

Article

Digital Transformation and Teaching Innovation in Higher Education: A Case Study

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Abstract: The digital maturity of universities has been a key element in coping with the forced situation brought about by COVID-19 and in subsequent years. This research paper presents a case study of a private Spanish university that aims to analyze the challenges and opportunities that have arisen after the pandemic in terms of resource management and training for teaching innovation and digitization. The nature of this study is qualitative, in which nine interviews were conducted with managers from different faculties and those responsible for Information and Communication Technologies. After analyzing the data with Atlas.ti, four categories were established (technological resources and devices, challenges, opportunities, and others). The study concludes by discussing the commitment to online training, the popularization of videoconferencing tools for teaching sessions, meetings, or synchronous tutorials, and the acceleration of digital transformation, among others.

Keywords: remote teaching; COVID-19; technological resources; digital transformation; higher education; teaching innovation



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1. Introduction

Due to its potential impact and the relevance of digitization in the digital era on different areas (education included), digital transformation (DT) was thought to be a key opportunity as posited in multiple research works focused on the educational field (e.g., [1–3]). Diverse research works from varied points of view have focused on different aspects of DT in education in the post-pandemic period, such as identifying the critical elements to implement DT [4] and the barriers to its implementation in higher education institutions (HEIs) [5]; finding different digital DT initiatives in HEIs [6]; the impact of DT on education [7]; or how DT can impact the sustainability of HEIs [8]. Therefore, shedding light on specific issues related to DT constitutes a relevant topic in the future of education institutions.

News of a new virus that became known as SARS-CoV-2 began to emerge at the end of December 2019 in Southeast Asia. As the virus spread over time, the World Health Organization declared SARS-CoV-2 (COVID-19) as a global pandemic. According to UNESCO [9], 32 countries on three continents either announced or implemented school and university closures in early March 2020. Within days, more than 160 countries ordered school closures, which affected 1.5 billion children and young people [10], especially the most vulnerable. According to Marinoni et al. [11], in May 2020, around 67% of HEIs transitioned to online teaching, 24% suspended their classes while looking for solutions, and 7% cancelled their teaching processes altogether (the remaining 1% were not affected). While every effort was made to ensure pedagogical continuity by promoting a window of opportunity in terms of innovation and the adoption of technology, COVID-19 brought

major challenges, such as engaging in distance teaching for the first time, increasing teachers' lesson planning workloads, gaps in connectivity and technological devices, and digital literacy, among others [12]. For most countries, the pandemic challenged education systems and accelerated DT, highlighting the need for new methodologies and approaches, infrastructure, access to connectivity, devices, digital platforms, learning resources, and digital skills, not to mention the human factors involved in transforming education [9].

In Spain, because of the health crisis, a state of emergency was declared in mid-March 2020 (by Royal Decree 463/2020, of March 14, declaring a state of alarm for the management of the health crisis situation caused by COVID-19) [13]. This piece of legislation brought about the imminent closure of the physical facilities of universities, and therefore gave rise to the need to seek new alternatives to enable the teaching–learning process to continue, in order to guarantee the academic and professional training of students in HEIs [14–17]. Spanish universities directly suffered the impact of the pandemic and were able to provide solutions and response mechanisms in a very short period of time. As reported in 2020 by CRUE [18] (a non-profit association that groups a total of 76 Spanish universities, both public and private), Spanish universities faced the challenges of using technology to innovate teaching, improve virtual laboratories and staff training in digital skills, and enhance issues related to data protection and assessment.

This research paper presents a case study that aims to analyze the challenges and opportunities that arose after the COVID-19 pandemic period in a private university in Spain, which is measured in terms of resource management and training for teaching innovation and digitization. This research examines the institution's management vision regarding its DT, as part of a triad of studies. Additionally, this comprehensive research includes a study on the teaching staff's perspective, particularly their acceptance or rejection of technology in the classroom [19], along with ongoing research focusing on student perceptions, well-being, and technology. The theoretical framework will succinctly outline several factors that contextualize the issues under study from a multifaceted perspective. This will be followed by a description of the research methodology used and a summary of the findings. Finally, these findings will be discussed, and the paper's conclusions will be presented.

