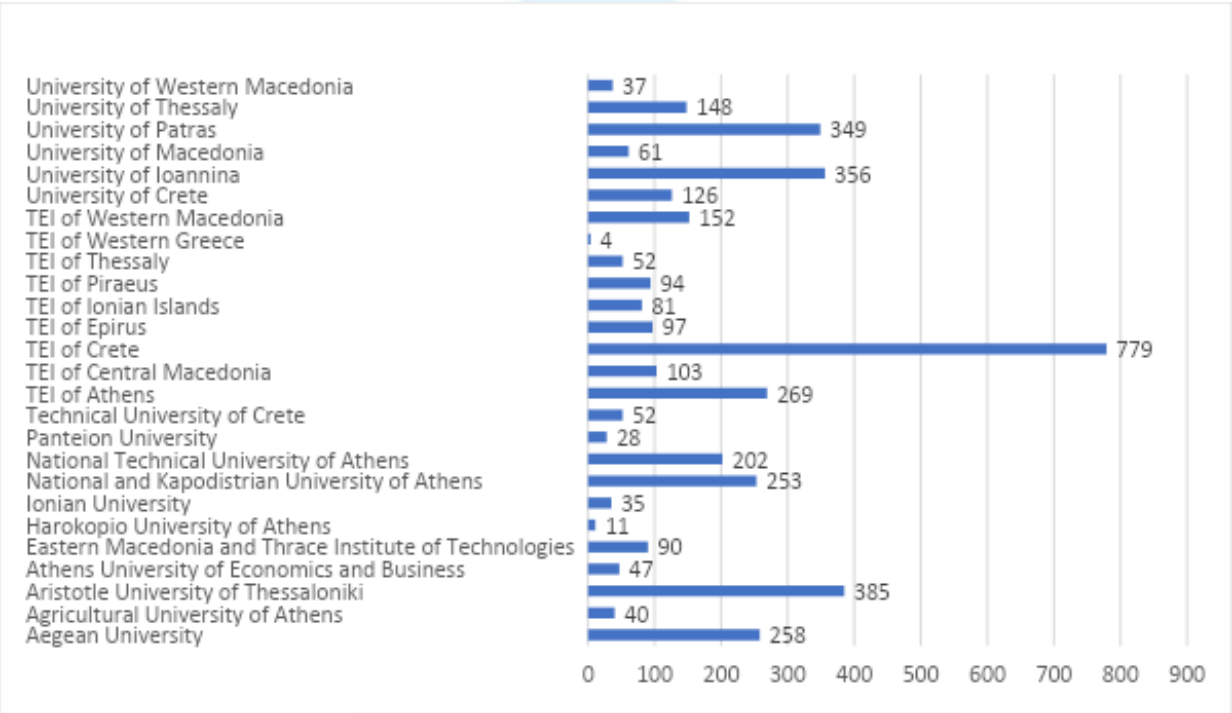

Figure 2 Number of online courses offered by Greek Universities

For a more detailed list and links to specific courses please refer to the website: https://opencourses.gr/universities.xhtml;jsessionid=52DACBF641A43A4A2E6CE95889126B20?ln=en

Of the offered courses only a subset of those offered by the National and Kapodistrian University of Athens contain synchronous lectures (https://elearningekpa.gr/). However, no courses were found that were fully synchronous.

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The courses that are offered cover a wide variety of disciplines from life sciences to mathematics and economics. Regardless of the institute or the offered course, the platforms that are used are a variation of a system called "eclass". The system offers the possibility to create a course, upload exercises and tests along with material for study (usually in the form of pdf or doc). Finally, the system allows the uploading of instructional videos.

The usual process involves the student registering to a course. Once accepted, the students watch (usually) pre-recorded lectures , they can download the material for the lecture and there are courses where the student will have to take some sort of test (multiple choice, open questions, boolean questions etc.). Depending on the university, the offered course could have a synchronous lecture that is usually about solving the students' question. Upon completion of the course, a certificate might or might not be offered. For example, the National and Kapodistrian University of Athens offers ECVET points that are recognized throughout Europe, however, the majority of the offered courses are simply followed by a completion certificate that is not recognizable by other institutes of countries.

In other countries in the Balkans, the situation is not so clear. For example for Bulgaria a search was performed for "online courses in Bulgaria". Several websites were mentioned, in which Bsc and Msc programs in the country were mentioned[2]. However, the majority of the programs were on campus. A visit to the website of the various universities showed that although many programs were targeted to foreign students no mention was made on where digital education was available.

However, one case where there was specific mention of a digital education was of the New Bulgarian University which explicitly offers education through Moodle, nonetheless the information was all written in the national language[3].

The studying of the offered online courses revealed the following insights:

- Synchronous education is not at the same level as asynchronous
- Certification is limited thus there is the need for a standardized framework

[2]For example: https://www.masterstudies.com/Masters-Degree/Bulgaria/Distance-learning/
[3]https://e-edu.nbu.bg/

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- New technologies and innovative multimedia almost non existent
- No online full programs are offered

References

Perifanou, M., & Economides, A. A. (2021, May). Digital Skills for Teachers: Policies and Initiatives in Greece. In *2021 Innovation and New Trends in Engineering, Science and Technology Education Conference (IETSEC)* (pp. 1-5). IEEE.

b. New trends, innovative technologies and multimedia contents for the future e-learning

Italy

The sources that were used for the literature review were entirely online. Several specialized platforms and databases were used as well as it was conducted extensive online search by specific keywords and phrases. Additionally, specific information and statistics was collected from several national institutions` websites.

The databases that were mainly used are JSTOR, CIMEA, Academy of Management DB, Eurydice, Thomson Reuters Web of Science, MIUR ANS, CNR research institutes databases, Italian TTS Database, National Library Directory, European Data Portal, ACM Digital Library and ISCED UNESCO. Various keyword combinations were applied, some which are: “university online courses” AND “Italy”, “digital education” AND “innovative technologies”, “digitalization” AND “Italian higher education”, “flex programs” AND “e-learning”. The same keywords were used both in English and Italian languages.

During the research significant innovative projects and reports regarding the HEIs, online education processes and their adaptation in higher education institutions were collected and analyzed. The publishing period of information sources was defined between 2016-2021. The most of them are funded projects, news, reports, academic research papers and studies covering the main topics of EDU-GATE in English or in Italian languages.

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In Italy, most Higher Universities are not prepared to adopt innovative technologies and multimedia contents. Faculty/department chairs and/or academic deans determine the degrees of varying face-to-face, online, or hybrid/blended experiences required for each academic course. As a result, most of HEIs prepare every month plans for several possible scenarios, including:

1) Face-to-face teaching/learning in the re-designed classrooms arrangements that follow the CDC guidelines, for example a) Covid-19 classroom maximum capacity for each classroom, lab, meeting room, etc., b) social distancing of at least 6 feet or about 2 meters between people – students, faculty, professional staff, etc.) wearing cloth face masks on campus and in the classrooms and labs, etc., d) change class schedule in a way that a sub-group of students to meet in person one day while others work remotely; these groups could reverse the next time their class is held, e) break up longer class periods into smaller time periods, and so on.
2) Fully online (in real time or asynchronous) teaching learning.
3) Hybrid (or, blended) teaching/learning.

HEIs continue to invest a lot of resources into the institution's hardware/software/technology infrastructure to effectively support various modes of advanced technology-based teaching/learning. The list of required technology to support education includes but is not limited to:

a) online class meetings and virtual classrooms' platform such as Adobe Connect Meetings, Bongo Virtual Classroom, Google Meets, Microsoft Teams, Zoom, WhatsApp, etc.;
b) modern Learning Management Systems (LMS) to support immersive and individualized learning such as Canvas, Moodle, Open edX, Docebo, TalentLMS, iSpringLearn, Blackboard, Adobe Connect, etc.;
c) streaming video system/services in each classroom/lab/meeting room;
d) systems for a design and development of pre-recorded video lectures and posting video clips on university/college LMS;

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e) systems for virtual labs and active use of virtual reality (VR), augmented reality (AR), mobile reality (MR), extended reality (XR);

f) cloud computing and highly secure Virtual Private Networks (VPNs) from dorms and student houses to proprietary software systems in university/college computers labs;

g) university wide systems for Data Analytics, Student Academic Progress (SAP) data analytics and intervention systems,

and many other systems and technologies.

These technologies may provide quality online/hybrid education at a lower cost than that of conventional education.

In any case an effort is being made to introduce them through European-funded programs. For example, some related EU projects based on innovative online contents and simulations in higher education are:

innCREA - Standards for implementing programs at discovering and developing creativity, pioneering in pursuit of innovation (Erasmus+ 2020-1-PL01-KA203-081849) was designed to transfer, adapt and implement a set of basic training programs and advanced (inherent both teaching materials and innovative methodologies) to transfer to university students, teachers' concepts and methods of contents development based on creativity and the ability to innovate. Furthermore, the project is also geared towards developing the necessary soft skills and, at the same time, contributing to reducing the gap between the skills required in the world of work and the skills offered by university education courses.

(https://inn-crea.eu/)

Digitalisation - Strategy Development Tool for the Digitalisation of SME (Erasmus+ 2017-1-DE01-KA202-1411139) for the development of practices for businesses in the context of innovative teaching and digital services in the organizations. Strengthen the skills of teachers, trainers, and students, bring the skills required in the educational fields and enhance the skills offered by higher education.

(https://digital-transformation-tool.eu/)

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Latvia

Overall, distance learning in Latvia appeared more than 12 years ago (approximately in 2006) and successfully existed on an experimental basis for improving the pedagogical skills of the Latvian lecturers and preparing reports for international scientific conferences (Skvorcovs & Graurs, 2018). However, no centralised register or catalogues of such programs still exists. The authors of this review were able to identify in total 14 Masters level and 19 Bachelor level distance learning HEI programs in 2021 by scanning the web pages of all Latvian HEI. Unfortunately, not much information on the curricula or the innovative multimedia used for teaching in those programs is available. The most popular means of distance learning are recorded videos, online remote lectures (by MS Teams, Zoom and related), electronic textual files, forums and tests in e-learning systems.

As was mentioned above, no advanced multimedia usage for HEI learning were found for Latvia. Therefore, some appropriate examples are shared from other neighbouring countries, especially from Estonia, which has a strong focus on digitalisation and has been assessed as the Top 1 performer in digital education in Europe by the Centre for European Policy Studies (Education Estonia, 2020b).

"Education Estonia" (https://www.educationestonia.org/) is an initiative for international education cooperation by the Government of Estonia. Their web portal provides a list of services and products in the field of education offered by Estonian education organisations and companies: digital solutions for schools and HEI, educational games, summer courses, mentoring programs, study visits and many others. Furthermore, it allows sorting by education level and solution.

To support the teachers and parents in this new situation [during the Covid-19 pandemic], Nordic countries have opened up their e-learning solutions for the world for free. At their online resource "Education Nation" (https://education-nation.99math.com/), one may find 40+ remote learning solutions from Estonia, Finland, Denmark, Iceland, Latvia, Lithuania, Norway and Sweden on gaming, virtual reality, interactive bring-your-own-device learning and others provided for now for free. Some are also available for HEI level and academic staff.

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The Education and Youth Board of Estonia (Harno, harno.ee/en) was recently awarded the Global Showcase Award for International EdTech Programme of the Year at the Bett Awards in London (Education Estonia, 2021). Harno is a governmental organisation responsible for implementing education with the main goal to support the learner and his/her individual development through educational services. Estonia embraces the possibilities of technology throughout the education system: educational institutions have modern IT infrastructures. Digital competence and IT skills are a crucial part of the educational work in schools and the training programs for teachers. Students and teachers use digital textbooks, e-diaries, e-learning materials, and other digital solutions. The web portal of Harno supports the centralised list of various resources for teachers of different education levels starting from kindergarten to the university level on increasing their digital competence level and applying digital forms of learning.

E-sisuloome (sisuloome.e-koolikott.ee) is another Estonian web portal providing different H5P templates for teachers to create learning materials, create different types of interactive exercises, tasks and learning content. Those may be freely and openly used and integrated into teaching of all education levels.

Cleanbeat (https://www.clanbeat.com/) is an Estonian app for all levels of education. It helps track emotions, reflections and other relevant feedback during distance learning. It claims to help students build positive learning habits with regular reflection nudges, work planner and goal setting features. It also provides insights and data on students' mood and well-being to the instructors.

CTF Tech Portal (https://www.ctftech.com/) is an Estonian portal providing possibilities to "learn, play and compete in the cyber world." They provide learning materials (after registration) on ethical hacking, with differentiation by expertise levels. The portal also provides various practical tasks and challenges. The tasks are related to real-life cyber incidents in one way or another. Each task helps the player to develop his/her knowledges further on different cyber security topics (e.g. steganography, forensics, and others). Finally, the portal offers regular opportunities to compete against other users.

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Global Virtual Solutions (https://globalvirtualsolutions.eu/) is a global company that originated in Estonia. It provides various hybrid solution hosting, including virtual workshops and events, webinars, meetings and others. That is another level of online meetings, covid-19 safe for the participants.

Mobi Lab (https://lab.mobi/mars/liitreaalsus-hariduses) is an Estonian company, which combines UX and UI designers, software engineers and product managers. Among all, they offer augmented reality solutions for education

References

Education Estonia (2020). How did Estonia become a new role model in digital education? Available at https://www.educationestonia.org/how-did-estonia-become-a-new-role-model-in-digital-education/

Skvorcovs A., and Graurs I. (2018). Improving the quality of distance learning courses in Latvia. Proccedings of the 10th International Conference on Education and New Learning Technologies (EDULEARN18), July 2-4, 2018, Palma, Spain. pp. 4733-4740

Bulgaria

In order to identify the state of digital education in Bulgaria several keywords combinations were used. The collection of resources was focused on gathering data and information regarding the current state of digital education in higher institutions, challenges that they face and strategies for future improvements in digital learning and teaching.

The main keywords that were used and applied in different combinations are: “Digital education“, “improving e-learning”, „e-learning in universities”, “Online teaching” AND “Bulgaria”, “higher education”.

Although the distance learning, blended learning programs and use of online platforms have been used by many universities in Bulgaria, only after Covid-19 all of them altogether were informed to entirely adjust to e-learning. This caused many difficulties that different university had to deal with in various levels. As a result, the majority of studies, academic

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articles, research reports have been focused on analyzing and fining approaches how to adjust the learning content and improving people skills in order to better suit to the e-learning environment. Hence, the new trend and technological innovation were not considered as much.

Greece

In order to investigate new trends and innovative technologies in digital education, the following platforms were searched Erasmus+, Horizon along with the scientific databases of Google scholar and scopus. The keywords that were used were: “innovative technologies” AND “digital education” AND “Greece”. After the initial screening of the works, the focus was placed on those that seemed relevant for the present document and a new search was performed. For example, one of the new trends that was observed for higher education was that of digital games as a means for teaching, hence the platforms were searched anew with the relevant keywords.

In Greece, innovative technologies and multimedia are very limited. An effort is being made however to introduce them through European-funded programs. For example, Game-based learning is gaining traction in higher education (Kirstavridou et al. 2020). Examples and best cases include:

SUSTAIN project (**Erasmus+ KA2- 2017-1-EL01-KA203-036303**) (Armenia et al., 2019): In which a board game was designed to teach higher education students the complexities of managing and attempting to achieve sustainable development in an urban environment. The board game was taught physically and at the same time it was translated digitally in tabletopia (https://tabletopia.com/games/sustain-erasmus).

Another innovative technology that could be used in higher education is simulation. In their research, Thompson et al. (2019) describe simulation programs as programs -software (software), simulating natural phenomena in safe conditions and as realistically as possible. They help learners understand, record, and analyze various phenomena related to the Natural Sciences, think critically about them, repeat the experiment and solve any problems they may encounter. Such software can be used to teach for example physics

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Examples of such software can be found in: http://www.csun.edu/science/software/simulations/physics.html

References

Armenia, S., Ciobanu, N., Kulakowska, M., Myrovali, G., Papathanasiou, J., Pompei, A., ... & Tsironis, L. (2019). An Innovative Game-Based Approach for Teaching Urban Sustainability. *Romania*

Kirstavridou, K., Kousaris, K., Zafeiriou, C., Tzafilikou, K. (2020). Types of Game-Based Learning in Education: A Brief State of the Art and the Implementation in Greece. *European Educational Researcher*, *3*(2), 87-100

Game-based learning in higher education

Thus, it appears from the previous sections, that game-based teaching is gaining traction in universities as part of the digitized education. For that reason, it was deemed important to provide some details on the phenomenon.

The use of games as an educational tool is not new; it dates back to the 1950s with the integration of operations research, computer science and war games that were used by the military (particularly in the United States of America)(Whitton, 2007), when researchers and the military identified the intrinsic connection between fun and learning that characterized games(Fabricatore & Lopez, 2012).

Hence, serious games can be defined as:

SGs are games that use pedagogy to infuse instruction into the game play experience (Bellotti, et al., 2010).

One of the first inclusions of SGs in higher education occurred in 1986 in the department of psychology of the Moscow University, where a graduate student was trying to teach about the construct of time to a psychology class for students of high school. The name of the student was Dmitry Davidoff and to make his teaching more accessible, meaningful and not boring for the high-schoolers, he invented a game that he named “Mafia”. In the context of the game, the majority of the students took the role of villagers, while a small number of

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them took the role of Mafiosi. The purpose of the game was for the villagers to find out who their evil co-citizens were, without first being killed. The game required no special equipment, it had only a handful of rules and it allowed for the introduction of variations.

The game spread like fire in the dormitories of the Moscow University. Soon enough, the game left the borders of the (then) Soviet Union and became a worldwide sensation, favored as one of the best party games and became the basis for a number of variations (the most famous of which is the Werewolf game[4]). The game demonstrated in the most emphatic way that teaching difficult subjects can be associated with fun and at the same time produce something that has repeatability in a non-classroom context. Simultaneously, the game itself drives scientific research across a variety of areas such as mathematics (Bi &Tanaka, 2016), artificial intelligence (Hirata, et al., 2016), psychology and communication (Oertel & Salvi, 2013), social dynamics (Violi, et al., 2011) and more.

Examples of such games that have been used in Higher Education in combination with digitization are provided on Table 1 below.

Table 1Example of educational games in education

Game	Purpose	Author/reference
The Social Seducement experience	To develop a serious online role play game which trains people facing disadvantages in the labour market and teaches them how to set a social enterprise (Erasmus+ Project	https://www.socialseducement.net

[4]https://www.playwerewolf.co/

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Gates- Building skills for social entrepreneurship	to develop the emergent skills and competences for the labour market and social entrepreneurship of young people empowering them for a better integration into the labour market (Erasmus+ projectID Number: 2017-2-PL01-KA205-039199)	https://play4impact.eu/
Awareness on social enterprises	A serious game was designed to raise awareness about social enterprises and the role they can play in the economy	(Damani, et al., 2015)

References

Bellotti, F., Berta, R., & DeGloria, A. (2010). Designing effective serious games: Opportunities and challenges for research. *iJET, 5*(SI3), 22-35.

Bi, X., & Tanaka, T. (2016). Human-side strategies in the werewolf game against the stealth werewolf strategu. *International Conference on Computers and Games*, (стр. 93-102).

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Damani, B., Sardeshpande, V., & Gaitonde, U. (2015). Use of serious games for creating awareness about social enterprises. *Journal of Computers in Education, 2*(4), 493-511.

Fabricatore, C., & Lopez, X. (2012). Sustainability Learning through Gaming: An Exploratory Study. *Electronic Journal of e-learning, 10*(2), 209-222.

Hirata, Y., Inaba, M., Takahashi, K., Toriumi, F., Osawa, H., Katagami, D., & Shinoda, K. (2016). Werewolf game modeling using action probabilities based on play log analysis. *International Conference on Computers and Games*, (стр. 103-114).

Oertel, C., & Salvi, G. (2013). A gaze-based method for relating group involvement to individual engagement in multimodal multiparty dialogue. *Proceedings of the 15th ACM on International conference on multimodal interaction*, (стр. 99-106).

Violi, N., Goldbeck, J., Cheng, K., & Kuter, U. (2011). Caretaker: A social game for studying trust dynamics. *Privacy, Security, Risk and Trust (PASSAT) and IEEE Third International Conference on Social Computing (SocialCOm)*, (стр. 451-456).

Whitton, N. (2007). An investigation into the potential of collaborative computer gamebased learning in higher education. Edinburgh Napier University.

c. Open access platform for academics' courses

Developing an innovative e-learning course is not only through the use of the most innovative and overwhelming technology, but the innovation that is put into the modality of the contents, the production process and the tools used is very important.

