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PAPER

Enhancing Student Engagement: Technology Acceptance in Higher Education during COVID-19

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ABSTRACT

COVID-19 has caused institutions across the sector to transition from conventional teaching and learning environments into virtual environments. Amidst this paradigm shift, academics have adopted a range of technology-based strategies to support the online learner. However, low attendance, engagement, and participation continue to challenge the execution of eLearning across the higher education (HE) sector. Within this narrative, there has been an interest in understanding the acceptance and adoption of technologies in education from the learners' perspective. As a result, there has been an increased focus on technology acceptance models as a theoretical lens to unpack attitudes and beliefs relating to eLearning. Motivated by these environmental shifts, this study aims to capture themes and perspectives considered in educational literature worldwide to present future considerations for studied and practitioners as we emerge from the pandemic. By systematically reviewing global educational literature, the study aims to provide valuable insights and future considerations for both studied and practitioners as the HE sectors transitions out of the pandemic. The study is guided by the central study question: What influences the learners' acceptance and continuation of use of education technologies during forced emergency conditions such as the COVID-19 pandemic? Based on these findings, we then share recommendations for education technology adoption in the HE sector.

KEYWORDS

technology acceptance, higher education (HE), COVID-19, distance education, e-learning, technology adoption, learner

1 INTRODUCTION

2020 signalled the beginning of the global pandemic, causing unprecedented upheaval and disruption to everyday life and necessitating the imposition of lockdowns by governments to curb the virus' spread. This unpredictable situation prompted higher education (HE) institutions to adapt their teaching and learning (T&L) methods to ensure operational continuity [21]. Thus, distance education, facilitated by T&L technologies, emerged as an alternative solution during this time

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[22, 23, 40]. However, the *COVIDification* in HE [64, 31] amplified inequalities between learners in the Global North and the Global South due to poor or non-existing infrastructure.

The transition to the new normal post-pandemic prompts a re-evaluation of the future of HE. [49] stresses the importance of technology usability for enhancing student cognitive connectivity and motivation; this is further elucidated by Kok et al. [42], who emphasized the need for institutions to comprehend learner needs broadly. Previous literature by Granić and Marangunić [33] and Al-Samarraie et al. [12] recognizes the prevalence of technology acceptance models in understanding learner experiences. That said, Abu Talib et al. [1] identify a notable gap in scholarly understanding, following COVID-19, regarding the effects of digital transformation and well-being on learners in HE settings. Our preliminary investigation revealed a notable lack of study into user acceptance of T&L technologies introduced during emergencies by HE institutions. This study aims to address this gap by focusing on learners' experiences as users of educational technologies during the COVID-19 emergency.

While a range of predictive models are available for studied to understand the factors influencing technology adoption, the focus of this study is to examine the findings of such studies to inform and enhance the learning experience in teaching and learning environments. These models, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), provide valuable frameworks for identifying variables that affect the adoption and effective use of technology. However, the utility of these models extends beyond mere prediction. By critically analysing the discoveries from these studies, this study aims to translate theoretical insights into practical applications that can improve educational practices. Specifically, the study seeks to bridge the gap between theoretical understanding and real-world implementation, offering strategies for educators to better integrate technology in a way that enriches the learner's experience. Furthermore, this study recognises the importance of contextualising technology adoption within the unique dynamics of different educational environments. While predictive models often focus on individual factors such as perceived usefulness and ease of use, this study emphasises the interplay between these factors and broader institutional, cultural, and socio-economic contexts.

As a result, relying on models such as TAM and UTAUT for understanding the learner experience in educational environments is somewhat limited by the variables these models consider. While TAM and UTAUT provide foundational insights into factors such as perceived usefulness, ease of use, and behavioural intention, they do not fully capture the complex, multifaceted nature of the learner experience. This limitation underscores the need for the development and adoption of novel models that encompass a broader range of variables and contextual factors. Emerging models that integrate aspects such as emotional engagement, social influences and cultural contexts can lead to a deeper and more comprehensive understanding of the learner experience. These new frameworks can offer richer, more nuanced perspectives that better reflect the realities of technology use in diverse educational settings, ultimately enhancing our ability to support and improve the learning experience through informed, holistic approaches.

Ultimately, this study aspires to contribute to the ongoing discourse on educational technology by providing a nuanced and evidence-based perspective that can guide future study and practice. By bridging the gap between theory and practice, it aims to improve an educational landscape where technology serves as a catalyst for innovation and excellence in teaching and learning. The central study question guiding this study is: *What influences the learners' acceptance and continuation of use of education technologies during forced emergency conditions such as the COVID-19 pandemic?* By systematically

reviewing global educational literature, this study seeks to provide valuable insights and lessons learnt from this unprecedented period, offering future considerations for studied and practitioners in the evolving landscape of higher education.

2 MEASURING TECHNOLOGY ACCEPTANCE

Popular predictive models such as the TAM [74], UTAUT [75], and the general extended technology acceptance model for e-learning (GETAMEL) [76] have been increasingly adapted to study factors influencing the acceptance of technologies in education. Over time, the original TAM and UTAUT models have been expanded by scholars to capture additional variables that influence technology acceptance.

Though GETAMEL has been designed especially to examine the acceptance of education technologies, Jiang et al. [77] argue that the validation of GETAMEL is still in its infancy. Hence, Jiang et al. [77] question the applicability of the GETAMEL model in a specific condition. Doleck et al. [78] further convey that the context-specific nature of technology limits GETAMEL's ability to cater to conditions beyond generic environments. As a result, though designed specifically for eLearning environments, GETAMEL continues to remain under-studied.