2. Theoretical Framework

The suspension of face-to-face classes and the start of lockdown forced educators and students to rapidly use different Information and Communication Technologies. This situation was seen both as an opportunity [20] and a challenge [21], due to the shortfalls in infrastructure, training, and connectivity on the part of universities [22] and students. In order to overcome the digital divide, the Spanish government recommended improving universities' computer equipment and online networks, as well as training teaching staff in the use of digital communication and connectivity.

The pandemic was both a challenge and an opportunity for teaching staff at all educational levels, since it required the development of new skills in the use of digital devices and programs, curriculum adaptations, and even innovation in educational processes in order to ensure the acquisition of knowledge and the development of competences by students [23,24]. According to Satorre Cuerda [25], the fact that this compelling situation occurred overnight accelerated the implementation of didactic innovations and different modes of teaching that were hitherto only theories and intents. Numerous research articles have focused on different specific aspects, such as the shift from face-to-face training on university campuses to remote training (e.g., [26–31]), analyzing various specific issues arising from not being physically present in the classroom (e.g., [32–35]), the implications for the well-being of those concerned [36–40], or the new opportunities arising in education from the adoption of remote or hybrid formats (e.g., [41–43]).

In Spain, despite the digital advances driven by COVID-19, according to Gómez [44], 71% of HEIs consider themselves digitally distressed, as 'digital maturity is a gradual process that unfolds throughout the organisation over time, no organisation can become

digitally mature overnight' (p. 10). However, according to the 2022 UNIVERSITIC report [45], digital maturity in Spanish universities has improved since 2020, because during this period, they had a budget of EUR 142,85 million promoted by the UniDigital Plan of the Ministry of Universities [46] to digitize the university system, and university leaders have understood the importance of increasing digital maturity for their institutions to be competitive in a digital and rapidly changing environment. In recent years, innovative teaching initiatives and classrooms with advanced technological equipment have been promoted, which have included offering online classes in real time and redesigning classrooms and laboratories.

Fernández et al. [6] conducted a literature review of the DT initiatives that universities have carried out and concluded that the most of the emerging technologies used included advanced analytics (23%), servers (20%), and artificial intelligence (16%). They highlighted that HEIs in Spain are merely taking their first steps towards digital maturity, as only one in four institutions have a detailed digital strategy in place.

Various frameworks exist in the literature for assessing the digital maturity of universities. For example, Molina-Carmona et al. [47] proposed the MD4U model with seven strategic challenges that any university should consider if they are to increase their digital maturity and improve their strategic processes. These challenges are as follows: expanding digital skills and culture among the university community; optimizing information security and maintaining business continuity; being competitive thanks to the high quality of services provided; offering high quality, competitive education; meeting the emerging demands of clients (students); having information and knowledge for optimal decision-making; and achieving the university's strategic objectives (vision).

3. Objectives and Methodology

The university that is being analyzed in this case study provided teaching remotely from 14 March until the end of the 2019–2020 academic year. The following academic year, 2020–2021, it returned to face-to-face teaching, but with safety measures: setting a limited ratio of students per class, leaving some free seats between students, an obligation to wear masks indoors, and ensuring good ventilation. In degree courses with a large number of students, the full classes were divided into two groups. The students in these groups attended classes on alternate days in person, and one of the sessions for each subject took place with the whole group remotely. Finally, in the 2021–2022 academic year, the course returned to full in-person attendance.

The research question of the study is as follows: how has the digital transformation implemented by a private university in Spain during the period 2019–2022 influenced its ability to address post-pandemic challenges and leverage new opportunities? Therefore, the overall objective of this research is to present a case study of a private university in Spain in which the post-pandemic challenges and opportunities are analyzed on the basis of the measures implemented at the time to minimize and combat the effects of COVID-19.

