An analysis of best practices to enhance higher education teaching staff digital and multimedia skills

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Abstract.

BACKGROUND: The COVID-19 pandemic has transformed the teaching ways in universities, rapidly moving from face-to-face delivery models to online and distance learning. Consequently, the multimedia and digital competencies of the teaching staff were suddenly put onto the stage, resulting in the realisation that many of them were not sufficiently skilled to face this challenge due to a lack of prior training.

OBJECTIVE: The goal of this explanatory research is to present and make a comparison of key training programs, deemed best practices, that address different ways to assist higher education teaching staff to acquire the multimedia competencies required to be technologically- proficient in their classes.

METHODS: A desk research provides the data for a multiple case study of courses implemented in universities of five European countries, namely Spain, Lithuania, North Macedonia, Romania, and Slovenia.

RESULTS: The results of the study show a total of 28 courses ranging from how to deliver online teaching to gamification, going through other topics such as photo and video editing, that enable higher education teachers to acquire digital skills. The main challenges detected for the success of these training programs are the teachers' lack of time for training, non-positive attitudes towards technology, and lack of innovative capacity in their teaching processes. Among the positive outcomes, we can find that these universities opt for programs with courses varied in content, to cover a wider range of skills, as well as offering courses at several levels of development so that all staff may improve, from the very beginners to more advanced tools.

CONCLUSION: By identifying the challenges and success factors behind the best practices hereby analysed, the lessons obtained from this research may serve as benchmarks for other universities to develop efficient multimedia training programs for university staff.

Keywords: Higher education, multimedia competencies, ICT teaching tools, teaching staff development programs, ICT integration

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1. Introduction

The report on the future of higher education [1] stresses that digitalization is a fundamental way to ensure learner and institutional success in light of this new reality. Globally, 71% of higher education institutions (of 350 universities analysed) can be considered digitally distraught, according to IDC's 2019 Global DX Leaders Survey. Although these institutions have taken digital initiatives, these have been tactical, short-term, and isolated. This digitalized university represents a new approach to higher education that confronts the challenges of an increasingly global and digitised environment by becoming flexible, agile, and technological [2]. As the OECD [3] states, although digital technologies cannot transform education by themselves, they do have huge potential to transform teaching and learning practices in universities and open new horizons.

The COVID-19 pandemic paralyzed the education process and educational institutions all over the Globe. In the beginning, educational institutions, such as schools and universities, suspended all on-campus activities [4, 5]. According to the available data provided by UNESCO through the online Global Monitoring of Schools Closures, the resulting situation was unthinkable: 1,579,634,506 affected learners worldwide (90.2%), and 191 education entities closed [6]. These dramatic changes provoked an urgent shift from mostly face-to-face course delivery models to online and distance learning models [5]. Universities and other educational institutions launched e-services through innovative technology, social media forums, and higher educational platforms to offer computer-mediated classes and online learning [7], but without the strategic, sequential, multi-stakeholder transition that well-planned online teaching requires [8, 9]. Schools and higher education institutions (HEIs) were confronted with a huge gap in knowledge, resources, and technology, and teachers' and learners' digital competencies were suddenly put in value.

Digital tools and social media became necessary during the pandemic for educational purposes, communication, and entertainment [4, 5]. However, despite the significant technological advances produced in the 21st century, also called the digital era, the current situation has shown that greater use of technology in classrooms was needed because university staff is not integrating multimedia as they should [10]. Therefore there is still a lack of training on the use of technologies [11] considering teaching staff between somewhat and quite digitally competent [12] since they integrate only the most popular and currently digital tools in their lessons [13]. Although it may seem paradoxical, much has been written in the literature about the multimedia competencies of students and the existing information and communication technologies (ICT) tools to generate contents. However, little has been said about the need for teacher training in technology.

Therefore, the objective of this research is to present various training courses that have been developed in different universities in Europe where

teaching staff can acquire the multimedia competencies they need to be able to integrate information and communication technologies in their classes. This research is part of the project Multimedia Competencies for University Staff to Empower University–Community collaborations (MUST), funded by the European Commission (2020-1-Ro01-KA203-080399). The selected case studies represent different formats of digital skills training programmes formats try to participate in this project, namely Spain, Lithuania, North Macedonia, Romania, and Slovenia.