There are several points that need to be kept in mind when developing an e-learning course:

• The contents to be included: and which are therefore exhaustive and complete;

• The simplicity in being able to reach those contents by the user, by navigating the e-learning product;

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• Keep the attention of the user high, who uses those contents, calling him to interactions and solicitations but also to the eye-catching product in the layout;

• Achieve the training objectives of the contents included in the product, and therefore that they are simple and easy to use.

These important points do not always pass through the use of a particularly technological and innovative e-learning tool or product, but technology certainly helps in this direction.

It is advisable to initially operate these activities:

- Analysis of the target recipient of the product, to analyze the age group and hypothesize the most suitable type of format to use;
- Content analysis to identify the most suitable format to represent them but also together with the previous point;
- Infrastructure for the delivery of the e-learning course, to understand, both on the server and on the client side, the possibilities allowed so as to imagine all the possible and usable technology;
- Delivery of the elearning, desktop, mobile and proximity product.

The technology has evolved a lot both in terms of infrastructure and connectivity, allowing great optimizations, and therefore the possibility of developing very complicated types of products.

First of all it is important to make a distinction between live and on-demand products that refer to the same analysis flow as above. Many training actions using e-learning tools are used in mixed mode, and for the on-demand mode both in the fixed and proximity version. Fixed means delivered in a station usually desktop computer or lap top VR / AR viewer. Proximity e-learning training is intended as close as possible to the user who will use the content.

The training actions in e-learning mode are always the right mix of a series of types and technologies used, so as to better be "around" the user, at any time of his day depending on the places where he is and with the device at the moment used. Obviously, also on the

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content side, these will have to be reshaped according to the tool used, and very often they will not be a duplication but an integration.

The live mode is usually used in which the speaker prepares to answer a series of questions from users, who arrive in the classroom already prepared on the subject matter, perhaps using an on-demand product first. In this situation, the teacher will create moments of interaction with users by answering questions or creating moments of interaction to verify that the learners know on the one hand they have learned the contents in a pre-virtual classroom phase, on the other hand the answers to the questions have been exhaustive.

In live mode there are several tools that can be used, both internal to the main platforms and through the use of external tools, including:

- Survey system
- Blackboard with white sheets
- Whiteboard shared with users
- Various games and interactions

The live part should in fact be used for moments of comparison and maximum interaction and not for the mere development of the lesson and explanation of the contents. Participants should arrive already aware of the subject and with clear ideas about the contents and questions to ask.

This activity can be carried out through on-demand e-learning products, in the different ways of implementation, always depending on the content and target and therefore:

- WBT elearning;
- Elearning video teaching
- Cartoon
- Gaming
- Virtual Reality

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- Interactive simulations
- Tutorial

The e-learning platform always remains the place where all the training activities delivered in multimedia e-learning mode start and end. The place where all activities are concentrated in a path, from on-demand courses, to live virtual classrooms, to in-depth materials to discussions in forums or to learning verification tests. The sequence in which these contents are delivered within the course, and within the e-learning platform determines the training effectiveness and are the basis of the methodological design.

Here are some recommended methodologies in the development of on-demand e-learning courses

Methodology and characteristics of the online training

The courses in the e-learning method should be provided with different **teaching methodologies and different technological solutions**, depending like before we write in the first part of the document, on the specificity of the contents to be valued and targets to achieve.

Of course, the most important characteristic that is detected is adopted in production and the highest **attention to detail**, the great attention to the **aspects of communication**, both in **graphic parts** that in the use of **video**, audio and connected **effects**.

The **teaching methods** adopted are, of course, always aimed at making learning paths that are *life-centred*, i.e., close to the personal experience of end-users*, task-centred*, i.e. framed with respect to the conduct of their operational tasks and *problem-centred*, based on the resolution of the problems.

The **learning path** is progressive in that internally the user can move freely, or in any case in a sequential manner depending on the educational lines defined together to the customer, displaying and viewing even more insight environments of insights (regulations, glossaries,

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cards, etc.) and participating actively in their own learning process through specific moments and interactive assessment/self-assessment that allow you to:

- observe your learning in total, shedding light on the possible aspects that require further study.
- support the entire formative path, providing moments of reflection and also testing with respect to the topics covered in a specific segment or learning object;
- improve their own learning processes.

The technologies used allow you to submit the contents by combining the simultaneous use of multiple media depending on the characteristics of the different courses that you are going to define with the customer in the context of planning (movies, written text, charts, and images that summarise the topics, animations made in flash, audio contributions, etc.) always in full compliance with the requirements required by industry standards (W3C, AdlScorm, ISO/IEC 9241 and ISO/IEC 13407, etc.) and by existing legislation (Law no. 4 dated 9 January 2004) and those required in the notice, including full integration in Moodle platform, fruition from work stations equipped with Windows XP, Vista, Windows 7, Linux, Mac OSX and fruition from tablet iOS and Android in addition to Scorm 2004.

Usability

The course develop should be adopts methods for the design and development of interactive training products by integrating the user-centred approach in the entire production cycle and calibrating the processes of learning about real needs and characteristics of learners. The first key element in the design is undoubtedly the usability understood as the effectiveness, the efficiency and the satisfaction with which specified users achieve specified goals in particular environments. The concept of usability[5] is born within traditional ergonomics, particularly in the framework of studies to improve the

[5] Definition contained in the standard ISO 9241-11:1998

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usability of software products by analysing the way in which users build a mental model of the product that they are using, creating certain expectations on its functioning; task of usability studies and try to match as much as possible the mental model of who designs the software (design model), with the mental model of its operation that the end-user builds (user model) in such a way as to make the interaction easy and rewarding.

Interactiveness

The simple fact that students have at their disposal the means of communication to interact amongst themselves is not sufficient to ensure that these interactions take place and that, above all, the communication exchanges activated from learners produce useful results from the point of view of learning and are appreciated by the students.

There are, in fact, a multiplicity of factors that can affect the quantity and quality of the interactions in an online course, which should be taken into consideration in the design and distribution of courses to create a learning environment in which students can establish a constructive dialog with the teachers and be of support to each other. Among the factors that most influence the interactions there are:

- the level of structuring of courses;
- the magnitude of the classes;
- the feedback;
- the familiarity that learners have with technologies;

Promoting interactions therefore means taking into consideration all of these elements, not limited to put at the disposal of the students the tools to communicate, but encouraging them to use them and involving them in activities that facilitate socialisation.

The solution should or suggest it consists in the realisation of an e-learning product based fundamentally on the methodological approach of the extended e-learning. The educational model puts the focus on interactivity and the strong involvement of the learner, diversifying

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the times for the enjoyment and use of the learning tools. The fundamental element is represented by the modular organisation of the content into self-consistent educational units (Learning Object) that can be used in contexts and different paths, ensuring the ability to vary the path structure in time by adding or reconfiguring towards further Learning Objects. An important aspect is represented by the different nature of the Learning Object developed, that vary both in terms of multimedia and interactivity.

The structure of the learning path

The contents of the learning path should be structured in Modules and teaching units.

The logical structure of each instructional unit will include three complementary moments that will become even three graphical environments of fruition at the interface level:

Introduction and development of educational objectives (Animations). This section reveals the objectives of the instructional unit in the form of questions so as to capture the attention of the learner and to motivate in an attempt to find the answer to the questions posed initially. Then it performs the fruition of the sequential narrative/interactive animations, commented by an external sound. During the exposure are inserted interactive moments that require a strong educational involvement of the learner acquainting himself with the proposed contents. At the end of the exhibition the summary is conducted of the concepts covered in such a way as to display the path taken.The issues exposed in the screens are accompanied by links to materials for in-depth study. The terms of greater importance or complexity are connected to the glossary.

Documents. In this section are made available to the learner the downloadable documents relating to the content proposed in the previous section in addition to access to the complete glossary, bibliography, and links to reference, so as to enrich and deepen in the themes covered with the times and the procedures that are more suited to the learning style of the learner. In addition, they can recall the multimedia slide for a further review.

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Self-Assessment (Test). In this stage the acquisition of content delivered via a test composed of multiple choice questions or GAME. The aim is not to evaluate quantitatively the acquired knowledge but to stimulate personal reflection of the learner on the concepts treated also indicating any deficiencies through the reintroduction of the content in which these weaknesses have emerged during the test.

In the articulations of the modules there may be inserted exercises and case studies of study proposed by the teachers or by the learners themselves in the context of the creation of a robust work community. Of course, there is the possibility to verify with the customer in the context of the project performance. The teaching units will be consumed by the user in full autonomy without identifying any prerequisites.

The design of the interface and information

The intended use of the interface will show in the upper part the elements that contextualise the navigation, and in particular the menu relative to the environments of interest described in the previous paragraph (Animations, Documents, Self-Assessment) so that the user can rapidly guess his position in the entire learning trail. In the menu there will be active only the chosen environment and will display the name of the module and the instructional unit running with the identification of the total number of subjects that make up the instructional unit. The number of active topic should be identified by a different colour. In the upper part there is also a search engine that allows you to quickly locate desired content using, from a semantic point of view, metadata inserted to describe learning resources according to theIEEE LTSC LOM (learning object metadata) of the Scorm Package. The search results are shown in a box that provides a direct connection to the requested content. In this portion of the interface there is also entered the Close button to finish the conclusion of the course.

In the lower part of the interface should be grouped the elements that allow access to the functionality provided for the course:

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- The function keys:
  - **Help**
  - **Insights (that includes access to the bibliography, links, FAQ)**
  - **Glossary**
  - **Bookmark**
  - **Map**

- The navigation buttons:
  - **Back**
  - **Forward**
  - **Review**
  - **Pause/Play**
  - **Scroll Bar (which allows you to graphically view the duration of the screen and slide animations quickly by dragging the "forwarding head"**
  - **Button through which the audio volume is adjusted;**

Each product designed provides for the definition of some of the support tools divided into two categories:
- *-unique support tools*;
- *-generic support tools*.

The u**nique support tools** consist of materials of in depth materials[6] in relation to the treated theme, designed to be intended for consultation and the press.

The **generic support tools**[7] instead, include all the features and materials closely connected to a specific intervention and include:
- *print function (*all the content of the product, including the screens)
  - *Glossary* (which collects and describes all the words mostly used inside the product)
- *help* (which shows the individual functions present on the screen)

An example about organisational structure usually used

The professional persons involved in the various phases of one example project are:

Profession	Role
Instructional designers	Involved in the whole manufacturing process by alternating operational functions inherent in the design to their own managed ones of the coordination of development team, as well as customer care.

[6] In the drafting of the contents it will be possible to establish, definitively, the support tools specific to insert in the product.
[7] In the drafting of the contents it will be also possible to define the presence of additional tools for general support, to be agreed with the clientele.

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	Defines the system of the product and its overall style. Supervises the activities dealing personally with the nodal passages in the development of the project.
Art director	Is the person who manages all aspects relating to the *look'n'feel* of the product, designing the more functional graphic and communicative styles with respect to the project needs
Graphic designer	Fixed the main parameters with the Art director, this person deals with the creation of graphic proposals relating to the collection of all the objects, symbols and elements which characterise the product and its form.
Software developer	His task is related to the management of all the technical-functional aspects of the product. He is responsible for the creation of the structure that houses the course and that determines the correct operation. Takes care of navigation functions, interaction and tracking, etc.
Sound design & video engineer	Takes care of the conception, design and production of audio traces depending on the products on which they will be heard (abbreviations audio, sound loop, sound effects etc.).

An example about the steps of the production process

In general terms the following activities are present:

General study of the product - Design, general Layout, aspects of communication, graphic aspects and analysis of technologies to implement;

Study and elaboration of storyboards provided by customer in agreement with the same;

Graphic Production of the entire product, interfaces to use the contents and elements to be matched to the individual portions of the text object of the parts, content, and animations;

Audio and video recording with professional speakers;

Technological packaging of content, Coding and implementation. Implementation of animations;

Debugging, modification, publication, and testing.

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3. Surveys/ Questionnaires and analysis of the results

Edu-Gate responses of students

A semi-structured questionnaire has been administered to University students in four countries; Bulgaria, Latvia, Greece and Italy. 249 filled questionnaires were collected out of which 246 were complete and usable, since all closed-ended questions were filled. Respondents' cross-country breakdown is laid out in Fig. 1.

26 out 28 were 5-Likert scaled questions in the first part on digital learning needs.

10 out 16 were 5-Likert scaled questions in the second part on IT technologies and media innovations.

8 open-ended questions were included to let respondents elaborate on their perception with regard to the digital maturity of their organizations both internally and externally in relation with other stakeholders.

The results have been statistically processed with SPSS version 25. Comparison of data across countries is discussed in the following section.

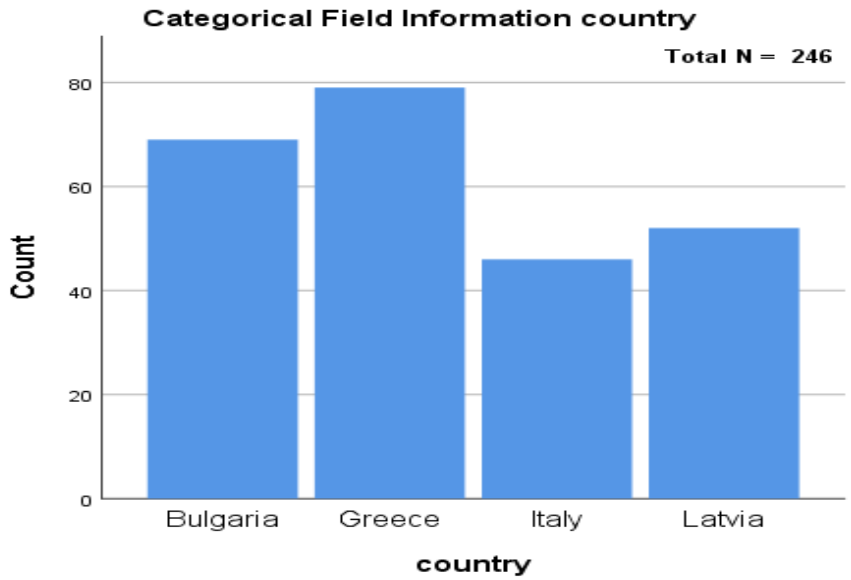

Figure 3 Respondents break-down across countries

Students in all four countries share the same perceptions regarding their support with tutorials (high), their industry 4.0 awareness level (medium to low), their training needs (medium to high), their awareness of open-source applications (medium to high), cloud

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storage and cloud computing. What is also worth noticing is that all students are aware of the online threats and the cyber security measures. However, students do not seem to know the legislation that is relevant to digital content reproduction. Results are further discussed in the next paragraphs.

Except for Greece, students think that Industry 4.0 and Quality 4.0 topics fit rather well to their studies' curricula. The majority of students think that IT equipment is adequate in their Universities. They believe that digital education enhances their interactions allowing the effective sharing of course materials. Hybrid teaching is highly evaluated.

Regarding digital literacy, statistically significant differences have been found, primarily, among Bulgaria and Greece. Bulgarian students reported higher knowledge levels of terms like "digital natives", "digital nomads", and "digital literacy" and higher levels of digital education development. Moreover, Greek students reported inadequate cyber security measures compared to Bulgarian students. Furthermore, Greek students reported lower affinity of industry 4.0 to their department's curriculum compared to Bulgarian students.

Latvia and Bulgaria showed different level of digital transformation awareness, particularly with regard to Quality 4.0 and Education 4.0, whereas Greece and Bulgaria showed different levels of Education 4.0 awareness. Students of Latvia Universities reported lower levels of Education 4.0 applications compared to both Bulgaria and Italy University students.

Digital platforms that are currently used for e-learning are rated higher by the majority of Bulgarian students compared to Greek students. Italian students emphasized higher connectivity with other Universities compared to the other three groups of respondents from Bulgaria, Greece and Latvia.

Interestingly, students of all four countries reported similar satisfaction levels regarding the software applications used for online learning and the technical support from the technical staff and the IT companies that support their digital - online and blended - learning activities.

Zoom and Microsoft Teams were reported as the two predominant communication platforms.

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The participants were asked to elaborate on certain questions. Their responses follow.

1. To the question:

Qual.Q.1. Could you please mention the Industry 4.0 and/or Quality 4.0 applications at your University, if any?

The respondents reported the following:

- I don’t know/I have no idea/I do not know what that is (22)
- Not sure, we do have courses in, e.g., Big Data analysis
- No (7)
- I don't even know what Quality 4.0 is
- Yes (3)
- If I am familiar with the applications then I can mention them.(2)
- computer network, cloud storage, communication channels
- 2021noveber
- Data science
- Google cloud computing and gmailetc seminars
- IoT
- google cloud platform, microsoft office etc
- remote learning
- Automation of information systems and administrations
- The fact that the libretto of the university is digitized will come as a badge to accept the structure
- Big Data, The Cloud

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2. To the question:

Qual.Q.2. Could you please mention the Education 4.0 and University 4.0 applications at your University, if any?

The respondents reported the following:

- moodle
- november 2021
- seminars for further education
- I have no idea what 4.0 even means.
- I don't even know what Quality 4.0 is
- If i find out about the app then i can mention it
- online classes and online assessments
- e-class
- Moodle, Zoom, Skype, Microsoft applications
- Moodle
- Accelerator programs, incubators
- Online lessons, Luiss Application
- Yes, I would (2)
- If I am familiar with the applications then I can mention them.(2)
- No/none (6)
- don’t know/not aware (17)
- Big Data, The Cloud
- google cloud computing
- L’utilizzo di dispositivi elettronici per le spiegazioni a lezioni

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3. To the question:

Qual.Q.3. What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.

The respondents reported the following:

- Up to date software and younger lecturers.
- need to return students to premises, I have only online classes
- The max amount of connections, which won't cause system to overload.
- Not so much resources, but rather willingness from faculty to use not only traditional education is
- No need improvement
- *I have no idea what would be needed as I am no a tutor. I guess everything is set up thanks to COVID for online part, and for traditional things should had been set up thanks to historical fact of traditional learning being the only way of teaching for many years.*
- Haven`t had the chance to experience in person lectures yet.
- A united and easy to understand system , unnecessary complexity and disorder results in frustration
- We haven't had traditional classes so it's hard to say yet.
- Not sure what kind of resource but improving ortus speed would be great!
- My opinion is that shoehorning blended education techniques using curriculums not specifically designed to take advantage of them usually doesn't present any improvement over using only traditional methods—respectively, the curriculum itself (including all particular courses) needs to be redesigned to take advantage of blended techniques, given that digital techniques present a fundamentally different

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approach to interaction and learning which both opens new possibilities but also doesn't work that well with curricula that are not suitable for it.

- More cameras for meetings and students have to be right to choose online and offline education.
- up-to-date software and modern computers, good internet/ better hardware and network connections/more and better equipment / better computers (6)
- Laptops for everyone to allow people to be connected and on the same level as the others
- Hardware, like camera / on body mic for teachers (2)
- The basics are needed such as classrooms, projectors, up to date computers etc
- to actually provide hybrid classes
- organizaton and clarity on the program/agenda - what and how will be organized the blended learning/teaching. Perhaps centralization but combined with flexibility on the tools and approaches should be used in such cases.
- I don’t know (3)
- At my university the technology is very good. A camera and a microphone are provided to carry out the hybrid training. Also the teacher shares a screen and sees everything. Just like if you're in the classroom. I don't think there should be any improvement
- I think that digital education in my university is possible, as well as traditional
- I don't think I need additional resources for education
- For now, I don't have any need for blended traditional or digital learning.
- there is no hybrid
- better use of the eclass
- for the students to have access to digital textbooks during class

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- Video recordings of classes would be the first step and would prove extremely useful if implemented
- More technological resources needed.
- datacamp
- I think my University is covered in any field.
- maybe cloud platforms / Maybe we could use online platforms like Slack (2)
- interactive boards, zoom classes in addition to the lectures
- The basics are needed such as classrooms, projectors, up to date computers etc
- My teachers, professors etc. need to be educated how to work with E-tech, because of the age diff. (60-70 years old people) they are still inadequte with computers, internet etc.
- updating courses for professors in order to improve digital education
- More content online, instead of books
- Every single book should be available in the e-library of the University.
- Increase distance learning
- More videos, more exercises
- Registration of the lessons to make the process of learning easier for students, but also helps if problems happen during the lessons and students are unable to understand the teacher

4. To the question:

Qual.Q.4. What are the stakeholders that you consider important within a digital classroom community?

The respondents reported the following:

- Students (2)

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- teacher, students, IT support
- The students, the teacher, the alumni
- Students, teachers, businesses
- professors, technical support staff, students
- Teachers and students (7)
- Teachers and other universities
- department
- Enterprises members
- Along with the direct target groups the developers and providers are also to be engaged and produce apps, possibilities and tools that are easy to be adapted and used in the education.
- consultants and sector professionals who intervene during the lesson
- tutor, some sort of trade union like organization, for example, students parliament or course congregation
- e-business / Microsoft
- I think everyone is important
- the platform that is being used
- Advanced self experienced people that can teach "outside the box"
- For now, there are no stakeholders that I consider important in the digital classroom community.
- I don’t know / I don’t understand the question (4)

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5. To the question:

Qual.Q.5. What types of digital innovative learning are you currently using?

