

Pandemic-accelerated Digital Transformation of a Born Digital Higher Education Institution: Towards a Customized Multimode Learning Strategy

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ABSTRACT: The COVID-19 pandemic has forced the digitalization of the majority of universities, prior to which they were largely operating using face-to-face modes of learning. Increased competition in the digital environment places universities under greater pressure to offer an innovative learning experience. The purpose of this paper is to understand the effects of the sudden pandemic on the ongoing process of digital transformation (DT) and how the learning value proposition of higher education institutions (HEIs) has been affected. The research is based on a single case study of a born digital university, focusing on the changes made to the learning value proposition, and particularly to the multimode learning offer. The paper uncovers the relation between multimodality and customized and personalized learning, all of which are dependent on the use of digital educational technology. The originality of this paper is its longitudinal look at a single case, observing how the significant DT process already underway prior to the pandemic has been impacted by it, accelerating the process, and clarifying the envisaged post-pandemic future for HEIs. Another distinctive aspect is the consideration of the learning proposition as a core element and part of a larger and interdependent value proposition within the overall HEIs business model.

Keywords: Higher Education Institutions, Customized learning, Multimode learning, Digital transformation, Business model

1. Introduction

The impact of the COVID-19 pandemic on higher education institutions (HEIs), defined as universities, colleges, and polytechnics that offer degrees beyond secondary education, has been dramatic on a global scale. The so-called emergency or forced digitalization allowed HEIs to continue offering their students learning opportunities when social distancing and lockdown were mandatory. The COVID-19 shock has been revolutionary and has impacted the entire higher education system, causing a drastic shift in the scale of change (Alvesson & Sveningsson, 2015) in a sector that was already immersed in a continuous digitalization process, with digital technologies threatening to disrupt HEIs (Posselt et al., 2018).

Research carried out prior to the pandemic already considered the adoption of digital technologies and processes inevitable to remain a relevant player in higher education (Khalid et al., 2018). Most HEIs were already proving to be adaptive to these technologies, implementing new teaching and learning methodologies rapidly, at least operationally (Alvesson & Sveningsson, 2015). According to a global survey of 424 HEIs in 106 countries (Marinoni et al., 2020), at the onset of the pandemic, 67% of HEIs were able to replace classroom teaching with online distance teaching and learning. This research concludes that the forced learning and testing of new digital tools and methodologies (e.g., video conferences) has changed the digital mentality of teachers, opening a window to explore more flexible learning paths now that online learning is envisaged to be a more integral part of teaching plans. What remains to be seen is whether this proven operational capacity to change and adapt to an emergency situation will become fully integrated into HEIs and evolve into a strategic capacity to implement change (Alvesson & Sveningsson, 2015). This integration will be essential in a sector whose boundaries are being aggressively trespassed by new competitors, including the so-called “EdTech” companies, understood as companies that intensively apply “technological resources and processes for learning and teaching purposes” (Kaplan, 2020). These new entrants are competing with innovated-digitalized business models to change the rules of the training industry (Posselt et al., 2018).

Marinoni et al. (2020) uncover that the pandemic has significantly helped increase inequality in learning opportunities, at least in the short run, since almost a third of HEIs did not adapt fast enough to the new digitalization-forced reality. Although this situation is expected to be resolved in the near future, it reminds us the challenges arising from the previously acknowledged academic digital gap (Bond et al., 2018).

The COVID-19 pandemic is an example of an exogenous shock, defined as “a period of prolonged and widespread crisis in which actors struggle to reconstitute all aspects of social life” (Fligstein & McAdam, 2011, p. 32). The impact of exogenous shocks has been explored at the business model level (Corbo et al., 2018; Morgan et al., 2020), and the specific impact of COVID-19 has been explored in other contexts such as start-ups (Kuckertz et al., 2020) and family businesses (Soluk et al., 2021), among others. Research on the impact of COVID-19 on the HEI sector has also been carried out (Marinoni et al., 2020; Vlachopoulos, 2020), but what is still unknown is its impact on the business model of HEIs, especially in terms of the effect on the DT process already underway. The success and direction of the DT of HEIs in the midst and aftermath of COVID-19 is of present importance because HEIs are a backbone for training, knowledge generation and transfer, and ultimately social development. Beyond the COVID-19 impact, the findings of this research can also be informative for future shocks to the HEI sector.

HEIs are being forced to adapt to the ongoing cultural and societal changes challenging traditional educational practices, a central aspect of which is the rapid and continual development of digital technologies, some of which have been specifically developed for educational purposes. Education research should be grounded within current social, political, and philosophical changes, with a strong call towards sustainability (Stepanyan et al., 2013). Building on the societal issue of technological change related to education, we aim to contribute to the debate on the present and future of a higher education immersed in a continuous DT, exposed to a highly competitive landscape, and affected by exogenous shocks of a societal, health, economic, and sectoral nature. Most scholarly approaches to higher education, educational technology, and the business models of HEIs tend to focus on dual associations, mostly higher education and educational technology, with little research at the intersection of the three issues. The research at this intersection also responds to calls for further enquiry into new business models based on technological innovations (Stepanyan et al., 2013), especially when they encompass mobile, ubiquitous, and game-based learning (Kinshuk et al., 2013), the cultural diversity of stakeholders when deploying technology-assisted learning in international contexts (Habib et al., 2014), and the issue of inequality concerning the web lecturing mode (Montrieux et al., 2015), among others. Additionally, in the context of the ongoing digitalization process, there have been recent calls for further research into different aspects of customized or personalized learning (Lee et al., 2018) in higher education, including the challenges of digitalisation in different learning contexts and student engagement and motivation within these personalized learning environments (Alamri et al., 2021). Other authors call for more research on personalized learning content and delivery modes (Xie et al., 2019), the performance of technology platforms, and personal learner profiles (Alamri et al., 2021), among others.

To address the knowledge gap of the impact of COVID-19 on the future of the HEI sector, the purpose of this paper is to understand the effect of the unexpected pandemic on the learning value proposition of HEIs as a core element of their business models (BM), adding to the already huge impact of the ongoing DT. We thus propose the following research question: How has the COVID-19 shock affected the ongoing DT of HEIs, especially as regards the learning value proposition?

We use a longitudinal single case study to investigate the research question, observing how the significant DT process is currently being impacted by the pandemic, accelerating the desired vision of the studied HEI. An original element of this study is its positioning at the triple intersection of COVID-19, digital transformation, and business models in the HEI sector. Our theoretical framework and empirical findings uncover the use of multimodality to facilitate customized and personalized learning. We build on existing research to explore multimodality in teaching, mainly from two approaches. The first is the taxonomic proposal of Margulieux et al. (2016), which is based on three dimensions, face-to-face versus online learning, the delivery medium, and the instruction type. And the second focuses on the main e-learning forms in higher education, namely distance, formal, and open education (Nguyen et al. 2019), and online distance learning (Kaplan & Haenlein, 2016), understood as all forms of instruction where the student is separated by distance from the instruction and whose interactions are mediated by digital technologies. Within this context, this paper understands the concept of multimode digital learning as the matrix of digital methods, forms, and tools, including direct instruction via synchronous video conferences and asynchronous videos, group-project-based learning, and online exams, that can be used for digital or digitally enhanced learning. In this paper we argue how this matrix will allow HEIs and students to respectively offer and choose from a very large set of learning combinations, which will eventually lead to HEIs offering a customized learning value proposition that will change the *what*, *when*, *how*, and *where* of the learning journey.

