

Article

Empowering University Lecturers in the Digital Age: Exploring the Factors Influencing the Use of Digital Technologies in Higher Education

Garazi Azanza ¹, Oihane Korres ², Jessica Paños-Castro ^{2,*} and Josep Petchamé ³

¹ Department of Social and Human Sciences, Faculty of Social and Human Sciences, University of Deusto, 48007 Bilbao, Spain; garazi.azanza@deusto.es

² Department of Education, Faculty of Education and Sport, University of Deusto, 48007 Bilbao, Spain; oihane.korres@deusto.es

³ Department of Engineering, Ramon Llull University, 08022 Barcelona, Spain; josep.petchame@salle.url.edu

* Correspondence: jessicapanos@deusto.es

Abstract: In an era where digital technologies (DTs) are reshaping educational delivery methods, university lecturers' ability and willingness to integrate these innovations into their teaching practices are increasingly important. This study, conducted from October 2022 to February 2023, aims to examine the impact of attitude and training on university lecturers' self-efficacy in using DTs and to assess the influence of self-efficacy on their interest in using DTs. A total of 294 university lecturers participated in the study and completed a questionnaire assessing their perception of DTs as a didactic tool, attitude towards the use of virtual classrooms, perceived self-efficacy, and interest in the use of DTs, and training in the use of DTs. Data were analyzed using descriptive statistics, correlations, and multiple linear regressions to explore the relationships between study variables. The results indicated that positive attitudes and suitable training were positively associated with higher self-efficacy. Moreover, high levels of self-efficacy were found to be aligned with an interest in using DTs. These findings shed light on key factors that can effectively encourage the successful adoption of DTs among lecturers.



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1. Introduction

Education plays a key role in the training and development of the digital competences of students at all learning stages, a significance that has been accentuated by the COVID-19 pandemic. To prevent the spread of the virus, nearly 200 countries were forced to close their schools and universities, which affected 1.6 billion learners worldwide (94% of the total), as noted by UNESCO [1]. The need to continue students' academic education led to a massive transition to distance education and e-learning at all stages, and entailed a 'strong move towards the digital transformation of educational institutions, mainly at university level' [2] (p. 9).

Due to the restrictions adopted to combat the pandemic both in terms of mobility and physical contact between people, university professors were forced to adapt quickly to the adoption of distance learning formats. In fact, distance learning can be defined as "some form of instruction [that] occurs between two parties (a learner and an instructor), [which] it is held at different times and/or places, and uses varying forms of instructional materials" [3] (p. 130). Generically, the distance format can be implemented through different means, such as postal mail, online, etc. [3], or even using radio or television [4]. As a result, the online teaching–learning option, i.e., in this study, the "access to learning experiences via the use of some technology" [3] (p. 130), is based on digital technologies (DTs), i.e., a

“segment of technology that is based on electronic data acquisition, processing, or analysis” [5] (p. 7), which was one of the options most widely adopted by many universities (e.g., [6]) and schools (e.g., [7]). In general, lecturers acknowledged being unprepared for the shift to online education and faced difficulties in successfully implementing DTs [8–10], and this process highlighted the differences that existed among university teaching staff in terms of attitudes, training, and the ability to use DTs (e.g., [11–13]), as well as with respect to the use and integration of digital technologies into their teaching practices (e.g., [14,15]).

These disparities in the use and attitudes towards DTs emphasized the need to strengthen and promote lecturers’ digital competence. Digital competence refers to the set of skills that enable people to take advantage of technology to improve their daily activities [16,17]. This encompasses the skillful, savvy, and responsible use of information society technologies in the fields of work, leisure, and education [18]. Thus, the development of digital competence by teaching staff is one of the challenges of current education at all stages, since, as Barbazán et al. [19] pointed out, nowadays ‘the traditional classroom has been complemented with virtual spaces that force today’s teachers to have to develop new digital strategies suitable for these new teaching and learning environments’ (p. 270). Furthermore, UNESCO [20]), emphasized that educators not only need to possess ICT (Information and Communication Technology) skills and the ability to foster these skills in their students, but also to effectively utilize ICT to foster students’ collaboration, problem-solving abilities, creativity, and innovation, helping them become engaged and contributing members of society. And it should be noted that taking advantage of ICTs requires digital competence.

While the pandemic posed significant challenges, such as the sudden shift to online teaching and the lack of preparedness among educators, the adoption of ICT in education also provided new opportunities and highlighted its potential in the teaching–learning process [21]. Teaching staff showed adaptability to the digital environment and flexibility in the use of ICT, and their learning was maintained after lockdown [22]. Moreover, following this experience, lecturers had an improved attitude and confidence in using ICT, and their motivation to enhance their digital skills and use these technologies in the classroom had increased [9,23–25].

There are different models and theories that seek to determine which factors affected the adoption or non-adoption of technology by individuals, including the Technology Acceptance Model (TAM) [26]; the Technological Pedagogical Content Knowledge (TPACK); and the Teaching Typology in the Adoption and Use of Digital Technology (TAUT) [27]), among others. These models share a common focus on examining the interaction between users and technology, highlighting the importance of attitudes or beliefs towards technology, contextual factors such as organizational support and training in the effective adoption and utilization of DTs in educational settings. A systematic literature review of the TAM in higher education during the pandemic [28] found that a key gap was the lack of focus on the intrinsic motivation of participants, suggesting that future studies should include variables such as self-efficacy. Additionally, there was a call for more studies utilizing lecturers as samples to better understand their perspectives and experiences with technology adoption.

