International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 26, Number 2

May – 2025

A Blended Learning Future: COVID-19 Lessons for "Phygital" Higher Education

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Abstract

The pandemic transformed higher education, making it clear that the future of education lies in the use of technology. Recognizing this development, this study examined the blended learning experiences of students and teachers during the COVID-19 pandemic in order to propose targeted strategies for the evolving "phygital" (physical + digital) university ecosystem. Drawing on existing literature, it explores three critical dimensions of the educational experience: technology, the teaching-learning process, and social interaction. Following a transcendental phenomenological approach, the study used a convenience sample of 10 students and 10 teachers, selected based on the saturation criterion. Using Leximancer software for text analysis, in-depth interviews with a representative sample of students and teachers were conducted. The findings exposed significant challenges faced during the pandemic, including a lack of digital tool proficiency among users, inadequate engagement with online content, organisational hurdles, increased workload, diminished personal interactions, and emerging mental health concerns among students. These insights underscore the urgency of crafting tailored strategies to enhance the phygital learning environment, focusing on improving infrastructure and providing comprehensive training to both students and educators.

Keywords: blended learning, higher education, Leximancer, phygital, learning experience

Introduction

The COVID-19 pandemic has reshaped the university ecosystem, with online tutoring, digitized administrative procedures, and blended teaching becoming commonplace. This new "phygital" (physical + digital) context integrates physical and digital dimensions across all university operations, making technology a cornerstone of daily activities. By going beyond teaching modalities, the phygital model enhances learning experiences, administrative efficiency, and inclusiveness, addressing the needs of a digitally connected generation.

Reports have indicated a significant shift toward blended work and educational technologies, with virtual and augmented reality in education projected to grow substantially by 2030 (Statista, 2023). Universities are redesigning their programs to incorporate technology, driven by changing student preferences for flexible learning models, such as blended learning (BL), and a rise in absenteeism (Kohnke & Moorhouse, 2021).

During the pandemic period, universities adopted the BL modality fostering better communication and improving academic performance (Robson et al., 2022; Zeng, 2023). However, this modality also revealed challenges such as inequalities in access to education and excessive teacher workloads (Carius, 2020; Müller et al., 2021). Existing studies often analyze BL from either the student or teacher perspective, but few adopt a holistic approach to draw comprehensive conclusions.

This paper identifies specific measures that can be applied to the new university ecosystem, based on the experiences of students and teachers during the pandemic. To this end, in-depth interviews were conducted with students and university teachers after the pandemic. The data collected was examined using Leximancer, a machine-learning text-analysis tool. The study addressed two research questions:

1. How did students and teachers experience blended learning during the COVID-19 pandemic in terms of technology, learning processes, and social interactions?

2. What lessons from these experiences can guide higher education institutions in shaping the new phygital context in the post-pandemic era?

The results provide insights into the strengths and weaknesses of BL, highlighting opportunities for fostering a user-centered phygital environment. By addressing challenges in integrating digital and physical dimensions, this study offers adaptable solutions for higher education institutions worldwide, enhancing resilience, inclusivity, and competitiveness.

This paper is organised into four sections. First, the following section reviews the theoretical underpinnings of the phygital concept and its applications, focusing on its relevance to higher education. Next, the methodology and analysis are described, followed by the results obtained. Finally, the results are discussed, and the future lines of research, limitations of the work, and conclusions are presented.

Literature Review

Phygital Environment

The concept of phygital is relatively new, and although it has been used mainly in the context of retail, it extends to the domains of tourism, gaming, and education (Almeida & Silva, 2020). It is underpinned by theoretical frameworks that explain the integration of physical and digital environments (Jenkins, 2006).

From a marketing perspective, a phygital environment provides a seamless physical and digital experience through emerging technologies such as virtual reality, artificial intelligence, smart devices, and so forth (Hollebeek et al., 2019). The phygital concept is based on global connectivity and the pervasive influence of the Internet in our daily physical life (Uspenski, 2013), reaching a point where technology blurs the boundary between the real and the simulated (Gaggioli, 2017). All of this aims to increase the value proposition offered, adapted to specific contexts such as tourism or education (Purcarea, 2019).

From the perspective of educational psychology, Vygotsky's sociocultural theory of learning (1978) highlighted the interplay between individual development and social interaction, emphasizing the role of tools and mediated interactions as essential components of cognitive and social development. This makes technology integral to meaningful learning processes. Additionally, Milgram and Kishino's (1994) reality-virtuality continuum illustrated how technology blurs boundaries between physical and digital environments.

The phygital model also aligns with principles of open and distance learning (ODL) by addressing challenges such as engagement, interactivity, and community building in hybrid environments. By integrating physical and digital elements, it reduces transactional distance and fosters meaningful connections, which are critical in ODL settings.

In education, the concept of phygital extends beyond blended learning by encompassing governance, social interactions, and institutional processes, creating a seamless hybrid ecosystem (Christensen et al., 2015). A phygital academic environment refers to the use of technology in the daily life of students and teachers on campus, in administrative and teaching processes, and in any other activity carried out at the university. The phygital phenomenon does not replace BL or e-learning but rather expands on it by eliminating the boundaries between the virtual and the face-to-face.

For instance, a university equipped with interactive screens in administration offices or virtual reality tools is able to provide students and teachers with an optimised environment in terms of resources and time (Torres, 2022). These innovations also contribute to improving cognitive, affective, and psychomotor learning outcomes (Spitale et al., 2019).

Blended Learning: Online and Face-to-Face Teaching and Learning

In a phygital environment, teaching is also transformed, and it is here that BL emerges as one of the main teaching modalities. BL is a teaching modality that began in the mid-twentieth century and has evolved with advancements in technology (Singh et al., 2021). Initially, it was conceived as the balanced combination of face-to-face learning experiences in the classroom with online learning experiences outside the classroom, with neither predominating (Garrison & Kanuka, 2004). However, the technological revolution has caused the concept of BL to evolve, giving rise to new definitions such as

those given by Goncharov et al. (2020) or Siripongdee et al. (2020). For these authors, BL refers to the combination of face-to-face learning with the use of any technology inside or outside the classroom for the assimilation of knowledge, skills, and abilities.

The evolution of BL into phygital ecosystems provides a robust framework for advancing ODL. By blending synchronous and asynchronous elements with digital tools, this model enhances flexibility and inclusivity, two core tenets of ODL.

This new conceptualisation, which eliminates the need for balance between the two learning experiences, results in a flexible framework that embraces all forms of academic instruction by integrating physical and digital resources and spaces.

The breadth of the concept of BL and its popularisation in recent decades, together with the availability of advanced educational technologies (Hadiyanto et al., 2021), has led to the emergence of a wide variety of BL models (Goncharov et al., 2020) such as station, lab or individual rotation, flipped, flexible, self-mix, and enriched virtual (Batista-Toledo & Gavilan, 2022).