This introduction is followed by a theoretical section that sets the frame for the research and identifies the gap. The methods section describes the case study chosen and the methodological process followed. The results section presents the empirical findings, evidenced by interviewees' direct quotations and structured codifications

of the changes in the learning value proposition. Next, the discussion considers the results in the light of the research question and the theoretical background. Last, a concluding section provides an overall assessment of the paper with its highlighted contribution, some limitations, and future research proposals.

2. Theoretical background

2.1. Educational technology, learning multimodality, and personalized learning

2.1.1. Educational technology

It can be argued that research on educational technology has not generally been supported by and connected to learning theories. There are, however, some attempts to do so and connections have been made with existing theories, including constructivism and behaviourism (Albirini, 2007). Behaviourism considers learning as a reactive process (Clark & Salomon, 1986), with students taking a passive role and a teacher-centric lecturing approach (Gärdenfors & Johansson, 2005). Educational technology within the digital milieu, however, does not fit well with behaviourism since digital means enabling an active and more student-centric approach more in line with a constructivist view (Albirini, 2007). The constructivist theory pioneered by Jerome Brunner in 1966 (Sejzi & Aris, 2012) proposes that “learning is an active process where students construct knowledge or new concepts based on their experiences” (Alamri et al., 2021, p. 427), becoming autonomous and independent learners (Alamri et al., 2021) who take responsibility for their learning anytime and anywhere (Sejzi & Aris, 2012). Information and communication technologies such as learning management systems and videoconferencing tools, among others, can provide a constructivist context for learning (Sejzi & Aris, 2012), even if there are some concerns about the lack of clarity as to what students are constructing (Gärdenfors & Johansson, 2005).

2.1.2. Learning multimodality

Extant research underlines the importance of DT in HEIs (Kaplan & Haenlein, 2016) and its impacts on different processes and groups, including students, staff, and professors. A myriad of digitally-driven opportunities are explored, including adding digital technologies to be able to develop new learning strategies that are more interactive and based on co-learning (Pucciarelli & Kaplan, 2016), and customising individual lessons (Renz & Hilbig, 2020). With the rise of new teaching and learning methods that integrate new digital technologies, including artificial intelligence, machine learning, and learning analytics, the HEIs’ BM is becoming more digitalized and data-based (Renz & Hilbig, 2020). This digitalization of HEIs opens a world of options, including digital/non-digital hybridizations of learning systems and tools that increase its multimodality.

There are some attempts to define the multimode teaching options that emerge from combining face-to-face and online learning (Margulieux et al., 2016), including hybrid, blended, flipped, and inverted methodologies, among others. The taxonomy has been established by combining two dimensions, the delivery medium (via an instructor and/or via technology, when an electronic system mediates between the teacher and the learner) and the instruction type (if students are mainly receiving content during instruction and/or applying content). This combination of teaching modes contributes to adapting to the personal preferences and type of learner (Felder & Silverman, 1988), e.g., visual or verbal, active or reflective, and so on.

As regards technological means, some previous research has focused on the main e-learning forms in higher education, including distance, formal (homologated), and open education (Nguyen et al., 2019). According to the same authors, e-learning represents a new way of teaching and learning which is: (i) more learner-centric and learner-personalized, (ii) supported by the ever changing digital technologies that offer ubiquity in the access and delivery of teaching resources and services anytime, anywhere; and (iii) uses interactive, collaborative, and personalized modes.

Other authors understand online distance learning (Kaplan & Haenlein, 2016) as all forms of instruction when the student is separated by distance from the instructor and when interactions are mediated by digital technologies. Distance learning can be developed with time separation (asynchronous) or not (synchronous). Considering that the number of participants can be limited or unlimited, this time and space combination offers an interesting multimode portfolio of teaching opportunities for distance learning. For example, the asynchronous method allows for Massive Open Online Courses (MOOCs; open-access online courses for the

open community) and Small Private Online Courses (SPOCs; for limited participants), while the synchronous method allows for Synchronous Massive Online Courses (SMOC; open access but with students simultaneously digitally present) and Synchronous Small Online Courses (SSOC; the same as SMOCs but for a limited number of participants). While all these possibilities already existed pre-pandemic, their application was uneven and optional. HEIs embraced the former innovations at their own pace and under the influence of various contextual, organizational, and individual factors.

2.1.3. Personalized learning

Multimodality opens a myriad of possibilities to offer learning experiences more adapted to students' needs and wishes. Despite increased interest in personalized learning at the academic level in recent years, there is no agreed definition of the concept (Shemshack & Spector, 2020; Schmid & Petko, 2019). A recent systematic review of published research on personalized learning has revealed that different terms, such as adaptive learning, individualized instruction, and customized learning, have been used interchangeably (Shemshack & Spector, 2020). Customized learning considers "individual differences and needs, characteristics, interests, and academic mastery" (Shemshack & Spector, 2020, p. 6). According to Hsieh and Chen (2016) personalized learning aims to match the learning experience with the needs of different cognitive style groups, using adaptivity to automatically tailor content, structure, and presentation to each individual (Treiblmaier et al., 2004). Personalized learning is controlled by the system, or the educational technology platforms, and it is system driven (Kay, 2001). In contrast, customized learning aims to tailor the experience to the needs of each individual, endowing individuals with adaptability to make modifications to the content presentation and format layout by themselves (Treiblmaier et al., 2004). Customized learning is controlled by the user (Hsieh & Chen, 2016), so it is user driven (Kay, 2001), with users involved in the initiation, proposal, selection, and even production of learning elements (Kobsa et al., 2001). Users can choose from a menu of available options (Frias-Martinez et al., 2009) that offer different degrees of customization (Teng, 2010), reducing the risk of improper adaptation (Findlater & McGrenere, 2004) of personalized systems. Customization and personalization can both be applied to accommodate the diversity of students' cognitive styles (Hsieh & Chen, 2016).

From the perspective of learning theory, personalized learning is ingrained in the constructivist theory (Alamri et al., 2021), and has the potential to develop learner-centred strategies, with information technology platforms facilitating this process (Albirini, 2007). However, customized learning involves more agency from the student, which is even more aligned with a constructivist view.

2.2. Digital transformation and the HEI business model

While there is no unified definition of digital transformation (DT), a recent review of 124 articles has defined the concept as "a fundamental change process enabled by the innovative use of digital technologies, accompanied by the strategic leverage of key resources and capabilities aimed at radically improving an entity (an organization, a business network, an industry, or society) and redefining its value proposition for its stakeholders" (Gong & Ribiere, 2021, p. 12).

The concept of business model has been widely studied in academia (Foss & Saebi, 2017) and much used in the business world, especially in entrepreneurial environments thanks to the popularization of tools like the Business Model Canvas (Osterwalder et al., 2010). A generally accepted definition of BM describes the concept as a "story" that essentially explains how firms work (Magretta, 2002) and how a firm does business (Demil et al., 2015), or "the rationale of how an organization creates, delivers and captures value" (Osterwalder et al., 2010). When the focus is on explaining the different elements or dimensions that configure the BM, there are different BM frameworks such as the BM in five value dimensions, namely value proposition, value communication, value creation, value delivery, and value capture (Abdelkafi et al., 2013).