Building on these insights, this study contributes to the research related to lecturers’ attitude and training, based on the understanding that these aspects influence the pedagogical use of DTs. The hypotheses guiding this study are set out below, considering the previous literature. While existing studies have extensively explored general attitudes and contextual variables in education, this research adds value by testing hypotheses that link specific attitudes and training to self-efficacy and subsequent interest in using digital technologies, by focusing on higher education. Additionally, by situating this research in the post-lockdown period, it captures the evolving dynamics of digital competence and attitudes shaped by recent global shifts towards online and hybrid learning models.

2. Literature Review

2.1. University Lecturer Attitude and Self-Efficacy

When analyzing the educators' technology adoption, self-efficacy plays a key role as shown in diverse research studies (e.g., [29–32]). As Cabero-Almenara et al. [33] noted, 'the beliefs and attitudes that lecturers have regarding the opportunities that technologies can offer them for their professional development are essential' (p. 17), both when in terms of using them in their teaching, and in the way they do it. In a similar vein, diverse authors (such as Arancibia et al. [34], Beardsley et al. [9], Hidalgo-Cajo and Gisbert-Cervera [27], or Nuñez-Ramírez et al. [23]), underlined that the relationship that lecturers have with ICTs is consistent with their attitudes and/or motivations, among others.

The Technology Acceptance Model (TAM) presented by Davis [26] is one of the most widely used models to analyze and understand how and why people adopt or reject a new technology. It suggests that attitudes towards and use of technology are based on two factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to how an individual considers that a particular technology will improve their performance on specific tasks, and perceived ease of use relates to the perception of how simple and easy it is to use the technology. Thus, the TAM model proposes that the more useful and user-friendly a person perceives a particular technology to be, the more likely they are to adopt it. This idea has been contrasted in different studies that have applied the model to different contexts [35–39].

Previous studies have shown that lecturers who have a positive attitude towards technologies make more use of online environments [40,41]. This positive perception not only influences their intention to use technologies, but also contributes to perceived self-efficacy [42], understood as the beliefs an individual possesses about their own ability to perform an action to gain the desired outcome. It has also been highlighted that motivation plays a key role on educators' actions [43]. Studies conducted with graduate students have also shown that positive attitudes towards technology contribute to perceived self-efficacy [44]. Even if the TAM model has been extensively used, Rosli et al. [28] highlighted the need for research, focusing on higher education and examining the role of self-efficacy.

In view of the above, this paper proposes the following hypothesis:

H1. *Lecturers' positive attitudes towards DTs contribute positively to self-efficacy in the use of DTs.*

H1a. *The perception of DTs as a didactic tool will positively contribute to self-efficacy.*

H1b. *Positive attitudes towards virtual classrooms will positively contribute to self-efficacy.*

2.2. Training and Self-Efficacy

UNESCO [20] stressed the importance of ongoing training and support for educators to develop the necessary ICT skills and strategies, and to include them into their teaching. Developing digital competence among educators is essential because it enables them to create, execute, and assess educational activities aimed at encouraging the effective use of technology in teaching their students [8].

Along these lines, as different studies have pointed out, educators' digital competence training is related to their use of technology and also influences perceived self-efficacy [42,45]. A study of faculty members in US colleges of education [46] concluded that there were significant correlations between technology literacy and pedagogical practice integration. Studies with graduate students have also shown that digital competence contributes to perceived self-efficacy [44].

However, some studies conducted both before the pandemic (e.g., [47–50]) and others carried out during and after that period [8] found that educators had a moderate or medium level of digital competence, which needed to be further developed. In particular, during COVID-19, the lack of digital skills training was one of the major difficulties identified by teaching staff [13].

These results are consistent with those reported by pre-service teachers, who valued ICT highly but recognized that there was a lack of training in how to use them in the classroom [51], as they were mainly applied to everyday issues and direct communication [52]. In addition, prospective teachers with more training in the educational use of ICT had higher levels of perceived self-efficacy in educational use [53]. Thus, several authors have stressed the need for institutions to promote plans for their training and development, both in the technological and pedagogical fields [8,36,51]. As Li et al. pointed out [42], ‘effective professional development needs to address school culture, teachers’ mindset, and provide sufficient time for modelling, experimentation, and reflection, as well as follow-up support for technology integration in the classroom’ (p. 514).

The following hypothesis is therefore proposed:

H2. *Lecturers’ training in DTs positively contributes to self-efficacy in the use of DTs.*

2.3. Self-Efficacy and Use of DTs

Self-determination theory (SDT), proposed by Deci and Ryan [54,55], suggests that individuals are motivated when their needs for autonomy, competence and relatedness are satisfied. It is therefore considered that greater self-efficacy in the use of digital technologies can satisfy the competence required for including them in pedagogical practice, leading to greater intrinsic motivation and interest in the use of these technologies.

Previous studies have indicated that lecturers’ perceived self-efficacy is a significant factor determining their use of technology; therefore, self-efficacy in the use of technology is related to a more frequent use or intention to use technology in the classroom (e.g., [56–58]), while educators who lack confidence in their digital skills are less likely to use digital technology [59]. As suggested by the TAM model [55] lecturers’ technological self-efficacy may increase their expectations of achieving optimal teaching outcomes, resulting in the greater application of DTs in the classroom. Furthermore, educator self-efficacy is positively related to a greater ability to integrate technology into their pedagogical practice [46], as was also the case of students in initial teacher training [37,53].