The analyzed university has more than 130 years of experience and offers a wide variety of degrees, double degrees, master's degrees, and doctoral degrees in the fields of Business, Law, Health Sciences, Psychology, Sports, Education, Social Sciences, Theology, Languages, and Communication. More than 12,000 students were enrolled in the 2023–2024 academic year, and more than 1600 employees were involved.

This research is based on a case study methodology using a qualitative approach. This methodology was used because the research sought to understand and gain in-depth knowledge of a specific situation, consistent with a case study approach [48]. Specifically, this work focuses on the analysis of digital transformation in a post-pandemic scenario from the point of view of the university's ICT managers and leaders. A total of nine interviews were carried out: five of them with the managers of the different faculties, one with the Pro-Vice-Chancellor for Academic Affairs, one with the Information Technology support staff, one with the manager of the Online Training Unit, and another one with the person in charge of the Teaching Innovation Unit. These participants were selected

because they had an insider's view of the institution and because they were responsible for many decision-making processes. These staff members were sent an email that requested their participation, and those who did not respond were reminded by telephone. Table 1 includes further details of the participants, who are identified with the labels P1 to P9.

Table 1. Detail of the participants in the study.

Participants	Position	Sex
P1	Manager of the Faculty of Economics	Male
P2	Manager of the Faculty of Social Sciences and Humanities	Female
P3	Manager of the Faculty of Education and Sport, and Health Science	Male
P4	Manager of the Faculty of Law	Male
P5	Manager of the Faculty of Engineering	Male
P6	Pro-Vice-Chancellor for Academic Affairs	Female
P7	IT Support	Female
P8	Online Training Unit	Female
P9	Teaching Innovation Unit	Male

Semi-structured in-depth interviews were used to collect the data. They included the following questions, which revolved around resource management, challenges, and opportunities, and their effects on digital transformation:

1. What digital technology resources have been available to the faculty since the beginning of the pandemic?
2. Which kind of technological support devices have been acquired by the faculty?
3. How have technological support devices been managed?
4. What challenges and opportunities have you seen with regard to the use of digital technology in teaching?

The interviews were conducted from October 2022 to December 2022. In order to improve validity, the interviews were recorded to obtain the verbatim narratives of the participants. They were analyzed and verified by three researchers using the Atlas.ti software, version 9. The interviews lasted an average of 25 min.

The participants were at all times aware of the ethical principles of confidentiality, anonymity, privacy, and free choice of participation. They were also informed about the purpose of the research.

A deductive coding technique was used, that is, the initial categories were determined prior to data collection based on the interview script. While these were supported by the previous literature, emerging codes and categories were also created [49].

4. Results

A categorical content analysis was carried out. Based on a total of one-hundred and fourteen interview excerpts, four categories and twenty-seven codes were assigned.

A fast way to obtain an overview of the interview content is by creating a word cloud or word list. After using filters to exclude words such as prepositions and determiners, the most mentioned terms were as follows: pandemic, online, education, university, educators, changes, cameras, meetings, and face-to-face.

The most significant root codes (the most represented codes) were related to cameras (N = 13), hybrid classrooms (N = 13), and licenses (N = 7). A table that details the categories and codes is presented below (Table 2):

Table 2. Interview categories and codes.

Categories	Codes	Root Codes (N)
Technological resources and devices	Cameras	13
	Camera lights	6
	Licenses	7
	Laptop computers	4
	Interactive whiteboards	4
	Tablets	3
	Headphones	4
	Hybrid classrooms	13
	Google Meet	4
	Google Drive	4
	Website	2
Challenges	Forum	3
	Online education	4
	Emergency remote teaching	2
	Opening markets	2
	In-service training	6
	Low birth rate	5
	Assessment	1
Legislation	2	
Opportunities	Online Training	4
	Low birth rate	5
	Trust	4
	Remote meetings	5
	Peer network	5
	Optional webinars	4
Others	Management	2
	Teamwork	5

The categories and codes that emerged from the interviews are analyzed below:

(a) Technological resources and devices:

Before COVID-19, the analyzed university already had sufficient technological resources such as laptops for each member of the full-time teaching and research staff (known in Spanish as PDI), desktop computers for administration and service employees and some teaching and research staff members, software licenses, interactive whiteboards in some classrooms, loan laptops for teaching staff with temporary contracts, 360-degree cameras, and some hybrid classrooms. However, during the pandemic and afterwards, it was necessary to purchase new technological resources. Since most laptops have a built-in camera, it was not necessary to buy a lot of cameras; on average, about four to six cameras were required per faculty. However, a more significant disbursement was made for a widespread purchase of lollipop/giraffe 360-degree cameras with the support of the Vice-Chancellor's Office. These cameras were mainly used during COVID-19 for hybrid teaching, i.e., one subgroup was in the classroom for a face-to-face session while the members of the other subgroup were following the sessions from home. In the specific case of the Faculty of Law, P4 stated that there was a need to have technical support for the management of this kind of camera, allowing the professor to focus on teaching tasks. This issue was resolved with the help of a scholarship student, who was enrolled in a master's degree with a specialization in Information and Communications Technologies. Overall, the participants highlighted that the audio quality of these cameras was excellent for addressing the listener. Despite the large disbursement, after the return to normality, they were only used for some postgraduate meetings due to visa problems that made it difficult for certain students to attend the doctoral seminars.

In addition to the lollipop/giraffe cameras, light cameras, headsets, tablets, licenses (especially for the Screencast-O-Matic and Loom resources for video tutorials), and laptops were purchased during the COVID-19 period.

On the other hand, all participants rated Google Meet and Drive as the most used applications during the pandemic. P2 stated the following: 'For example, here at the faculty, don't ask me why, as luck would have it, we didn't work with Drive, we had everything in folders', but 'just before the pandemic we decided to save everything in Drive'. Moreover, during the pandemic, a website was created to collect all the information related to remote teaching, such as a forum to ask questions or share examples of good practices.

Finally, it is worth noting that hybrid classrooms existed before the pandemic. These spaces could be used by anyone, regardless of the faculty in which they were located. Strangely enough, 'the faculty of theology was a pioneer in all this' (P2). The aim of these rooms is that students who are away from the classroom can connect under the same conditions as those in the classroom. P8 argued that these 'spaces should be used for specific things that make sense in terms of length and time'. For example, these spaces could be used for talks between different campuses or doctoral courses, since 'it makes no sense for someone from Colombia to come to a three-hour doctoral seminar' (P8).

(b) Challenges:

One of the major challenges identified by the participants was online education. In future academic years, the analyzed university will offer two online degrees; to a certain extent, these have been streamlined and 'somewhat driven by the pandemic' (P1) and the low birth rate, although the design and planning process had already started two years before the COVID-19 crisis. Eighty percent of the participants believed that the online offering should be attractive and dynamic, and that great care should be taken in the design of the materials and the platform. Moreover, P5 argued that digital literacy is extremely important, as is the creation of engaging videos and video tutorials. According to P2, a key element was to have the ability to open up to the market and attract new students, as she believed that the university has a relatively local scope.

However, P2 was wary about online education, as she thought that a differentiating feature of this university is face-to-face education. P5 pointed out that the drop-out rate in some online degrees can be high, and therefore considered that it cannot be offered in all faculties.

Linked to the above ideas, P6 and P8 argued that the pandemic emergency meant that, 'everything was done in a hurry, and many did not have enough time, it was a bad experience', and that 'these points of reticence remain among the teaching staff'; therefore, it may be difficult to persuade some educators to teach an online degree.

Lifelong learning was also noted as a challenge. P3 noted that 'historically, the number of online in-service training courses has been quite low'. However, during the pandemic, both technology-savvy and reluctant teaching staff attended many of the webinars that were offered. The webinars that were most in demand were those on how to motivate students, keep them engaged, and prepare for online exams. With regard to this last aspect, P7 stressed that new sites with specific guidance on assessment were generated, as assessment was one of the most sensitive issues.

In addition, all the participants indicated that after the return to normality, many students asked for some classes, review work, and meetings to be held remotely for convenience, although the analyzed university decided not to change the regulations and to remain committed to face-to-face learning, except in exceptional cases.