Rising consensus that business practices are becoming necessary in HEIs (Pucciarelli & Kaplan, 2016) has led to the recent use of the BM concept and approach in the context of universities (Abdelkafi et al., 2018; Rosi et al., 2018). Posselt et al. (2018) analyse the evolution of universities towards being more entrepreneurial, pointing to the importance for universities of expanding and digitalizing their offering. Only limited research has explored how the business model is innovated due to the impact of DT in the particular context of HEIs (Rof et al., 2020).

Digitalization is changing the higher education sector. New “EdTech” companies are entering the sector with innovative business models (Kaplan, 2020), some of them integrating state of the art technologies for education purposes, including learning analytics and artificial intelligence, into their BM (Renz & Hilbig, 2020). Furthermore, recent research states that digital technologies are disrupting universities (Posselt et al., 2018) and that HEIs must adapt to technological changes if they want to stay relevant (Zulfikar et al., 2018; Khalid et al., 2018). The growth of distance learning and derivative formats (MOOCs, social media, etc.) can potentially remodel the education industry in the near future, increasing the risk of disappearance of the non-adapted players (Kaplan & Haenlein, 2016). In the same line, some argue that implementing new technologies is essential to be digitally relevant, and that the real challenge is the appropriate execution of digital plans and strategies (Nguyen, 2018). More particularly, other research explores how DT impacts professors and students, including how to address the academic digital gap by developing professors’ digital skills since students are very motivated to use digital tools for learning (Bond et al, 2018).

2.3. The effects of COVID-19 on the HEI value proposition

The COVID-19 shock has been explored in other contexts such as start-ups (Kuckertz et al., 2020) and family businesses (Soluk et al., 2021). Recent research has also focused on the impact of COVID-19 on HEIs, covering multiple topics as diverse as whether online education should be considered a threat or an opportunity (Vlachopoulos, 2020), how digital innovation was encouraged during the emergency (Agasisti et al., 2020), and how cloud services can support online learning (Bhardwaj et al., 2021). As regards teaching modalities, there are studies on how online teaching methodologies such as the inverted classroom (flipped) can add value in the new context (Izagirre-Olaizola & Morandeira-Arca, 2020), how examination issues have been resolved creatively by replacing exams with research papers (El-Bassiouny & Mohamed, 2020), and what learning strategies were attempted in the initial stage of pandemic and what results they produced (Dietrich et al., 2020), among others. Current research is focusing on the situation post the initial stage of the COVID-19 pandemic, the so-called “new normality” (Nandy et al., 2021; Tesar, 2020).

Despite the research gap on the impact of the pandemic on the HEI business model, research on the impact of COVID-19 on HEIs (Marinoni et al., 2020) is showing that the forced shift from face-to-face teaching to online distance teaching and learning methods has created both challenges and opportunities that impact to varying degrees on the different blocks of the BM. For example, a forced digitalisation has been triggered (Marinoni et al., 2020), causing a change in the learning value proposition, or the bundle of teaching products and services offered by the HEI, and creating an opportunity to make the future higher education sector more flexible. The increased use of multimode learning approaches, such as blending face-to-face and online learning activities (hybrid learning), and combining synchronous learning with asynchronous learning, are among these opportunities. All these new modes change the nature of the relationships and channels used with students, modifying the value the student receives from the HEI through a transformed learning value proposition. As regards the teaching staff, the forced learning and testing of new digital tools and methodologies (e.g., video conferences) has changed their digital mentality, which is expected to influence future teaching plans (part of the value proposition) to make online learning more integral, triggering innovation in both pedagogical methodologies (e.g., examinations) and delivery modalities. Other relevant identified opportunities include investing in cloud services to digitalize access to resources (e.g., library) and processes (e.g., administrative procedures), more remote working opportunities for lecturers and staff, and increased awareness among students of lifelong learning opportunities.

All these changes, which have already been applied to adapt teaching to the state of emergency, impact the current learning value proposition, a core element of BM. There will also be further repercussions of different types on most of the blocks that configure the business model. Understanding this configuration calls for a detailed analysis of multimode teaching/learning and how it affects the elements of BM building blocks.

3. Method

To answer the research question as to how the COVID-19 shock affects the DT of HEIs, this paper looks longitudinally at a single case study of a pioneering, born digital HEI headquartered in Spain. Qualitative in approach, the research design observes the studied HEI in two separate moments in time, a year before the start of the COVID-19 pandemic (November 2018 to January 2019) and a short time after its emergence (July 2020-December 2020), to understand how the significant DT process started before the pandemic is being impacted by it, and how the process is accelerating the desired vision of the studied HEI. Case studies provide qualitative

and rich data and allow the study of current management challenges (Yin, 2009). The shock effect of COVID-19 triggering the so-called “forced digitalization” adds complexity to a DT process that was already impacting the business model of the HEI. The complexity and depth of the combined impacts of COVID-19/DT make the use of a single case suitable to observe in depth the experiences and insights of its participants regarding DT and its impact on the BM both before and after the emergence of the COVID-19 pandemic, and particularly on the online learning value proposition.

Table 1. Methodological summary and interviewee

Methodological orientation	Qualitative exploratory research discourse analysis				
Technique	Case study				
Number of cases	One				
Field work	Ex-ante (before the emergence of the pandemic); interviews from Nov 2018 to Jan 2019. Secondary data: Oct 2018 to Jan 2019				
	Ex-post (after the emergence of the pandemic): administered questionnaire from Jul 2020-Dec 2020. Secondary data: Jul 2020 to Dec 2020				
Primary source of information	Individual interviews				
Participant selection	Purposive sampling				
	Executive committee members, executive positions				
	Criteria: heterogeneity by function, position, contractual relationship				
	E-mail approach				
Instrument used	Semi-structured questionnaires				
Main topics of the interview	Pre-pandemic: Digital transformation concept (DT). Impact of DT. Main DT innovations. Main challenges and opportunities derived from DT. Tensions derived from the DT process, and solutions				
	Post-pandemic: areas of the university most significantly impacted by the effects of COVID-19 forced digitization, worst and best situations and how they were handled, impact on the vision of what DT is and its importance, impact map for stakeholders, challenges and opportunities, and visions of the future because of the impacts of DT and COVID-19				
Setting and data collection	Pre-pandemic: Interviews conducted in the workplace. Interview guide provided in advance. Audio recording. Field notes by authors during and after interviews. Additional/missing/incomplete information requested after the interviews				
	Post-pandemic: administered questionnaire post-pandemic				
Data analysis	2 coders				
	Coding: Primary codes—Themes; Secondary codes—Sub-topics; Aggregate dimensions				
	Themes derived from the data				
Secondary sources of information	Public data: website, annual reports, HEI presentations, press news				
Number of informants	4	1	1	1	1
Informants work position	Total	DMO	VRSPR	VRCE	VPOT
Function		Innovation projects (Admin., teaching, research)	Strategy and Research	Competitiveness and Employability	Operations and Technology
Background		Comp. Engineering	Medicine and Surgery	Economics, Finance.	ICT
Duration of interview (minutes)	323'	73'	118'	55'	77'

Notes. HEI, higher education institution. DMO (Management): Director Management Office; VRSPR (Strategy): Vice Rector of Strategic Planning and Research; VRCE (Competitiveness): Vice Rector of Competitiveness and Employability; VPOT (Operations and Technology): Vice President of Operations and Technology.