In view of the above, the following hypothesis is proposed:

H3. *Lecturers’ self-efficacy positively contributes to their interest in using DTs.*

The conceptual model of the study is summarized in Figure 1:

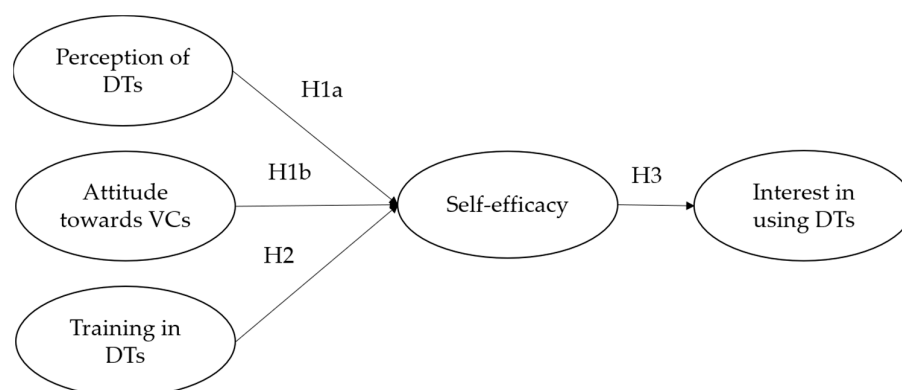


Figure 1. Conceptual model.

3. Methods

3.1. Objective

This study had two main objectives. The first one was to examine the impact of attitude and training on university lecturers’ self-efficacy in using DTs, and the second was to assess the influence of self-efficacy on interest in using DTs.

3.2. Participants

A total of 294 university lecturers participated in this study. The sample size was selected to be representative of the university teaching population in the participating universities. The participants had an average age of 46.42 years old ($SD = 10.87$). The average teaching experience of the participants was 13.42 years ($SD = 10.78$). Forty-eight percent of the participants were men. Seventy percent of the lecturers were employed full time, while 30% were employed part time. Thirty-eight percent taught both undergraduate and graduate programs, while 60% exclusively taught undergraduate programs. Only 2% of the lecturers exclusively taught graduate courses.

3.3. Procedure

Data collection consisted of the administration of a questionnaire to university lecturers from two Spanish universities. An initial step involved presenting the study's objectives to the universities and securing permission to administer the questionnaire to all lecturers. An email was then sent to all lecturers affiliated to the selected universities. The email included a brief explanation of the study's purpose, as well as a link to access the online questionnaire on Qualtrics. The email invitation emphasized that participation was voluntary and assured that the responses were confidential and anonymous.

The questionnaire focused on the lecturers' use of digital technologies in their teaching. Participants were encouraged to answer all the questions to the best of their knowledge. The completion of the questionnaire was estimated to take approximately 10 min.

Ethical considerations were followed throughout the study, ensuring that participants' personal information remained confidential and that their responses were anonymized and used solely for research purposes.

Data collection was conducted from October 2022 to February 2023. Throughout this period, three reminders were sent to the lecturers to encourage their active participation and improve the overall response rate. The study was conducted in the aftermath of the COVID-19 lockdowns, a period marked by significant changes in educational delivery methods. During this time, there was a heightened focus on the integration of digital technologies in teaching due to the shift to online and hybrid learning environments.

3.4. Measures

The questionnaire used in this study included several scales to assess different constructs related to the use of digital technologies. The scales and their psychometric properties are described below:

Perception of Digital Technologies as a Didactic Tool: This scale aimed to assess DTs' perceived efficacy in and relevance to the educational process. It comprised seven items, rated on a 5-point Likert scale ranging from 0 = 'never' to 5 = 'always'. Sample item: 'Does digital technology enable you to achieve educational objectives with your students more effectively?'. The scale was adapted from the TAUT questionnaire by Hidalgo-Cajo and Gisbert-Cervera [27]. The internal consistency of this scale was found to be high, with a Cronbach's alpha coefficient of 0.88.

Attitudes towards the Use of Virtual Classrooms (VCs): This scale measured lecturers' attitudes towards using virtual classrooms and consisted of two sub-dimensions: Utility (AU_1) and Ease of Use (AU_2). It included a total of 12 items equally divided between the sub-dimensions. Items were rated on a 5-point Likert scale, ranging from 'completely disagree' to 'completely agree'. Sample items included 'Using virtual classrooms would increase the efficacy of my academic work' (utility) and 'Accessing virtual classrooms to complete tasks would be easy for me' (ease of use). The scale was derived from the TAUT questionnaire developed by Hidalgo-Cajo and Gisbert-Cervera [27], and demonstrated high internal consistency, with a Cronbach's alpha coefficient of 0.92. It is worth noting that one of the participant universities implemented a Smart Classroom system (see [6,60]), which facilitated the virtual classrooms (VCs) through various hardware components—Smart Board, imaging system, and sound system—and software, namely Zoom [60] (p. 5). Addi-

tionally, the other university opted to deploy a mobile camera system that could be used in different classrooms to conveniently enable VCs using Google Meet and Zoom software.

Perceived self-efficacy in the use of digital technologies: this scale, adapted from McDonald and Siegall [61], assessed the perceived self-efficacy in using digital technologies. It consisted of five items rated on a 5-point Likert scale, ranging from ‘totally disagree’ to ‘totally agree’. Sample item: ‘Digital technologies will enable me to perform my work better and more efficiently’. The internal consistency of this scale was found to be good, with a Cronbach’s alpha coefficient of 0.82.

Interest in the use of digital technologies: This scale measured lecturers’ interest in incorporating digital technologies into their pedagogical practices. It consisted of 7 items rated on a 5-point Likert scale, ranging from ‘not interested at all’ to ‘totally interested’. The scale was adapted from the TAUT questionnaire developed by Hidalgo-Cajo and Gisbert-Cervera [27]. The internal consistency of this scale was assessed and resulted in a Cronbach’s alpha coefficient of 0.82.