The respondents reported the following:

- Learning through MS Teams, e-learning platform Moodle
- matlab
- video, online tests, online e-books, programming IDEs
- Virtual classroom, MOOC
- Youtube is a great digital learning platform
- Just Zoom, MSTeams, Google Classroom, ORTUS, GitHub, Mentimeter, Miro
- Datacamp, Google Cloud Services, Kaggle
- Online learning platforms (e.g.: Datacamp)
- lessons online, lim
- python
- prestashop
- Moodle
- Webex app
- Different kinds of tools. For example Webex, Mural ...
- zoom (3)
- e-learning/e-courses (5)
- online classroom
- openeclass (3)
- E-class where only slides are uploaded with no other use of the platforms capabilities

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- Moodle , e-student, zoom, google classroom
- moodle, e-library, online courses
- Online case study and project based communication.
- wiki/Wikipedia (2)
- Bloomberg Market Concept
- none (1)
- I don't know (4)

6. To the question:

Qual.Q.6. What software applications are currently used in the blended/digital courses? Please specify.

The respondents reported the following:

- Webex (13)
- Luiss learn (5)
- Moodle (18)
- Zoom (18)
- Microsoft teams (24)
- Big Blue Button (2)
- skype
- mentimeter
- Office (2)
- Online University platform
- e-class / openeclass (8)
- cloud access

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- digital e-study portal
- python (2)
- prestashop
- Pycharm, ,
- VSC (2)
- InteliJ
- Jupyter (2)
- Adobe Photoshop, Adobe Illustrator, Visual Studio (2)
- Solid Edge (2)
- Excel (vba and automatization) (3)
- MatLab
- Eclipse (3)
- Octave (2)
- Google applications / Google Workspace / google meet (4)
- specific softwares free versions or with students version
- fast message transfer tools
- Presently all courses are digital, hence there are no particular tools that are used for blended learning only. To an extent the curriculum is integrated with Moodle as a digital hub which contains resources used both in digital and traditional environments.
- I don't know (2)

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7. To the question:

Qual.Q.7. What software applications/platforms are you currently using in your work? Please specify.

The respondents reported the following:

- MS teams (34)
- Zoom (35)
- Moodle (22)
- Webex (13)
- Openeclass (2)
- Solidworks / Solid Edge 2022 (2)
- Photoshop, Visual Studio
- Matlab (2)
- ORTUS (3)
- Discord
- google meet (6)
- Luiss
- skype (2)
- e-learning
- Big Blue Button (2)
- jupyter (https://jupyter.org/try) (2)
- eclipse (3)
- InteliJ
- Octave

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- VS code (2)
- visual studio
- Excel / Excel VBA (4)
- Word (1)
- Google Workspace / Google classroom / Google drive (5)
- Google docs (2)
- google chrome (2)
- gmail (2)
- replit
- anaconda (3)
- Pycharm
- Octave
- Prestashop
- mentimeter
- MS office / microsoft office 365 (2)
- cloud
- dropbox
- specific softwares free versions or with students version
- Notepads, pdf, ppt
- I don't know (2)

8. To the question:

Qual.Q.8. What kind of technical support / multimedia tools do you consider necessary to apply in digital innovative learning in the classroom? Please elaborate.

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The respondents reported the following:

- *Interactive whiteboards / blackboard (2)*
- *Presentations, recording whole lecture and sharing it in our system (ORTUS)*
- *Stable communication application with an ability to chat and make calls*
- *the ability to record something*
- *sharing screen and interactive parts of the classes, like maybe Kahoot*
- *Some app or programm that allows you participate in lecture actively, practial upgrade*
- *More cameras, fast internet and good microphone*
- *Gamified platforms*
- *video, audio, presentations*
- *up to date computers / pc with new software / computer and multi-media (2)*
- *tutors / training on platforms (2)*
- *internet, laptops for all students*
- *eclass*
- *Webex, Power Point, Excel, Mural*
- *IT assistant for general problems, the possibility to make questions and to have a registration of the course*
- *Difficulties were often encountered on the occasions of interventions by external guests, the support was always present, but it could be easier and quicker if the professors themselves could be able to solve the problem. Maybe through some courses or an easier front page of the software.*
- *a digital place where students and teacher can share documents, slides lesson and cases of study*

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- *I think more important than tools is support that updates solution seeking process reports regularly. For now I have no idea what more tools could be needed.*

9. To the question:

Qual.Q.9. Do you have any asynchronous e-learning (self-learning) resources available at your University? Please kindly specify.

The respondents reported the following:

- *library*
- *teachers' slides uploaded online (3)*
- *Presentations are recorded - recordings are uploaded online (3)*
- *e-class (5)*
- *Google cloud / google drive (2)*
- *Youtube videos / Youtube tutorials (3)*
- *Stack overflow*
- *some books we find online / book databases (2)*
- *datacamp (3)*
- *moodle (3)*
- *Luiss learn website makes me vision materials from the course whenever I need to*
- *self-learning courses and modules (2)*
- *Videos, presentations, lecture recordings, additional resources advised for homereading*
- *Yes, although they are considered supplementary and not complementary to the synchronous learning resources. They primarily are additional materials provided by the teaching staff that can be of various forms (written materials, online materials, videos etc.)*

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10. To the question:

Qual.Q.10. Based on your experience with Covid-19, what kind of psychological and social resources do you need to ensure mental and psychological well-being of colleagues and students in the event of a future emergency? Please elaborate.

The respondents reported the following:

- *Sharing the links for online internships*
- *I need babysitter for my kids*
- *Large portion of live communication (calls, video calls) to keep in touch with your friends and don't lose yourself.*
- *I think oftentimes more flexible deadlines would helpful, because when feeling stressed it is sometimes hard to motivate oneself to work.*
- *the ability to meet up with my peers and to socialize with them. A way to not lose my physical strength that is easy to access.*
- *I would like to be involved in non formal meetings with classmates. I don't know them at all :(*
- *Social gatherings in safe environments (outside in fresh air) (2)*
- *online events,*
- *counselors / easily available psychologists / A therapist and various group meetings (3)*
- *better quality assurance that students will not lose their exams due to internet problems*
- *competitions and other fun activities that can be done remotely*
- *just some common adventures or experiences should do it I guess.*

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- *supporting telephone lines*
- *Online courses doesn't let students to have a well round character and socialize with others. The chance to talk and socialize with fellow group mates. (2)*
- *Make the blended learning more often.*
- *Family and friends.*
- *good collaboration and communication tools*
- *More elaborated personal contact and control (2)*
- *Best would be face to face learning however due pandemy another alternative is during lecture take some time to talk about life!*
- *I will advise students to be calm. The most important thing is not to think about Covid-19. At my university, online learning is wonderful and I don't think it will be a problem to study online.*
- *A chance for students to get help with mental health issues from specialists, understanting from professors(understand students problems and try to consider their needs)*
- *An understanding if work is not being done on time (mostly there is no problems with that). Maybe for some - psychological support.*
- *Makes articles and presentations about the main problems in students and solve with them , and be near to them*
- *Primarily I cannot stress enough the fact that attempting to fulfill previously set goals under adversarial conditions (such as a state of emergency) is not an optimal objective. When a state of emergency is declared, a lot of attention needs to be paid to reconsider the course of action because the individual environment of students might not be ideal for learning, and therefore having overly high expectations (i.e., presuming that the same activities should be performed in a state of emergency as if it were considered normal conditions, including tests and individual classwork) is*

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prone to causing overly high levels of stress on students, especially compounding with the state of emergency itself.

- *I think the possibility to go for fewer students should always be available since I had some friends struggling while being at home for long. I personally find online courses way better than lessons held at the university because I focus more, I have more time for my passions and interests, and my performances improved.*
- *What was lost due to the pandemic was sociality. I hope for a deep psychological support through interviews with expert, and maybe the creation of virtual study classes that unite students of the same course so they can discuss about notes and exercises.*
- *I also think that exams should be held exclusively at the university and not at home.*
- *I do not need psychological and social resources. / None, I am very comfortable working and learning at home (2)*

A respondent elaborated more on the ramifications of Covid-19 on students and possible tackling measures.

"Should be online meetings with lecturers and students, sometimes just for students communication in a way of team-building for students. Of course there are some imperfections while in online classroom, but everything is developing pretty fast and it is possible to overcome difficulties with studies. But in order to minimize stress and anxiety from all the situation and improve mental and psychological well-being more simple socializing should be added to the students life. Because it is what is taken away with distant learning - socializing, usual communication with students at the same group who study the same subjects, have the same issues. In a normal situation students communicate with each other easily at least in breaks between lectures.

The suggestion is if situation continues or repeats - universities should also think of possibilities of organizing simple "team-building" online events for students. Otherwise students are left isolated with their problems withou0.t normal human interaction with the people of the same interest. University used to be a place were lots of people found their

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friends for life - I am sure for the past two years not so many students have managed to find new best friends for life during online lectures."

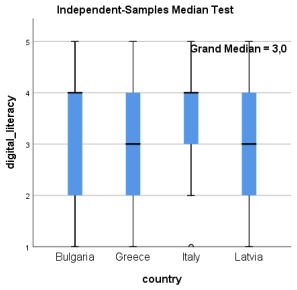
Statistical processing of data is displayed in the following pages.

In the tables and figures that follow only comparisons with respective significance level of independent samples median tests below 0,05 are shown, meaning that significant differences were found.

digital_literacy across country

Independent-Samples Median Test Summary

Total N	244
Median	3,000
Test Statistic	13,052
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,005**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Greece-Bulgaria	10,542	,001	**,007**
Latvia-Bulgaria	4,887	,027	,162
Greece-Latvia	,566	,452	1,000
Greece-Italy	5,978	,014	,087
Latvia-Italy	2,481	,115	,692
Bulgaria-Italy	,180	,671	1,000

digital_education_level across country

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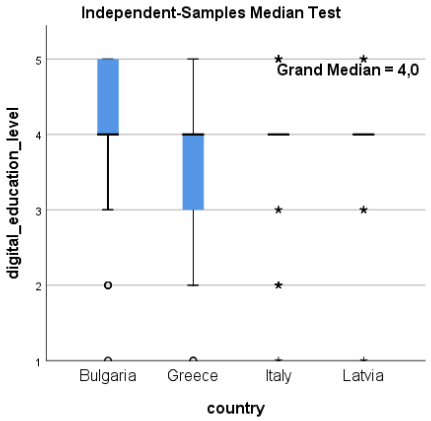
Independent-Samples Median Test Summary

Total N	245
Median	4,000
Test Statistic	11,519
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,009**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	10,294	,001	**,008**
Bulgaria-Italy	2,140	,144	,861
Bulgaria-Latvia	4,299	,038	,229
Greece-Italy	2,003	,157	,942
Greece-Latvia	,695	,404	1,000
Italy-Latvia	,291	,590	1,000

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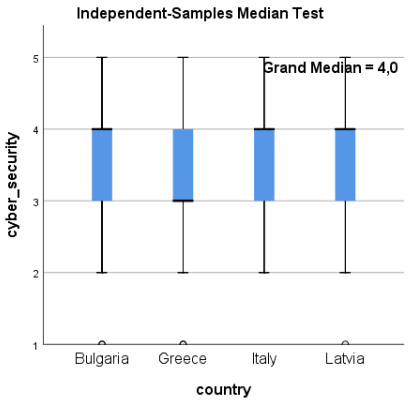
cyber_security across country

Independent-Samples Median Test Summary

Total N	246
Median	4,000
Test Statistic	11,408
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,010**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Greece-Bulgaria	9,802	,002	**,010**
Greece-Italy	4,044	,044	,266
Greece-Latvia	4,011	,045	,271
Bulgaria-Italy	3,920	,048	,286
Bulgaria-Latvia	,039	,843	1,000
Italy-Latvia	3,933	,047	,284

Industry_four_fit_curriculum across country

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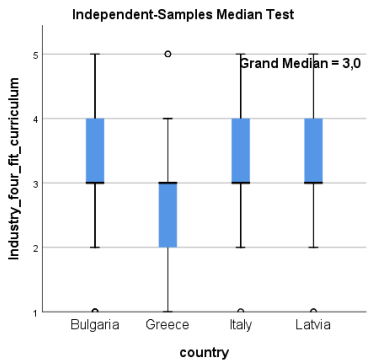
Independent-Samples Median Test Summary

Total N	243
Median	3,000
Test Statistic	11,184
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,011**



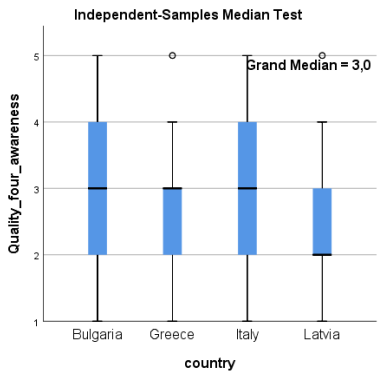
Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	8,820	,003	**,018**
Bulgaria-Italy	,345	,557	1,000
Bulgaria-Latvia	5,110	,024	,143
Greece-Italy	4,265	,039	,233
Greece-Latvia	,155	,694	1,000
Italy-Latvia	2,312	,128	,770

Quality_four_awareness across country

Independent-Samples Median Test Summary

Total N	244
Median	3,000
Test Statistic	10,193
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,017**



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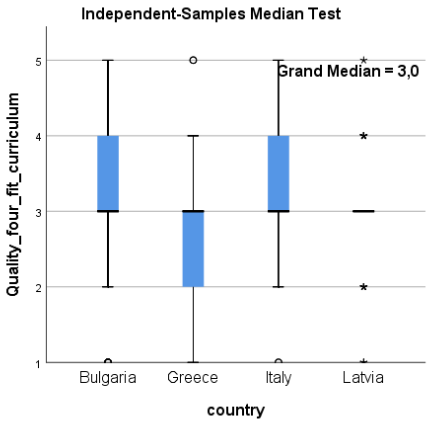
Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Latvia-Bulgaria	8,099	,004	**,027**
Latvia-Greece	,032	,857	1,000
Latvia-Italy	2,255	,133	,799
Bulgaria-Greece	5,763	,016	,098
Bulgaria-Italy	1,578	,209	1,000
Greece-Italy	,724	,395	1,000

Quality_four_fit_curriculum across country

Independent-Samples Median Test Summary

Total N	243
Median	3,000
Test Statistic	8,267
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,041**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	3,723	,054	,322
Bulgaria-Italy	,516	,472	1,000
Bulgaria-Latvia	6,987	,008	**,049**
Greece-Italy	,957	,328	1,000

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Greece-Latvia	1,047	,306	1,000
Italy-Latvia	3,220	,073	,436

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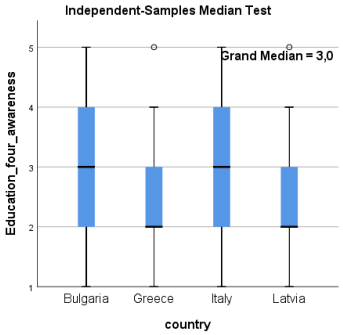
Education_four_awareness across country

Independent-Samples Median Test Summary

Total N	243
Median	3,000
Test Statistic	15,820
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,001**



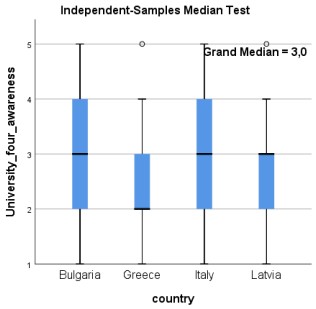
Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Greece-Bulgaria	9,957	,002	**,010**
Latvia-Bulgaria	11,318	,001	**,005**
Greece-Latvia	,256	,613	1,000
Greece-Italy	2,212	,137	,822
Latvia-Italy	3,275	,070	,422
Bulgaria-Italy	2,941	,086	,518

University_four_awareness across country

Independent-Samples Median Test Summary

Total N	239
Median	3,000
Test Statistic	11,741
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,008**



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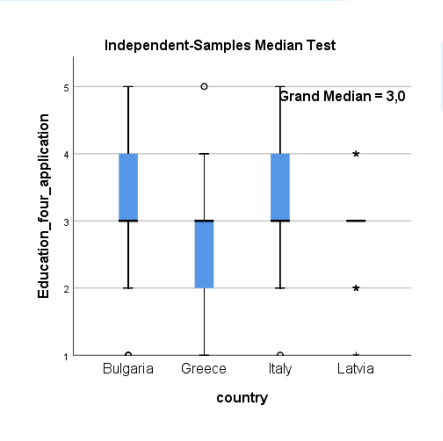
Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Greece-Bulgaria	6,713	,010	,057
Greece-Italy	2,339	,126	,757
Greece-Latvia	,064	,800	1,000
Bulgaria-Italy	,662	,416	1,000
Bulgaria-Latvia	8,447	,004	,022
Italy-Latvia	3,981	,046	,276

Education_four_application across country

Independent-Samples Median Test Summary

Total N	238
Median	3,000
Test Statistic	16,192
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,001**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	7,521	,006	**,037**
Bulgaria-Italy	,005	,942	1,000
Bulgaria-Latvia	10,050	,002	**,009**
Greece-Italy	5,952	,015	,088
Greece-Latvia	,818	,366	1,000
Italy-Latvia	8,577	,003	**,020**

University_four_application across country

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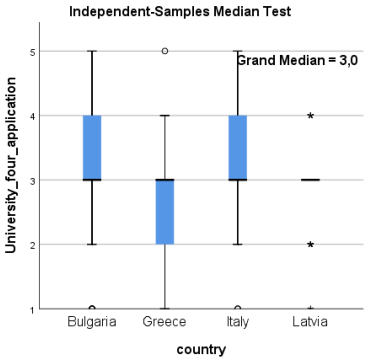
Independent-Samples Median Test Summary

Total N	237
Median	3,000
Test Statistic	18,841
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,000**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	5,371	,020	,123
Bulgaria-Italy	,157	,692	1,000
Bulgaria-Latvia	16,145	,000	**,000**
Greece-Italy	2,879	,090	,538
Greece-Latvia	5,005	,025	,152
Italy-Latvia	12,197	,000	**,003**

game_learning_aware across country

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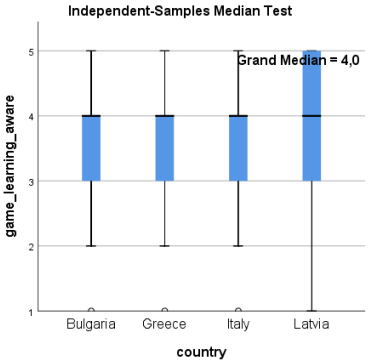
Independent-Samples Median Test Summary

Total N	243
Median	4,000
Test Statistic	10,058
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,018**



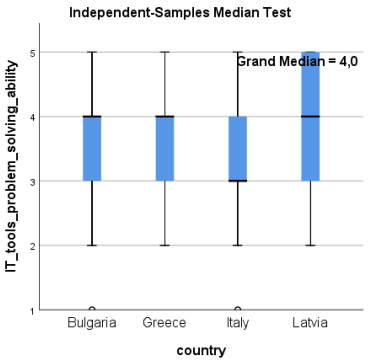
Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	1,005	,316	1,000
Bulgaria-Italy	,159	,691	1,000
Bulgaria-Latvia	3,872	,049	,295
Greece-Italy	,224	,636	1,000
Greece-Latvia	8,770	,003	**,018**
Italy-Latvia	4,330	,037	,225

IT_tools_problem_solving_ability across country

Independent-Samples Median Test Summary

Total N	243
Median	4,000
Test Statistic	13,004
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	,005



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Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Italy-Bulgaria	5,715	,017	,101
Italy-Greece	,288	,592	1,000
Italy-Latvia	8,113	,004	**,026**
Bulgaria-Greece	4,514	,034	,202
Bulgaria-Latvia	,435	,510	1,000
Greece-Latvia	7,217	,007	**,043**

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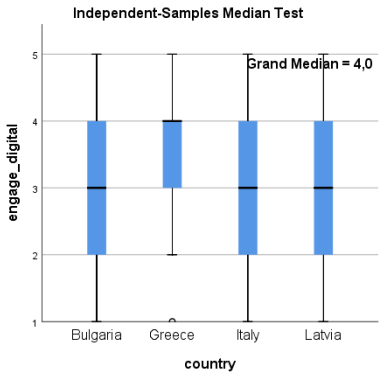
engage_digital across country

Independent-Samples Median Test Summary

Total N	246
Median	4,000
Test Statistic	8,559
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,036**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Italy	1,697	,193	1,000
Bulgaria-Latvia	,579	,447	1,000
Bulgaria-Greece	5,929	,015	,089
Italy-Greece	3,420	,064	,386
Latvia-Greece	3,180	,075	,447
Italy-Latvia	,292	,589	1,000

digital_platforms_learning across country

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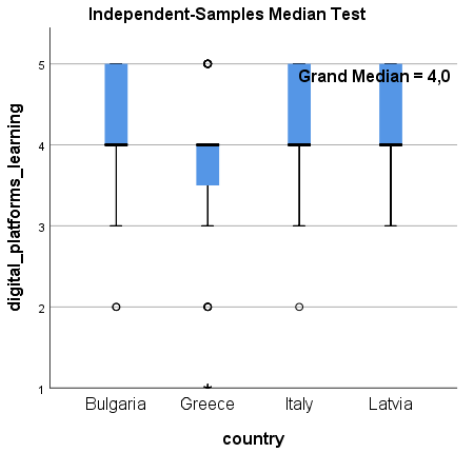
Independent-Samples Median Test Summary

Total N	246
Median	4,000
Test Statistic	9,907
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,019**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	9,468	,002	**,013**
Bulgaria-Italy	,749	,387	1,000
Bulgaria-Latvia	,448	,503	1,000
Greece-Italy	3,616	,057	,343
Greece-Latvia	4,848	,028	,166
Italy-Latvia	,044	,834	1,000

digital_connectivity_peers across country

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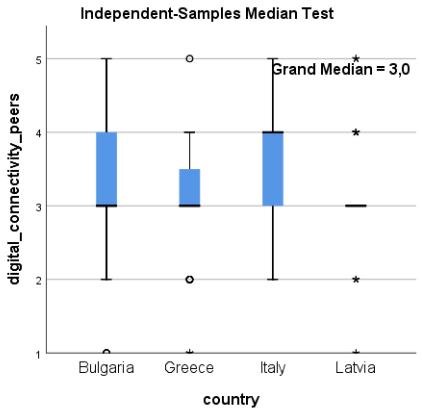
Independent-Samples Median Test Summary

Total N	243
Median	3,000
Test Statistic	19,260
Degree Of Freedom	3
Asymptotic Sig.(2-sided test)	**,000**



Pairwise Comparisons of country

Sample 1-Sample 2	Test Statistic	Sig.	Adj. Sig.[a]
Bulgaria-Greece	1,580	,209	1,000
Bulgaria-Latvia	1,432	,231	1,000
Bulgaria-Italy	7,582	,006	**,035**
Greece-Latvia	,011	,916	1,000
Greece-Italy	15,535	,000	**,000**
Latvia-Italy	12,882	,000	**,002**

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Edu-Gate responses of instructors

Sample breakdown by country

country	N
Bulgaria	13
Greece	12
Italy	4
Latvia	7

In general, there aren't any significant differences in the instructors' ratings across countries. Latvian instructors reported lower levels of Education 4.0 and University 4.0 awareness than their Bulgarian, Greek and Italian peers.