Table 1 presents a methodological summary and provides details of the participants interviewed, including their current function at the institution and their background. The selection criteria included people who altogether represented a variety of functions (innovation policy, strategy and research, competitiveness and employability,

operations, and technology) and positions occupied (vice-rectors, vice-presidents), and who had a consolidated tenure in the HEI (average of 12 years in the HEI and 2.5 years in the current position). The single case selected is a pioneering, born digital HEI, defined as an organization where IT has played a central role since its conception, and whose growth has had a clear linkage to the use of digital technologies (Tumbas et al., 2015). Established in 1995 and headquartered in Spain, it is medium-sized, private but partially state-funded, with an international community of 4,000 remote professors. It has grown from 50,000 to 75,000 students in five years. It was the first university to operate exclusively online. It revolutionized higher education with its asynchronous online educational model and is considered a digital native. It is a global university born in the digital age that is willing to educate global and digitally skilled citizens, generating a positive social impact. Considered the world's first online university, it has a unique online methodology consisting in its proprietary learning model based on three elements: learning resources, personalized student support from teaching staff, and collaboration. Its 100% online methodology is unique, innovative, and internationally renowned.

The longitudinal approach is gained by the research being developed in two moments:

- Ex-ante (before the emergence of the pandemic; November 2018 to January 2019): In this stage, the first part of the interview guideline was adapted from a previous research work on BMI in Industry 4.0 (Müller et al., 2018) to include five blocks: (a) the interviewee profile; (b) the interviewee's understanding of the DT concept; (c) the DT process; (d) the tensions and solutions derived from DT for each of the BMI sub-constructs (Clauss, 2017), namely value creation, value proposition, and value capture; and, (e) the HEI's vision for the future due to the impact of DT. All the interviews were audio recorded and literally transcribed. The data were coded simultaneously but separately by two coders, who identified themes derived from the data with the aim of identifying meanings in the transcribed interviews (Corbin & Strauss, 2015). Sentences or groups of sentences were coded, compared (interrater agreement: 0.75), and discussed until agreement was reached on codification and analysis.
- Ex-post (after the emergence of the pandemic; July 2020-December 2020): In this stage, the investigation was structured around three temporal phases in relation to the pandemic: (i) COVID-19 emergency phase (March-June 2020), with topics including areas of the university most significantly impacted (teaching, research, transfer, others) due to forced digitalization, worse and better situations and how they were handled, and if the situation experienced impacted the vision of what DT is and its importance; (ii) New normality COVID-19 stage (July 2020-December 2020), with topics including the impact map of DT for the main HEI stakeholders (students, teaching and research staff, administration and services personal, companies, and society), main DT-derived challenges and how to overcome them, and main DT-derived opportunities and how to take advantage of them; (iii) Visions of the future, with the focus on understanding the HEI's vision for the next five years in the light of the impacts of DT and COVID-19. All the interviewees were administered a questionnaire via e-mail, and telephone support was provided where required.

Aside from the primary data gathered through interviews, information was provided by two of the authors who have had more than 25 years of combined experience in the HEI studied. The first collaborated from its foundation in 1995 until 2000, designing teaching materials and acting as a remote teacher. The second has been teaching remotely in the HEI since 1999, experiencing firsthand many of the digital transformation changes that have occurred over the last two decades. These two authors provided information via direct observation and access to internal and external communications through the intranet and the website, respectively.

4. Results

4.1. Digital transformation before and after the COVID-19 shock

4.1.1. External drivers of change

Increased collaboration, competitive pressure, and technology adoption: The results show that an expected strategy for overcoming this DT challenge is based on collaboration between HEIs themselves, governments, and industry, as stated by one of the participants: *"The challenges of technological change are so great that they push for collaboration [...]. It is mandatory for us to work together, otherwise we will not succeed."* (VRCE). This shock effect of the pandemic has had a catalytic effect on the institution, representing a turning point in its acceleration towards developing a new learning value proposition. Forced digitalization has suddenly created new competitors in both domestic and international markets. The vast majority of traditional HEIs have begun to

develop online teaching in one of its multiple modalities, ranging from integrating video conferencing systems in the virtual campus to continue offering classes in synchronous mode to simply opening a discussion forum for questions.

Demand shock: The magnitude of the COVID-19 pandemic, its initial stage of total confinement, the subsequent new normality with its possibilities for face-to-face and online hybrid teaching, albeit under the enormous uncertainty of what will happen in the short-term future, have forced thousands of newcomers to the university world to consider educational options as no previous generation has. Eighteen-year-old, traditionally mostly face-to-face university students have suddenly become digital students, a target audience for whom the HEI studied is not prepared, having previously not been their focus, illustratively stated as: *“We say we are a complementary university to the university system because the face-to-face universities have already got the 18- to 25- year olds, whereas we have many of the rest of students”* (VRCE).

4.1.2. Effects on competition and digital transformation

Blurring competitive boundaries: In the pre-pandemic stage, the institution was already actively immersed in a continuous DT process: *“We are an online university, but we already needed this process of digital transformation, and we are now immersed in it.”* (DMO). As a born digital HEI with a strong international presence, the institution had acknowledged the incipient entry of new competitors such as the technological giants in the world of higher education, and had already taken important steps to be able to prevail, including assigning a significant fixed annual budget for investment in technologies that would facilitate DT. Paradoxically, despite being born digital, the organization lacks the digital mentality: *“We do not know how to manage the efficiency that digital transformation can give us, and this is because we still do not have the digital mindset.”* (VRSPR). Consequently, the commitment of the management team and the governance and decision-making structures are perceived as necessary to overcome the different pockets of resistance.

In this pre-pandemic stage, the HEI saw the global digital technology companies (e.g., Google), EdTech unicorns (e.g., Udemy, Coursera), and start-ups as the only disruptive groups of competitors, aware that as a born digital university its value proposition was already clearly differentiated from traditional HEIs. Despite this incipient and growing threat, the priorities of digitalization are still closely linked with the search for efficiency and using digital technologies to do things better and save costs, while there is also increasing internal pressure to use DT to transform the *what* the HEI does. Pressure towards innovation is growing in the direction of personalizing the learning experience and offering learning programs and teaching methodologies focused on the development of the job market demanded skills rather than the simple issuance of official degrees. For example, one of the participants asked, *“Will we survive ourselves? We could die as a university because of not being able to offer this customization of the curriculum [...]. It will not be enough for companies if you have a master’s degree ... their question is “Do you know how to solve this?”* (VRSPR). At the other extreme, the risk of digital fracture is also perceived by the students who do not follow the pace of online training.