This variety of BL models puts the learners at the centre, giving them considerable flexibility to customise their learning experiences to their particular schedules and needs (Rahman et al., 2020). It allows them to progress at their own pace, increasing their motivation and engagement levels (Singh et al., 2021). In short, BL is based on both the teacher's perspective and the understanding of the student's experience, integrating both approaches to enhance the educational process.

Student Experience in Education

In education, although there is much controversy about the focus on students as customers (Guilbault, 2018), experience management is fundamental to gaining a competitive advantage and securing the future of an institution (Waśkowski, 2017).

Schwager and Meyer (2007) understood customer experience as the subjective perceptions that customers have during any interaction, whether direct or indirect, with a company. In contrast to physical goods, which are usually evaluated based on their attributes, services involve a combination of processes, people, and facilities (Ding & Keh, 2017). This increased complexity means that there is no broad consensus on the aspects that make up the customer experience (Bueno et al., 2019).

One of the approaches taken and accepted as valid is that of Grace and O'Cass (2004) who proposed the concepts of core service, employee service, and servicescape as the aspects that contribute to the experience. Core service refers to what the company offers, the essential benefit that customers purchase. Employee service refers to the interactions that occur in the delivery of the service. Servicescape is the physical environment where the service takes place and includes design, layout of physical elements, electronic equipment, accessibility, and so forth.

Based on the above, and following what is proposed by Grace and O'Cass (2004), we identify technology, the teaching-learning process, and social interaction as essential dimensions of experience, which the phygital environment integrates into a cohesive institutional framework:

- **technology**: Classrooms and the university campus form the environment of the service offered by universities in cases where face-to-face training is provided. However, in the case of a phygital university, technology is integrated with the existing physical facilities, modifying the

entire environment and expanding the off-campus experience, making technology the defining environmental component of the experience.

- **teaching-learning process**: Students seek training provided by universities through their academic programmes, and the achievement of training is obtained through the teaching process by professors and the learning process by students.

- **social interaction**: For the existence of the teaching-learning process, interaction between student and teacher is necessary. This interaction is not only limited to these actors but given the characteristics of education, there are other interactions between students and university staff (not related to the teaching process) and among students themselves. Moreover, in a phygital context, these interactions take place both face-to-face and online, both being fundamental in the construction of the experience.

These dimensions are in line with the research by Izquierdo-Yusta et al. (2021) on the experience in e-service environments where phygital universities would be framed. The authors showed that the quality of virtual systems and the personal relationships that take place in them have the greatest influence on the final experience. Likewise, the teaching-learning process and the social interactions in that process are seen as fundamental and inherent to academic life (Munna & Kalam, 2021). Building on these theoretical insights, this study employed a qualitative methodology to examine how these dimensions—technology, teaching-learning processes, and social interactions—manifested in the experiences of students and teachers during the pandemic.

Methodology

This study adopted a transcendental phenomenological approach, collecting and analyzing the individual perspectives of students and teachers in the BL context. Through this approach, it aimed to identify the most significant common elements of the experience in this context (Creswell & Poth, 2018). Specifically, semi-structured in-depth interviews and a focus group were conducted through the Google Meet app. Qualitative techniques are a useful method for obtaining information and understanding participants' perceptions (Bell, 2015). They are widely used in the social sciences, particularly in the educational field (Merriam & Grenier, 2019).

Data Collection

The selected sample was obtained from the Complutense University of Madrid since there was a common pattern throughout the university to implement BL, which consisted of students alternating one week of face-to-face and online classes. This sample provides diverse perspectives on the experience within the same BL mode.

Interviews were conducted with students and teachers in the four main branches of knowledge: sciences, social and legal sciences, health sciences, and arts and humanities. The sampling process began with random cluster sampling for the choice of faculties. Then, within the faculties, participants were obtained by convenience sampling, a technique suitable for studies that require individuals with accessibility, availability, and willingness to participate (Etikan et al., 2016). The sample size was 20, defined by the criterion of saturation or tendency to repeat responses (Gavilan & Martinez-Navarro, 2022), which was evident in the sample used.

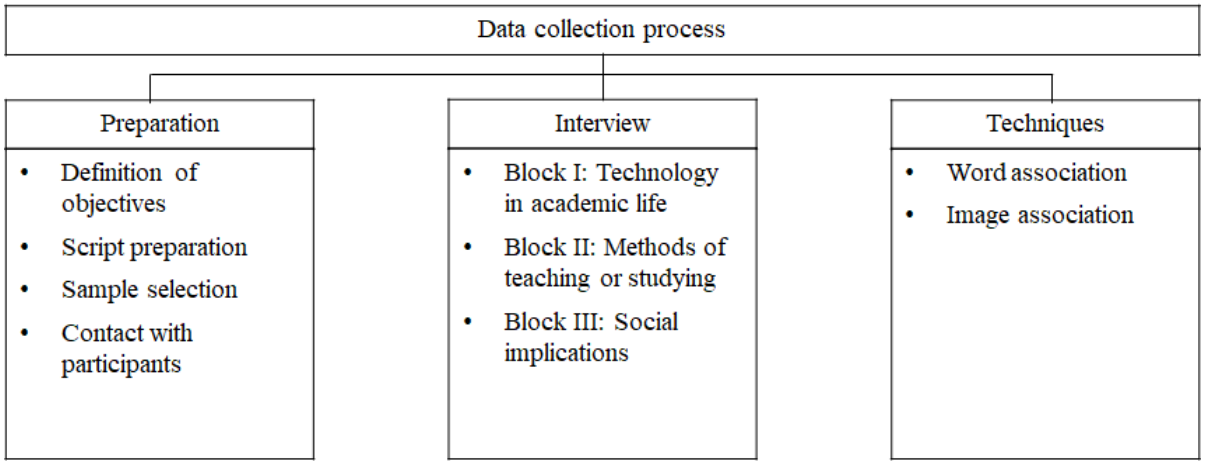
The interviews, lasting approximately one hour, were conducted between April and August 2022, and recorded to facilitate their subsequent transcription. Participants were informed about the objectives of the research and the use of the data. They were asked permission for their participation and the recording, which was collected at the beginning of each interview.

The data collection procedure is shown in Figure 1. A semi-structured personal interview was conducted, following a script designed and validated according to the procedure established by Carrera Farran et al. (2011), to collect data from three blocks: technology in academic life, teaching-learning methods, and social implications of BL.

The interviews were complemented with two types of projective techniques that were ideal for obtaining data about aspects that may have been difficult for participants to express directly, such as underlying attitudes or feelings (Malhotra, 2006). These included projective techniques of word and image association (images of a traditional classroom and an online class), both of which were used transversally in all blocks.