Greek and Latvian instructors report higher levels of awareness in terms of cloud data storage compared to their Bulgarian and Italian peers.

Greek and Latvian instructors reported far less connectivity to other stakeholders, such as municipalities, ministries, charters or other public or private bodies, than their Bulgarian and Italian peers.

Italian and Bulgarian instructors are more satisfied by the technical support in their digital teaching activities compared to the Greek and the Latvian instructors.

The participants were asked to elaborate on certain questions. Their responses follow.

Qual.Q.1. Could you please mention the Industry 4.0 and/or Quality 4.0 applications at your University, if any?

The respondents reported the following:

- 3D printers,
- online educational platform,
- eLibrary

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- moodle
- robotics
- VR lab, Educational robotics lab,
- 360 camera online lectures
- Teachers' evaluation is now fully digitalized. Students have direct access to e-questionnaires for the quality evaluation of both the courses and the instructors.
- Enabling technologies,
- Machine learning,
- Data science
- cloud, simulation
- nothing

Qual.Q.2. Could you please mention the Education 4.0 and University 4.0 applications at your University, if any?

The respondents reported the following:

- 3D printers,
- online educational platform,
- LMS based on open-source platform Moodle
- eLibrary; Library digitalization
- Gamebased pedagogy; gamification; game-based learning
- interactive multimedia contents,
- project-based learning,
- flipped-classroom,
- blended learning

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- e-learning courses,
- digital signature,
- digital election procedures
- zoom
- New Pattern for exams,
- Project-based learning
- cloud,
- simulation
- nothing; none that I am aware of

Qual.Q.3. What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.

The respondents reported the following:

- Human resources
- enough storage space, fast internet, modern audio and video equipment, interactive whiteboards, wireless presentation displays, augmented reality apps
- More ipads, to be sure students have necessary tools at home, subscriptions to most popular and Best edu tool online, faster training for all new opportunities
- Practical working with the different electronics hardware like CPU, Voltage measurements etc.
- Additional training is needed.
- interactive boards,
- auto tracking (PTZ) cameras
- Reliable and new hardware equipment,

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- network connection stability
- Hardware equipment to be up-to-date
- Equipment (hardware) is obsolete. Projectors, sound equipment, internet connection are out-of-date.
- Mostly training
- technical resources
- more game-based learning
- the digital culture in the mind of teacher

Qual.Q.4. What are the stakeholders that you consider important within a digital classroom community?

The respondents reported the following:

- Dialog with the practical environment
- Teachers and students
- Lecturer, students
- Instructor, students, guest speakers
- Instructors, IT department
- Information system companies, software licence providers, funding bodies/sponsors, research institutes, technological innovators
- University students
- private companies, SMEs, NGOs
- managers, students, businessmen, researchers
- Students, teachers, institutions/organization
- Teachers of other Universities and other educational institutions

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- Contents creators, virtual reality experts, and graphic experts
- Ministries, Schools, other Universities, International Associations of Academies

Qual.Q.5. What types of digital innovative learning are you currently using?

The respondents reported the following:

- interactive classroom,
- online quizes,
- adaptive learning,
- gamification,
- blended learning
- Last practical news of the electronics word.
- Blended learning
- Google classroom, BigBlueButton
- Not much. I use poll questions organized via zoom but such things are probably rather standard in our days.
- online tutorials, quizzes, student-enabled annotation in exercises, polls, break-out classes for exams and/or class teamwork
- blended teaching, game-based teaching
- google-form questionnaires for game-based learning
- E-learning, teleconference applications, digital libraries, social media groups
- E-learning
- Open educational resources
- E-learning platform Moodle
- Live classrooms and videos

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- E-learning platform designed by our university

Qual.Q.6. What software applications are you currently using for blended/digital courses? Please specify.

The respondents reported the following:

- Moodle (3),
- Zoom (3),
- MS Teams (6),
- Google Colab
- Webex
- Google Forms, Google Docs, Google Drive,
- social media, projector
- google meet

Qual.Q.7. What software applications/platforms are you currently offering for your online courses? Please specify.

The respondents reported the following:

- Zoom (3),
- MS Teams (4),
- Google Colab
- Anaconda Navigator, Jupyter Notebook, Figma, Keynote, Office 365

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- Active presenter,
- Google Drive,
- Moodle (2),
- Google Meet (3),
- Google Forms,
- Google Docs,
- social media,
- laptop
- Jitsi,
- Google classroom

Qual.Q.8. What kind of technical support / multimedia tools do you need in the classrooms to apply digital innovative learning? Please elaborate.

The respondents reported the following:

- free university accounts in Canvas, Bookcreator and etc.
- support and tools for producing high quality educational video and multimedia learning objects, tools to provide active learning, development of serious games
- Technical support in general
- Effective training before using

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- Programming learning and programmers
- interactivewhiteboard
- A person dedicated to each lecture to solve potential problems and assist students
- I need hardware support from the technical staff of my university. I need software from licensed software providers.
- I need assistance available 24/7.
- Simulation tools, dashboards
- More interactive lessons and immersive activities
- Mural
- Technicians for link and audio problems
- Video-streaming

Qual.Q.9. Do you have any asynchronous e-learning (self-learning) resources available at your University? Please kindly specify.

The respondents reported the following:

- yes, lots of + the databases that our library covers
- Video lessons
- There are self-learning resources - interactive multimedia lessons, videos, e-lectures, presentations, automatically scoring quizzes and etc.
- Different electronics hardware
- I have computer

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Qual.Q.10. Based on your experience with Covid-19, what kind of psychological and social resources do you need to ensure mental and psychological well-being of colleagues and students in the event of a future emergency? Please elaborate.

The respondents reported the following:

- My students and me miss the social contact, but honetsly they participate with more intensity in online classes
- Psychological consultations
- Strengthening the community support. At every assessment's stage to be involved persons of concern (participatory assessment). Designing interventions on the basis of sufficient information. Developing an understanding of, and consistently reflecting on, universal human rights, power relations between outsiders and COVID-affected people.
- Not Remote Learning for 100% time
- I need a time

Qual.Q.11. Would you have anything to add? Your inputs and comments will be highly appreciated.

The respondents reported the following:

- Practical working in online learning will be better for the engineering specialist.
- Self-reading
- Very interesting project. It can help small public Universities that are not organized and often very old on these aspects.
- Please share a common open platform to every universities in EU.

Data processing with SPSS 25.0 is displayed in the following pages.

digital_literacy

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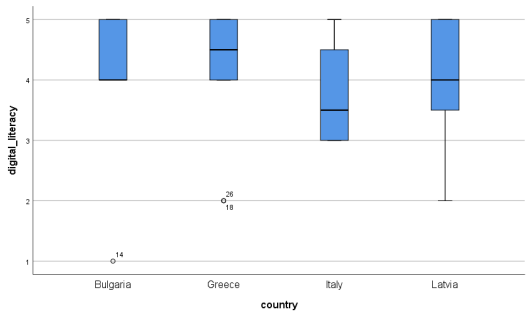
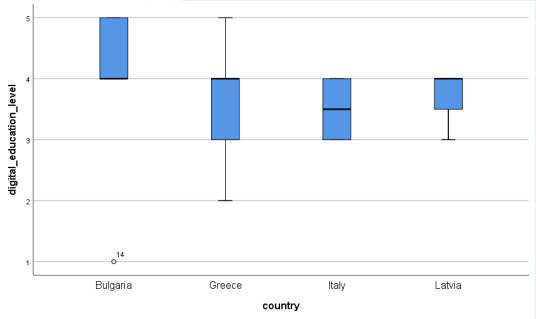
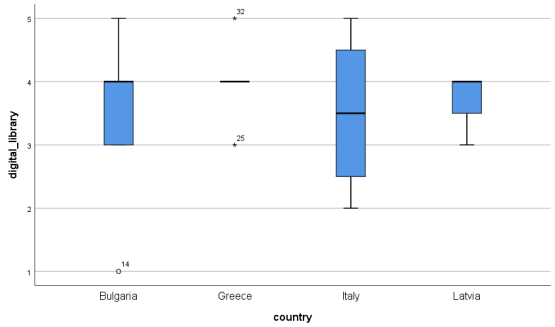


digital_education_level



digital_library



cyber_security

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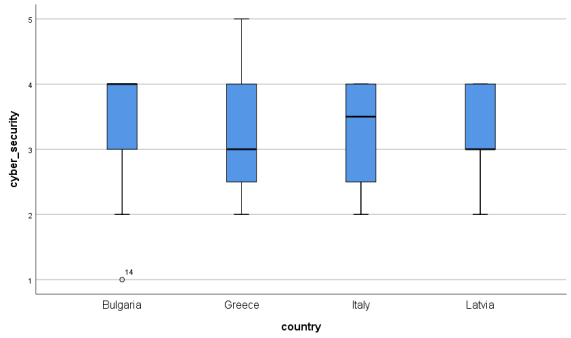

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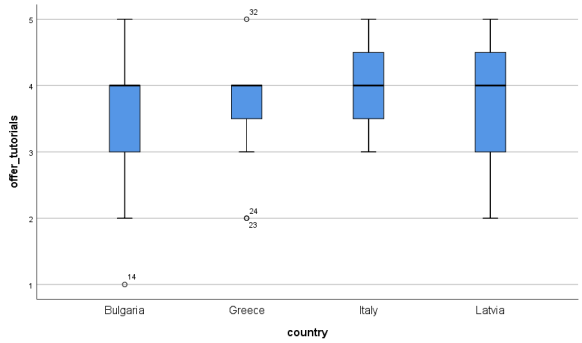
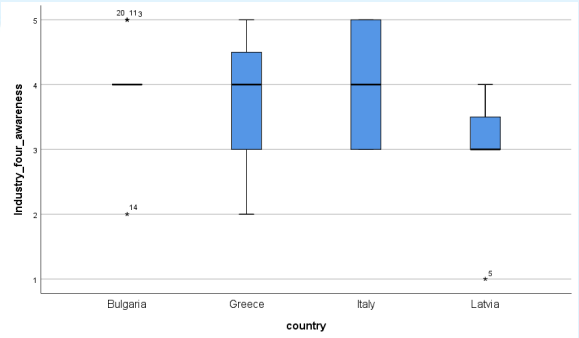
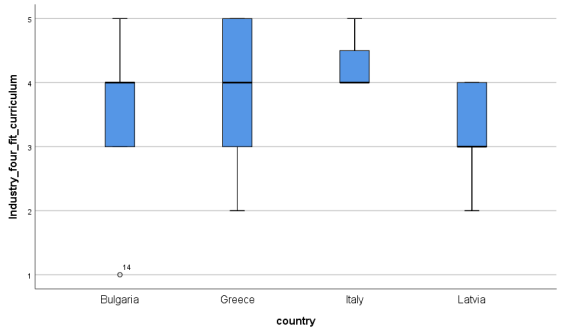
offer_tutorials



Industry_four_awareness



Industry_four_fit_curriculum



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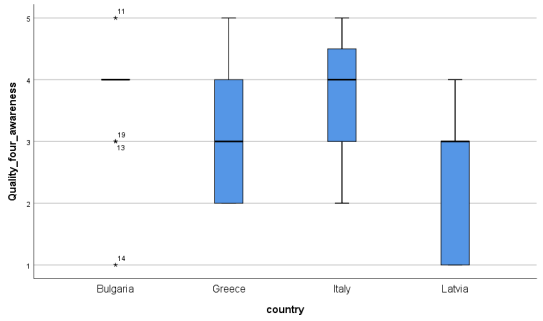
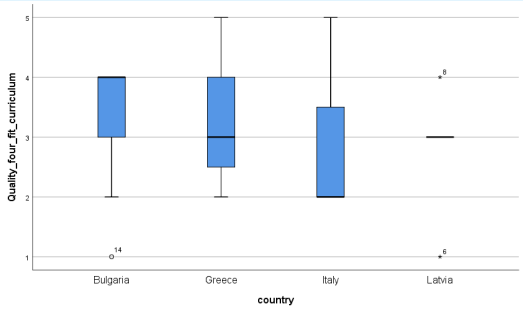
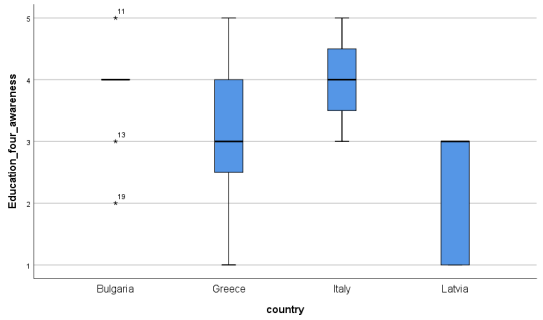
Quality_four_awareness



Quality_four_fit_curriculum



Education_four_awareness



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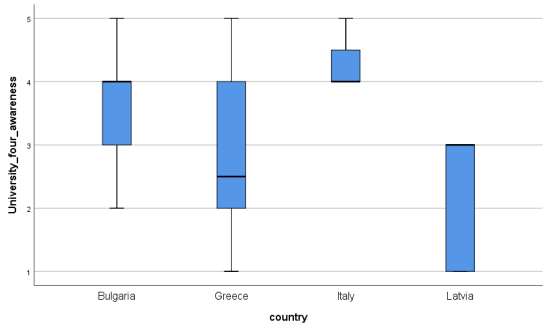
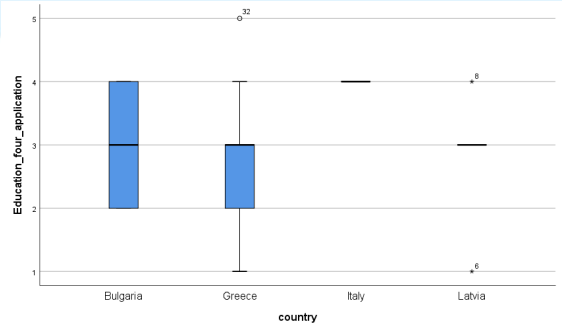
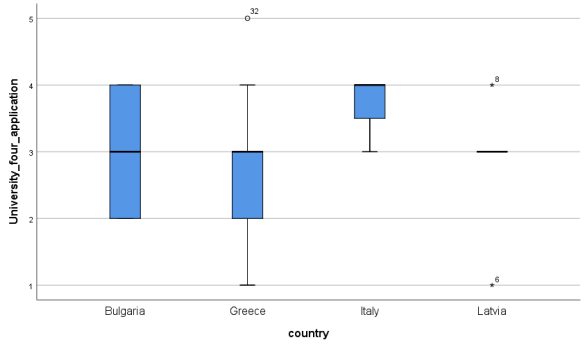
University_four_awareness



Education_four_application



University_four_application



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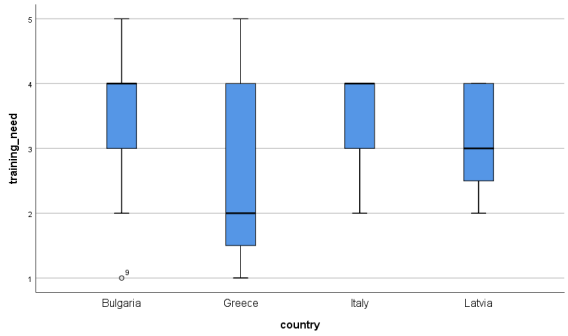
training_need



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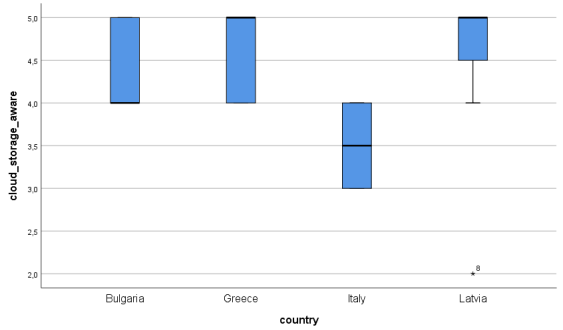

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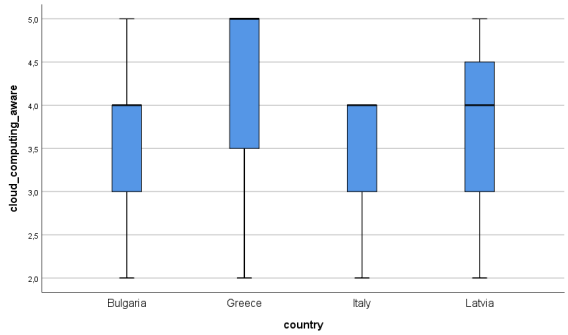

game_learning_aware

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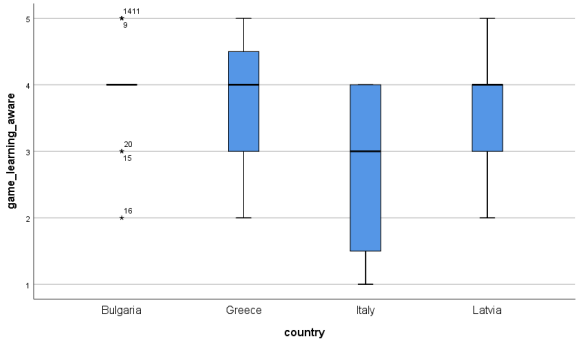