The studied HEI will have to update the delivery medium via technology to be able to move towards offering the student a full online personalized learning experience, even if as a born digital player this delivery is instructor-mediated. e.g., offering virtual face-to-face synchronous sessions using videoconferences that will complement other asynchronous e-learning strategies such as discussion boards, e-mail, etc. Technology investments will be needed to allow customization to be scalable and automated, with artificial intelligence and data management included among the required technologies, and always with a mobile-first mentality. The studied HEI will have to make changes to the instruction type to move towards this personalised learning experience, with students receiving customized content based on the chosen curriculum and selected itinerary. Innovation is likewise required in how they apply content (e.g., *“Do we have to set everyone the same exam? Individualization and personalization of exams [...].”* (VRSPR), with different modes to deliver the activities, including video, audio, and text, based on personal preferences and type of learner.

Acceleration of DT: The COVID-19 shock has not had such a dramatic effect on the studied HEI as on the HE sector as a whole, at least in terms of online teacher education, which has been carried out digitally in the studied HEI for the last 25 years. However, it undoubtedly urgently increases the need to significantly accelerate the DT started, not only to redirect the situation in the short term (e.g., to work remotely), but above all to accelerate the strategic transformation towards a new value proposition in teaching, as illustrated in the following examples:

The COVID-19 effect has further impacted the need to fully implement digitalization. In recent years [...] much importance has been given to the transformation of the HEI, considered as an entity. The greatest impact has been the speed with which these changes have been made and the symbiosis that has been caused between the changes in the HEI and society itself, which has also advanced in a definitive way towards its digitalization (VRSPR).

4.2. Learning value proposition and business model changes

In reaction to the combined effect of emerging EdTechs and the forced digitalization of traditional HEIs, the born digital HEI feels pressured to accelerate the design of a new online learning value proposition that will act as a renewal engine, significantly impacting the different dimensions of the current business model (Table 2), namely value proposition, value communication, value creation, value delivery, and value capture (Abdelkafi et al., 2013). As regards the value proposition, the HEI is clearly aiming towards a more student-centric lifelong learning relationship model, a crucial aspect of which is offering the student a digital experience (SX) at the level of the best practices of global benchmarks. The strategy to achieve this SX is clear: enabling a new personalized online value proposition for each student and becoming a guide for the student before (what to study?), during (how to improve teaching?), and after finishing a particular program (how to improve employability?). This new vision impacts the entire learning value proposition, not only changing what the HEI wants to offer (e.g., adding new short-term professionalizing programs based on skills development, offering MOOCs), but also the typology of teaching materials (e.g., more multimedia materials, curated from third parties) and how they are distributed (based on personalized curriculums and itineraries, recommendations, etc.) and consumed (interactively with the professor, with a flexible self-paced approach). A fundamental aspect of this new learning value proposition is the significant increase in the number of different learning methodologies and activities offered, creating a digital ecosystem of multimode learning methods and tools. These include, among others, direct instruction via synchronous video conferences and asynchronous videos, project-based learning, employer-based learning, mobile learning, peer-to-peer learning, simulators, self-assessment tests, online exams with identification of the person, and authorship of the content. Included as important additional benefits of this renewed learning value proposition are a new student-trainer relationship supported not only by multimode learning tools but also by artificial intelligence and data analytics, and access to a customized virtual campus developed with a mobile-first mentality, highlighting the need to deploy both digital and educational technologies. As stated by different participants: *“Regarding the offering, the real opportunity is the idea of being able to offer personalization [...], such as enabling students to decide their own curriculum. Some students are already asking for this and we are not able to offer it.”* (VRSPR); *“Learning resources end up being much more multimedia [...] There is text, there is video, there is audio, there are other types of resources such as simulators...”* (VPOT); *“More customizable teaching, and we can customize itineraries. Here we have challenges that without the new technologies we would not even consider.”* (VRCE).

Personalization means one by one, therefore you should be able to progress at the student’s pace; and while this is true for teaching it is still lacking for assessment and examination [...]. We have now achieved monthly enrolment but imagine there were 365 different enrolment periods, every day of the year and whenever the student wants [...]. It means a different organization [...]. This is not feasible without artificial intelligence ... because otherwise the question is, what is the alternative? Having as many teachers as students? (VRSPR).

As regards **value creation**, the HEI will need to put the appropriate combination of own resources and activities and those contributed by partners to work to create a new learning value proposition that leverages both digital and education technologies and capabilities. Undoubtedly, a key resource is and will continue to be the virtual campus as the motor for configuring the personalization of the learning experience and customizing curricula, itineraries, and paces of study, providing access to a multitude of types of both received and applied content and tools for maximising student-professor interaction. New skills and mindsets are needed to be able to create this value, such as detailed planning of all teaching activity: *“You need to plan everything carefully, there is no window for improvisation.”* (VRSPR); a more open concept in terms of technology, for example a *“Lego style platform.”* (VRCE), enabling third party technologies and capabilities that incorporate artificial intelligence and data analytics to be “plugged in”: *“It is teaching improvement based on data analytics, not so much intuitively [...] but systematically monitoring what happens in classrooms, and we do that through technology.”* (VRCE); new operative processes, for example enrolment 365 days a year; and technologies to guarantee the identification of the student and authorship of the content of exams, among many others.

As regards **value delivery**, the HEI will have to update the customer segments targeted, the distribution channels used, and the customer relationship developed to deliver this new learning value proposition. Getting

to know the students better is crucial to be able to offer tailored automated learning services (contents, methodologies, assessments, etc.) in a co-creation environment and with individual support. Ubiquity due to the mobile phone, “*The University is in your pocket, in space and in time.*” (VRCE), and social networks will be fundamental to interact with students as the prior importance of the teaching classroom decreases, as stated by one participant: “*A challenge is that the classrooms disappear [...]. We are in the digital world [...] but in fact we continue thinking about students and classrooms.*” (VRSPR). To implement this value delivery mechanism, the appropriate amount and combinations of digital educational technologies will need to be deployed.

As regards **value capture**, this new learning value proposition will represent not only new sources of revenue (e.g., shorter professionalizing programs) and new forms of revenue (e.g., subscription-based), but also new challenges in the cost structure. These include continuous investment in technology (many of them digital educational technologies), attracting digital talent, software licences, cloud services, and the creation of content offered for free (e.g., MOOCs). An illustrative statement is: “*Will subscription happen with university services? Services that you subscribe to, and depending on the level of subscription you have, you will be able -or not- to access a typology of course.*” (VRCE).

As regards **value communication**, this new learning value proposition must be translated into a highly attractive storytelling narrative that connects in both a relevant (narrowcasting approach) and an automatic way:

[...] better and more personalization of the student experience and maybe what we offer them and our relationship with them. Therefore, there is a great opportunity for us to know more about the student and prepare a valuable customer journey from awareness of our offering to employability (VPOT).