Training in digital technologies: This scale, adapted from Taquez et al. [62], aimed to assess the breadth and depth of lecturers’ training experiences with various digital technologies commonly used in educational settings. It consisted of 20 items listing different digital technologies. Participants rated their level of training on a 5-point Likert scale, ranging from ‘I have no training’ to ‘I have very good training’. The scale demonstrated high internal consistency, with a Cronbach’s alpha coefficient of 0.92.

To ensure the robustness of the findings, the internal consistency of each scale was evaluated using Cronbach’s alpha coefficients, all of which indicated good-to-excellent reliability. Additionally, the scales were adapted from well-established questionnaires in the field of educational technology, ensuring their content validity.

3.5. Data Analysis

The questionnaire responses were recorded using the Qualtrics platform and data analysis was conducted using IBM SPSS Statistics (version 28). Descriptive statistics were used to summarize the data, including measures such as means, standard deviations, frequencies, and percentages. Inferential statistical analyses such as correlations and regressions were performed to explore relationships between study variables.

4. Results

Table 1 shows the means, standard deviations, and correlations among the study variables. To test Hypotheses 1 and 2, the relationship between the perception of DTs as a didactic tool (H1a), attitudes towards virtual classrooms (H1b), training in DTs (H2), and lecturers’ self-efficacy were examined. The results depicted in Table 1 indicate that there were significant correlations between each of the hypothesized predictors and lecturers’ self-efficacy. With respect to Hypothesis 3, which posited that self-efficacy would positively influence the interest in using DTs, we also found significant correlations among the variables, as presented in Table 1.

Table 1. Descriptive statistics, scale reliability, and correlations.

	M (SD)	α	1	2	3	4
1. Interest in using DTs	3.06 (0.89)	0.82				
2. Perception of DTs	3.65 (0.77)	0.88	0.43 *			
3. Attitude towards VCs	3.42 (0.74)	0.92	0.36 *	0.44 *		
4. DTs’ self-efficacy	3.65 (0.75)	0.82	0.24 *	0.41 *	0.59 *	
5. Training in DTs	2.42 (0.60)	0.92	0.25 *	0.26 *	0.28 *	0.43 *

* $p < 0.01$.

The results indicate significant correlations among the variables, supporting the hypothesized relationships. To further validate Hypotheses 1 and 2, we conducted multiple linear regressions to assess the effect of attitude towards DTs and training in self-efficacy

were conducted. The regression results, presented in Table 2, confirm that all predictors had significant positive effects on self-efficacy. These variables collectively explained 44% of the variance in self-efficacy in the model test, $F(3283) = 76.12$, $p < 0.01$.

Table 2. Multiple linear regression explaining self-efficacy.

Variable	B	β	SE
Constant	0.73		0.20 **
Perception of DTs	0.15	0.15	0.04 *
Attitudes towards VCs	0.45	0.44	0.05 **
Training in DTs	0.33	0.26	0.05 **
R ²	0.44		

* $p < 0.005$. ** $p < 0.001$.

Hypothesis 3, which posited that self-efficacy would positively influence interest in using DTs, was also examined. The regression results, shown in Table 3, confirmed this hypothesis, with self-efficacy explaining 6% of the variance in interest in using DTs, $F(1292) = 18.86$, $p < 0.01$.

Table 3. Multiple linear regression explaining interest in the use of DTs.

Variable	B	β	SE
Constant	2.00		0.25 **
Self-efficacy	0.29	0.24	0.06 **
R ²	0.06		

** $p < 0.001$.

5. Discussion

It seems relevant to investigate instructors' perceptions on technology, once it is incorporated into the educational facilities as a solution to meet the challenges arising from access restrictions when the COVID-19 pandemic was declared. This research study was carried out once the pandemic was over, and after analyzing the results collected from 294 respondents—from two universities—through a survey, several ideas are highlighted next.

Various studies have focused on student and lecturer perceptions of developments and changes in educational aspects brought about by the evolution of a specific technology, such as the impact of artificial intelligence [63,64] or the implementation of smart classroom technologies [65–67]. The approach that has been taken in this paper has deliberately avoided focusing only on a specific technology, as it was aimed to capture lecturers' perceptions of and attitudes towards the use of technologies. The intention was to gather results to provide some guidelines that can be useful in the design of education policies, in line with other research works on the digital transformation in the educational context, such as [68,69].

The results showed that both lecturers' attitudes and training were positively associated with self-efficacy. Moreover, high levels of self-efficacy were found to be aligned with an interest in using DTs. These significant results played a crucial role in identifying key factors that could effectively encourage the successful adoption of DTs among lecturers. The conclusions of this study have several practical implications for educators and institutions aiming to promote the successful integration of digital technologies in educational settings.

Firstly, in line with previous studies (e.g., [40,42]), lecturers' attitudes were found to be positively associated with self-efficacy. Therefore, it is crucial to encourage positive attitudes towards digital technologies among lecturers, as these attitudes have a positive impact on their self-efficacy in using these tools. Institutions should actively support and promote familiarity with and use of DTs among faculty members, since a new technology's perceived usefulness and ease of use can be influential in an individual's attitude towards and use of that technology, as the Technology Acceptance Model [55] suggested.

Secondly, the study highlights the importance of providing sufficient training opportunities for lecturers to enhance their self-efficacy in using digital technologies, providing personalized plans. Institutions should consider offering comprehensive training programs, professional development courses and readily available guides in order to support faculty members in developing the necessary skills and confidence to successfully include DTs in their teaching [8].