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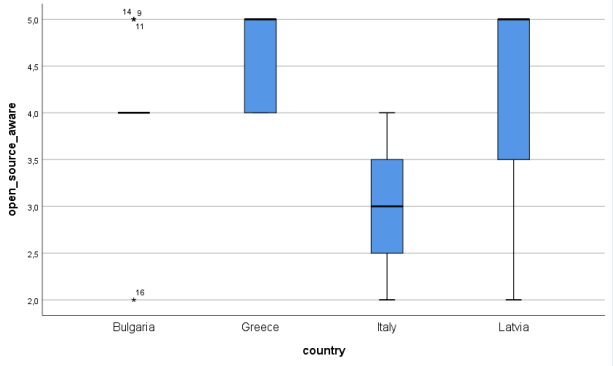
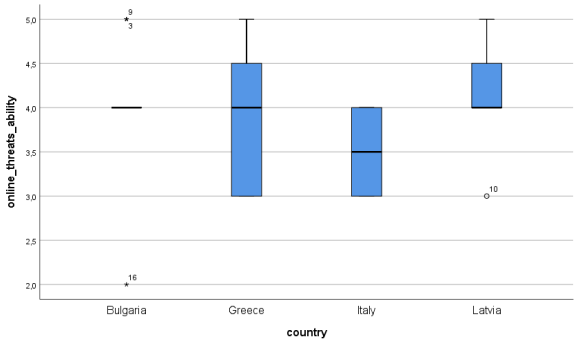


online_threats_ability



safe_identity_online

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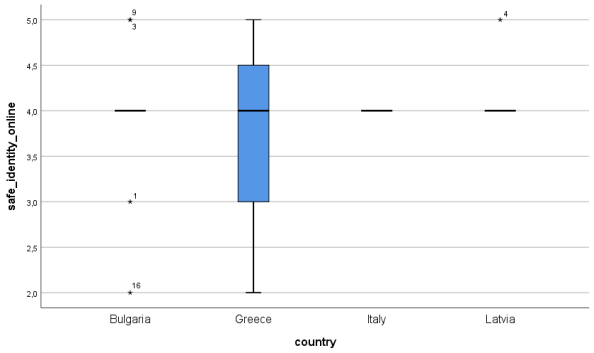
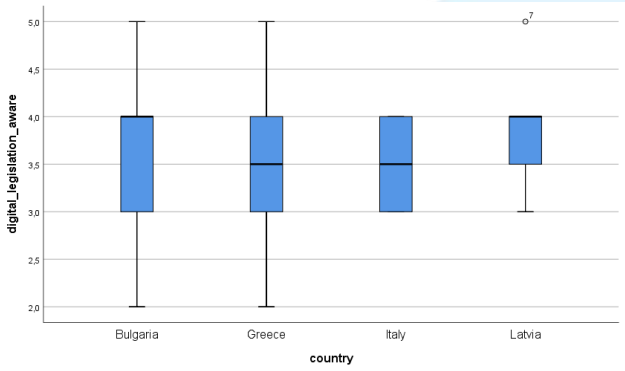


digital_legislation_aware



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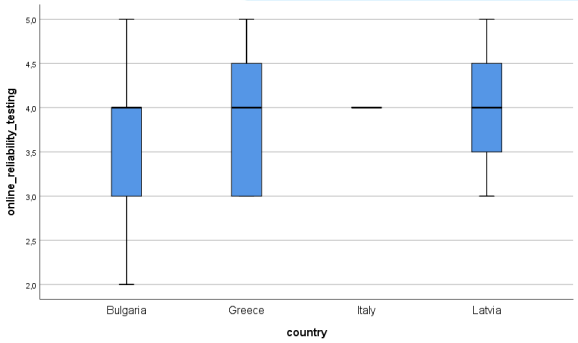

IT_tools_problem_solving_ability

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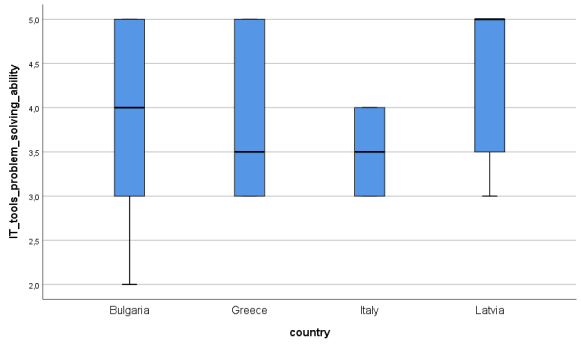
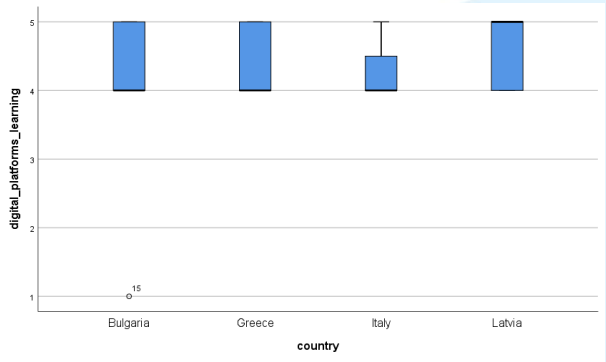
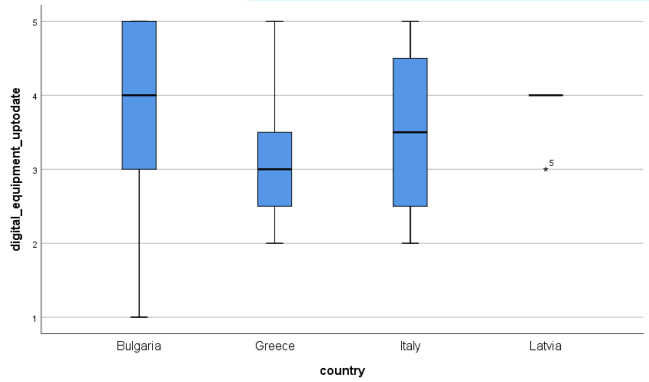


digital_platforms_learning



digital_equipment_uptodate



hybrid_teaching

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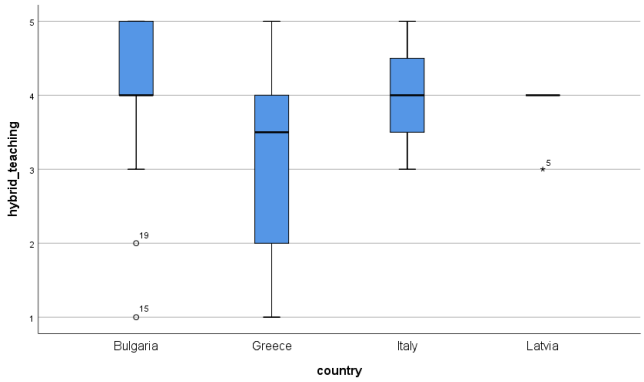
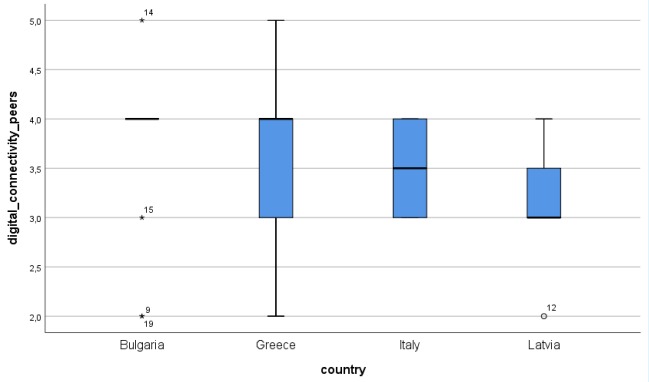
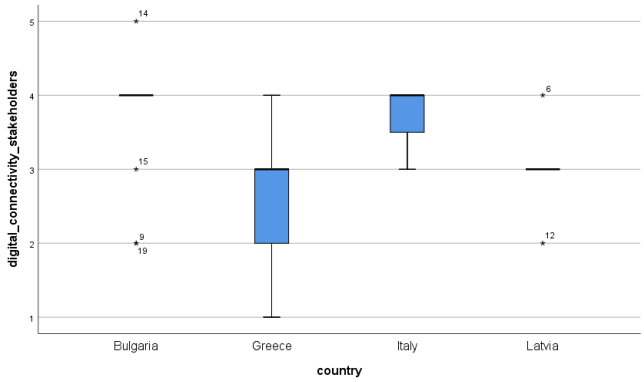


digital_connectivity_peers



digital_connectivity_stakeholders



SW_digital_teaching_satisfaction

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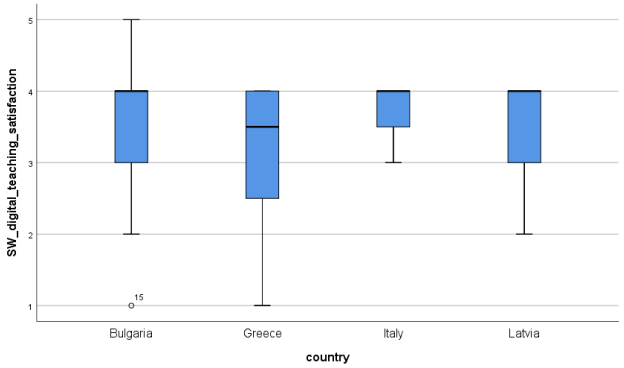
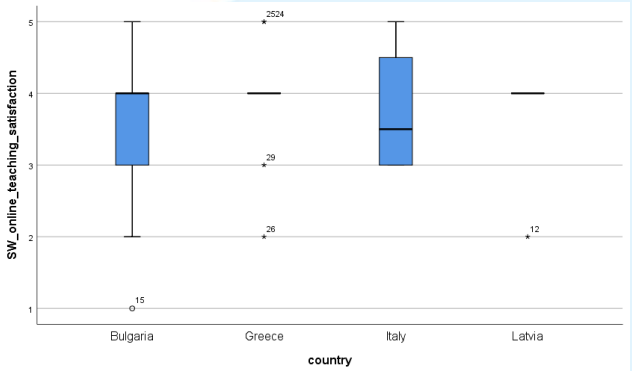
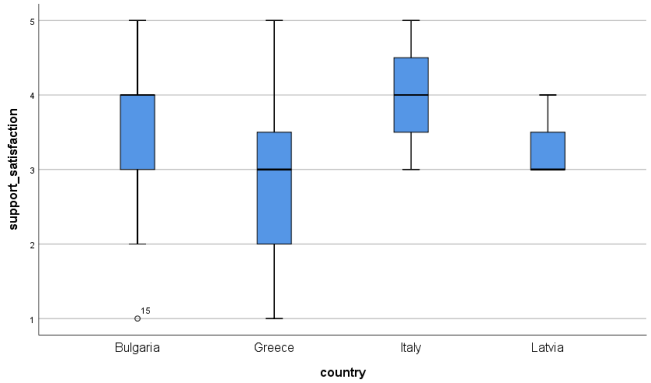


SW_online_teaching_satisfaction



support_satisfaction



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Edu-Gate Staff - Comparison of responses across countries

country	*N*
Bulgaria	4
Greece	7
Italy	10
Latvia	3

In general, Bulgarian and Italian University staff report higher levels of digital transformation, in terms of digital literacy and Education 4.0 and University 4.0 awareness and preparedness, compared to the Latvian and Greek University staff. All of the respondents report low connectivity with other Universities and stakeholders.

IT infrastructure is considered adequate and up-to-date by all of the survey participants, irrespective of country. Latvian HEI employees emphasize that digital education enables students' interaction. The majority of the respondents report low levels of legislation awareness in terms of digital content reproduction.

The participants were asked to elaborate on certain questions. Their responses follow.

11. To the question:

Qual.Q.1. Could you please mention the Industry 4.0 and/or Quality 4.0 applications at your University, if any?

The respondents reported nothing.

12. To the question:

Qual.Q.2. Could you please mention the Education 4.0 and University 4.0 applications at your University, if any?

The respondents reported the following:

- cloud for storage of data,

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- interactive whiteboards
- e-learning platform,
- e-services for staff and students
- PC and smartphone supportive classrooms,
- online assessments
- Moodle and
- Blackboard.

13. To the question:

Qual.Q.3. What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.

The respondents reported the following:

- digital classroom
- modern equipment, regular qualification courses
- More digital technology into classroom lessons, use of apps and games in the teaching process
- More smartboards at classrooms
- Technicians and e-learning contents creators
- Blended learning is the best solution

14. To the question:

Qual.Q.4. What are the stakeholders that you consider important within a digital classroom community?

The respondents reported the following:

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- lecturers, students, staff
- Everybody has an important role (teachers, staff, students, parents etc),
- Teaching communities
- Teachers and students
- Companies and academic suppliers

15. To the question:

Qual.Q.5. What types of digital innovative learning are you currently using?

The respondents reported the following:

- flexible learning
- asynchronous elearning platforms,
- teleconferences,
- videoprojectors,
- rarely smartboards
- online streaming
- none

16. To the question:

Qual.Q.6. What software applications are currently used in the blended/digital courses? Please specify.

The respondents reported the following:

- office 365,
- moodle (2),
- openeClass,

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- Zoom, and
- Google Meet.

17. To the question:

Qual.Q.7. What software applications/platforms are you currently using in your work? Please specify.

The respondents reported the following:

- moodle (2)
- office 365
- open eclass (2)
- zoom (2)
- Many, concerning data services and operating systems
- Adobe connect

18. To the question:

Qual.Q.8. What kind of technical support / multimedia tools do you consider necessary to apply in digital innovative learning in the classroom? Please elaborate.

The respondents reported the following:

- modern courseware authoring tools, regular technical support, and
- more smartboards at classrooms for keeping the remote learners connected.

19. To the question:

Qual.Q.9. Do you have any asynchronous e-learning (self-learning) resources available at your University? Please kindly specify.

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The respondents reported the following:

- self-paced e-learning courses
- yes, opencourses
- open eClass Platform
- openeclass platform that is used widely for the professors

20. To the question:

Qual.Q.10. Based on your experience with Covid-19, what kind of psychological and social resources do you need to ensure mental and psychological well-being of colleagues and students in the event of a future emergency? Please elaborate.

The respondents reported the following:

- online communications, collaborative spaces
- Hard to say. I suppose more communication even throught teleconference and preparation for a situation like that
- I don't know (4)

In the following figures responses are compared across the four countries of respondents' origin.

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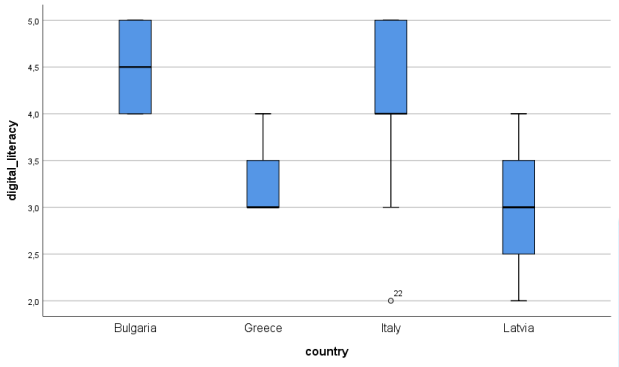
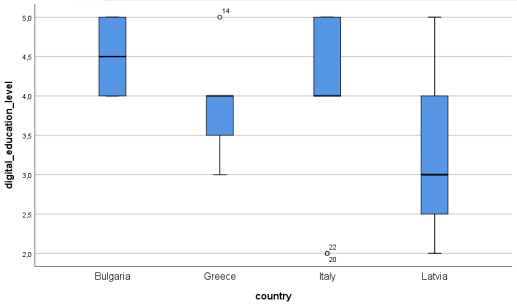
Digital maturity

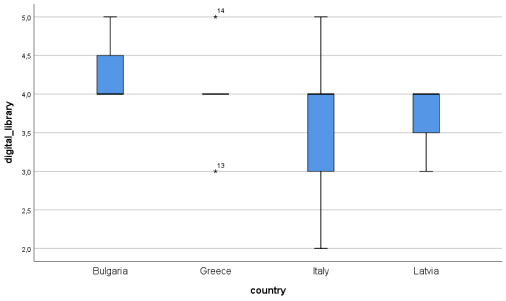
Q1.1. Terms like “digital natives”, “digital nomads”, and “digital literacy” are well-known to me.



Q1.2. Digital education is developed at my University.



Q1.3. The University library is digitalized.



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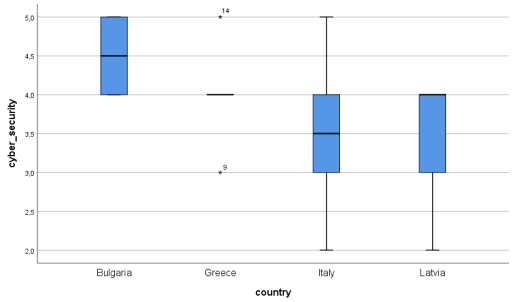
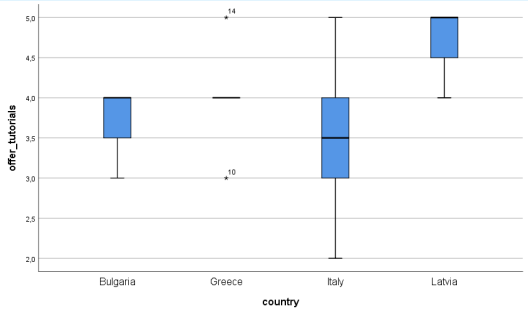
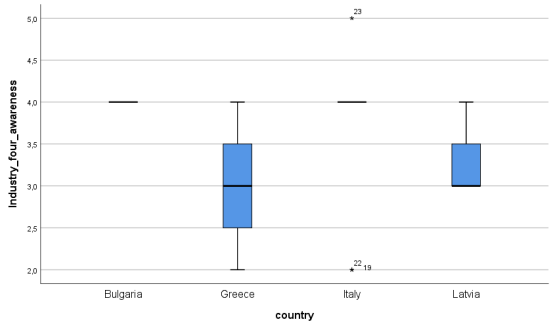
Q1.4. Cyber security measures are adequate at my University.



Q1.5. My Department and University Library offer e-tutorials for their digital services.



Q1.6. I am aware of the Industry 4.0 applications.



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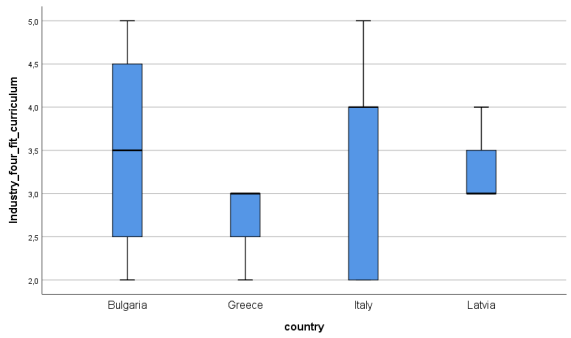
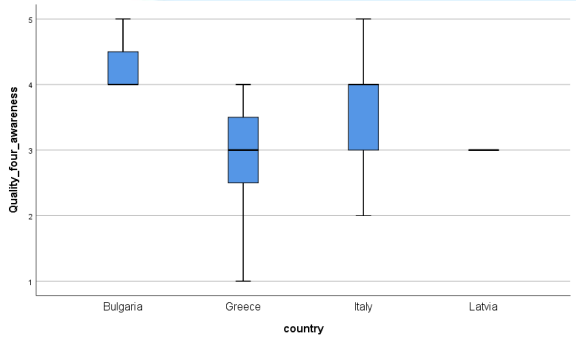
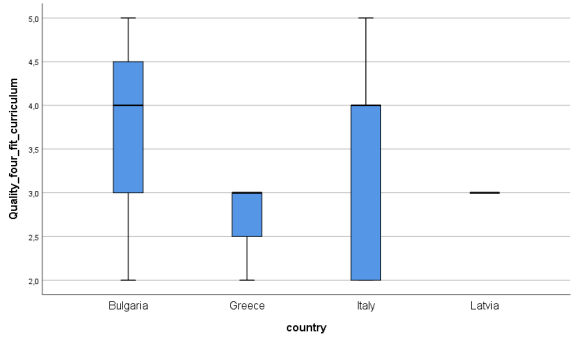
Q1.7. Industry 4.0 fits well within the scope of my Department's curriculum.



Q1.8. I am aware of the Quality 4.0 applications.



Q1.9. Quality 4.0 fits well within the scope of my Department's curriculum.



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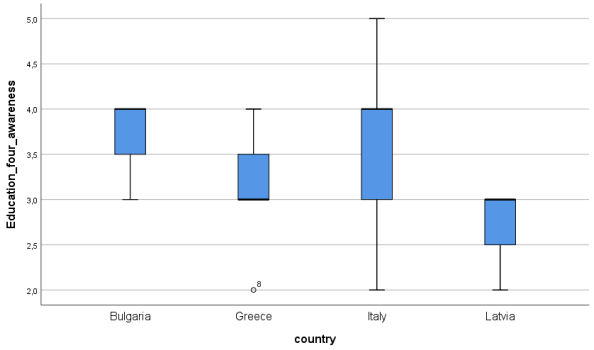
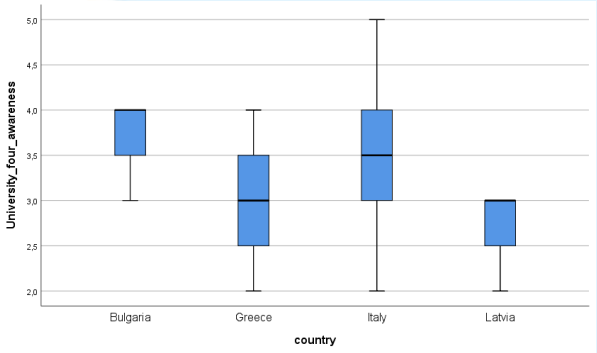
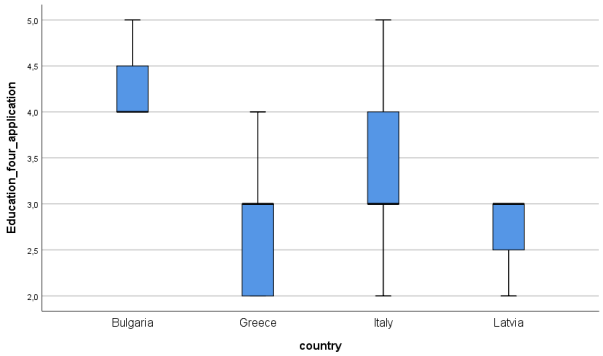
Q1.11. I am aware of theEducation 4.0 applications.