The outcome of this study is aimed at serving as a guide for other universities that want to develop coherent multimedia training programs for university staff. To this end, the study is guided by the following research questions: (1) What courses does each university implement? (2) Which ICT tools are given more importance within each university? (3) How are these training programs designed? (4) How can the HEI staff's multimedia competencies be improved in each of the courses?

2. Literature review

2.1. Multimedia: Concepts, tools, and outcomes

According to Mayer [14], the use of multimedia involves presenting materials in two or more forms such as text (alphabetic or numeric, spoken or printed) symbols, images, pictures, photos, video, or animation usually with the support of technology to improve understanding or memorization [15]. The main distinctive characteristic of multimedia is that it requires a software tool that allows for a substantial degree of interactivity which makes possible the retrieval and presentation of the above information [16]. Even though there exist several characteristics in multimedia like diversity, integration, and interaction, the last is the most important one [17]. Its effectiveness lies in the fact that it is multi-sensory and interactive, stimulating the many senses of the audience and enabling the end-users of the application to control the content and flow of information [18].

In this light, multimedia technology can be understood as the hardware and software used for creating and running multimedia applications [19] that are moving from a single PC environment to either a multi-user o to a personalized use environment [20]. The development of multimedia applications supports the educational system by improving the knowledge-sharing process and, at the same time, influencing people to think creatively [19]. One important aspect of multimedia technology is how information can be digitally presented using different media such as text, audio, and video. However, when discussing the curricula, ICT is more concerned with how the information will be used rather than what information is [21].

The use of multimedia presentations, e-learning, computer games, simulation, and virtual reality environments allows learners to process information in both verbal and pictorial form [22]. These multimedia tools can be categorized into standalone applications and Web-based applications [23]. Standalone tools are not delivered or used over the internet, and they must be installed, copied, loaded, and used on teachers' or students' personal computers or workstations. Microsoft PowerPoint©and Word©processing are the most used tools in teaching and learning within this category, although some tools for practicing new concepts such as 3D technology for modelling and printing or understanding augmented reality are especially useful [15]. In the other category, web-based multimedia tools are delivered online for teaching and learning purposes and they are used largely in university teaching and learning. Examples of these tools are the online teaching and learning resource platforms [24], multimedia tools for teaching optimization [25], and educational videos [26].

The appropriate use of ICT in teaching can transform the learning environment from teacher-center to learner-center [27] where teachers are there as facilitators and collaborators not as knowledge transmitters [15] and instruction must move from memorization to problem-solving [28]. The integration of appropriate technology into classroom practice can positively impact active learning, critical thinking, communication skills, instructional effectiveness, and multicultural education [29]. In addition, motivation and engagement in lessons are better when using educational technologies [30]. Moreover, ICT makes it possible to establish new communication channels and connect classrooms with other learning spaces throughout life [13, 31], improving the individual's social and communication skills, reducing stress, and enhancing knowledge sharing [32].

In the literature, many scholars have highlighted the benefits of multimedia application tools for teaching and learning [17, 33–39]. Multimedia-aided teaching can turn abstract concepts into concrete

content, provide information within a limited time, stimulate students' interest in learning, and provide teachers with the ability to know their students' position in learning [17]. Following this, a multimedia learning platform can enhance traditional learning methods through personalized teaching, effective teaching materials, stimulating learning scenarios, supporting repetitive learning, and providing immediate feedback [34].

2.2. Multimedia for teaching: Needs, professional development, and digital skills

Despite the benefits of multimedia applications in education, it is not until the COVID-19 crisis that the demand for technology-based solutions has grown in educational institutions around the world [40–43]. Due to the pandemic, universities embarked on e-learning and online mode of education with the involvement of technology and media integration to meet the needs of students in the reception of lectures and educational content [7]. However, teaching mode by using virtual technology is not a new phenomenon for educational provision [44].