This study has several limitations that should be acknowledged. Firstly, the research design employed was cross-sectional. This design was appropriate for examining associations and correlations among the variables of interest. However, future studies adopting longitudinal or experimental designs would be beneficial in establishing causal links between these variables. Secondly, the data collection relied on a survey approach, which is subject to common limitations such as social desirability bias and self-reporting inaccuracies. Respondents may have provided responses that they perceive as more socially acceptable or may not have accurately recalled their attitudes or training experiences. Using additional data collection methods such as interviews or observations could provide more comprehensive and nuanced insights into participants' behaviors and perceptions. Another limitation pertains to the sole reliance on the 'interest in using DTs' as an outcome variable. While this provides valuable information about participants' intentions, future studies should consider incorporating behavioral measures or actual usage data to assess the real-world implementation of digital technologies in lecturers' teaching. Furthermore, the study focused on lecturers' perspectives and did not explore potential influences from other stakeholders, such as students or university administrators. Including a broader range of participants could offer a more comprehensive understanding of the factors influencing the successful integration of DTs in educational settings.

6. Conclusions

New technologies have played a key role in addressing the effects of the pandemic, which once led to physical restrictions in education centers. Now that these technological devices are in the educational centers to stay, it seems timely to focus on several aspects derived from the use of these technologies by users, such as attitudes, training, and skills in the use of technology. For this reason, and in order to shed light on this topic, this research work focuses on the study of these facts in a university environment, and for this purpose, we surveyed university professors from two universities. In doing so, we want to identify and analyze the diverse perceptions of these professors regarding technology in higher education, which can help consolidate the transformation of educational institutions. Therefore, this study collected lecturers' views on the use of DTs in the classroom, with a dual-fold objective: (1) to contribute to an effective implementation of educational policies that leverage the advantages of using technology; and (2) to consider the conditioning factors derived from lecturers' use of technology. Once the results are analyzed, it can be highlighted that both the lecturers' attitudes as well as their perception of self-sufficiency in relation to the use of technology are really relevant.

As already mentioned in the previous section, this research work has limitations. However, this study lays a foundation for understanding the relationships between attitudes, as well as training, towards self-efficacy and interest in using DTs among lecturers. Addressing these limitations in future research will lead to more robust conclusions and facilitate the development of effective strategies for promoting the successful adoption of digital technologies in educational contexts.

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Informed Consent Statement: Informed consent was digitally obtained from participants.

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References

1. UNESCO. La Educación en Tiempos de la Pandemia de COVID-19. Comisión Económica para América Latina y el Caribe [Education in Times of the COVID-19 Pandemic. Economic Commission for Latin America and the Caribbean]. 2020. Available online: <https://unesdoc.unesco.org/ark:/48223/pf0000374075?posInSet=1&queryId=6606d041-e555-4f06-b4c4-42ea1b4153e9> (accessed on 25 November 2023).
2. Cabero-Almenara, J.; Valencia-Ortiz, R. La pandemia: ¿transformación futura de los escenarios formativos? [The pandemic: Future transformation of training scenarios?]. *Rev. Cocar* **2023**, *17*, 1–17.
3. Moore, J.L.; Dickson-Deane, C.; Galyen, K. e-Learning, online learning, and distance learning environments: Are they the same? *Internet High. Educ.* **2011**, *14*, 129–135. [CrossRef]
4. Guri-Rosenblit, S. Distance education in the digital age: Common misconceptions and challenging tasks. *Int. J. E-Learn. Distance Educ.* **2009**, *23*, 105–122.
5. Bican, P.M.; Brem, A. Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable “Digital”? *Sustainability* **2020**, *12*, 5239. [CrossRef]
6. Petchamé, J.; Iriundo, I.; Villegas, E.; Riu, D.; Fonseca, D. Comparing Face-to-Face, Emergency Remote Teaching and Smart Classroom: A Qualitative Exploratory Research Based on Students’ Experience during the COVID-19 Pandemic. *Sustainability* **2021**, *13*, 6625. [CrossRef]
7. Carrillo, C.; Flores, M.A. COVID-19 and teacher education: A literature review of online teaching and learning practices. *Eur. J. Teach. Educ.* **2020**, *43*, 466–487. [CrossRef]
8. Cabero-Almenara, J.; Barroso-Osuna, J.; Rodríguez-Gallego, M.; Palacios-Rodríguez, A. La Competencia Digital Docente. El caso de las universidades andaluzas [Digital Teaching Competence. The case of Andalusian universities]. *Aula Abierta* **2020**, *49*, 363–372. [CrossRef]
9. Beardsley, M.; Albó, L.; Aragón, P.; Hernández-Leo, D. Emergency education effects on teacher abilities and motivation to use digital technologies. *Br. J. Educ. Technol.* **2021**, *52*, 1455–1477. [CrossRef]
10. Arriaga, O.G.; del Carmen Lara Magana, P. La innovación en la educación superior y sus retos a partir del COVID-19 [Innovation in higher education and its challenges from COVID-19]. *Rev. Educ.* **2023**, *47*, 460–474. [CrossRef]
11. Dorfsman, M.; Horenczyk, G. El cambio pedagógico en la docencia universitaria en los tiempos de COVID-19 [The pedagogical change in university teaching in times of COVID-19]. *RED Rev. De Educ. A Distancia* **2021**, *67*, 475151. [CrossRef]
12. García Aretio, L. COVID-19 y educación a distancia digital: Preconfinamiento, confinamiento y posconfinamiento [COVID-19 and digital distance education: Pre-confinement, confinement and post-confinement]. *RIED-Rev. Iberoam. De Educ. A Distancia* **2021**, *24*, 9–32. [CrossRef]
13. Portillo Berasaluce, J.; Romero, A.; Tejada, E. Competencia digital docente en el País Vasco durante la pandemia del COVID-19 [Teaching digital competence in the Basque Country during the COVID-19 pandemic]. *Relatec Rev. Latinoam. Tecnol. Educ.* **2022**, *21*, 57–73. [CrossRef]
14. Toto, G.A.; Limone, P. From Resistance to Digital Technologies in the Context of the Reaction to Distance Learning in the School Context during COVID-19. *Educ. Sci.* **2021**, *11*, 163. [CrossRef]
15. Meishar-Tal, H.; Levenberg, A. In times of trouble: Higher education lecturers’ emotional reaction to online instruction during COVID-19 outbreak. *Educ. Inf. Technol.* **2021**, *26*, 7145–7161. [CrossRef] [PubMed]
16. Ferrari, A. DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe. Joint Research Center. 2013. Available online: <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC83167/lb-na-26035-enn.pdf> (accessed on 23 September 2023).
17. INTEF. Marco de Referencia de la Competencia Digital Docente. Ministerio de Educación y Formación Profesional [Reference Framework for Teaching Digital Competence. Ministry of Education and Vocational Training]. 2020. Available online: https://intef.es/wp-content/uploads/2023/05/MRCDD_GTTA_2022.pdf (accessed on 23 November 2023).
18. European Comission. Comunicación de la Comisión al Parlamento Europeo, al Consejo, al Comité Económico y Social Europeo y al Comité de las Regiones [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions]. 2018. Available online: <https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:52018DC0022&from=EN> (accessed on 7 November 2023).