4.3. Roadmap towards a customized multimode learning strategy

In response to these anticipated changes at the level of the different dimensions of the business model, the HEI is designing its roadmap towards a customized multimode learning strategy that will change the *what*, *when*, *how*, and *where* of the learning journey (Figure 1). In this roadmap, the HEI helps to match students’ needs, aspirations, and interests with opportunities (e.g., professional-related, discovery-related), which is the basis for establishing the customized student learning briefing (learning objectives and desired learning journey). Once their goals are established, the student gets automatic recommendations and can configure a personalized learning experience that covers (a) the what (instruction type), both for receiving content (multimedia teaching materials) and applying content (project-based learning, employer-based learning, peer-to-peer learning, simulators, self-assessment tests, etc.); (b) the how (delivery medium), including person-to-student (technology-enabled; e-mail, SMS, bulletin boards, forums, video conferences, etc.), machine-to-student (artificial intelligence such as automated answers), and recommendation algorithms (e.g., teaching materials), chatbots...; (c) the when (time synchronicity), both asynchronously (e-mail, bulletin board, forums, feedback, MOOC, SPOC, etc.) and synchronously (video conferences, chat, calls, SMOC, SSOC, etc.); and (d) the where (instructional location space), both in a PC-Internet connection space or on a mobile device. This “mobile-first mentality” in the development of digital technologies will lead to a ubiquitous learning mode, making learning possible any time and in any place. Following this individually configured online multimode learning journey, the student will undergo a “learning impact” (what the student will know, understand and be able to do) and a unique student experience (SX).

Table 2. Envisioned business model of the digitalised university

Value communication	Value proposition <u>Role of the HEI</u>	Value creation
Offer and promote the best learning experience to the 14-18-year-old segment; Use CRM software and digital communication tools and channels to automate demand management and campaigns; Use social media to create and	Offer the best global student digital experience (SX) before deciding what to study, during the learning process, and afterwards (relational); Personalize learning: tailoring learning for each student based on needs, interests, aspirations, and background; Customize the what, how, when, and where the students learn; Guide the student throughout the learning journey; Provide the (potential) student free content (MOOC’s); Facilitate a self-managed digital student in the job market; Build a community of innovation, creativity, and entrepreneurship; Promote sustainability and break the digital barrier.	Design a customized virtual campus with a variety of learning methodologies to deliver a fully personalized student journey with high flexibility (self-paced); A more open concept in terms of technology (“Plug and Play”); Mobile-first mentality; Create the best multimedia teaching materials available online; Alliances and active role in

communicate attractive targeted promo materials and campaigns.

Value capture

Subscription; New sources of revenue from new “professionals”, shorter programs; Receiving content that is free (e.g., MOOCs); Re-invest cost savings in added value for the student; Attract digital talent (data, analytics, cybersecurity, etc.); Fixed investment and continuous renewal of technology.

Selection, distribution, and consumption of contents
 Personalization of curriculums and customization of learning itineraries; New courses and contents based on a faster connection to the labour market (new offering); Access to a learning resource hub with more contents and multimedia resources; multimedia resource centre that integrates both proprietary teaching materials and those developed by third parties; Value-added interactive teaching materials, with marks, comments, etc. to support the student.

Design of learning methodologies and activities
 New forms of applying content; dual training, professional final projects, simulators, etc.; High flexibility, self-paced learning approach; Blending a variety of learning online modes and methods: direct instruction via synchronous video conferences and asynchronous videos, project-based learning, employer-based learning, mobile learning, peer-to-peer learning, simulators, self-assessment tests, etc.; New forms of virtual internships.

Assessment
 Online exams with identification of the person and authorship of the content; Certified guarantee of identification of the student and authorship of the content.

Student – Professor interactions
 Synchronous video conference interactions, both individual and group; Asynchronous video interactions, both for one individual or a group; Improved teaching process by incorporating data analytics; Improved teaching process complemented with artificial intelligence; Choose or being assigned the best expert based on the student’s teaching needs; Getting to know the students better to offer tailored automated learning services (contents, methodologies, assessments, etc.) in a co-creation environment and with individual support.

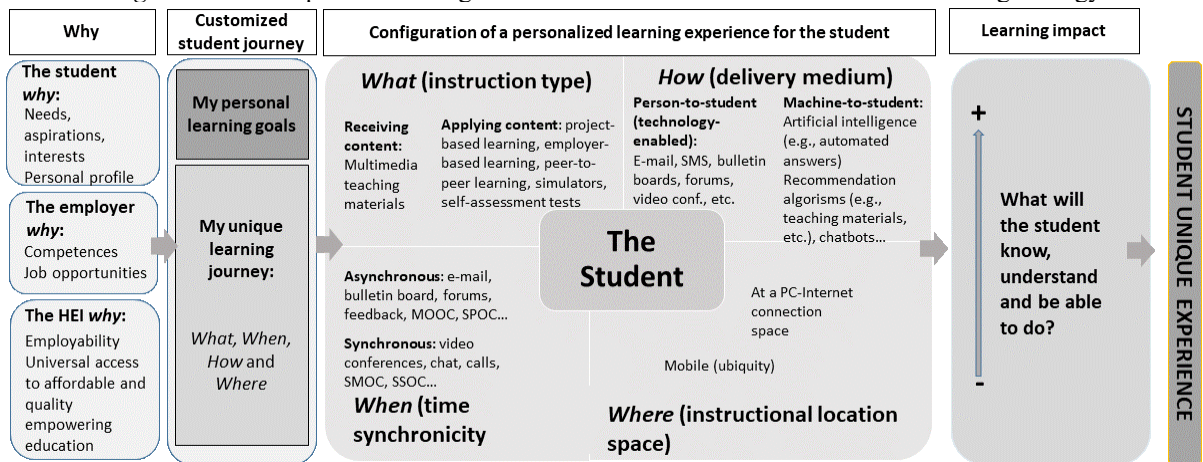
Virtual campus and Technology strategy
 A customized virtual campus with a variety of learning methodologies to deliver a full personalized student journey with high flexibility (self-paced); Total mobile ubiquity.

the wider eco-system; Online exams with identification of the person and authorship of the content; Artificial intelligence and analytical data to systematically improve teaching; SasS subscription-based payments; Micro-monitor the competences developed by each student; Scalability due to digitalization (e.g., student support); e.g., customization based on industrialization and scalability.

Value delivery

One by one interaction (online classroom disappears); Ubiquity thanks to the mobile; A digital licensing system (digital teaching materials developed by third parties); The student sets the pace of study and examinations (time is variable); New social media support channels; The new channels to connect fast with the current and new markets; Getting to know the students better to offer tailored automated learning services; Getting to know the students better to offer tailored automated learning services (contents, methodologies, assessments, etc.) in a co-creation environment and with individual support.

Figure 1. Roadmap for a born digital HEI towards a customized multimode learning strategy



To be able to deliver this customized multimode learning strategy, the HEI will deploy new digital and educational technologies and capabilities that will impact the different business model dimensions (Table 2), including: (i) social CRM software (to be a guide for students prior to enrolling, during the learning process, and after graduation); (ii) profiling and customization software (to personalize curriculums, assessments, self-pace, etc.); (iii) portfolios of online learning modes and methods (e.g., direct instruction via synchronous video conferences and asynchronous videos, project-based learning, employer-based learning, mobile learning, peer-to-peer learning, simulators, self-assessment tests, etc.); (iv) the resource platform (to integrate third party multimedia resources) and interactive teaching resources (with marks, comments, etc.); (v) recommendation engines (e.g., library); (vi) student identification software (e.g., for online assessments); (vii) authorship software (e.g., to avoid plagiarism); (viii) data analytics (e.g., to learn better teaching practices); (ix) artificial intelligence (e.g., to support the professor); (x) mobile-first mentality, technology integration, and partnerships (e.g., Google Workspace for Education Fundamentals); and (xi) 365 days a year enrolling software (e.g., the concept of classroom disappears).