Teaching with technology is a complex phenomenon that involves understanding teachers' motivations, perceptions, and beliefs about learning and technology [28]. It is therefore the teacher who develops a methodology in the training process who decides the role to be played by technologies [45]. This means that the teacher is the one who must diagnose the needs of the subject, decide how to introduce ICT, and apply them, which requires training and dedication to current and future needs in the classroom. Time is a scarce resource and teachers may be wary of any activity that takes away time from their actual instruction [46].

In the current era, the traditional teaching "models" and learning environment are heavily criticised for their inability to offer learners any scope for variation, and the incredibly increasing popularity of social media has made the transition to supplementary flexible models of teaching a necessity [32]. According to some scholars, sometimes ICT is used more to support the traditional method (focused on the teacher) than to change to other methodologies [47, 48]. Following this assumption, teachers should have a strong conviction that the use of computer technology is more efficient and effective than the use of traditional or alternative instructional strategies [49, 50]. Therefore, the reason why technology is usually insufficiently and inadequately used by a teacher may

be closely linked to their desire and ability to integrate it [51–54]. In this regard, the higher the individual attitude toward the use of technology, the higher the choice of using it [7]. Therefore, perceived usefulness and relative advantage are found to directly affect the teaching staff's intention to use technology [55]. For example, if they consider that technology improves the quality of their teaching, they are likely to adopt and integrate technology into their academic work, so lecturers need to be self-motivated, interested, and willing to use it in their courses [28].

Despite the staff's will, motivation, and ability to integrate technology into teaching, other external and internal barriers obstruct this process [56]. The former refers to those factors that are beyond the teacher's control, such as technical and administrative support, no time to learn new technologies, lack of ICT skills or difficulty to access ICT resources, and the physical environment in which multimedia-delivery classes took place [15, 36]. These barriers can lead to high levels of frustration discouraging teachers to integrate multimedia tools into the classroom [36]. Conversely, internal barriers are those within the teachers' control and are a part of their disposition, such as resistance to the adoption of ICT, lack of teachers' confidence in the use of technology, resistance to change on the part of teachers, and the computer anxiety [15, 36, 40]. These internal and external barriers can affect and impact both the integration of multimedia in teaching and learning and the uptake of multimedia technologies too [15, 36, 57–60].

In this regard, teachers' beliefs and attitudes are significant determinants of multimedia integration. Some scholars found that positive attitudes toward technologies were the most critical factor in distinguishing the teachers who were more and less successful at integrating technology [61–63]. For instance, technology readiness, optimism, innovativeness, insecurity, and discomfort affect attitude towards the use of ICT [7]. Moreover, digital knowledge and multimedia skills are also predictors of classroom integration. Lecturers who have more digital knowledge were more engaged with ICT use in class and more skilled at developing ways to integrate multimedia [64]. Moreover, teachers with a low perception of their multimedia skills will exhibit higher levels of anxiety and therefore lower technology integration [65]. In sum, reducing these barriers may lead to improvement in integration practices and an increase in the use of technology in the teaching process [36].

It has been proved that lessons designed to promote multimedia skills for teachers reduce computer anxiety, promote more positive attitudes, increase the enjoyment of technology, and improve ICT integration in the teaching methods [46, 66–69]. These lessons are designed to improve teachers' multimedia attitudes and skills and are usually learner-centered, requiring teachers to learn in the way they are expected to teach. They also involve in-depth training with a focus on specific programs or skills and face-to-face or online support [36]. For this reason, the design of the training programs to enhance the multimedia skills of the teaching staff must be influenced by different factors [68]: (a) the time allotted to the training; (b) the focus on content rather than simply learn to use diverse ICT; (c) the active experiencing with innovations within the technological context; (d) the collaboration with other teachers to increase their common knowledge and skills regarding the use of multimedia; and (d) the long-term, sustained pedagogical and technical support. Hence, permanent training must support the training of teachers and keep the focus of the training on the students [70].