19. Barbazán, D.; Ben, K.D.; Montes, C.M. La competencia digital docente en educación superior: Estado del arte en España y Latinoamérica [Teaching digital competence in higher education: State of the art in Spain and Latin America]. *Etic@net Rev. Cien. Electr. Educ. Comun. Soc. Conoc.* **2021**, *21*, 267–282. [CrossRef]
20. UNESCO. Marco de competencias de los docentes en materia de TIC. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [Competency framework for teachers in ICT matters. United Nations Educational, Scientific and Cultural Organization]. 2019. Available online: <https://unesdoc.unesco.org/ark:/48223/pf0000371024> (accessed on 12 December 2023).
21. Carranza-Marchena, P.; Zamora-Sánchez, G. Desafíos y oportunidades en tiempos del COVID-19: Contexto pedagógico desde la Universidad Nacional y la Universidad Estatal a Distancia [Challenges and opportunities in times of COVID-19: Pedagogical context from the National University and the State Distance University]. *Rev. Innovaciones Educ.* **2020**, *22*, 162–170. [CrossRef]
22. Avendaño-Castro, W.R.; Hernández-Suárez, C.; Prada-Núñez, R. El docente universitario ante la emergencia educativa. Adaptación a las TIC en los procesos de enseñanza [The university teacher in the face of the educational emergency. Adaptation to ICT in teaching processes]. *Educ. Humanismo* **2021**, *23*, 27–46. [CrossRef]
23. Nuñez-Ramírez, M.; Atila-Lijerón, J.; Banegas-Rivero, R.; Esparza-García, I. Predictores de la intención hacia el uso de tecnologías de la información y la comunicación (TIC) por profesores universitarios en Bolivia durante la pandemia por COVID-19 [Predictors of intention towards the use of information and communication technologies (ICT) by university professors in Bolivia during the COVID-19 pandemic]. *Form. Univ.* **2021**, *14*, 109–118. [CrossRef]
24. Sales, D.; Cuevas-Cerveró, A.; Gómez-Hernández, J.-A. Perspectives on the information and digital competence of Social Sciences students and faculty before and during lockdown due to COVID-19. *Prof. Inf.* **2020**, *29*, e290423. [CrossRef]
25. Ricardo, C.; Vieira, C. Creencias y concepciones docentes de educación superior en enseñanza remota en el contexto de COVID-19 [Teacher beliefs and conceptions of higher education in remote teaching in the context of COVID-19]. *RIED-Rev. Iberoam. Educ. A Distancia* **2023**, *26*, 17–37. [CrossRef]
26. Davis, F. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Q.* **1989**, *13*, 319–339. [CrossRef]
27. Hidalgo-Cajo, B.; Gisbert-Cervera, M. Diseño y validación de un instrumento para evaluar la adopción de la tecnología digital en el profesorado universitario [Design and validation of an instrument to evaluate the adoption of digital technology in university teaching staff]. *Campus Virtuales* **2021**, *10*, 51–67.
28. Rosli, M.S.; Saleh, N.S.; Md Ali, A.; Abu Bakar, S.; Mohd Tahir, L. A Systematic Review of the Technology Acceptance Model for the Sustainability of Higher Education during the COVID-19 Pandemic and Identified Research Gaps. *Sustainability* **2022**, *14*, 11389. [CrossRef]
29. Cardullo, V.; Wang, C.H.; Burton, M.; Dong, J. K-12 teachers' remote teaching self-efficacy during the pandemic. *J. Res. Innov. Teach. Learn.* **2021**, *14*, 32–45. [CrossRef]
30. Alzahrani, A. Un análisis del Modelo de Aceptación de la Tecnología TAM para comprender la intención del comportamiento de la facultad en el uso del Internet de las Cosas IOT [An Analysis of the TAM Technology Acceptance Model to Understand Faculty Behavioral Intention in Using the Internet of Things IOT]. *Int. J. Educ. Res. Innov.* **2023**, *19*, 153–169. [CrossRef]
31. Kaqinari, T.; Makarova, E.; Audran, J.; Döring, A.K.; Göbel, K.; Kern, D. A latent class analysis of university lecturers' switch to online teaching during the first COVID-19 lockdown: The role of educational technology, self-efficacy, and institutional support. *Educ. Sci.* **2022**, *12*, 607. [CrossRef]
32. Kuo, Y.-C.; Kuo, Y.-T.; Tseng, H. Exploring the Factors That Influence K-12 Teachers' Use of Open Educational Resources. *Educ. Sci.* **2024**, *14*, 276. [CrossRef]
33. Cabero-Almenara, J.; Valencia-Ortiz, R.; Palacios-Rodríguez, A. La formación virtual en tiempos de COVID-19. ¿Qué hemos aprendido? [Virtual training in times of COVID-19. What have we learned?]. *IJERI Int. J. Educ. Res. Innov.* **2022**, *17*, 14–26. [CrossRef]
34. Arancibia, M.; Cabero, J.; Marín, V. Creencias sobre la enseñanza y uso de las tecnologías de la información y la comunicación (TIC) en docentes de educación superior [Beliefs about the teaching and use of information and communication technologies (ICT) in higher education teachers]. *Rev. Form. Univ.* **2020**, *13*, 89–100. [CrossRef]
35. Alharbi, S.; Drew, S. Using the Technology Acceptance Model in Understanding Academics' Behavioural Intention to Use Learning Management Systems. *Int. J. Adv. Comput. Sci. Appl.* **2014**, *5*, 143–155. [CrossRef]
36. Cabero-Almenara, J.; Gallego Pérez, O.; Puentes Puente, Á.; Jiménez Rosa, T. La 'Aceptación de la Tecnología de la Formación Virtual' y su relación con la capacitación docente en formación virtual [The 'Acceptance of Virtual Training Technology' and its relationship with teacher training in virtual training]. *EDMETIC* **2018**, *7*, 225–241. [CrossRef]
37. Ju Joo, Y.; Park, S.; Lim, E. Factors Influencing Preservice Teachers' Intention to Use Technology. *Educ. Technol. Soc.* **2018**, *21*, 48–59.
38. Teo, T. Factors influencing teachers' intention to use technology: Model development and test. *Comput. Educ.* **2011**, *57*, 2432–2440. [CrossRef]
39. Lee, D.Y.; Lehto, M.R. User acceptance of YouTube for procedural learning: An extension of the Technology Acceptance Model. *Comput. Educ.* **2013**, *61*, 193–208. [CrossRef]
40. Ruiz-Aquino, M.; Borneo Cantalicio, E.; Alania-Contreras, R.D.; García Ponce, E.S.; Zevallos Acosta, U. University teachers' attitudes towards ICTs and the use of virtual environments during the COVID-19 pandemic. *Publicaciones De La Fac. De Educ. Y Humanidades Del Campus De Melilla* **2021**, *1*, 107–121. [CrossRef]