5. Discussion

5.1. Contribution of the paper

In the pre-pandemic stage, our results on DT as a necessary continuous process, including for a born digital HEI, confirm previous research (Zulfikar et al., 2018; Khalid et al., 2018). The findings on the need to offer a ubiquitous learning mode through a mobile device respond to research calls (Kinshuk et al., 2013) and confirm how digital technologies are becoming inevitable (Albirini, 2007) and are disrupting universities (Posselt et al., 2018), and especially but not exclusively the traditional HEIs. Research has also confirmed how new digital asynchronous and synchronous applications are changing the learning process, placing insufficiently adapted HEIs at risk of irrelevance (Kaplan & Haenlein, 2016), as happened at least temporally to almost a third of HEIs during the very first stage of the COVID-19 forced digitalization (Marinoni et al., 2020). This paper contributes further empirical evidence by showing that even though it was born digital the organization lacks a digital mentality, in line with previous research that points to the importance of addressing the academic digital gap during DT processes (Bond et al., 2018). The results also evidence that a shock such as COVID-19 is a cultural change that can eliminate digital resistances practically immediately, accelerating the digitalization mentality and processes by means of working/studying remotely and online exams. This confirms recent extant research on how the forced learning and testing of new digital tools and methodologies experienced by teachers during the pandemic has changed their digital mentality (Marinoni et al., 2020), even when new skills and mindsets such as planning all teaching activity in great detail are needed (Nguyen, 2018). The results also show that the magnitude of the COVID-19 exogenous shock (Fligstein & McAdam, 2011, p. 32) for the entire higher education sector has shown that HEIs need to be more business oriented to survive, contributing further empirical evidence that business practices are becoming a necessity in HEIs (Pucciarelli & Kaplan, 2016). Regarding the impact of DT on the BM, our results contribute to some recent attempts to connect the business model concept with the field of universities (Abdelkafi et al., 2018; Rosi et al., 2018; Posselt et al., 2018; Rof et al., 2020).

One of the primary effects of the COVID-19 shock is an acceleration of the HEI intention to design a personalized online value proposition (customer-centric). This finding is consistent with previous research showing how adding digital technologies can contribute to developing new interactive and co-creation-based learning strategies (Pucciarelli & Kaplan, 2016), and how e-learning is more learner-centric and learner-personalized, supported by the always changing digital technologies that offer ubiquity in the access and delivery of teaching resources and services anytime, anywhere, in an interactive, collaborative and personalized manner (Nguyen et al., 2019). The COVID-19 pandemic has not brought about a technological jump since digital technologies were previously available and disrupting the sector (Posselt et al., 2018), but rather it has generated a cultural jump that has caused a new digital mind-set (Marinoni et al., 2020), removing, or at least making inoperative, resistance to change. The state of emergency has automatically answered the key questions “*Is this the moment?*”, “*Is it really necessary?*” “*Are we ready?*” and “*Is this the solution?*” in the affirmative, facilitating the adoption of new technologies and learning systems (Agasisti et al., 2020; Izagirre-Olaizola & Morandera-Arca, 2020; El-Bassiouny & Mohamed, 2020; Dietrich et al., 2020). The finding about the importance of creating a digital ecosystem of multimode learning methods and tools (e.g., direct instruction via synchronous video conferences and asynchronous videos, project-based learning) for this learning value proposition is in line with previous research on different forms of instruction, explaining online distance learning (Kaplan & Haenlein, 2016). The results at the level of the complementary BM dimensions that contribute to creating this new learning value proposition (value creation), delivering it (value delivery),

generating new sources of revenue and costs associated with it (value capture), and the way to communicate it (value communication), show the necessary interconnection between the different building blocks of the business model (Osterwalder et al., 2010; Abdelkafi et al., 2013). The findings also clearly show that to innovate the BM several of its dimensions must be changed simultaneously (Winter & Szulanski, 2001; Johnson et al., 2008; Baden-Fuller & Haefliger, 2013; Baden-Fuller & Mangematin, 2013).

This article contributes to the previous debate on learning theory associated with educational technologies (Albirini, 2007) and responds to recent calls for further personalized learning research (Xie et al., 2019). Although most of the empirical results obtained point to the development of a customized multimode learning strategy that shares the basic principles of the constructivist theory, the reality is that, in its pure state, the constructivist theory can generate certain problems, especially regarding “knowledge construction” (Gärdenfors & Johansson, 2005). There are different ways to meet students’ unique learning needs and at least two will use technology and multimodality: (i) customization, leaving the agency (the choice of multimodality options) to students; and (ii) personalization (using data and algorithms to create a personalized learning by leveraging multimodality options). In the latter case, new technologies that decide for the student, such as learning analytics and artificial intelligence, can open the pathway to methodologies that are closer to behaviourism through personalizing learning journeys for students with similar learning profiles (e.g., adaptive learning technology) in a scalable manner. The optimal learning paths are likely to be somewhere between the two strategies, combining the best of customization (constructivism) and personalization (likely behaviourism), thus contributing to satisfying a diversity of students’ cognitive styles (Hsieh & Chen, 2016).

5.2. Managerial implications for HEIs

This empirical research has several practical implications. The findings presented provide “out-of-the-box” tools and frameworks that can encourage reflection, help design a student-centric multimodal learning value proposition, and facilitate the required changes to the BM. The analysis is of great value for the entire higher education sector, including both born digital and traditional HEIs, because as the competitive boundaries blur due to digitalization participants become potential international competitors of all the others.

HEI managers could use the “Envisioned Business Model of the Digitalised University” framework (as exemplified on Table 2) to benchmark with the innovative EdTech to find sources of differentiation, and to prioritize decisions and plans about building and managing the right digital and educational technologies ecosystem (e.g., direct instruction via synchronous video conferences and asynchronous videos, group-project-based learning, online exams, etc.). This framework, as a practical tool for strategic reflection, could also be used to explore the trade-offs between the concepts of cost-efficiency, effective education, and continuous innovation, a topic that calls for further investigation (Stepanyan et al., 2013). It could also be used internally (employees) and externally (students and other relevant stakeholders) to test ideas, design new ideas (e.g., in a participative way to build shared vision), and communicate results.

Second, HEI managers could reflect and build their “Envisioned Business Model of the Digitalised University” to create an overview of the desired business model associated with this new multimode learning value proposition, and to deploy the required digital and educational technologies. Detailed specifics of the BM dimensions would enable DT, academic, and organizational “going toward” plans to be formulated: a) At the level of learning value proposition: clarification and reflection on the role of the HEI, the selection, distribution, and consumption of content, the design of learning methodologies and activities, assessments, student-professor interactions, and virtual campus and technology strategy; b) At the level of value creation: resources, activities, and partnerships to create this new learning value proposition; c) At the level of the value delivery: customer segments targeted, the distribution channels used, and the customer relationship developed to deliver this new learning value proposition; d) At the level of value capture: sources of revenue and cost structure associated with this new learning value proposition; and e) At the level of value communication: how this new learning value proposition will be translated in a highly attractive storytelling narrative that connects in both a relevant and automatic way.