Figure 1

Data Collection Process



Data Analysis

The analysis of the interviews was performed using Leximancer software (Version 4.51) to map the BL experiences of students and teachers during the pandemic, aiming to identify key lessons for enhancing the phygital ecosystem.

Leximancer is a text-analysis tool that uses machine-learning techniques and enables the visualisation of concepts and their interrelationships (Rooney, 2005). It extracts co-occurrence information in stages—semantic and relational—using a proprietary algorithm (Smith & Humphreys, 2006). The use of machine-learning algorithms in Leximancer helps reduce researcher bias and provides greater objectivity in the analysis, as highlighted by McKenna and Waddell (2007). Furthermore, the software ensures stability and reproducibility in the results, reinforcing the validity of qualitative analyses (Thompson et al., 2014).

Leximancer automatically identifies words (seeds), which are subsequently grouped into concepts based on their frequency and weight (Leximancer Pty Ltd., 2021). It then identifies clusters (themes) based on the co-occurrence of the identified concepts. Leximancer also shows the words that appear most frequently associated with each concept, as well as the likelihood that they have a positive or negative connotation. By combining the depth of qualitative analysis with quantitative data, Leximancer is a practical and powerful tool for understanding complex data and supporting more comprehensive research (Berná Sicilia et al., 2013).

In this study, we manually selected the words (seeds) for analysis to enhance the richness of the results and generated concept maps for the dimensions of technology, teaching-learning, and social interaction. These identified themes provide a detailed understanding of the challenges and opportunities involved in achieving a seamless integration between physical and digital elements in a phygital ecosystem.

To generate each map, student and teacher comments referring only to the topic to be analysed were included. Finally, the maps show the labels of the participant (student or teacher) and the field of knowledge. The proximity between the label and the cluster signifies a relationship between them. The size of the spheres represents the relative importance of each theme within the dataset, with larger spheres indicating the themes mentioned by a greater number of respondents. Moreover, the importance of the themes follows the colours of the rainbow, with the most important themes being shown in red, followed by orange, yellow, green, blue, and purple (Leximancer Pty Ltd., 2021). The maps display 33% of the most relevant concepts, and the themes are scaled to 40% of their original size to enhance clarity and interpretation.

Results

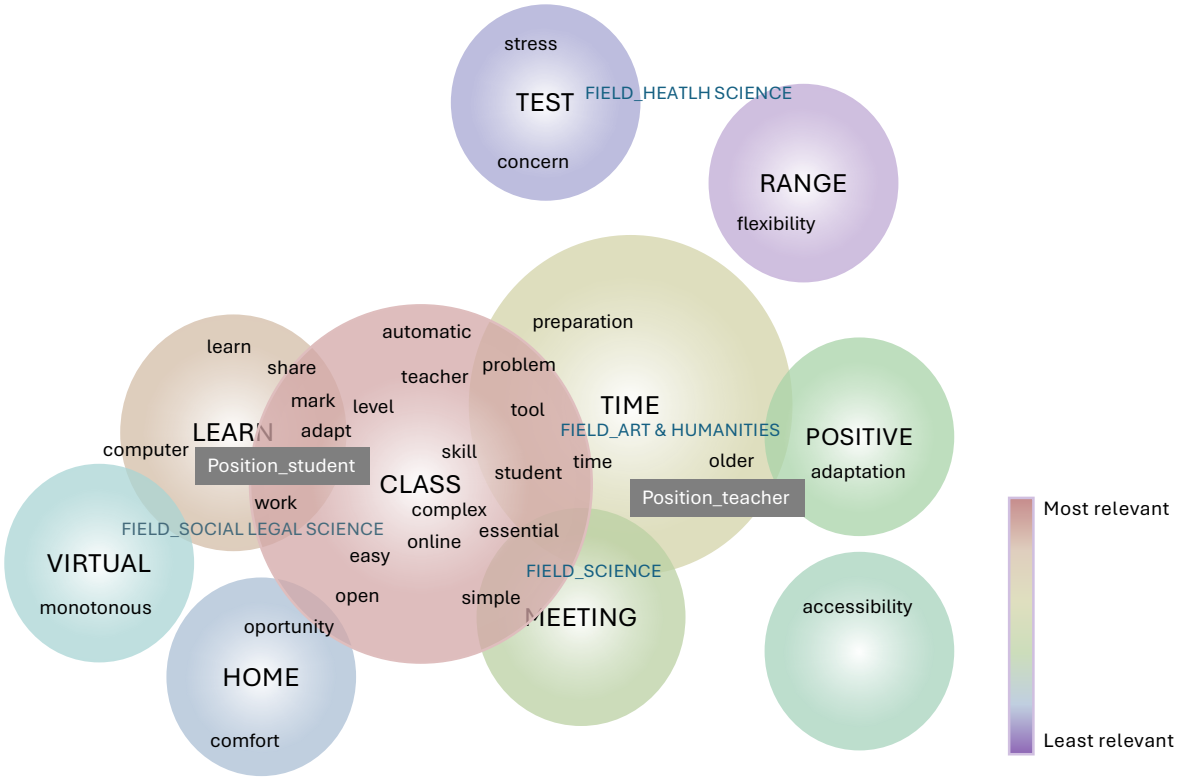
Technology

Technology provides support to BL. The introduction of technology in teaching through online classes and its combination with face-to-face classes is what makes this teaching modality unique and differentiated.

Figure 2 represents the conceptual map of the technology dimension. Ten different themes were obtained, namely class, learning, time, virtual, positive, home, meeting, range, exam, and diversity, in order of importance.

Figure 2

Conceptual Map of Themes in the Technology Dimension



The main theme was *class*, which is more associated with students. Reference was made to the preparation and use of technology in classes. Some related words were *complex* and *recording*, with a 100% probability of being associated, followed by *preparation* (50%), *tools* (50%), or *time* (20%):

- "I think that preparation in online tools is indispensable for teaching classes because the teacher cannot lose an hour of class due to technical problems." (teacher)
- "At the beginning, it was noticeable that no one had any knowledge of how to do an online class. We have had teachers who have been interested in learning." (student)

In this regard, learning and time emerged as relevant issues. Teachers need to learn how to use technology to teach, and students need to spend time using technology to learn. This had an impact on the time spent due to a lack of technological knowledge and skills (Bezliudna et al., 2021):

- "The important thing is to want to learn while doing it. In my case, I learned a lot with the computer to work with different files." (student)
- "I had never done a Meet meeting in my life, and I had never used Teams, but you put yourself in and spend a little time on it, and that's it." (teacher)
- "I signed up for all the courses they gave. They should be done by both teachers and students." (teacher)

The simultaneous existence of two groups of students in the class—some online and some face-to-face—posed a challenge to teachers and students. For instance, teachers had to attend to both groups of students while increasing and dispersing their attention. For students at home, classes became monotonous and boring because they were constantly watching a screen and often felt overlooked. This situation showed the poor integration of technology into existing infrastructures (Mdhlalose & Mlambo, 2023):