These training programs often have content related to online ICT resources, teaching tools, and productivity applications. Photo, video, and audio editing using Microsoft office©and Google applications for education and training, digital storytelling, podcasting, blogging, and wikis are examples of what teachers will learn and apply by attending these seminars [46, 71]. The different examples of ICT tools and their potential use in education available online allowed attendants to explore different technological tools and suitable teaching methods and to decide which ICT would best meet their needs [66]. Further, blended teaching gives teachers attending these courses greater benefits in terms of knowledge, time savings, the opportunity for exploring, and idea exchanges [9]. A collaborative environment or the creation of an online discussion forum encourages the exchange of ideas and solutions to improve the audience's understanding of the topic discussed in class and allows them to better integrate multimedia into their teaching [66, 67, 72].

As mentioned above, to successfully implement technology as a teaching tool, teachers should learn some technical skills, but they do not need to be experts [28, 46, 54]. Although it is agreed that the effective use of multimedia technologies depends on the activities of the educators, this requires a high level of ICT competence of the teacher [73].

Educators should develop abilities and skills in the educational media and multimedia technology design, that is, it is important to develop a digital teaching competence that allows them to carry out their work effectively [74–76]. Thus, the preparation of tomorrow's teachers does not depend solely on how well emerging technologies are incorporated but depends on how well incoming teachers are taught to leverage the technologies to help their students develop these same skills [77]. This underlies the idea proposed by the 2017 Horizon Report on Higher Education [70] that digital competence is not only about understanding how to use technologies, but the impact of technologies in a digital world, so collaboration must be promoted to integrate them effectively.

However, to develop these competencies is first necessary to have a model that allows knowing the elements to be evaluated and some tools that facilitate their measurement. Although several authors have tried to identify digital competencies for teachers [69–72], there was no homogeneous framework for the analysis of competencies until 2013, when the European Commission published the Digital Competence Framework for Citizens (DigComp). This tool was born to improve citizens' digital competence, help policy-makers formulate policies that support digital competence building, and plan education and training to improve the digital competencies of specific target groups [78]. Within this framework, five competence areas outline what digital competency entails [79]: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The first three areas deal with competencies that may be traced back to specific activities and uses. On the other hand, safety and problem-solving are categorised as transversal because they can be applied to any activity carried out through digital means.

3. Methodology

The methodology of this research is the case study. This research method can be defined as an empirical inquiry that investigates a contemporary phenomenon in depth and within a real-world context [80]. This allows the researchers to closely examine the data within a specific context and it is one of the most frequently used qualitative research methodologies in education research [81, 82]. Thus, similar studies to this one have deployed this methodology [71, 83] mostly focusing on one case. Since

case studies are contextually situated, what works in one country may not be appropriate in another [84]. However, given the objective of this research, it was decided to use several case studies to compare and enlighten the different aspects of multimedia training for teachers.

The selection of participants in the study is a result of the extensive experience of these HEIs in offering training courses for teachers. Since the 1990s, these universities have been supporting the development of different departments, research centers, and other institutions that offer their staff multimedia development programs as a combination of technology and pedagogy. By examining the training programmes offered at different European universities, it is possible to get a broader picture of the digital skills encouraged in each country.

This cross-sectional descriptive research took place from June to December 2021 which allowed us to obtain information regarding the pandemic COVID-19 Scenario [85–87].To carry out this analysis, secondary sources were examined, such as the web pages of each of the HEIs. The courses were reviewed and selected according to their involvement with ICT, using a common framework to facilitate an unbiased analysis.

4. Results

The results show the training courses for teachers in multimedia competencies that are being carried out in each of the universities selected for the study. They are distributed by country and a brief description of the training sessions and their main objectives are provided.

4.1. Lithuania

Kaunas University of Technology (KTU) has been participating in multimedia-related projects since 2004 [88]. A huge role has been played by the e-Learning Technology Centre at KTU, which focuses on internal and external stakeholders addressing their need for multimedia competencies. Addressing University–community cooperation, the e-Learning Technology Centre at KTU organizes a digital Content Workshop for Teachers, as well as other courses and consultations regarding technical aspects of distance studies. Another relevant actor in this field is EDU-Lab, a laboratory for teaching, learning, and education at KTU [89]. EDU-Lab's didactic policy

is to ensure that the University's studies involve the use of learning and teaching methods consistent with the current reality. Thus, EDU-Lab aims to create and develop the necessary didactic skills for university staff to educate students, combining teaching and active learning tools and establishing a teachers' collaboration community. To achieve this, they developed 17 courses in 6 clusters for the development of teaching competencies. One of the clusters refers to Technology Takeover (4 courses), which is shown in more detail in Table 1.