Q1.12. I am aware of theUniversity 4.0 applications.



Q1.13. Education 4.0 applications are applied at our University.



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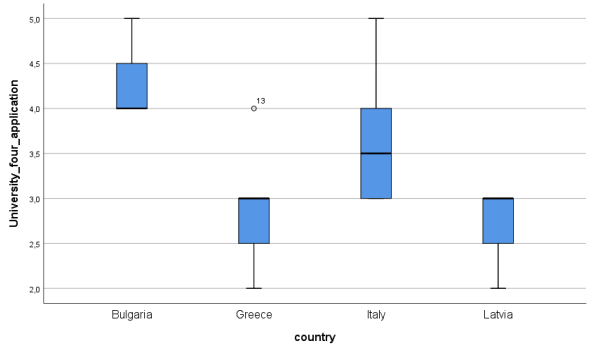
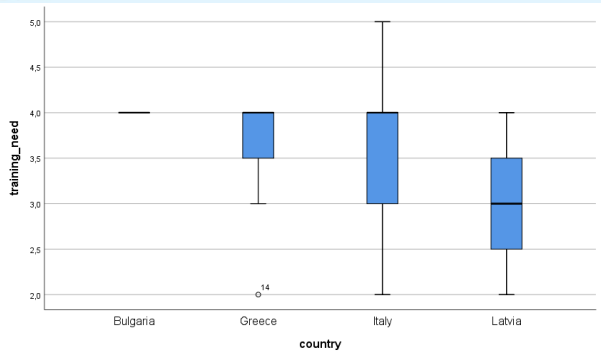
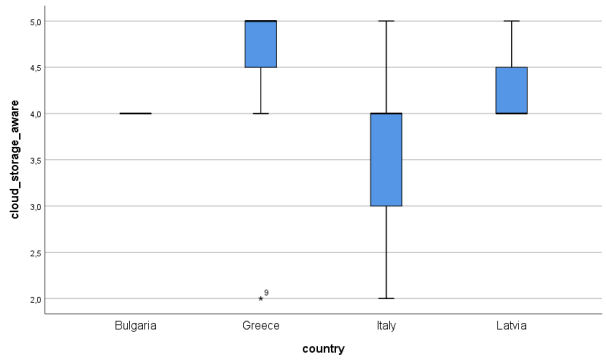
Q1.14. University 4.0 applications are applied at our University.



Q1.16. I need training for the use of digital equipment (software, hardware, interactive whiteboards, etc.).



Q1.17. I know how to use cloud for storage of data.



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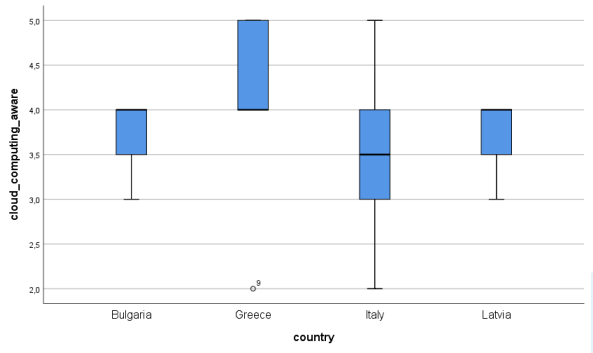
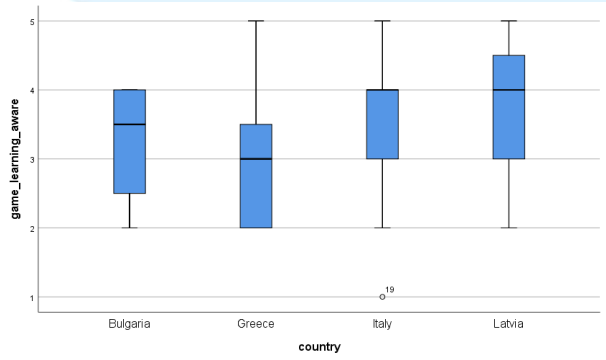
Q1.18. I am well aware of cloud computing.



Q1.19. I am aware of game-based learning.



Q1.20. I know what open-source content and practices are.

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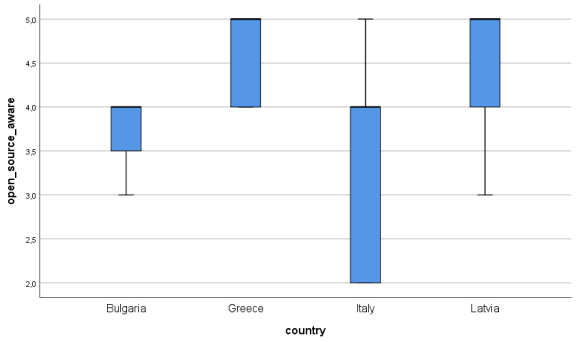
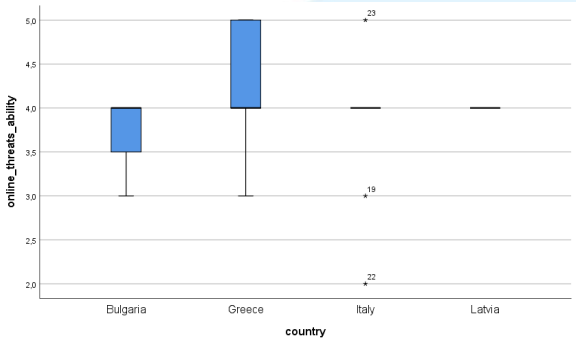
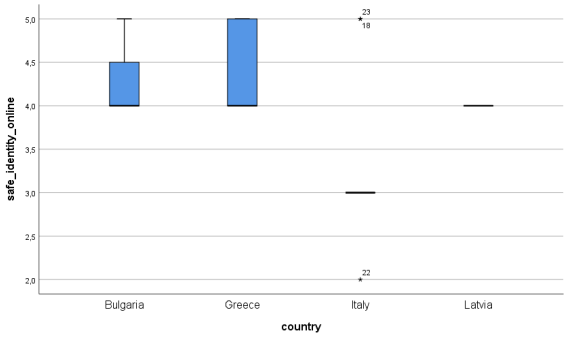


Q1.21. I can identify online threats.



Q1.22. I can build a safe identity online.



Q1.23. I am aware of the digital content reproduction legislation.

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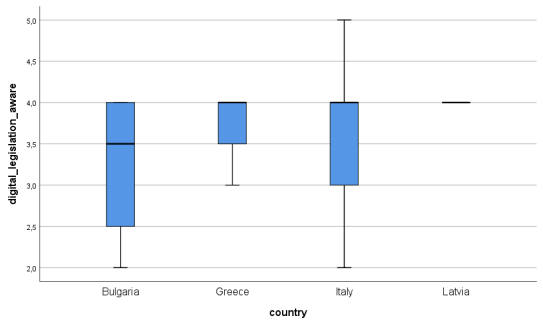
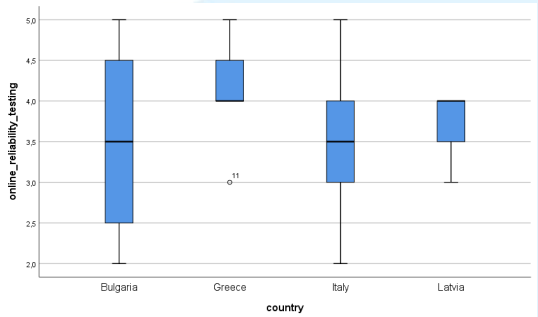
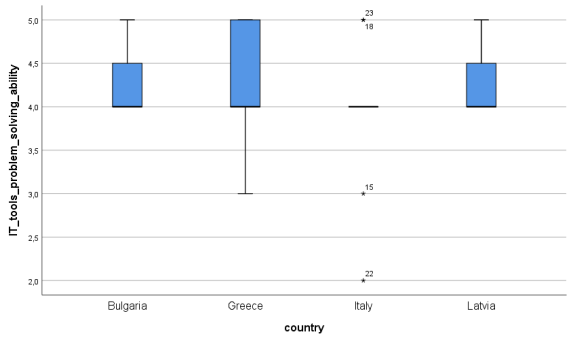


Q1.24. I can test the reliability of online content.



Q1.25. I can use appropriate technology (IT tools) to solve problems, e.g. technical, content-related, communication-related, etc.



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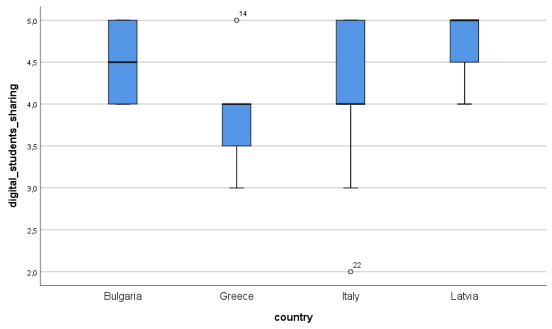
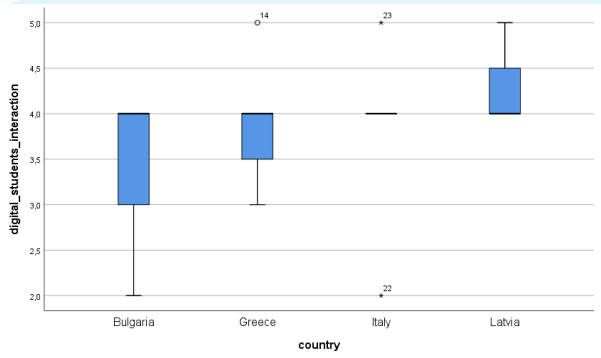
Q1.26. Digital education enhances effective sharing of materials betweenstudents.



Q1.27. Digital education enhances students' interaction.



IT infrastructure

Q2.1. Digital platforms are currentlyused for e-learning at my University.

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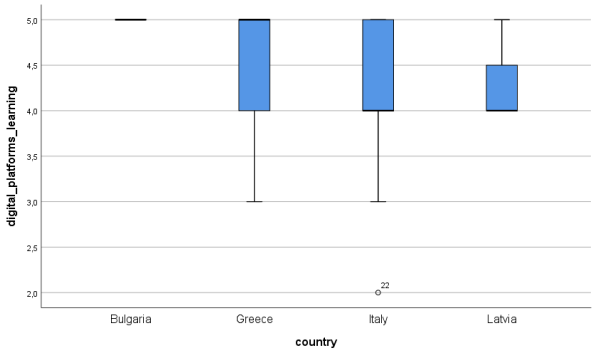
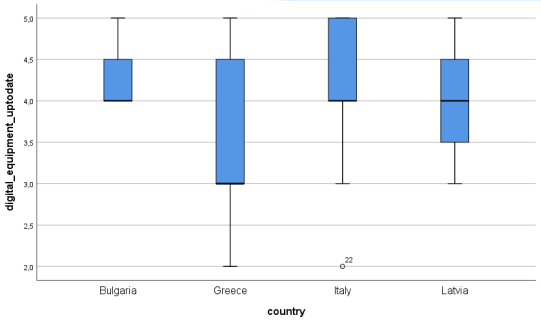
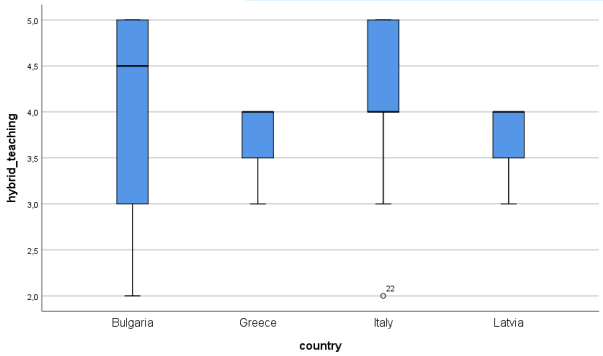


Q2.2. Digital equipment at my University is up-to-date.



Q2.3. Blended (hybrid) teaching is possible in our classrooms.



Q2.5. My University is digitally connected with other universities (HEI network)..

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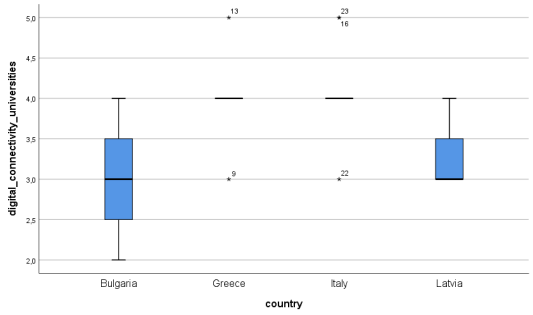
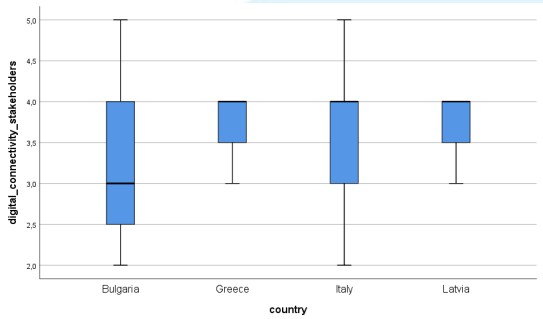
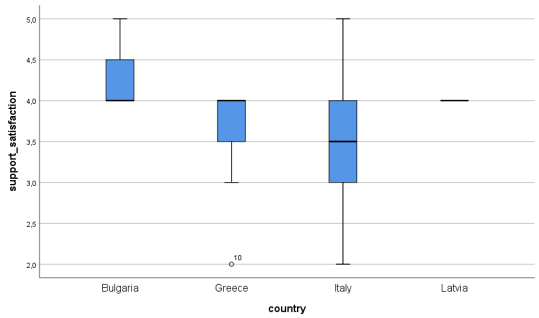


Q2.6. My University is digitally connected to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.



Q2.10. I am satisfied with the technical advice I get from the technical staff and / or the IT companies that support our digital - online and blended - learning/teaching activities.



Q2.11. The software applicationsused for onlinelearning meet the needs of both teachers and students.

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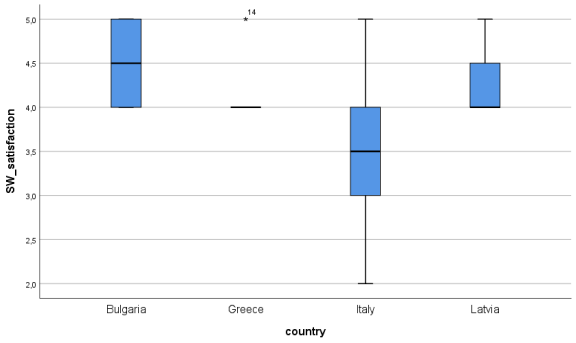

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Edu-Gate IS companies – Cross-country comparison of responses

Respondents' breakdown across countries

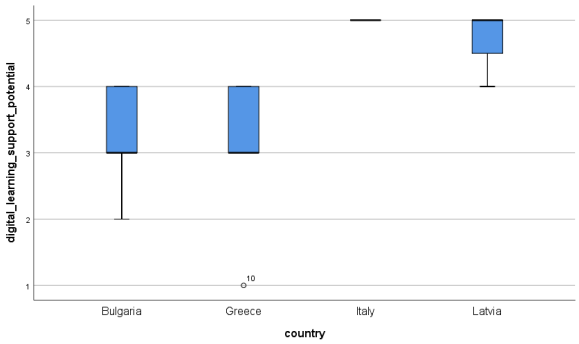
country	*N*
Bulgaria	5
Greece	5
Italy	2
Latvia	3

In general, Italian and Latvian Information Technologies' companies report higher levels of digital transformation competencies and expertise. Italian IT companies outperform all the others, in terms of Education 4.0 and University 4.0 preparedness and connectivity potential across different HEIs and of HEIs to their stakeholders. Greek respondents reported lower connectivity potential with other Universities and stakeholders than the other survey participants.

Detailed comparisons are displayed in the following graphs.

Digital maturity for HEI

Q1.1. My company can provide digital education /e-learning support to Universities.



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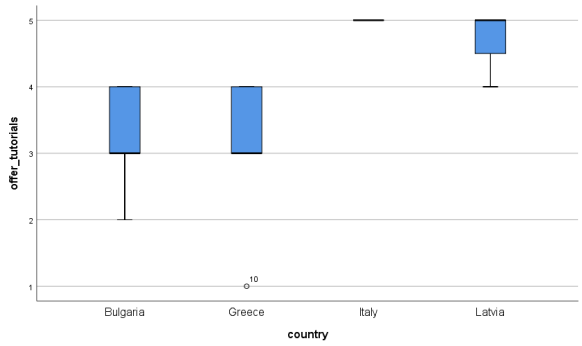
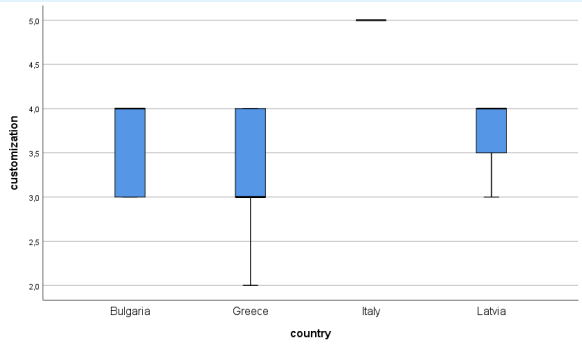
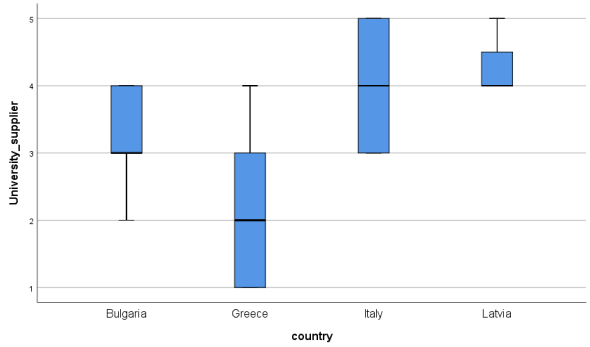
Q1.2. My company offers e-tutorials for the digital products and services provided.



Q1.4. Customized multimedia applications can be provided.



Q1.5. My company has provided digital applications to Universities.



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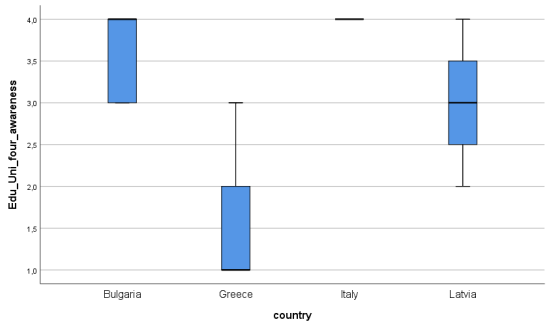
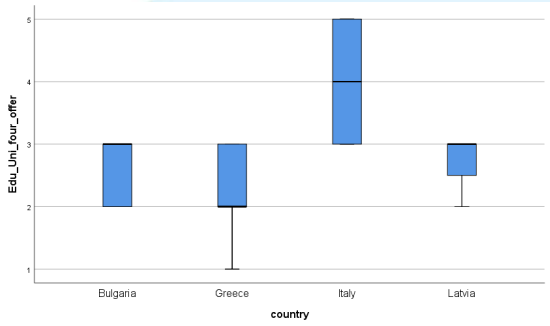
Q1.6. I am familiar with Education 4.0 and/or University 4.0 applications.

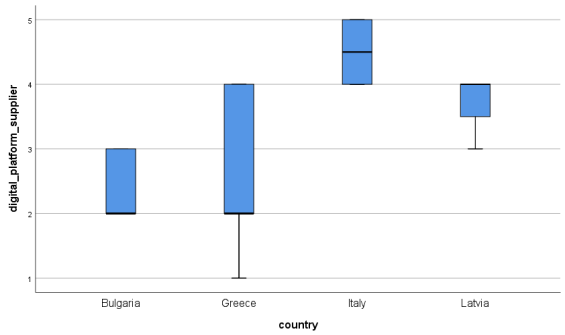


Q1.7. My company offers Education 4.0 and/or University 4.0 applications to Universities.