- "Having some students face-to-face and others at home is a problem for the teacher. Managing them has been difficult for me." (teacher)
- "Putting the camera on made the difference between a boring class and an entertaining one." (student)

The remaining themes covered issues related to the impact of technology on meetings, on differences in students' digital skills, or on feelings about taking online exams:

- "One positive thing I have found is that meetings are more effective online." (teacher)
- "There were students who knew how to handle the tools without problems and others who had never done so, and this modality has forced everyone to have to know how to handle them." (student)
- "If you are taking an exam via computer and if your Internet goes down, what do you do? You feel unprotected." (student)

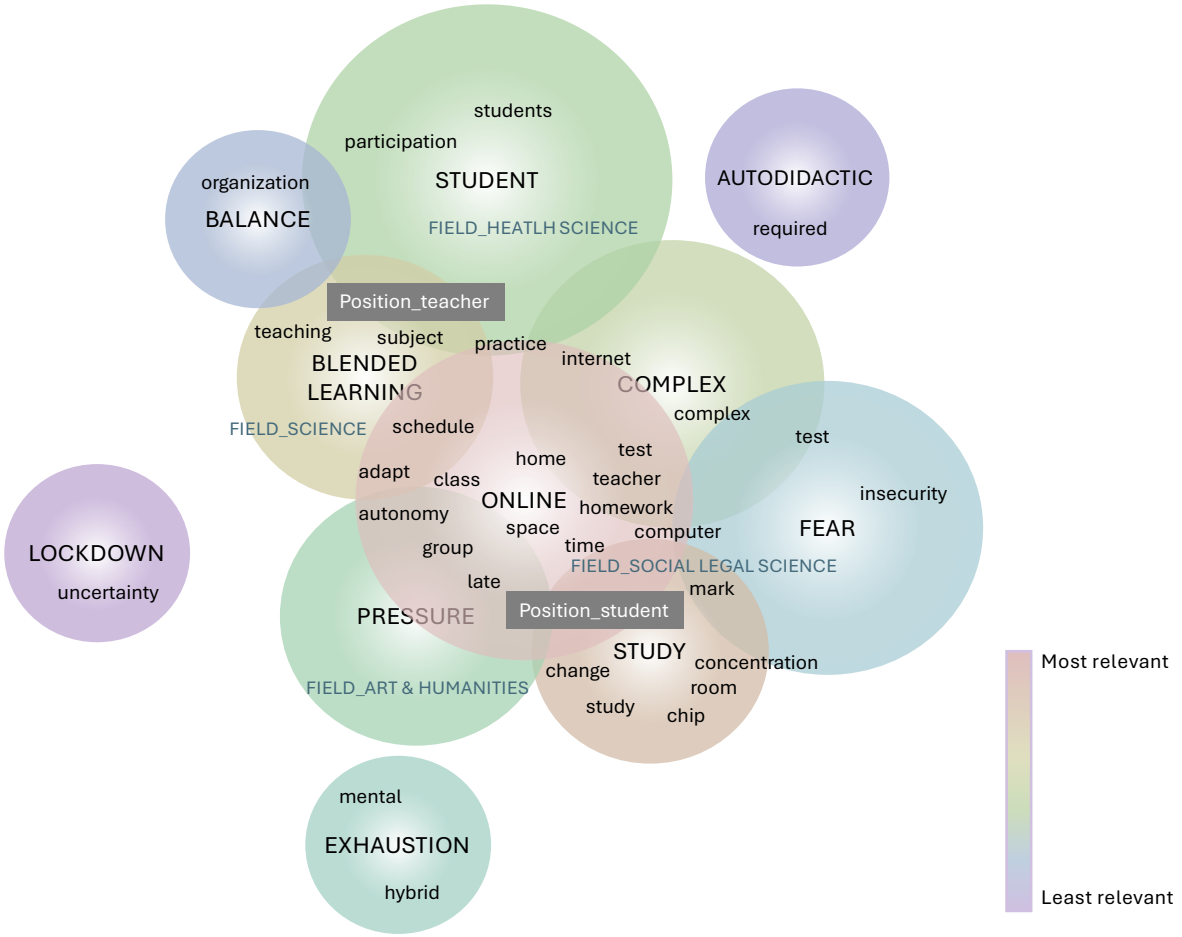
The Teaching-Learning Process

The implementation of BL affects all actors involved. For teachers, it represents a change in the way of teaching, and consequently, for students, it means a new way of learning. Both must go through a process of adaptation and adjustment, which, in the context of this study, was characterised by a lack of time for assimilation.

Figure 3 shows the conceptual map of the teaching-learning dimension. The themes that emerged included online, study, BL, complex, students, pressure, fear, exhaustion, lockdown, autodidactic, and balance.

Figure 3

Conceptual Map of Themes in the Teaching-Learning Process Dimension



Teachers' problems in adapting their teaching methods to virtual environments and combining both modalities at the same time (Rahman et al., 2015) made it difficult to attract the attention and interest of students (Buck & Tyrrell, 2022):

- "When I rebroadcast the class, it was hard because I had to go 15 minutes earlier to class to go online and set everything up. There were Internet glitches that meant that those at home couldn't see, but the teaching itself went along quite well." (teacher)

- "The weeks that were face-to-face, I took the opportunity for debates, presentations, or projecting advertisements, where they participated more. Classes that were more theoretical [were saved] for the online weeks because sometimes, the tool would crash because it did not support a certain advertisement, or it would hang and then they did not participate as much." (teacher)

Learning was also a challenge for the students as evidenced by words such as *disconnection* (100%), *distraction* (100%), *performance* (50%), and *habits* (50%) that were mainly related to studying. The change in teaching modality affected their study behaviour (Schwerter et al., 2022). Students found it

difficult to establish study habits, requiring more rest, which affected their performance (Potra et al., 2021):

- "I studied more the week I went to class because it was very difficult for me to spend 4 hours with the computer in front of me, taking notes and then get down to studying. Many times, I had to disconnect and distract myself with anything to concentrate again." (student)

- "I managed my time better when it was online because you finish the class, and you can move on to something else. However, when you had to go face-to-face, I would arrive tired from interacting all day, and the tiredness is not physical, but mental." (student)

- "I have stopped studying, and my performance has dropped quite a bit. I didn't get bad marks but not the ones I should." (student)

Student problems occupy the remaining themes; they focus on how teaching methodologies influenced their knowledge acquisition and performance. Students faced difficulties interacting with the teacher and their classmates when resolving doubts or studying in a group. This, together with the lack of appropriate methodologies (Rahman et al., 2015), meant that students were autodidactic. These findings highlight the need for tailored strategies to address challenges such as autodidactic learning and improve collaborative tools, ensuring that hybrid models promote interaction and inclusivity:

- "The teachers would give you the slides, and that was it. You had to prepare it on your own with all that that entailed. That affected my performance." (student)

- "I had less pressure when I had to do assignments and not exams." (teacher)

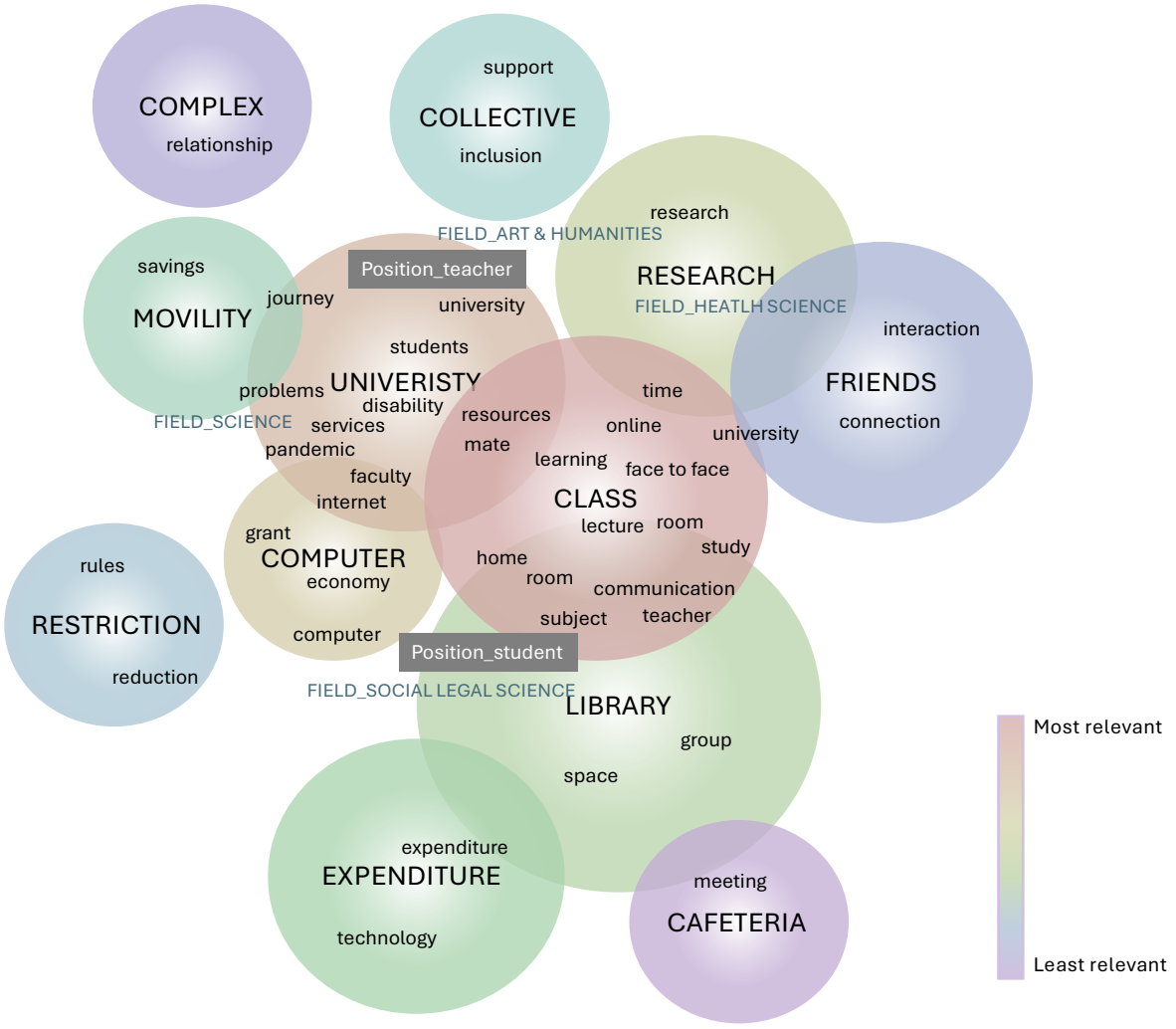
Social Interaction

In the context of the pandemic, social interaction was limited to the possibilities offered by technology. The reduction of face-to-face meetings between students impoverished the social part of both the recreational and academic experience at the university; however, technology enabled new channels for online relationships. Additionally, the dependence on certain resources (e.g., equipment, connections, space, etc.) to have access to this new educational and social ecosystem posed a challenge, where the risk was that the implementation of BL would increase already-existing social gaps.

Figure 4 shows the conceptual map of the social interaction dimension, and as in the previous maps, classes appear as the most important topic, followed by the university, the computer, research, spending, the library, the collective, mobility, friends, restrictions, the cafeteria, and the complex.

Figure 4

Conceptual Map of Themes in the Social Interaction Dimension



Online classes affected students with disabilities or few resources, highlighting the role of the public university as a corrector of these inequalities (Carius, 2020):

- "It depends on the disability and the circumstances of the student if it can generate inequality. There are people who do not have a space at home to sit quietly to receive a class because they live with five people." (teacher)

- "I think it is very discriminatory for students who have resource problems to have that adequate space, that privacy, or computer equipment. The student in the public university makes use of the resources that the university makes available." (teacher)

- "To go to university, you have to have enough money or be on scholarship. The university is not to blame, but the least it can do is try to help those who need it." (student)

The campus is the meeting point for the development of university life. Activities such as going to the library to study with classmates, participating in activities, or dedicating time to research were modified during the pandemic:

- "We did not have the opportunity to sign up for many activities because the groups were small due to COVID limitations; there were people from other years, etc." (student)
- "Time for research was still scarce because we had to train ourselves in knowing the tools, managing classes …" (teacher)
- "Things like going to libraries or studying in groups was lost." (student)

The reduction of face-to-face classes at universities affected social relationships among students and with teachers (Egan & Tiernan, 2023). For instance, students particularly emphasised less contact with friends both in the classroom and in the cafeteria:

- "I feel like I lost half of my college life by not seeing my classmates." (student)
- "Making friends was complicated. You could no longer stay after class and go to the cafeteria, for example." (student)

The limitation of social life could have affected students' emotional well-being as well (Bezliudna et al., 2021):

- "The numbers of students who have needed psychological help from the university in the last year have multiplied from the services they provided before the pandemic." (teacher)

Discussion

This study aimed to extract valuable lessons from the phenomenological analysis of university teachers' and students' experiences with BL during the pandemic. This analysis offers insights for enhancing BL's implementation in the evolving post-pandemic landscape.

The study identified key challenges in BL implementation, which must necessarily be addressed within the emergent hybrid (phygital) scenario, where the physical and digital realms converge in higher education. Table 1 illustrates these challenges. Conceptual maps generated by Leximancer provide a systematic analysis of the qualitative data, highlighting key themes and their interconnections. These themes—such as improving technology access, fostering innovative teaching environments, and enhancing communication through integrated physical and digital elements—directly align with the study's purpose of identifying strategies to facilitate the transition to a cohesive phygital ecosystem.