Third, HEI managers could use the “Roadmap for a born digital HEI towards a customized multimode learning strategy” framework (Figure 1) to visualize the desired student-centric learning strategy. This tool would also be useful for internal communication, further driving opportunities to develop an interactive version to communicate the value proposition to the potential student community.

6. Conclusion

The COVID-19 pandemic has shaken up the entire higher education system, causing a forced and severe shift in the scale of DT, which became mandatory to remain operational during the shock, moving from a situation of “an ongoing digitalization process” to a situation of “digitalize now or stop operating.” It can be argued that the essence of the COVID-19 effect has been more of a “real-time” cultural transformation than a DT one, at least for two thirds of HEIs. Before the pandemic, digital technologies were there to be used. EdTech players had already detected this opportunity, but resistance forces were at play in the more traditional HEIs. However, the outbreak of the pandemic and especially the lockdown meant the immediate elimination of all resistance.

In this context, our study responds to the call for more research on the impact of COVID-19 in the HEI sector, empirically exploring the case of a born digital HEI and providing an analysis of the changes that have taken place since the COVID-19 shock. This paper contributes to the limited literature on the learning value proposition of HEIs as the core component of their BM, but within a more global and interdependent HEI BM. The business approach to HEIs allows for a better analysis of their requirements for competitiveness and survival as organizations in a competitive sector. Second, the analyses made describe the decision and visions both prior to and post the emergence of the COVID-19 pandemic, uncovering the practice of digital transformation and how it has been accelerated by the shock. The findings and discussion uncover the sources of organizational challenges for HEIs (managers, teachers, and staff) in their digital transformation. Third, the importance, nature, and possible evolution of learning multimodality is described and analysed in this DT context. And fourth, this research contributes by designing a roadmap towards this customized multimode learning strategy to offer a unique personalized learning journey for each student based on goals, preferences, and cognitive styles (Hsieh & Chen, 2016), among others. In a global sense, this research provides empirical evidence and is a critical analysis at the intersection of the HEI business model’s digital transformation in response to the COVID-19 shock.

This paper is subject to some limitations regarding its methodology and findings. The contribution is limited due to the use of a single case study from a specific sector, so it should be considered exploratory and theory-grounding research. Future research should validate our findings and respond to some unanswered questions, the first of which is whether the effect of COVID-19 forced the need for multimodality and personalization. This paper argues that this was a forced test and that higher education will be transformed to deliver personalized multimode learning value propositions. This personalization will require decisions about technology models (Alamri et al., 2021), the development of a variety of technological tools aligned with different ways to learn (Stepanyan et al., 2013), and a general cultural shift (Renz & Hilbig, 2020). The business model vision will be fully integrated into HEIs’ decision-making and management processes. What is not clear is whether and how this multimodality will be used for differentiation among HEIs and other education suppliers, allowing for different types of learning value propositions, or whether students will demand the maximum customization of all education offers and all suppliers will evolve towards the same standards of multimodal customization. However, the degree to which the COVID-19 state of mind and practice as regards digitalization and customization has been implemented during the first year of the pandemic has been at a huge and unsustainable cost to HEIs and their staff. Thus, questions arise about the degree to which this forced digitalization will have a permanent cultural effect or will it be eroded when the situation goes back to “normal” or stays stable in a “new normality” scenario: *Is it a lost war for some of the stakeholders? For example, for teachers required to be available 24X7?* We wonder whether this digitally prone mindset will continue among HEI managers, teachers, and staff so that current methods cease to be used and the new emerging ones fully adopted. Any forced organizational change may be subject to possible setbacks and restraining forces (Alvesson & Sveningsson, 2015).

Any relevant level of customization or personalization faces the problem of scalability in the sense of being able to personalize the learning experience for many students, including international students with a high cultural diversity, making it necessary to offer different options in terms of technology-assisted learning tools (Habib et al., 2014). This will require investment in both digital and educational technology to allow for automation, creating a technological challenge for the delivery medium (Margulieux et al., 2016), which can be resolved using artificial intelligence applications (Renz & Hilbig, 2020). Nonetheless, this is likely to pose important challenges for the management team, raising the question, Will HEIs become like EdTech players? Aside from managerial and other organizational barriers to the adoption of artificial intelligence solutions (Renz & Hilbig, 2020), more research and experimentation is needed to test whether promises made to produce satisfaction on each personalized learning journey are kept, especially given that a cultural change is needed (Renz & Hilbig, 2020). Where these technologies are used successfully it will be interesting to further explore how they will combine with real-people (teachers, tutors, staff) support and how this will change the role of teaching and non-

teaching HEI staff. Further research must also be developed on the impact of artificial intelligence on the BM and the return on investment (Stepanyan et al., 2013).

Inequality concerns are another social challenge for the DT of HEIs. According to (Marinoni et al., 2020), a third of HEIs did not adapt fast enough to the new digitalization forced by COVID-19, begging the question as to how many HEI students have consequently been unable to catch up. There is also the risk of digital fracture for students who do not follow the pace of online education, as has already been shown in studies that suggest that the degree of suitability of web-based lectures depends on the characteristics of the student (Montrieux et al., 2015), being less suitable for low achieving students (Owston et al., 2013). This raises the issue of what the HEI will offer these students and will they be able to deal with this problem, or alternatively will it become a social one? Although university students are generally highly skilled for technology adoption, some technologies may require more sophisticated infrastructure and ICT competences, which might not be available or evenly distributed among students in different geographical areas and with varying economic statuses. These challenges may be insurmountable for HEIs and need a systemic public approach. In this line, collaboration among HEIs, the government, and even industry may be necessary for a smart and inclusive DT of higher education.

Our paper points to a highly customized unique student experience delivered in a multimode learning modality, further questioning how quality is perceived and predictably understood, valued, and interpreted in a way in which traditional quality becomes obsolete and excellence and delight gain prominence. It is relevant to know what students value in terms of learning/training quality, platform quality, study material quality, and learning experience quality, to mention just a few, as they seek human interaction in their learning path, conditioning the degree and quality of Artificial Intelligence applications in the HEI sector (Renz & Hilbig, 2020). Regarding the issue of quality, several questions can be asked from a behaviourist point of view. For example, will students be capable of constructing their learning packs or paths (e.g., when choosing the open digital badge or the competency-based learning program)? Will learning be constructed in the right way (effectively, efficiently, etc.)? And from a strategic point of view, we may ask what model of personalization will universities adopt in the future, how the collective intelligence of experienced professors will be leveraged, who will lead this future customized multimode learning strategy, the student, the professor, or the algorithms, and how will these decisions affect quality?

Last, our study shows the ingredients needed for *technology acceptance, questioning the diffusion and perdurance of the outcoming innovation*. Further research could tackle already traditional approaches in the field of innovation (Technology Acceptance Model and the Diffusion of Innovation Theory) and test their robustness and universality in new and critical circumstances. Some experts predict that COVID-19 is just a first materialization of a series of shocks that will intensify and become more frequent due to climate change and derivatives. It appears that we need to prepare organizations and future generations to cope with these shocks and manage transformation processes in a sustainable way, and HEIs and the public sector serve as an appropriate illustrative example.

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