4.2. North Macedonia

South East European University (SEEU) is the leading HEI in the North Macedonia region regarding the digitalization of student records and the use of learning management systems in education. To maximize the use of ICT, this university has established an IT Department [90] and an e-learning Centre [91] to ensure that students and staff have the necessary tools and infrastructure. The e-learning Center was born to help improve the way education is delivered, assisting the university community in exploiting the potential of technology to enhance teaching and learning. Its primary goal is to promote quality self-paced learner-centered education through the development and delivery of quality blended learning and web-based courses that can be delivered online.

Moreover, the eLearning Center assists in enhancing teaching and learning effectiveness by supporting the staff to develop interactive online supplementary material to traditional courses, as well as organizing training workshops for the staff to be able to develop and deliver online material for their courses. These tailored training programs cover a wide range of topics, beginning with the instructional design of online courses where participants are introduced to various concepts and tools that help in designing and developing online content for the courses. In addition, the center provides training on Google apps, such as Google Classroom to enable faculty members to publish their courses online (see Table 2 for more information).

4.3. Romania

Politehnica University of Timisoara (UPT) is a pioneer in multimedia education through its Multimedia Research Centre, which includes self-media broadcasts since the 1990s. In 1998, the eLearning Center (CeL) was established by a Senate resolution

Table 1

Courses developed by EDU_Lab

Course	Aim and objective
E-learning Tools and Methods	To introduce new learning tools and methods, to learn how to organise the integrated learning process for the students who are present in the classroom and for those who are studying remotely.
Improvement of E-learning Skills	Acquisition of deeper knowledge and skills of virtual and blended learning with the help of e-learning tools and methods.
MOODLE for Beginners	Provide the practical skills of applying MOODLE virtual learning environment in the study process
Distance learning: application of didactic principles and innovative study methods	Develop knowledge and skills to organize virtual and blended learning using virtual learning methods and tools.

Own Elaboration.

Table 2

Training sessions provided by eLearning Center

Name of the training session	Aims and objectives
Google Meet – Latest Tip	The main objective is to control Google Meet virtual rooms and manage student privileges in addition to the acquisition of video presentation skills using this application and the generation of MEET LINk Steps.
How to create Quizzes	The main objective is to know and learn how to develop quizzes using the Google Form tool.
Online Learning	Its main purpose is to learn how to use different multimedia tools to be able to offer online classes such as Recording screens or slides with LOOM, assigning interactive videos with quizzes directly to Google Classroom, and creating Po-Up quizzes in video lectures.
Google Classroom	The main objective is to learn how to use Google Classroom applications, that is, upload resources, create assignments, and create a virtual classroom.

Own Elaboration.

of Politehnica University of Timisoara as part of the Romanian network of study centres for open distance learning. This institution developed the UPT Virtual Campus [92], an online and mobile educational environment for academic support and communication for all UPT faculties to integrate online and mobile learning with Web 2.0 technologies, social media, and digital tools for academic learning support and management. The UPT Virtual Campus offers Moodle-based online training modules to university teaching staff to learn how to utilize and integrate ICT and web 2.0 tools. These courses are delivered online and provide didactical training in blog development, online exam methods, H5P content, and videoconferencing tools. It also offers a tutorial course for teachers that contains a series of videos and text to help in the activities carried out on Virtual Campus.

The eLearning Center also offers a series of practical webinars (see Table 3) on online education and experience for lecturers and students [93]. This project aims to collaborate and find ideas, experi-ences, and solutions to apply within online teaching. To be as practical as possible, each webinar consists of a short presentation with one to three speakers and a moderator, each of whom addresses the topic of the webinar, followed by a question-and-answer session.