Finally, it should be noted that strategy and leadership play a key role in the development of DT. This point was stated by P8: 'the route to DT depends on the leadership and strategy of the university (and its managers)'.

(c) Opportunities:

P3 stated that today's society is experiencing a profound decline in birth rates, and as a result, the number of teaching groups in each year in schools has been reduced, which is

a problem that will certainly also reach universities in 8 to 10 years' time. To address this, participants agreed that educational institutions should gradually prepare for the online world, which would provide the opportunity to open new markets in the future.

All the participants mentioned that people have become much more confident with technology, to the extent that they have become used to holding meetings online, 'and this feels natural, they're not nervous in front of the cameras' (P5). Before the pandemic, most staff meetings took place in person, but since then, meetings between staff from the three campuses, the dean's team, and students (to review work and activities) have tended to be held online using MEET. In the opinion of the participants, virtual meetings are more practical and convenient, mainly because of the quality of the video and audio in web conferencing. However, P1 indicated that he preferred face-to-face meetings when there is a new teaching team.

Finally, all the participants noted that strong and positive peer relationships were generated. They added that the fact that attendance to webinars was optional was a great success.

(d) Others

The management of technological resources at this university was centralized from the Pro-Vice-Chancellor's Office during the COVID-19 crisis. All the interviewees pointed out that the university had made a strategic commitment to include online learning in its strategic plans since 2010; therefore, the pandemic did not have a very significant negative impact in terms of technological resources and infrastructure. They agreed that 'perhaps the greatest value of the university is that we worked really closely together as a team, the IT service, the Teaching Innovation Unit and the Online Education Unit' (P8). Moreover, since 2010, the university has been engaged in team efforts in this regard and the three units (IT Support, the Online Education Unit, and Teaching Innovation Unit) have been meeting regularly.

5. Discussion

This study delves into the challenges and opportunities related to resource management and training for teaching innovation and digitalization that have emerged in the post-pandemic years. This case study not only sheds light on the current state of digital maturity in higher education at a Spanish private university, but also highlights the critical steps universities are taking to adapt and thrive in a post-pandemic world.

García-Peñalvo (2021) stressed that the DT of universities requires changes along three lines: in management and governance (through strategic plans), in physical infrastructure (connectivity, servers, storage space, audio-visual content production, etc.), and in logical infrastructure [50].

Regarding the findings gathered about technological resources and devices, different ideas are detailed below.

Most of the participants agreed that a positive aspect was the popularization of video-conferencing tools for teaching sessions, meetings, and synchronous tutorials. However, we should not overlook the various difficulties that these tools can pose, such as those related to the pace of the class, problems with the interaction between educators and classmates, and issues linked to attention and procrastination, among others [33,35,43,50]. In reference to the software used, the widespread use of the Google Meet and Drive applications coincides with other studies, as stated in [48,51,52]. Finally, it should be noted that in this university, hybrid classrooms already existed before the pandemic; similarly, as implemented in other universities [53–55].

In this case study, the participants' responses have not made explicit reference to the need to continue boosting emerging technological trends such as artificial intelligence, the Internet of Things, blockchain technology, and other relevant platforms and technologies such as social media, mobile platforms, big data analysis, and cloud computing, Robotic Process Automation, Virtual Reality and Augmented Reality, and Additive Manufacturing, in contrast to the results of the study of Truong and Diep [56].

In connection with the Challenges and Opportunities categories, the findings show a majority consensus (80% of the participants) in leveraging the technological impulse to implement a greater offering of online education, especially for university degrees and in-service training. A firm commitment to this strategy is all the more necessary given the low birth rate in Spain. However, some of the participants interviewed were reticent to the upsurge in online education, mainly due to two factors: (i) the structural paradigm shift that is required, and (ii) the difficulty in overcoming a certain level of resistance from the teaching staff due to the distressing experience they had had during the ERT (emergency remote teaching) phase. These types of barriers are also described in other studies [3,5].