41. Cavalcanti, D.R.; Oliveira, T.; Santini, F.O. Drivers of digital transformation adoption: A weight and meta-analysis. *Heliyon* **2022**, *8*, e08911. [CrossRef] [PubMed]
42. Li, Y.; Garza, V.; Keicher, A.; Popov, V. Predicting High School Teacher Use of Technology: Pedagogical Beliefs, Technological Beliefs and Attitudes, and Teacher Training. *Technol. Knowl. Learn.* **2019**, *24*, 1–18. [CrossRef]
43. Bandura, A. Self-efficacy: Toward a unifying theory of behavioural change. *Psychol. Rev.* **1977**, *84*, 191–215. [CrossRef] [PubMed]
44. Prior, D.; Mazanov, J.; Meacheam, D.; Heaslip, G.; Hanson, J. Attitude, digital literacy and self efficacy: Flow-on effects for online learning behavior. *Internet High. Educ.* **2016**, *29*, 91–97. [CrossRef]
45. Hatlevik, I.; Hatlevik, O. Examining the Relationship Between Teachers' ICT Self-Efficacy for Educational Purposes, Collegial Collaboration, Lack of Facilitation and the Use of ICT in Teaching Practice. *Front. Psychol.* **2018**, *9*, 935. [CrossRef] [PubMed]
46. Georgina, D.; Olson, M. Integration of technology in higher education: A review of faculty self-perceptions. *Internet High. Educ.* **2008**, *11*, 1–8. [CrossRef]
47. Castellanos, M.E.; Nieto, Z.C.; Parra, H.M. Interpretación de las competencias digitales profesoras presentes en el contexto universitario [Interpretation of the teaching digital competencies present in the university context]. *Rev. Logos Cienc. Tecnol.* **2018**, *10*, 41–51. [CrossRef]
48. Fernández-Cruz, F.J.; Fernández-Díaz, M.J. Los docentes de la Generación Z y sus competencias digitales [Generation Z teachers and their digital skills]. *Comunicar* **2016**, *46*, 97–105. [CrossRef]
49. George, A.; Sanders, M. Evaluating the potential of teacher-designed technology-based tasks for meaningful learning: Identifying needs for professional development. *Educ. Inf. Technol.* **2017**, *22*, 2871–2895. [CrossRef]
50. Moreno-Guerrero, A.; López, J.; Pozo, S.; López, J. Estado de la competencia digital docente en las distintas etapas educativas desde un alcance internacional [State of teaching digital competence in the different educational stages from an international scope]. *Rev. Espac.* **2020**, *41*, 19.
51. Tadeu, P. La competencia científico-tecnológica en la formación del futuro docente: Algunos aspectos de la autopercepción en respeto a la integración de las TIC en el aula [Scientific-technological competence in the training of future teachers: Some aspects of self-perception regarding the integration of ICT in the classroom]. *Rev. Educ. Siglo XXI* **2020**, *38*, 37–54. [CrossRef]
52. Gómez Jiménez, O.; Rodríguez Torres, J.; Cruz Cruz, P. La competencia digital del profesorado y la atención a la diversidad durante la COVID-19. Estudio de caso [The digital competence of teachers and attention to diversity during COVID-19. Case study]. *Rev. Comun. Salud* **2020**, *10*, 483–502. [CrossRef]
53. Tárraga-Mínguez, R.; Sanz-Cervera, P.; Pastor-Cerezuela, G.; Fernández-Andrés, M. Análisis de la autoeficacia percibida en el uso de las TIC de futuros maestros y maestras de Educación Infantil y Educación Primaria [Analysis of the perceived self-efficacy in the use of ICT of future teachers of Early Childhood Education and Primary Education]. *Rev. Electrónica Interuniv. Form. Profr.* **2017**, *20*, 107–116. [CrossRef]
54. Deci, E.; Ryan, R. The 'What' and 'Why' of Goal Pursuits: Human Needs and the Self-Determination of Behavior. *Psychol. Inq.* **2000**, *11*, 227–268. [CrossRef]