IT infrastructure potential for HEI

Q2.1. My company offers digital platforms to Universities.



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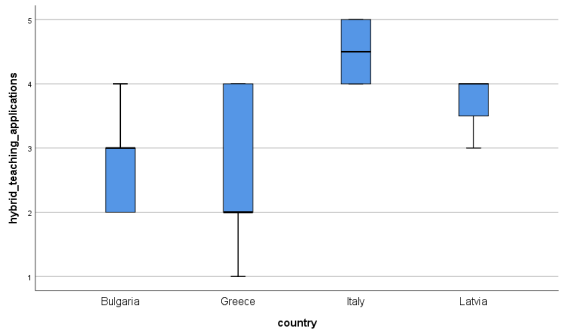
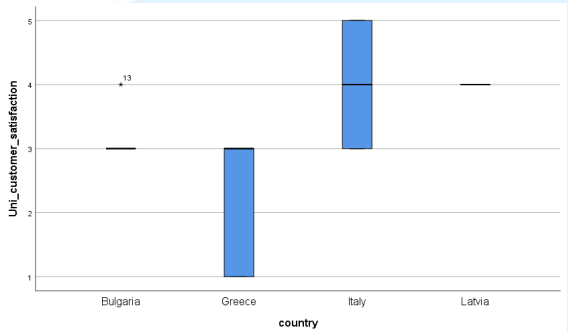
Q2.2. My company offers blended (hybrid) teaching applications to Universities.



Q2.4. My company can digitally connect Universities (create and/or support HEI networks).



Q2.5. My company can digitally connect Universities to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.

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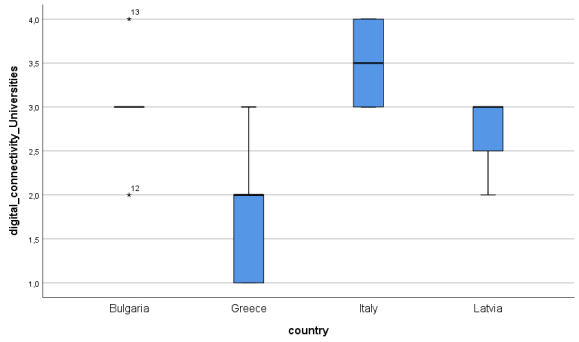
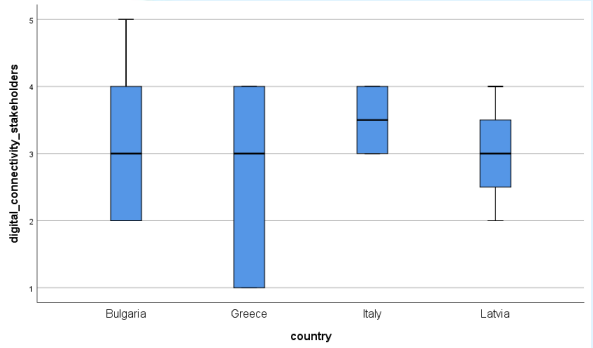
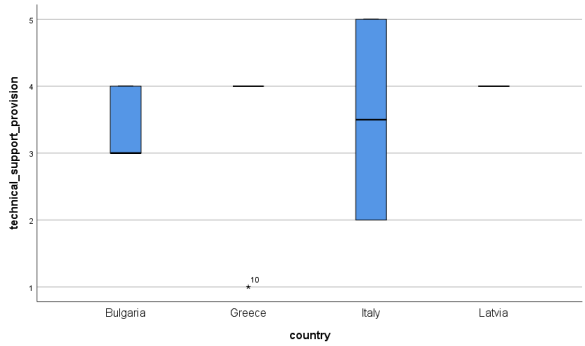


Q2.8. The Universities that belong to my company's customer list are satisfied with our products and services for digital education.



Q2.9. My company can provide all the technical assistance needed during e-learning, online and blended teaching activities.



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The participants were asked to elaborate on certain questions.

Q1.3. What kind of digital education applications/media are available upon request?

The respondents reported the following:

- presentations, online seminars
- moodle
- e-learning module development, H5Pmodules
- interactive video
- digital assessment
- collaborative learning
- documentation
- information and articles available on the website and social media profiles of the company
- educational platforms
- multimedia e-learning products
- on-line packages
- presentations concerning digital transformation on public sector

Q2.3. What resources are necessary to improve blended (mixed traditional and digital) education at Universities? Please kindly elaborate.

The respondents reported the following:

- Human resources
- Improvement of digital skills of faculty and students
- Kursove (a respondent from Bulgaria)

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- Time to adapt digital innovations in training process by comparing different teaching applications to achieve the best goals; Human resources with good knowledge of IT tools and willing to be flexible to change.
- Better connectivity and equipment
- more online and video tutorials, better access to e-libraries and learning materials offered by universities
- none
- better trained staff to be able to provide high-quality education based on digital resources, in other words better skills in digitalization
- e-learning platform and inside every kind of plug-in with more function, virtual classroom, exercises and more. With these elements will go a good e-learning project and it is possible to use it in a mixed classroom, that we called "hybrid classroom"
- Just change the teachers behaviour, as the hardware and the digital platforms that ca be used for the blended education are already available to Universities.
- persons with specific skills

Q2.6. What are the stakeholders that you consider important within a digital classroom community?

The respondents reported the following:

- Administration and NGO
- Students, Teachers, Business Community, Librarians
- university, professors, students, software developers/support representatives
- business, educational institutions, students themselves
- users or student
- teachers, students and helpers
- public and private stakeholders

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- All those who are interested in evolving spiritually and learning
- Don't know

Q2.7. What types of digital innovative learning are you currently offering to Universities?

The respondents reported the following:

- AI apps
- None
- H5P, interactive video
- Methodology for blended learning with use of technology tools
- Blended Learning in soft skills
- blended courses for internships - students communicate with their mentors and complete their tasks online and in the office
- currently some project-based work, specific platforms upon request but they cover certain courses
- elearning video teaching, gaming, sitcom video, simulation
- Virtual reality and AR
- dedicated Moodle website
- e-identity, cloud services, e-health, ...

Q2.9. What software applications are you currently offering for higher education blended/digital courses? Please specify.

The respondents reported the following:

- Moodle, MS Teams, zoom

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- For blended courses we use Viber, Skype, Zoom, email
- Moodle and BigBlueButton
- Moodle in conjunction with BigBlueButton
- collaborative platforms

Q2.10. What software applications/platforms are you currently offering for higher education online courses? Please specify.

The respondents reported the following:

- Moodle, MS Teams
- Moodle, MS forms
- Udemy (SW developer from Greece)
- Storyline and The Big Blue Bottom
- Moodle in conjunction with BigBlueButton
- collaborative platforms

Q2.12. What kind of technical support / multimedia tools do you suggest/offer for classrooms that apply digital innovative learning? Please elaborate.

The respondents reported the following:

- Zoom, teams,
- gamification and
- collaborative platforms.

One replied: “We offer the digital platform and the tutors to help the teachers during the lessons.”

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Q2.13. Do you have any asynchronous e-learning (self-learning) resources available for Universities? Please kindly specify.

The respondents reported the following:

- Resources on Google Classroom, Microsoft 365, Zoom
- Trainings in Moodle for specialist in dangerous equipment field
- Moodle
- Yes, we use to record the live sessions and to make them available for the whole year as a resource of the courses
- Some presentations

Would you have anything to add? Your inputs and comments will be highly appreciated.

The respondents reported the following:

- Even digital lessons should be made more interactive with the active participation of the participants. Interaction and active participation is what makes the difference in learning. It is either synchronous or asynchronous
- Many corporate or university are so older in this market, here in Italy

The questionnaires used for this survey are included in the Annex.

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4. Indicators

In this chapter there will be a description of the Assurance Framework, i.e. a plan on how digital education will be conducted. It will include indicators on how to assess the learning experience. The chapter will be based on the following blocks:

- Plan
- Implement
- Assess
- Review and Revise

Each partner suggested indicators and collected relevant data (or indicated the absence of data). The indicators could help future educators and teachers to better structure their courses and can also be used to assist policy makers of all levels on designing better policies.

Italy

Plan

Number of courses that include tests - Principally each training course encompasses a variety of activities/forms aiming the testing of the trainees and for this reason.

Platform/System used - Nearly 70% of Italian Higher Education institutions use open-source solutions as Moodle for their learning management systems. Other platforms that are used are: Blackboard, Zoom, Microsoft Teams, Classroom Google, Google Meet, Skype.

Implement

Official certification – The same as traditional HEI's.

Types of multimedia used – synchronous and asynchronous multimedia lessons, blended lessons, learning pills, educational clips, digital animations.

Assess

How many online courses are offered:

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In the beginning of 2021 only 11 Italian universities that are accredited for distance learning specialties and masters' programs:

1 – Università Telematica G. Marconi – 8 courses

2 – Università Telematica Mercatorum – 3 courses

3 – Università Telematica San Raffaele – 2 courses

4 – Università Telematica Uninettuno – 7 courses

5 – Università Telematica I.U.L. – 4 courses

6 – Università Telematica G. Fortunato – 2 courses

7 – Università Telematica Unitelma Sapienza – 4 courses

8 – Università Telematica Pegaso – 2 courses

9 – Università Telematica Niccolò Cusano – 2 courses

10 – Università Telematica eCampus – 6 courses

11 – Università Telematica L. Da Vinci – 2 courses

Number of enrolled students:

- Students enrolled in Distance learning programs 2020/2021 (Professional Bachelor, Bachelor and Master) – 334.823
- Total number of enrolled students in all programs in Italy (2020/2021) – 1.793.210

Review and Revise

Percentage synchronous (No data)

Level of satisfaction by the students (No data)

Latvia

Plan

1. Number of fully digitised courses that include final exams (held online) and provide ECTS with the completion (Latvia – No data available so far)

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2. Platform/System used (Latvia: Moodle in many HEI cases)
3. Number of accredited 100% distance learning programs (Latvia: 14Masters level & 19 Bachelor as identified by authors in IO1)
4. Share of HEI having e-learning platform/specifying the platform (Moodle most cases) - creation (Latvia: 68% based on the questionnaire during IO1)
5. Share of HEI having some kind of online materials/courses (Latvia:100% due to Covid situation)
6. Share of HEI having some internal quality regulations for digital course creation (Latvia: 68% based on the questionnaire during IO1)
7. Internet access available to households in Latvia (Latvia: 89% households (Central Statistical Bureau, 2020)

Implement

1. Official certification (Latvia - No data)
2. Types of multimedia used (Latvia: texts (digitalised/scanned textbooks, lecture notes), videos (recorded lectures), images (e.g. ppt slides with texts and illustrations)
3. Funds dedicated to education digitalisation - (Latvia: most information available about primary/secondary education only)

Assess

1. How many fully digitised, online courses are offered (Latvia: each university provides some online courses, especially during the Covid-19 lockdown periods. No specific number about them, since no separate accreditation).
2. Number of enrolled students (Latvia: no data about the number of students explicitly enrolled to 100% distance learning programs; due to Covid-19, all students have at least some exposure to digital courses)
3. Number of students that finished the course (Latvia - No data)

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4. Competences lacking in the labour market - (Latvia: to be researched, but digital skills are one of the top)

Review and Revise

1. Percentage synchronous (Latvia - no data)
2. Level of satisfaction by the students (Latvia: no data on satisfaction with distance learning. As regarding the remote learning during the first lockdown due to Covid-19 pandemic (March 2020) – only 9% of students did not face any kind of problems (Latvijas Studentu apvienība, 2020).
3. Information on competencies needed to be increased among academic personal/lecturers of HEI (Latvia: overall digital literacy; video recording techniques and tools; Moodle functionality - from questionnaire during IO1)
4. availability of learning resources for teachers (Latvia: Webinars and seminars provided by HEI and various resources on the market, no centralised trainings or information about such)
5. how advanced are formats/multimedia options most commonly used for digital courses (here may split into e.g. 3 stages (Latvia is on stage b):

a) basic - digitisation: switch from analogue to digital- scanned textbooks, video lectures, attached .doc and other files;

b) medium - digitalisation: online lectures (especially online seminars with interaction in chat rooms, shared documents), online tests

c) advanced - digital transformation: using all benefits of digital - VR, interactive courses, adaptive learning, AI lecturers etc.

Bulgaria

Plan

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Number of courses that include tests - Principally each training course encompasses a variety of activities/forms aiming the testing of the trainees and by this reason, more clear definition of this indicator should be provided

Platform/System used - Nearly 100% of Bulgarian Higher Education institutions use open-source solutions, more concretely Moodle, for their Learning management systems. Other platforms that are used are: Zoom, Microsoft Teams, Classroom Google, Meet Google, BigBlueButton, Skype, Blackboard, E-learning.

Implement

Official certification -Regarding the online courses' certification: The certification (issuing of a document) is a process conducted at University level according to prescribed procedures and rules. The instructors are not allowed to issue certificates. All University courses as a part of the University curricula are awarded with ECTS. For a successfully passed online course the University can issue certificate where its equivalent in ECTS is also documented. The recognition of these certificates, though, is up to the organization they are presented to (employer organization or other HEI).

Types of multimedia used – multimedia lessons, short educational video clips

Assess

How many online courses are offered:

In the beginning of 2021 several Bulgarian universities had accredited status for distance learning specialties and masters' programs:

- Burgas Free University - 4 distance specialties / master's programs,
- Varna Free University "Chernorizets Hrabar - 14 distance specialties / master programs,
- University of Veliko Tarnovo "St. St. Cyril and Methodius" - 29 distance specialties / master's programs,
- Higher School of Agribusiness and Regional Development Veliko Tarnovo - 6 distance specialties / master's programs,

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- Higher School of Insurance and Finance - 12 distance specialties / master programs,
- Varna University of Economics - 10 distance specialties / master's programs,
- College of Business Administration - 15 distance specialties / master's programs,
- Medical University – Pleven - 1 master's program,
- International Business School - 12 distance specialties / master programs,
- National Sports Academy - Vasil Levski (with 3 master's programs),
- New Bulgarian University - 22 distance specialties / master's programs,
- Angel Kanchev University of Ruse - 7 distance specialties / master's programs,
- Sofia University "St. Kliment Ohridski" - 10 distance specialties / master's programs,
- "D. A. Tsenov" Academy of Economics Svishtov - 1 master program,
- University of National and World Economy - 11 distance specialties / master programs
- University of Library Studies and Information Technologies - 4 distance specialties / master's programs.

(Data retrieved from: Zahariev, A. et al. (2021) Evolution in the regulatory framework for distance learning in a pandemic environment- the experience of Bulgaria.)

Number of enrolled students:

- Students enrolled in Distance learning programs 2020/2021 (Professional Bachelor, Bachelor and Master) – 9488
- Total number of enrolled students in all programs in Bulgaria (2020/2021) – 72035

Number of students that finished the course (No data)

Review and Revise

Percentage synchronous (No data)

Level of satisfaction by the students (No data)

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Greece

Plan

1. Number of fully digitized courses that include final exams (held online) and provide ECTS with the completion (No data available so far)

2. Platform/System used (eclass)

Implement

3. Official certification (No data available so far)

4. Types of multimedia used (majority videos)

Assess

5. How many fully digitized, online courses are offered (Check figure 2)

6. Number of enrolled students (No data available so far)

7. Number of students that finished the course (No data available so far)

Review and Revise

Percentage synchronous (~ 30% of offered courses offer some type of synchronous lectures)

Level of satisfaction by the students (No data available so far)

Table 2 below summarizes the results for the partner countries

Table 2 Indicators for all countries

Indicator	Italy	Latvia	Bulgaria	Greece
Number of courses that include tests	Principally each training course encompasses a variety of activities/forms aiming the testing of the	No data	Principally each training course encompasses a variety of activities/forms aiming the testing of the	No data

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	trainees and for this reason.		trainees and by this reason, more clear definition of this indicator should be provided	
Platform/System used -	Moodle, Blackboard, Zoom, Microsoft Teams, Classroom Google, Google Meet, Skype	Moodle	Nearly 100% of Bulgarian Higher Education institutions use open-source solutions, more concretely Moodle, for their Learning management systems. Other platforms that are used are: Zoom, Microsoft Teams, Classroom Google, Meet Google, BigBlueButton, Skype,	Eclass, Moodle

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			Blackboard, E-learning.	
Number of accredited 100% distance learning programs		14Masters level & 19 Bachelor		
Share of HEI having e-learning platform/specifying the platform		Moodle		
Share of HEI having some internal quality regulations for digital course creation		68%		
Internet access available to households		89%		
Share of HEI having some kind of online materials/courses		100% (due to COVID 19)		
Official certification	The same as traditional HEI's	No data	Regarding the online courses' certification: The certification	No data

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			(issuing of a document) is a process conducted at University level according to prescribed procedures and rules. The instructors are not allowed to issue certificates. All University courses as a part of the University curricula are awarded with ECTS. For a successfully passed online course the University can issue certificate where its equivalent in ECTS is also documented.	

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			The recognition of these certificates, though, is up to the organization they are presented to (employer organization or other HEI).	
Types of multimedia used – synchronous and asynchronous	multimedia lessons, blended lessons, learning pills, educational clips, digital animations.	digitalised/scanned textbooks, lecture notes), videos (recorded lectures), images (e.g. ppt slides with texts and illustrations)	multimedia lessons, short educational video clips	Videos, game-based content
Funds dedicated to education digitalisation		most information available about primary/secondary education only		
How many online courses are offered	42	each university provides some online courses,	161	Programs: no data,

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		especially during the Covid-19 lockdown periods. No specific number about them, since no separate accreditation		Individual courses: 4144
Number of enrolled students	334.823	no data about the number of students explicitly enrolled to 100% distance learning programs; due to Covid-19, all students have at least some exposure to digital courses	9488	No data
Number of students that finished the course		No data		No data
Competences lacking in the labour market		to be researched, but digital skills are one of the top		
Percentage synchronous	No data	no data	No data	~30%
Level of satisfaction by the students	No data	no data on satisfaction with	No data	No data

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		distance learning. As regarding the remote learning during the first lockdown due to Covid-19 pandemic (March 2020) – only 9% of students did not face any kind of problems (Latvijas Studentu apvienība, 2020)		
Information on competencies needed to be increased among academic personal/lecturers of HEI		overall digital literacy; video recording techniques and tools; Moodle functionality		
availability of learning resources for teachers		Webinars and seminars provided by HEI and various resources on the market, no centralised trainings or information about such		

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how advanced are formats/multimedia options most commonly used for digital courses		medium - digitalisation: online lectures (especially online seminars with interaction in chat rooms, shared documents), online tests		

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5. Online Course development methodologies and quality criteria

Developing a qualitative online course demands to follow a well-grounded methodology and quality criteria. Some previous efforts undertaken by Nordic and Baltic countries can help one make a choice. The work of Joshi (2021) presents principles for the holistic design of qualitative online degree programmes in higher education. The author understands an online degree programme as a programme completed online with the help of interactive elements, synchronous online meetings and guided study, as well as provision of student online access to all services and support provided by the education organisation. The offered model consists of three layers (organisational, pedagogical and online degree programme) displayed in Figure 4 that together allow integrating the organisation's digital needs to the needs of the pedagogical strategy (Joshi, 2021).