The United Nations Educational, Scientific, and Cultural Organization [57] has acknowledged that teachers play an essential part in the construction of inclusive, equitable, and quality education; therefore, in order to face the COVID-19 pandemic, it was necessary to develop skills in the use and management of Information and Communication Technology, reinforce remote teaching, and strengthen the morale and motivation of academics. Consistent with this need, the development of DT should be driven by the university's management structure in accordance with P8's comments.

It is worth highlighting a major idea expressed by the participants: the forced use of technology during the pandemic has increased the confidence in its use. In addition, ties between members of the university community have been strengthened. Therefore, these factors can facilitate the DT process at the university.

Finally, the findings of the study are aligned with those presented in the 2022 UNIVERSITIC study [45]. Firstly, the COVID-19 pandemic has accelerated the pace of digital transformation, which has been compared to the creation of the Internet, highlighting the extraordinary response by universities. In the analyzed case, this fact has been possible thanks to the measures adopted by the institution since 2010 (P6). Secondly, strategic planning is required to evolve towards a digital university paradigm; this involves transforming university processes to ensure that additional new students can be reached through a satisfactory experience that reinforces digital competences, which is in line with P8's comments. However, opportunities such as those brought about by artificial intelligence and threats such as cyber-attacks were virtually absent from the interviews. The 2022 UNIVERSITIC report urged universities to meet these challenges.

There are several contributions that study the pre-pandemic and pandemic scenario from the point of view of managers. Using a qualitative approach, this study brings together the perspectives of nine ICT university managers and leaders through in-depth interviews in a post-pandemic scenario. As Yin (2018) points out, case studies allow us to complement other types of studies that add data [48], such as the UNIVERSITIC study (2022), in the field studied [45]. Along these lines, Romero et al. (2023) highlight the need to collect information on digital transformation in universities from a qualitative perspective in the post-COVID-19 period, so that the lessons learned can be useful for other universities that want to embark on a similar path [58].

The findings of this case study are particularly useful for the institution analyzed. However, the implications of this research also extend to members of the university community and organizations involved in implementing DT in the educational field. On the one hand, a unique perspective on the same challenge has been obtained from different management roles. Furthermore, this managerial vision is part of a broader study that also analyses the perspectives of teaching staff [19] and students (study in progress), providing a multifaceted view of DT. Both the methodology used and the results obtained can serve as a foundation for new studies in other educational institutions undergoing DT processes.

One limitation of this research is that it is a case study in a specific context. Therefore, as part of future research, it would be interesting to conduct a longitudinal study with a larger sample of HEIs to analyze how their DT is progressing. Moreover, for future lines of research, it would be of interest to know the students' opinion on DT and even to replicate the same study in other universities, whether public and/or private, since the results may be different depending on the context.

6. Conclusions

This research work provides a business vision related to the adoption of technology in the university environment, at a time after the COVID-19 pandemic period. Therefore, this article outlines strategic reflections related to the adoption of technologies without the condition derived from restrictions imposed by the authorities. However, the changes forced by the pandemic have allowed us to draw a series of conclusions related to the use of technology. HEIs are no strangers to DT [59], but the road to it is often fraught with difficulties. As stated by Molina-Carmona et al. [47], DT is much more than digitization. Exploring it requires identifying the potential of technology to drastically transform business processes, create new services, or develop strategic business processes.

From this case study, it has been confirmed that there has been a DT strategy since 2010 that is detailed in the strategic plan and that the university has managers responsible for it. Furthermore, following the MD4U model mentioned in the theoretical framework [47], it can be concluded from the interviews that the analyzed university had digital resources and increased the quality and quantity of technological services. That is, the inclusion of specific technologies adopted by the university under study only partially describes the DT phenomenon, since a deep organizational change is clearly required. This change should be supported by the university managers in terms of leadership and strategy. In conclusion, it is worth mentioning that the main themes that emerged from this research work are related to the commitment to online training, the popularization of videoconferencing tools for teaching sessions, meetings or synchronous tutorials, and the acceleration of digital transformation, among others.

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