4.4. Slovenia

In 2017, the Ministry of Education, Science, and Sport (MIZŠ) proclaimed the establishment of projects integrating ICT into HEIs' pedagogical process. The funding for projects was provided 80% by the European Social Fund, and the rest by the Ministry. One of these projects, Digitalna Univerza, took place at the University of Ljubljana (UL). It consists of an online library to provide didactic knowledge and support for the quality of the teaching process through appropriate didactic methods and innovative use of ICT, applications, and services.

In addition, the Digital UL Center [94] offers teacher-to-teacher symposiums to exchange good

Table 3

Webinars provided by the e-learning Center

Webinars	Aims and objectives
Leveraging technology for a better future	To show educational resources developed and made available in the spirit of open education through the IEEE learning network.
Practical use of Open Educational Resources. UNESCO recommendations	To share a practical experience and good practices related to the use and integration of open educational resources (OER-Red).
Ideas and methods for online educational evaluation	From the personal experience of the speakers, presenting the various examination methods, online courses, and platforms used.
Use of OERs and MOOCs in education	Experts in the field presented the advantages of open educational resources that can benefit both those in higher and secondary education focusing on delivering online education virtually to anyone without time and space limits.
From Campus Education to Online Education	To present the experience and challenges of switching from traditional education to online education, combining theoretical methods with practical experience.

Own Elaboration.

Table 4

Online workshops offered by the Digital UL Center

Name of the Online Workshop	Aims and objectives
Didactical use of ICT in the learning and teaching process	The workshop is designed to reflect on and generate ideas for the use of ICT in the pedagogical process using the pedagogical wheel and the SAMR model
Moodle in education	The workshop aims to introduce and use the basic and advanced functionalities of the Moodle online classroom to support the organisation of teaching work, promote collaborative learning, and monitoring of students' progress
Interactive learning materials	The workshop introduces Mayer's principles for creating multimedia materials, as well as different ICTs for creating interactive presentations, videos, and adaptive materials
Formative assessment of the learning process using ICT	The workshop is designed to introduce the importance of formative assessment of knowledge, opinions, and ideas in the pedagogical process and the different ICTs that can facilitate this process.
Gamification using ICT	The objectives are to learn about the concept of gamification and the learning approaches of learning with games and get acquainted with the different ICTs that make it possible to integrate games into the pedagogical process.
Collaborative learning using ICT	To learn about different ICTs that promote collaborative learning among students, focusing on pedagogical approaches such as problem-based learning and project-based learning.
Learning Analytics in ICT-supported Environments	The workshop introduces good practices and tools to analyse one's own teaching and the possibilities of learning analytics in different learning environments to support the teaching process holistically.

Own Elaboration.

practices and experiences in the use of ICT in the pedagogical process. They also hold live workshops and webinars to learn how about current technological tools and their possibilities for their use in the teaching process. Furthermore, several online workshops have been deployed to promote the didactic use of ICT among higher education teachers (shown in Table 4). These workshops have an associated team of mentors available at all times to answer any questions or problems that may arise during the course.

4.5. Spain

In 2007, the Spanish National Agency for Quality Assessment and Accreditation (ANECA) developed the institutional program "Docentia" which establishes a general framework for universities to develop a model for evaluating the teaching activity [95]. Following these guidelines, in 2018 the University of Alicante (UA) implemented the program Docentia-UA to promote the continuous improvement of the