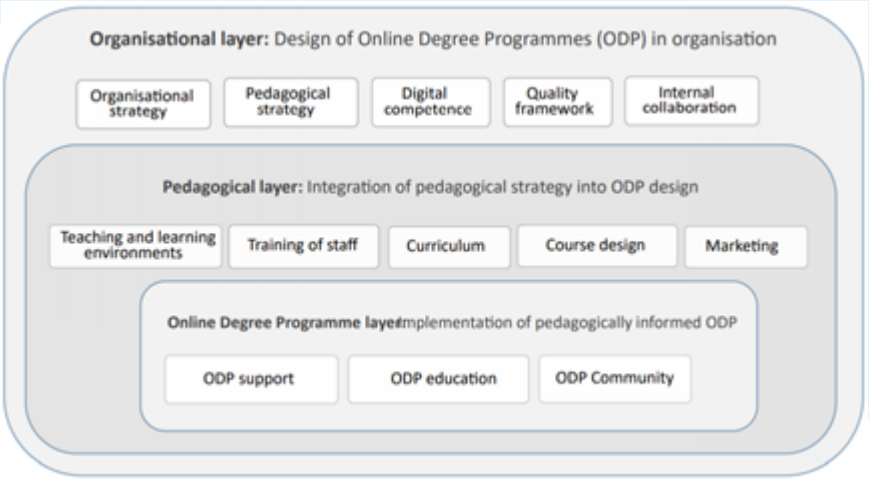

Figure 4 Three layers of the holistic design of online degree programmes (ODP) in higher education (adopted from (Joshi, 2021))

The resulting holistic design principles are summarised as follows (Joshi, 2021):

1. Organisational layer: Choosing the organisation-wide strategic and pedagogical approaches of the ODPs in a digitally competent context:
    - choose strategic starting points for the ODPs, including pedagogical, digital and design strategy;

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- check digital competence of the organisation for the provision of strategic approaches in ODPs;
- assess quality to ensure application of strategic approaches in ODPs;
- collaborate for organisation-wide consistency in the application of strategic approaches in ODPs;

2. Pedagogical layer: Ensuring awareness and implementation of the pedagogical strategy in the structure and operations of the ODP in a digitally competent context
   - create online and on-site environments that support the implementation of the pedagogical strategy in a digitally competent organisation;
   - train staff to apply pedagogical strategy and utilise elements of DigCompOrg in implementing ODP education;
   - make elements of pedagogical strategy and digital competence visible in the curriculum design;
   - create design templates for the online learning environments that enable and enhance the implementation of pedagogical strategy in implementing ODP education;
   - market pedagogical strategy as a differentiator for ODPs in a digitally competent organisation;
3. Online degree programme layer: Implementing online degree education to create a quality learning experience as intended in terms of pedagogical, technical and organisational strategy:
   - provide continuous pedagogical, technological and organisational support for the staff and students in the ODPs;
   - provide ODP education that is consistent with strategic approaches and meets the quality criteria;

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- support the staff and students' well-being in belonging to an ODP community as part of the educational organisation.

In turn, Latvian researchers (Skvorcovs and Graurs, 2018) postulate that the distance learning system should include four main components represented in Figure 5. In addition, the authors of the work suggest the following principles of distance learning at the level of each course:

1. Separate the technical, factual, mechanistic components and deliver them online via new-style instructions and assessment tools.
2. Maintain the consistent quality and measurement of the attainment.
3. Focus on face-to-face sessions exclusively on experiential learning: project work, games, simulations, debates, and others:
   a. make contact hours more engaging and memorable, more satisfying for both students and academic staff;
   b. autonomous, self-directed learning;
   c. faculty as a coach;
4. Free up to 30%-50% of programme faculty hours:
   a. reinvest in more experimental learning;
   b. add more students (class sections);
   c. direct to faculty research;
5. Adjust to Full-Time, Part-Time, Modular, or Distance formats.

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Figure 5 The main components of the distance learning system (adopted from (Skvorcovs and Graurs, 2018))

FITech (the Finnish Institute of Technology) initiative offers a joint platform created by all technical faculties in Finnish universities to support the digital transition in Finland that offers university courses from all technical universities in Finland - free of charge - for both degree students and lifelong learners (Smidt, 2020). In addition, the initiative has created valuable open-access materials in English for the development of online courses, among them (FITech, n.d.):

- The Design Book for Online Learning that describes practical tools (content, structure, activities, and others) for designing high-quality online learning;
- The Learning Design Toolkit that contains tools mentioned in the Design Book for Online Learning;
- Periodic Table of Online Activities that maps online learning activities based on desired learning outcomes.

FITech's online learning design process is represented in Figure 5.

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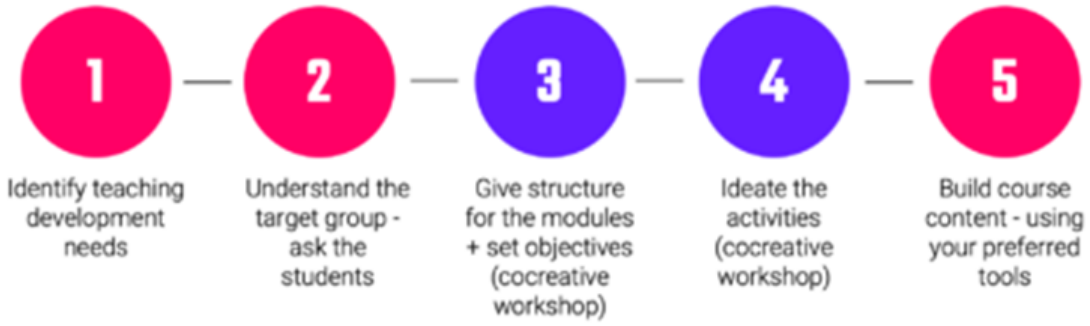

Figure 6 FITech's online learning design process (adopted from (FITech, n.d.))

According to FITech's learning designer Huhtanen (2020), six steps can help tomove teaching online:

1. Format: Choose the method. The possible guidelines are summarised in Table 3. So, depending on the number of course participants and their scope, it is necessary to decide the format (synchronous, asynchronous, or semi-asynchronous) of teaching and what it will include.

Table 3 Selecting the format of online teaching (adopted from (Huhtanen,2020))

	Degree / full-time students	Adult learners
Small group up to 20	Synchronous video-based: masterclass over video	Synchronous video-based: webinar, video meeting
Large group 20-100	Semi-asynchronous assignment-based: Group work, essays, online exams	Semi-asynchronous video-based: Assignments + video discussions to help (flipped learning)
Massive group 100+ (demands more teaching staff)	Semi-asynchronous autograded assignment-based: Quizzes, self-assesment, coding, math	Fully asynchronous autograded assignment-based: Quizzes, self-assesment, coding, math

2. Setup: The technical platform. It includes picking up the technical platform to implement teaching (Table 4).

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Table 4 Selecting technical solutions (created based on Huhtanen,2020))

Aspect	Tools
Assignment-based teaching	Moodle or other LMS, Blog platforms such as WordPress
Steamed video-based teaching	Zoom, Adobe Connect, Video conferencing tools (Skype for Business, Microsoft Teams, Slack, Google Meet, and others), Online whiteboards and activation tools (Flinga, Mentimeter, Miro, and others)
Video recording and publishing	Panopto or Echo 360, Youtube or Vimeo

3. Organise: A clear structure. It assumes deciding the structure of the course. On the very minimum level, an online course should be structured in four sections:

- Beginning and activation of prior knowledge: The course opens with a run-through of learning objectives, structure, assessment and tools used during the course.
- Basic knowledge: These modules cover the course's "must know" content. Each module comprises content and an active participation component.
- Deepening interaction: These modules task the learners with actively working on the topic in the form of projects, group work, writing exercises or other activities. These interactive components can be incorporated into the basic knowledge modules.
- Summing up and assessment: Summing up the topics covered by the course, e.g. through an online seminar. Assessment can occur either at the end of the course (summative) or throughout the course using smaller exercises (formative).

4. Activate: People learn by processing. It is based on selecting course activities, interactions and assignments.

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5. Crystallise: Be concise to maintain attention. In any type of content used in the course, it is necessary to identify core content and weed out unnecessary information.
6. Interact. It assumes finding ways of ensuring interaction among students and between students and the teacher.

In Estonia, the E-Learning Quality Task Force have worked out the methodology of evaluating the quality of e-courses, preparing a number of handbooks and propagating best practices nationally (Varendi et al., 2018). They also produced a manual for teachers that focuses on creating an e-learning course with good quality, irrespective of whether it is a new course or the improvement of the existing one.

Kazaine (2017) summarised e-learning material quality criteria mentioned in the literature and based on her personal experience. They are grouped into four sections:

- Formal quality segmenting and text structuring, grammatical and spelling errors, language, topicality, literature sources, copyright compliance, review of version
- Didactic: course objectives, course assessments, target group, media choice, course metadata, compliance with the curriculum
- Media: corporate design, content layout, graphics and fonts, multimedia, design of text and graphics, external content resources, search, material load time
- Usability: navigation, functionality, perception, accessibility, alternative provision, learning tasks and feedback

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ANNEX – Survey Questionnaires

A1. Students' questionnaire

Part One: Demographics

1. What is your age group?	
a. 18-24	
b. 25-34	
c. 35-44	
d. 45-54	
e. 55-65	
f. over 65	

2. What is your gender?	
a. male	
b. female	
c. I would rather not specify.	

3. **What is your highest degree or education level?**	
a. High school	
b. Bachelor's degree	
c. Master's degree	

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d. Doctorate degree	
e. other (please specify)	

4. **Please select the country where you are currently working in.**

5. What is your current role at the University?	
a. Undergraduate student	
b. Postgraduate student	

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Identification of digital learning needs

	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.	Terms like "digital natives", "digital nomads", and "digital literacy" are well-known to me.					
2.	Digital education is developed at my University.					
3.	The University library is digitalized.					
4.	Cyber security measures are adequate at my University.					
5.	My Department and University Library offer e-tutorials for their digital services.					
6.	I am aware of the Industry 4.0 applications.					
7.	Industry 4.0 fits well within the scope of my Department's curriculum.					
8.	I am aware of the Quality 4.0 applications.					
9.	Quality 4.0 fits well within the scope of my Department's curriculum.					
10.	Could you please mention the Industry 4.0 and/or Quality 4.0 applications currently used at your University, if any?					
11.	I am aware of the Education 4.0 applications					
12.	I am aware of the University 4.0 applications					

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	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
13.	Education 4.0 applications are applied at our University					
14.	University 4.0 applications are applied at our University					
15.	Could you please mention the Education 4.0 and/or University 4.0 applications at your University, if any?					
16.	I need training for the use of digital equipment (software, hardware, interactive whiteboards, etc.).					
17.	I know how to use cloud for storage of data.					
18.	I am well aware of cloud computing.					
19.	I am aware of game-based learning.					
20.	I know what open-source content and practices are.					
21.	I can identify online threats.					
22.	I can build a safe identity online.					
23.	I am aware of the digital content reproduction legislation.					
24.	I can test the reliability of online content.					

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	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
25.	I can use appropriate technology (IT tools) to solve problems, e.g. technical, content-related, communication-related, etc.					
26.	Digital education enhances effective sharing of materials with classmates.					
27.	Digital education enhances my interaction with other students.					
28.	I can easily feel engaged in online class.					

IT technologies & Multimedia innovations

Please respond to the following questions in relation to your University.

	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.	Digital platforms are currently used for e-learning at my University.					
2.	Digital equipment at my University is up-to-date.					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
3.	Blended (hybrid) teaching is possible in the classrooms.					
4.	What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.					
5.	My University is digitally connected with other universities (HEI network).					
6.	My University is digitally connected to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.					
7.	What are the stakeholders that you consider important within a digital classroom community?					
8.	What types of digital innovative learning are you currently using?					
9.	I am satisfied with the software I am using for digital learning.					
10.	What software applications are you currently using in the blended/digital courses? Please specify.					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
11.	I am satisfied with the software I am using for online learning.					
12.	What software applications/platforms are you currently using in the online courses? Please specify.					
13.	I am satisfied with the technical assistance during e-learning, online and blended learning activities.					
14.	What kind of technical support / multimedia tools to you consider necessary in the classroom for digital innovative learning? Please elaborate.					
15.	Do you have any asynchronous e-learning (self-learning) resources available at your University? Please specify.					
16.	Based on your experience with Covid-19, what kind of psychological and social resources are necessary to ensure mental and psychological well-being of teachers and students in the event of a future emergency? Please elaborate.					

Would you have anything to add? Your inputs and comments will be highly appreciated.

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If you are interested in the results of this research, you can leave your email here:

A2. Teachers' questionnaire

Part One: Demographics

1. What is your age group?	
a. 18-24	
b. 25-34	
c. 35-44	
d. 45-54	
e. 55-65	
f. over 65	

2. What is your gender?	
a. male	
b. female	
c. I would rather not specify.	

3. **What is your highest degree or education level?**	
a. High school	
b. Bachelor's degree	
c. Master's degree	
d. Doctorate degree	

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e. other (please specify)	

4. **Please select the country where you are currently working in.**

5. What is your current role at the University?	
Teacher/instructor	
Other (please specify)	

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Identification of digital learning needs

	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.	Terms like "digital natives", "digital nomads", and "digital literacy" are well-known to me.					
2.	Digital education is developed at my University.					
3.	The University library is digitalized.					
4.	Cyber security measures are adequate.					
5.	My Department and University Library offer e-tutorials for their digital services.					
6.	I am aware of the Industry 4.0 applications.					
7.	I am aware of the Quality 4.0 applications.					
8.	Industry 4.0 fits well within the scope of my Department's curriculum.					
9.	Quality 4.0 fits well within the scope of my Department's curriculum.					
10.	Could you please mention the Industry 4.0 and Quality 4.0 applications at your University, if any?					
11.	I am aware of the Education 4.0 applications					
12.	I am aware of the University 4.0 applications					
13.	Education 4.0 methodologies are applied at our University					

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	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
14.	University 4.0 methodologies are applied at our University					
15.	Could you please mention the Education 4.0 and University 4.0 applications at your University, if any?					
16.	I need training for the use of digital equipment (software, hardware, interactive whiteboards, etc.).					
17.	I know how to use cloud for storage of data.					
18.	I am aware of cloud computing.					
19.	I am aware of the game-based learning.					
20.	I know what open-source content and practices are.					
21.	I can identify online threats.					
22.	I can build a safe identity online.					
23.	I am aware of the digital content reproduction legislation.					
24.	I can test the reliability of online content.					
25.	I can use appropriate technology (IT tools) to solve problems, e.g. technical, content-related, communication-related, etc.					

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IT technologies & Multimedia innovations

Please respond to the following questions in relation to your University.

	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
17.	Digital platforms are currently used for e-learning at my University.					
18.	Digital equipment at my University is up-to-date.					
19.	Blended (hybrid) teaching is possible in the classrooms.					
20.	What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.					
21.	My University is digitally connected with other universities (HEI network).					
22.	My University is digitally connected to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
23.	What are the stakeholders that you consider important within a digital classroom community?					
24.	What types of digital innovative learning are you currently using? Please specify.					
25.	I am satisfied with the software I am currently using for digital teaching.					
26.	What software applications are you currently using for your blended/digital courses? Please specify.					
27.	I am satisfied with the software I am currently using for online teaching.					
28.	What software applications/platforms are you currently using for your online courses? Please specify.					
29.	I am satisfied with the technical assistance during e-learning, online and blended teaching activities.					
30.	What kind of technical support / multimedia tools do you need in the classroom to apply digital innovative learning? Please elaborate.					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
31.	Do you have any asynchronous e-learning (self-learning) resources available at your University? Please specify.					
32.	Based on your experience with Covid-19, what kind of psychological and social resources do you need to ensure mental and psychological well-being of colleagues and students in the event of a future emergency? Please elaborate.					

Would you have anything to add? Your inputs and comments will be highly appreciated.

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A3. Staff questionnaire

Part One: Demographics

1. What is your age group?	
a. 18-24	
b. 25-34	
c. 35-44	
d. 45-54	
e. 55-65	
f. over 65	

2. What is your gender?	
a. male	
b. female	
c. I would rather not specify.	

3. **What is your highest degree or education level?**	
a. High school	
b. Bachelor's degree	
c. Master's degree	
d. Doctorate degree	
e. other (please specify)	

4. **Please select the country where you are currently working in.**

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5. What is your current role at the University?	
a. administration employee	
b. technical staff (IT, telecommunications etc.)	
c. other (please specify)	

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Identification of digital learning needs

	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
29.	Terms like "digital natives", "digital nomads", and "digital literacy" are well-known to me.					
30.	Digital education is developed at my University.					
31.	The University library is digitalized.					
32.	Cyber security measures are adequate at my University.					
33.	My Department and University Library offer e-tutorials for their digital services.					
34.	I am aware of the Industry 4.0 applications.					
35.	Industry 4.0 fits well within the scope of my Department's curriculum.					
36.	I am aware of the Quality 4.0 applications.					
37.	Quality 4.0 fits well within the scope of my Department's curriculum.					
38.	Could you please mention the Industry 4.0 and/or Quality 4.0 applications currently used at your University, if any?					
39.	I am aware of the Education 4.0 applications					
40.	I am aware of the University 4.0 applications					

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	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
41.	Education 4.0 applications are applied at our University					
42.	University 4.0 applications are applied at our University					
43.	Could you please mention the Education 4.0 and University 4.0 applications that are used at your University, if any?					
44.	I need training for the use of digital equipment (software, hardware, interactive whiteboards, etc.).					
45.	I know how to use cloud for storage of data.					
46.	I am well aware of cloud computing.					
47.	I am aware of game-based learning.					
48.	I know what open-source content and practices are.					
49.	I can identify online threats.					
50.	I can build a safe identity online.					
51.	I am aware of the digital content reproduction legislation.					
52.	I can test the reliability of online content.					

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	Question					
	Digital maturity	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
53.	I can use appropriate technology (IT tools) to solve problems, e.g. technical, content-related, communication-related, etc.					
54.	Digital education enhances effective sharing of materials between students.					
55.	Digital education enhances students' interaction.					

IT technologies & Multimedia innovations

Please respond to the following questions in relation to your University.

	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
33.	Digital platforms are currently used for e-learning at my University.					
34.	Digital equipment at my University is up-to-date.					
35.	Blended (hybrid) teaching is possible in our classrooms.					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
36.	What additional resources are necessary to improve blended (mixed traditional and digital) education at your University? Please kindly elaborate.					
37.	My University is digitally connected with other universities (HEI network).					
38.	My University is digitally connected to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.					
39.	What are the stakeholders that you consider important within a digital classroom community?					
40.	What types of digital innovative learning (software programs or specific learning approaches/ techniques) are currently used in your university/department courses?					
41.	What software applications are currently used in your University's blended/digital courses? Please specify.					
42.	I am satisfied with the technical advice I get from the technical staff and / or the IT					

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	Question					
	IT infrastructure	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	companies that support our digital - online and blended - learning/teaching activities.					
43.	The software applications used for online learning meet the needs of both teachers and students.					
44.	What software applications/platforms are you currently using in your work? Please specify.					
45.	What kind of technical support / multimedia tools do you consider necessary to apply in digital innovative learning in the classroom? Please elaborate.					
46.	Do you have any asynchronous e-learning (self-learning) resources available at your University? Please specify.					
47.	Based on your experience with Covid-19, what kind of psychological and social resources are necessary to ensure mental and psychological well-being of teachers, students and staff in the event of a future emergency? Please elaborate.					

Would you have anything to add? Your inputs and comments will be highly appreciated.

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A4. IT companies' questionnaire

Part One: Demographics

1. What is your age group?	
a. 18-24	
b. 25-34	
c. 35-44	
d. 45-54	
e. 55-65	
f. over 65	

2. What is your gender?	
a. male	
b. female	
c. I would rather not specify.	

3. **What is your highest degree or education level?**	
a. High school	
b. Bachelor's degree	
c. Master's degree	
d. Doctorate degree	
e. other (please specify)	

4. **Please select the country where you are currently working in.**

5. What is your current role at the company?	
Project manager	
General manager	

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Assistant manager	
Multimedia developer	
Software developer	
Other. Please specify	

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Digital transformation learning needs

	Question					
	Digital maturity for HEI	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.	My company can provide digital education /e-learning support to Universities.					
2.	My company offers e-tutorials for the digital products and services provided.					
3.	What kind of digital education applications/media are available upon request?					
4.	Customized multimedia applications can be provided.					
5.	My company has provided digital applications to Universities.					
6.	I am familiar with Education 4.0 and/or University 4.0 applications.					
7.	My company offers Education 4.0 and/or University 4.0 applications to Universities.					

IT technologies & Multimedia innovations

Please reply to the following questions in relation to the Universities that are or could be your customers.

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	Question					
	IT infrastructure potential for HEI	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
48.	My company offers digital platforms to Universities.					
49.	My company offers blended (hybrid) teaching applications to Universities.					
50.	What resources are necessary to improve blended (mixed traditional and digital) education at Universities? Please kindly elaborate.					
51.	My company can digitally connect Universities (create and/or support HEI networks).					
52.	My company can digitally connect Universities to other organizations and institutions/entities, e.g. municipalities, ministries, charters or other public or private bodies.					
53.	What are the stakeholders that you consider important within a digital classroom community?					
54.	What types of digital innovative learning are you currently offering to Universities?					
55.	The Universities that belong to my company's customer list are satisfied with our products and services for digital education.					

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	Question					
	IT infrastructure potential for HEI	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
56.	What software applications are you currently offering for higher education blended/digital courses? Please specify.					
57.	What software applications/platforms are you currently offering for higher education online courses? Please specify.					
58.	My company can provide all the technical assistance needed during e-learning, online and blended teaching activities.					
59.	What kind of technical support / multimedia tools do you suggest/offer for classrooms that apply digital innovative learning? Please elaborate.					
60.	Do you have any asynchronous e-learning (self-learning) resources available for Universities? Please kindly specify.					

Would you have anything to add? Your inputs and comments will be highly appreciated.

If you are interested in the results of this research, you can leave your email here:

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