Table 1

Comparison Between BL Needs During the Pandemic and in a "Phygital" Ecosystem

Dimension	Blended learning needs	
	COVID-19 pandemic	Phygital ecosystem
Technology	Online tools training Adequate facilities	Adequate facilities
Teaching-learning	New ways of teaching New assessment frameworks New ways of learning	Training in new teaching methodologies Flexible training plans
Social	Reducing inequality Reducing social interactions	Phygital educational spaces New ways of communication

A paramount challenge is the seamless and coherent integration of technology, ensuring that it serves the educational process's academic and administrative needs rather than imposing constraints. Rasheed et al. (2020) reinforced this, emphasising the crucial role of technological adaptation and the provision of appropriate instruction technology. Moreover, fostering digital competencies is vital for the proficient use of technological tools, enabling a fluid transition between physical and digital spaces (Chowdhury & Singha, 2023). The pandemic's onset saw a rapid advancement in technological efficiency as the necessity to navigate various software and platforms spurred the acquisition of new skills and competencies (Hadiyanto et al., 2021). Nonetheless, technological proficiency does not inherently ensure its effective pedagogical application, adding complexity for both educators and students (Rasheed et al., 2020).

Addressing the interplay between teaching and learning is another critical challenge in transitioning to a phygital environment. Training educators in new online teaching methodologies will empower them to effectively deploy technological tools and engage students with compelling content (Gurrea et al., 2023). The issue of increased lecturer workload, previously highlighted by research (Maarop & Embi, 2016), underscores the necessity for strategies such as staff training, support, and networking to assist educators in overcoming these challenges. To mitigate exhaustion and workload challenges, universities should implement flexible training plans and provide institutional support, such as mentoring programs and time management workshops for staff.

From a student's perspective, acknowledging diverse learning styles and preferences, particularly in balancing face-to-face and online elements, is imperative (Donlon et al., 2022). Challenges such as the need for greater autonomy and difficulties in maintaining engagement highlight the importance of incorporating collaborative tools and designing hybrid environments that foster interaction and accessibility. These measures not only enhance students' satisfaction and performance (Shukla et al., 2023) but also ensure they feel supported in adapting to new methodologies. Thus, creating flexible and inclusive programmes within a phygital ecosystem can enrich learning experiences and enable universities to attract a more diverse student body (Singh, 2003).

The social dimension emerges as the third challenge in the phygital transition, where several researchers have recognised the importance of the affective component, thus considering it a socioaffective dimension. Developing an affective learning climate is crucial to mitigating learner isolation, which is a consequence of increased transactional distance in online environments (Boelens

et al., 2017). This socioaffective dimension necessitates the development of spaces equipped with technological and interactive tools for the entire university community's use (Carius, 2020). Beyond online interactions, physical engagement is vital for fostering relationships and a sense of community belonging (Balula-Dias & Alves-Diniz, 2014). Innovating communication tools that bridge the gap between physical and digital interactions, for instance, a university app that connects individuals engaging in similar campus activities, can significantly enhance the social environment.

This study underscores the holistic nature of the academic experience in the new phygital context beyond the sole focus on teaching in extant literature. Emphasising technology as a foundational pillar can substantially improve the academic experience across all university facilities.

The findings of this study have important implications for open and distance learning (ODL). By combining physical and digital elements, the phygital approach addresses key ODL challenges, such as improving engagement and fostering interaction. The socioaffective dimension further reduces transactional distance by enabling real-time collaboration and community building through hybrid tools. This approach enhances ODL practices, making them more inclusive, engaging, and adaptable to the needs of a diverse and connected student population.

From a theoretical perspective, the phygital model enhances the understanding of ODL by integrating Vygotsky's sociocultural theory of learning (1978) and the reality-virtuality continuum (Milgram & Kishino, 1994). These frameworks explain how hybrid ecosystems reduce isolation and transactional distance by blending physical and digital elements, fostering meaningful interaction and engagement.

Methodologically, the use of Leximancer demonstrates a robust approach to analyzing qualitative data. This highlights its potential for future ODL research to systematically analyze qualitative data and extract meaningful insights from reported learner experiences.

From a practical standpoint, the phygital model provides actionable strategies for higher education institutions transitioning to hybrid ecosystems. Institutions can prioritize: (a) enhancing technological infrastructure to seamlessly connect physical and digital spaces; (b) providing training for educators in hybrid methodologies to ensure effective use of digital tools; and (c) developing hybrid learning spaces that foster meaningful social interactions, addressing common issues of isolation in ODL contexts.

These contributions offer a pathway for advancing ODL practices, making them more inclusive, engaging, and adaptable to the needs of a diverse and connected student population in a rapidly evolving educational landscape.

Future research should aim to quantify the impact of identified measures on the academic experiences of students and teachers, validating this study's findings and exploring potentially more influential factors. Analysing the factors deemed most critical by students and teachers in a phygital environment will also guide universities in prioritising under budget constraints.

This study's limitation lies in its context being unique to the pandemic era, representing a specific experience that may not fully align with previous studies. However, as we navigate post-COVID realities, the insights offered are invaluable for understanding this period and leveraging learnt lessons.

In conclusion, as universities continue to integrate technology into their daily operations post-pandemic, they evolve into a hybrid phygital ecosystem. This transition emphasises the necessity of

understanding pandemic-era BL experiences to guide this new blended phase. The findings provide a comprehensive view of current BL implementation across three dimensions: technology, teaching-learning interplay, and socioaffective aspects, introducing the phygital ecosystem concept to higher education institutions. Applying quantitative methodology to qualitative data analysis, this research offers robust insights to enhance the future of universities in the phygital landscape.

Funding

This research was supported by the Student Observatory of the Complutense University of Madrid through project POE 17-212.