Table 5

Courses offered by ICE

Name of the Course	Aim and Objectives
Discover Google and its collaborative tools	Provide attendees with an overview of how free Google collaborative tools help in common teaching tasks.
LaTeX in the teaching context	To become familiar with the LaTex environment and its potential in the teaching environment and learn how to elaborate specific teaching materials such as exams, problem sheets, questionnaires, posters, and presentations.
Fundamentals of digital photography for teaching and research	In this practical course, the aim is to explore the audio-visual fundamentals to experiment with its production in teaching and research applications with desired results.
Creating accessible and inclusive digital materials	The objectives of this course are to learn the importance of designing accessible content to ensure curricular adaptation, how to create accessible teaching materials and how to make inclusive oral presentations.
Moodle UA: from A to Z	This course aims to know the possibilities of Moodle UA and the tools offered for the management of the teaching process.
Learning cooperating in virtual environments: peer-to-peer learning tools and techniques	The aim is to show, from a practical perspective the possibilities that digital tools offer to maximize collaborative learning and interaction in the teaching process.
Creation of gamified online activities with google spreadsheets	To learn how to use Google Spreadsheets to design all kinds of gamified activities.
Flipped classroom	A practical workshop on the explanation, techniques, and tools to integrate flipped classrooms into the lessons.

Own Elaboration.

teaching activity, including the enhancement of the digital competencies of the teaching staff. This plan offers several online and blended courses executed by the Institute of Educational Sciences (ICE). Those courses and workshops with a focus on ICT (see Table 5) are carried out based on three different levels of training, considering the starting point of knowledge or the participants. The initiation level comprises the introduction to online teaching, basic methodologies, and tools while the courses offered at the intermediate and specialized levels are related to more advanced ICT resources and technology-based teaching.

5. Discussion

Despite the rise of digital skills courses for teachers during the pandemic, all the universities studied have been implementing systems to improve the digital competencies of their teaching staff for years. In terms of the number of courses offered, UA and UL are the ones that provide the largest number including different and mixed multimedia content, despite their late inclusion in this kind of training programs. While UPT is the pioneer in setting up its e-Learning Center in the late 1990s, UA in Spain and UL in Slovenia were the last ones to develop teacher training in multimedia skills, and only did so as a direct response to national plans and projects.

About the contents of the courses, KTU is more focused on the development of digital skills related to e-learning tools and methods, while SEEU, in addition to online learning techniques, offers courses related to videoconferences, virtual quizzes, and visual classrooms. In the case of Spain and Slovenia, alternative uses of ICT are likewise considered, such as gamification, photography, and video editing. These universities share in common the promotion of collaborative tools in the teaching-learning process. This is meaningful because collaboration and interaction are the key instruments of multimedia learning [17, 18]. It is important to stress that apart from videoconferences, there are not many courses related to video and photo editing (except the Spanish Case). This follows the assumption that the text is the predominant multimedia component used in most educational materials [15], without forgetting that multimedia materials need to integrate text and pictures [14].

Most of the 28 courses hereby analysed offer training in web-based multimedia tools mainly using open-source programs. For example, Google Classroom seems to be the most widely used tool in the universities under study because it offers teaching and learning tools that favour learning from anywhere, allowing for simultaneous work. Furthermore, all the universities in this study offer training in understanding and using the Moodle platform. It represents one of the most widely open-source e-learning platforms that enable the creation of a course website [96]. Before the COVID-19 situation, Moodle had commonly been used to complement face-to-face lessons because it allows interaction among students and teachers [97], but after the pandemic, it became a widespread tool for fully online teaching, and as a consequence, the majority of the teachers had to learn how to effectively use all the applications that this platform has [7].

Concerning the modality in which the ICT teaching is delivered, most universities offer fully online courses. The possibility to access the online environment anytime, anywhere, will help the teachers save time and effort [9, 66]. Therefore, it helps to overcome several of the barriers identified in the literature [15, 46, 98]. Furthermore, other scholars have shown that the involvement of social media and technology in learning programs helps to reduce the drop-out rates of students [32]. Collaboration between teachers may increase their knowledge and skills regarding the use of multimedia, as is the case of UL where personal experiences in the use of ICT in the pedagogical process are exchanged, which is deemed as beneficial for the success of these training activities [68]. Thus, sharing difficulties in a safe, friendly environment can help to reduce frustration levels and resistance to change when integrating multimedia into the training process [46, 61, 63, 67, 72].