55. Deci, E.; Ryan, R. *Intrinsic Motivation and Self-Determination in Human Behaviour*; Springer: New York, NY, USA, 1985.
56. Brouwers, A.; Tomic, W. A Test of the Factorial Validity of the Teacher Efficacy Scale. *Res. Educ.* **2003**, *69*, 67–79. [CrossRef]
57. Cazan, A.M.; Maican, C.I. Factores determinantes en el uso del e-learning y la satisfacción docente [Determining factors in the use of e-learning and teacher satisfaction]. *Comunicar* **2023**, *74*, 89–100. [CrossRef]
58. Maican, C.; Cazan, A.M.; Constantin, R.; Dovleac, L. A study on academic staff personality and technology acceptance: The case of communication and collaboration applications. *Comput. Educ.* **2019**, *128*, 113–131. [CrossRef]
59. Wozney, L.; Venkatesh, V.; Abrami, P. Implementing Computer Technologies: Teachers' Perceptions and Practices. *J. Inf. Technol. Teach. Educ.* **2006**, *14*, 173–207.
60. Petchamé, J.; Iriondo, I.; Villegas, E.; Fonseca, D.; Yesa, S.R.; Aláez, M. A Qualitative Approach to Help Adjust the Design of Management Subjects in ICT Engineering Undergraduate Programs through User Experience in a Smart Classroom Context. *Sensors* **2021**, *21*, 4762. [CrossRef] [PubMed]
61. McDonald, T.; Siegall, M. The Effects of Technological Self-Efficacy and Job Focus on Job Performance, Attitudes, and Withdrawal Behaviors. *J. Psychol.* **1992**, *126*, 465–475. [CrossRef]
62. Taquez, H.; Rengifo, D.; Mejía, D. Diseño de un Instrumento Para Evaluar el Nivel de Uso y Apropiación de las TIC en Una Institución de Educación Superior. Portal Educativo [Design of an Instrument to Evaluate the Level of Use and Appropriation of ICT in a Higher Education Institution. Educational Portal]. Available online: <https://recursos.educoas.org/publicaciones/dise-no-de-un-instrumento-para-evaluar-el-nivel-de-uso-y-apropiaci-n-de-las-tic-en-una> (accessed on 2 February 2024).
63. Wang, Y.; Liu, C.; Tu, Y.F. Factors affecting the adoption of AI-based applications in higher education. *Educ. Technol. Soc.* **2021**, *24*, 116–129.
64. Al Darayseh, A. Acceptance of artificial intelligence in teaching science: Science teachers' perspective. *Comput. Educ. Artif. Intell.* **2023**, *4*, 100132. [CrossRef]
65. Alfoudari, A.M.; Durugbo, C.M.; Aldhmour, F.M. Exploring quality attributes of smart classrooms from the perspectives of academics. *Educ. Inf. Technol.* **2023**, *28*, 13109–13151. [CrossRef] [PubMed]
66. Wang, J.; Tigelaar, D.E.; Luo, J.; Admiraal, W. Teacher beliefs, classroom process quality, and student engagement in the smart classroom learning environment: A multilevel analysis. *Comput. Educ.* **2022**, *183*, 104501. [CrossRef]

67. Nguyen, L.T.; Kanjug, I.; Lowatcharin, G.; Manakul, T.; Poonpon, K.; Sarakorn, W.; Somabut, A.; Srisawasdi, N.; Traiyarach, S.; Tuamsuk, K. How teachers manage their classroom in the digital learning environment-experiences from the University Smart Learning Project. *Heliyon* **2022**, *8*, e10817. [[CrossRef](#)] [[PubMed](#)]
68. Petchamé, J.; Iriondo, I.; Korres, O.; Paños-Castro, J. Digital transformation in higher education: A qualitative evaluative study of a hybrid virtual format using a smart classroom system. *Heliyon* **2023**, *9*, e16675. [[CrossRef](#)] [[PubMed](#)]
69. Bond, M.; Marín, V.I.; Dolch, C.; Bedenlier, S.; Zawacki-Richter, O. Digital transformation in German higher education: Student and teacher perceptions and usage of digital media. *Int. J. Educ. Technol. High. Educ.* **2018**, *15*, 48. [[CrossRef](#)]

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