References

Almeida, F., & Silva, O. (2020). The impact of COVID-19 on tourism sustainability: Evidence from Portugal. *Advances in Hospitality and Tourism Research*, *8*(2), 440–446. https://doi.org/10.30519/ahtr.775340

Balula-Dias, S., & Alves-Diniz, J. (2014). Towards an enhanced learning management system for blended learning in higher education incorporating distinct learners' profiles. *Educational Technology & Society*, *17*(1), 307–319. https://www.jstor.org/stable/jeductechsoci.17.1.307

Batista-Toledo & Gavilan (2022). Implementation of blended learning during COVID-19. *Encyclopedia*, *2*(4), 1763-1772. https://doi.org/10.3390/encyclopedia2040121

Bell, E. E. (2015). Understanding African American males' schooling experiences: A qualitative inquiry. *The Qualitative Report, 20*, 1260–1269. https://doi.org/10.46743/2160-3715/2015.2250

Berná Sicilia, C., Martínez Martínez, H., & Zamora Medina, R. (2013). El relato de los movimientos sociales: claves del discurso ideológico y evolución en los mensajes de 'Democracia Real Ya' (2011–2013) [The story of social movements: Keys in ideological discourse and evolution of the messages from 'Democracia Real Ya' (2011-2013)]. *Historia y Comunicación Social*, *18*, 399–417. https://doi.org/10.5209/rev_HICS.2013.v18.44251

Bezliudna, V., Shcherban, I., Kolomiyets, O., Mykolaiko, V., & Bezliudnyi, R. (2021). Master students' perceptions of blended learning in the process of studying English during COVID 19 pandemic in Ukraine. *Rupkatha Journal on Interdisciplinary Studies in Humanities*, *13*(4), 1–14. https://doi.org/10.21659/rupkatha.v13n4.54

Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, *22*, 1–18. https://doi.org/10.1016/j.edurev.2017.06.001

Buck, E., & Tyrrell, K. (2022). Block and blend: A mixed method investigation into the impact of a pilot block teaching and blended learning approach upon student outcomes and experience. *Journal of Further and Higher Education*, *46*(8), 1078–1091. https://doi.org/10.1080/0309877x.2022.2050686

Bueno, E. V., Weber, T. B. B., Bomfim, E. L., & Kato, H. T. (2019). Measuring customer experience in service: A systematic review. *The Service Industries Journal*, *39*(11–12), 779–798. https://doi.org/10.1080/02642069.2018.1561873

Carius, A. C. (2020). Network education and blended learning: Cyber university concept and higher education post COVID-19 pandemic. *Research, Society and Development*, *9*(10), Article e8209109340. https://doi.org/10.33448/rsd-v9i10.9340

Carrera Farran, F. X., Vaquero Tló, E., & Balsells Bailón, M. (2011). Instrumento de evaluación de competencias digitales para adolescentes en riesgo social [Digital skills evaluation instrument for adolescents in social risk situation]. *Edutec: Revista Electrónica de Tecnología Educativa*, *35*, Article a154. https://doi.org/10.21556/edutec.2011.35.410

Chowdhury, R. R., & Singha, A. K. (2023). Importance of integration modern technology in higher education. *Knowledgeable Research*, *1*(9), 71–82. https://doi.org/10.57067/kr.v1i09.78

Christensen, C. M., Raynor, M. E., & McDonald, R. (2015, December). What is disruptive innovation? *Harvard Business Review*. https://hbr.org/2015/12/what-is-disruptive-innovation

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.

Ding, Y., & Keh, H. T. (2017). Consumer reliance on intangible versus tangible attributes in service evaluation: The role of construal level. *Journal of the Academy of Marketing Science*, *45*(6), 848–865. https://doi.org/10.1007/s11747-017-0527-8

Donlon, E., Johnson, M. C., Doyle, A., McDonald, E., & Sexton, P. (2022). Presence accounted for? Student-teachers establishing and experiencing presence in synchronous online teaching environments. *Irish Educational Studies*, *41*(1), 41–49. https://doi.org/10.1080/03323315.2021.2022520

Egan, A., & Tiernan, P. (2023). It wasn't all Zoom and gloom: Teacher and student experiences of online learning during the COVID-19 pandemic in an Irish post-primary school. *Education Sciences*, *13*(7), Article 637. https://doi.org/10.3390/educsci13070637

Etikan, İ., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11

Gaggioli, A. (2017) Phygital spaces: When atoms meet bits. *Cyberpsychology, Behavior, and Social Networking*, *20*(12), 774–774. https://doi.org/10.1089/cyber.2017.29093.csi

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001

Gavilan, D., & Martinez-Navarro, G. (2022). Exploring user's experience of push notifications: A grounded theory approach. *Qualitative Market Research*, *25*(2), 233-255. https://doi.org/10.1108/qmr-05-2021-0061

Goncharov, V., Stepanova, D., Kovalev, D., Kovaleva, T., & Batyrshina, A. (2020). Blended learning perspectives for students (University experience under constraints due to COVID-19 pandemic). *Revista Inclusiones*, *7*, 288–300. https://revistainclusiones.org/index.php/inclu/article/view/1370

Grace, D. A., & O'Cass, A. (2004). Examining service experiences and post-consumption evaluations. *Journal of Services Marketing*, *18*(6), 450–461. https://doi.org/10.1108/08876040410557230

Guilbault, M. (2018). Students as customers in higher education: The (controversial) debate needs to end. *Journal of Retailing and Consumer Services*, *40*, 295–298. https://doi.org/10.1016/J.JRETCONSER.2017.03.006

Gurrea, A. T., Ilustrisimo, R. K., Batolbatol, G. B., & Bonotan, A. M. (2023). Making math fun and engaging via the use of modern technology: Capacity building for mathematics teachers. *International Multidisciplinary Research Journal*, *4*(4), 174–183. https://doi.org/10.54476/ioer-imrj/003259

Hadiyanto, H., Failasofah, F., Armiwati, A., Abrar, M., & Thabran, Y. (2021). Students' practices of 21st century skills between conventional learning and blended learning. *Journal of University Teaching and Learning Practice*, *18*(3), 83–102. https://doi.org/10.53761/1.18.3.7

Hollebeek, L. D., Sprott, D. E., Andreassen, T. W., Costley, C., Klaus, P., Kuppelwieser, V. G., Karahasanović, A., Taguchi, T., Islam, J. U., & Rather, R. A. (2019). Customer engagement in evolving technological environments: Synopsis and guiding propositions. *European Journal of Marketing*, *53*(9), 2018–2023. https://doi.org/10.1108/ejm-09-2019-970

Izquierdo-Yusta, A., Jiménez-Zarco, A. I., Martínez-Ruiz, M. P., & González-González, I. (2021). Determinants of customer experience in e-services: The case of online universities. *Revista Brasileira de Gestão de Negócios*, *23*(1), 1–20. https://doi.org/10.7819/rbgn.v23i1.4097

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York University Press.

Kohnke, L., & Moorhouse, B. L. (2021). Adopting HyFlex in higher education in response to COVID-19: Students' perspectives. *Open Learning*, *36*(3), 231–244. https://doi.org/10.1080/02680513.2021.1906641

Leximancer Pty Ltd. (2021). *Leximancer user guide. Release 4.5.* https://static1.squarespace.com/static/5e26633cfcf7d67bbd350a7f/t/60682893c386f915f4b05e43/1617438916753/Leximancer+User+Guide+4.5.pdf

Maarop, A. H., & Embi, M. A. (2016). Implementation of blended learning in higher learning institutions: A review of literature. *International Education Studies*, *9*(3), 41–52. https://doi.org/10.5539/ies.v9n3p41

Malhotra, N. K. (2006). *Marketing research: An applied orientation* (6th ed.). Pearson Education Australia.