Furthermore, these training programs are learner-centered, which means that teachers learn in the way they are expected to teach, and involve in-depth training complemented with online or face-to-face support, all of which have been listed as success factors by the literature [68, 98]. The Slovenia case stands out because its online workshops have a moderator associated with them, who is available for as long as necessary to answer any questions or problems that may arise during the course. This is in line with Alayyar et al. [66] case study research, whose sample indicates that the online environment support saves them time and effort, as they did not need to wait until they could meet with the experts to ask for an explanation or solution. This online support will be a must for universities who want to integrate online training courses for their teaching staff because the ongoing support learnings could solve their problems directly whenever they arose at any time and place.

Finally, regarding the evaluation of the training courses, there is a distinct lack of disclosure of which measures are used to discern whether these have brought about any changes in the teaching of certain subjects, or at all. As it stands, the information disclosed about the practices in the studies' programs did not include a description of the transfer results, merely an evaluation of the courses.

6. Conclusions

The benefits of digital tools for teaching have been studied within the discipline in recent years. Using multimedia in the classroom can positively impact active learning and multicultural education, increase creative thinking, enable knowledge sharing and improve communication skills. However, the use of digital applications for teaching has been relegated to its use as a complement to the traditional way of teaching. The COVID-19 pandemic brought a radical change to this situation and educational institutions at all levels had to adapt to a new system of entirely online delivering instruction [40, 43, 44]. However, not all teachers had the necessary digital skills to deal with this new situation which forced universities to implement courses in new technologies for education. Within this context, technology readiness can improve innovativeness in teachers and reduce their insecurity, which will improve their attitude towards the use of technologies for education [7, 43].

The main objectives and contents of 28 courses on digital and multimedia competencies for HEI's staff across five countries in Europe have been analysed in this research. Throughout this explanatory study, the benefits of using digital technology in education and the main barriers teachers may face have been analysed. While much has been written about the benefits for students of the use of technology in education, little research has been done on the actual courses that enhance teachers' digital skills. This research has contributed to the theory of technology and education by revealing several success factors for the development of ways to make optimal use of technology in HEIs' classrooms, through an extensive literature review and the analysis of best practices.

All the training sessions provided in this research enable the acquisition of skills associated with information and data literacy, communication and collaboration, digital content creation, and problem-solving. The courses, workshops and symposiums presented in this article provide didactic content to develop the digital skills of their staff, such as online teaching techniques, e-learning tools and methods, videoconferencing development, quiz creation, virtual classroom, gamification, and video and photo editing. These practical courses, online delivered, focused on learning and fostering collaboration improve teachers' ability to integrate ICT into their lessons. However, no courses have been found on the issue of security competencies in the virtual environment, possibly because these skills are transversal and can be applied to any activity carried out through digital training [79].

Although the pandemic has boosted the use of digital tools, given their enormous benefits for education, we expect the multimedia skills of HEI teachers will continue improving. As it is known, the acquisition of digital competencies is a matter of lifelong learning to which universities must open more and are in a pivotal position to start a universal campaign on this. Technology and pedagogy must go hand in hand with digital education, and therefore a strategic approach to building such competencies needs to be set up at the university level.

7. Implications, research limitations, and future avenues of research

By analysing 28 courses carried out in five European universities, evidence has been provided of the diversity of courses that can be carried out to improve the competencies of lecturers in university teaching. The use of case studies has made it possible to compare the subjects relevant to each country and the mode of delivery of these courses. Offering online courses, symposiums where teachers can share their experiences, and workshops where new teaching applications are presented will help to address the attitudinal and motivational barriers to the use of technology in teaching. In this regard, in addition to its theoretical implications, this research is interesting for universities that want to implement multimedia training programs for their employees. The proper training improves the ability of teachers to integrate ICT into their lessons, helps to remove attitudinal barriers, and improves the quality of teaching.

This study is not without limitations. This is a descriptive research that does not use analytical techniques that would allow for a more in-depth analysis. For future research, it would be interesting to use a qualitative methodology using in-depth interviews with teachers attending these courses to find out whether they have improved their digital skills, they have changed their teaching methods thanks to these courses, and if so, how they have improved their digital competences. It would also be interesting to use surveys to determine through structural equation models the digital competencies developed in the courses and their relationship with the barriers to integrating technological applications in education.

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