McKenna, B., & Waddell, N. (2007). Media-ted political oratory following terrorist events: International political responses to the 2005 London bombing. *Journal of Language and Politics, 6*(3), 377–399. https://doi.org/10.1075/jlp.6.3.06mck

Mdhlalose, D., & Mlambo, G. (2023). Integration of technology in education and its impact on learning and teaching. *Asian Journal of Education and Social Studies*, *47*(2), 54–63. https://doi.org/10.9734/ajess/2023/v47i21021

Merriam, S. B., & Grenier, R. S. (2019). *Qualitative research in practice: Examples for discussion and analysis* (2nd ed.). John Wiley & Sons.

Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE Transactions on Information and Systems*, *E77-D*(12), 1321–1329. https://cs.gmu.edu/~zduric/cs499/Readings/r76JBo-Milgram_IEICE_1994.pdf

Müller, A. M., Goh, C., Lim, L. Z., & Gao, X. (2021). COVID-19 emergency eLearning and beyond: Experiences and perspectives of university educators. *Education Sciences*, *11*(1), Article 19. https://doi.org/10.3390/educsci11010019

Munna, A. S., & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: Literature review. *International Journal of Humanities and Innovation*, *4*(1), 1–4. https://doi.org/10.33750/ijhi.v4i1.102

Potra, S., Pugna, A., Pop, M.-D., Negrea, R., & Dungan, L. (2021). Facing COVID-19 challenges: 1st-year students' experience with the Romanian hybrid higher educational system. *International Journal of Environmental Research and Public Health*, *18*(6), Article 3058. https://doi.org/10.3390/ijerph18063058

Purcarea, T. (2019). Modern marketing, CX, CRM, customer trust and identity. *Holistic Marketing Management Journal*, *9*(1), 42–55. https://ideas.repec.org/a/hmm/journl/v9y2019i1p42-55.html

Rahman, N. A., Arifin, N., Manaf, M., Ahmad, M., Zin, N. A. M., & Jamaludin, M. (2020). Students' perception in blended learning among science and technology cluster students. *Journal Of Physics: Conference Series*, *1496*(1), Article 012012. https://doi.org/10.1088/1742-6596/1496/1/012012

Rahman, N. A., Hussein, N., & Aluwi, A. H. (2015). Satisfaction on blended learning in a public higher education institution: What factors matter? *Procedia: Social & Behavioral Sciences*, *211*, 768–775. https://doi.org/10.1016/j.sbspro.2015.11.107

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. *Computers and Education*, *144*, Article 103701. https://doi.org/10.1016/j.compedu.2019.103701

Robson, L., Gardner, B., & Dommett, E. J. (2022). The post-pandemic lecture: Views from academic staff across the UK. *Education Sciences*, *12*(2), Article 123. https://doi.org/10.3390/educsci12020123

Rooney, D. (2005). Knowledge, economy, technology and society: The politics of discourse. *Telematics And Informatics*, *22*(4), 405–422. https://doi.org/10.1016/j.tele.2004.11.007

Schwager, A., & Meyer, C. (2007). Understanding customer experience. *Harvard Business Review*. https://hbr.org/2007/02/understanding-customer-experience

Schwerter, J., Netz, N., & Hübner, N. (2022). *Do school reforms shape study behavior at university? Evidence from an instructional time reform*. Social Science Research Network. https://doi.org/10.2139/ssrn.4166635

Shukla, A., Singhal, S., Choudhury, T., & Mohanty, S. N. (2023). Learners' acceptability of adapting the different teaching methodologies for students. *International Journal of E-collaboration*, *19*(1), 1–20. https://doi.org/10.4018/ijec.318335

Singh, H. (2003). Building effective blended learning programs. *Educational Technology*, *43*(6), 51–54. https://asianvu.com/bookstoread/framework/blended-learning.pdf

Singh, J., Steele, K., & Singh, L. (2021). Combining the best of online and face-to-face learning: Hybrid and blended learning approach for COVID-19, post vaccine, and post-pandemic world. *Journal of Educational Technology Systems*, *50*(2), 140–171. https://doi.org/10.1177/00472395211047865

Siripongdee, K., Pimdee, P., & Tuntiwongwanich, S. (2020). A blended learning model with IoT-based technology: Effectively used when the COVID-19 pandemic? *Journal for the Education of Gifted Young Scientists*, *8*(2), 905–917. https://doi.org/10.17478/jegys.698869

Smith, A. E., & Humphreys, M. S. (2006). Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behavior Research Methods*, *38*(2), 262–279. https://doi.org/10.3758/bf03192778

Spitale, M., Piselli, A., Garzotto, F., & Del Curto, B. (2019). Designing phygital activities in a smart multisensorial room: A collaborative cognitive environment for children with and without disabilities. In S. Colombo, Y. Lim, M. Bruns Alonso, L.-L. Chen, T. Djajadiningrat, L. Feijs, J. Hu, S. Kyffin, E. Özcan, L. Rampino, E. Rodriguez Ramirez, & D. Steffen (Eds.), *Design and semantics of form and movement. DeSForM19 proceedings. Beyond intelligence* (pp. 140–148). DeSForM. https://doi.org/10.21428/5395bc37.cad4f6dc

Statista. (2023, October). *Metaverse education—Worldwide*. https://www.statista.com/outlook/amo/metaverse/metaverse-education/worldwide

Thompson, J., Davis, J., & Mazerolle, L. (2014). A systematic method for search term selection in systematic reviews. *Research Synthesis Methods*, *5*(2), 87–97. https://doi.org/10.1002/jrsm.1096

Torres, G. C. (2022). *Phygital approaches and intangible cultural heritage as a tourism experience enhancer. Tradition and innovation for a 21st century academic museum of the University of Coimbra* [Doctoral dissertation, University of Coimbra]. Estudo Geral. https://hdl.handle.net/10316/102649

Uspenski, I. (2013). Shared in confidence: A machine to a machine (The birth of post-semantic aesthetics). In J. Romportl, P. Ircing, E. Zackova, M. Polak, & R. Schuster (Eds.), *Beyond AI: Artificial Golem Intelligence* (pp. 41–57). University of West Bohemia. https://www.beyondai.zcu.cz/files/BAI2013_proceedings.pdf#page=53

Waśkowski, Z. (2017). Possibilities and limitations of using the customer experience management concept by universities. *Marketing of Scientific and Research Organizations*, *24*(2), 1–14. https://sciendo.com/article/10.14611/minib.24.06.2017.07

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Zeng, C. (2023). Student engagement and academic performance during the COVID-19 pandemic: Does a blended learning approach matter? *International Journal for the Scholarship of Teaching and Learning*, *17*(1), Article 7. https://doi.org/10.20429/ijsotl.2023.17107