In an effort to examine technology acceptance, scholars have also turned to other models such as Innovation Diffusion Theory (IDT) [75, 79, 80], Social Cognitive Theory (SCT) [81], Information Systems Success Model (ISSM) [82], and Expectation Confirmation Theory (ECT) [83, 84, 85] to capture what motivates usage and adoption. These theoretical models provide insight into attributes considered when measuring user adoption of education technologies. Thus, in this systematic literature review, we draw on the nature of findings emerging from the application of such models to critically examine the learners' experience.

2.1 Broader context of technology acceptance during COVID-19

Technology adoption models, such as the TAM, UTAUT, GETAMEL, IDT, SCT, ISSM and ECT, relate to the study's findings and the broader context of technology acceptance in higher education during the COVID-19 pandemic. These models offer theoretical frameworks for understanding the factors that influence technology adoption and usage in educational settings, and by applying these models to the study's findings, studied can gain insights into how these theoretical constructs manifest in real-world scenarios, particularly in the context of the unprecedented shift to remote learning brought about by the pandemic.

More specifically, relating the study's findings to these models can support the study by validating existing models and aligning the study's findings with established technology acceptance models such as TAM, UTAUT and GETAMEL, where studied can validate the applicability of these models in the context of higher education during the COVID-19 pandemic. Understanding how well these models predict technology acceptance in the current scenario can therefore inform future study and practice. Furthermore, the identification of relevant factors identified in the study, (IDT, SCT, ISSM and ECT) can provide a nuanced understanding of what motivates users to adopt educational technologies. This analysis can highlight key determinants of technology acceptance and usage that are particularly salient in the pandemic-induced remote learning environment. Additionally, comparing and contrasting the implications of different theoretical models on technology acceptance in higher education can help explain the strengths and limitations of each framework. Researchers can leverage this comparative analysis to refine existing models or develop new frameworks that

better capture the complex dynamics of technology adoption in educational contexts. Finally, linking the study's findings to technology adoption models can facilitate the translation of study insights into actionable recommendations for educators, administrators, and policymakers. Understanding how theoretical constructs manifest in practice can guide the development of strategies to enhance technology integration and improve the overall learning experience for students in higher education.

3 METHODOLOGY

This study examines study surrounding the acceptance of education technologies in HE with a specific interest in forced emergency conditions (e.g., the COVID-19 pandemic). As we emerge from the pandemic, it is necessary to examine what has been learnt through the adoption of education technologies and the learners' experiences to provide a critical view of the future for HE institutions.

A particular interest in this study is in how the transition to educational technologies, decided at an institutional level, has been accepted by learners in the context of HE and the implications of technology in practice. To do this, it is necessary to examine how acceptance has been studied during the COVID-19 pandemic. To do this, we consider: *What influences the learners' acceptance and continuation of use of education technologies during forced emergency conditions such as the COVID-19 pandemic?*

To better understand this situation, we consider scholarly articles published between 2019 (pre-pandemic) and March 2022 (post-pandemic to endemic). By answering the above study question, the study aims to provide institutions, practitioners, and studied with an understanding of the lessons learnt by:

- Providing a critical overview of key learnings from technology acceptance-based study.
- Providing an overview of the key challenges identified from the perspective of the learner.

3.1 Research protocol

For this study, we chose the Web of Science as the key search engine due to its access to full-text study across multi-disciplinary study databases. To ensure quality outcomes, we chose three restrictive criteria: (1) Only peer-reviewed journal articles were considered. Thus, books, book chapters, conference proceedings, working papers, and other similar unpublished work were excluded from the sample; (2) as this study is particularly interested in the events surrounding the COVID-19 pandemic, only articles published between 2019 and 2022 were considered; and (3) for the purpose of interpretation, only articles written in the English language were considered.

Following the process suggested by Newman and Gough [48], we were keen to examine works relating to technology acceptance from different contexts and regions. Thus, it was important that we not only look at high-impact journals, as is often seen in systematic literature reviews. A focus directed at high-impact journals alone may risk overlooking experiences from studies that may be visible in more regional journals. To ensure quality, a full-text review phase was involved once the initial screening was completed. A particular interest in drawing on the systematic literature review process defined by Newman and Gough [48] for this study was, firstly, the authors particular focus on how a systematic literature review may be conducted in educational study, and secondly, how findings emerging from such reviews can be synthesised. This approach provided structure for the present study.

Newman and Gough (2020) explain that it is the study questions that give structure and shape to the study. Thus, the initial step of any systematic literature review is to formulate the study questions and aims of the study. Guided by the study question, we examined multiple combinations of key words to assess the relevance of the study results to the study aim. Initial key words were formulated and used on a trial-and-error basis to understand the relevance of the results. The initial search strings were "Distance Education" AND "TAM", "Covid-19" AND "Distance Education", "TAM" AND "Higher Education", and "Technology Acceptance Model" AND "Higher Education". It was identified that the use of "Distance Education" AND "TAM" or "Distance Education" AND "Covid-19" produced a large volume of search results that were not in line with the study question. Furthermore, the inclusion of "Higher Education" helped to scope the search results and align them to the study question.

Consequently, the following search string was adopted: "TAM" OR "Technology Acceptance Model" AND "HE" OR "Higher Education". The decision to adopt this search string was informed by the relevance of the preliminary results to the study question. The initial search returned 1630 search results.

The consideration of publications between 2019 and 2022 further reduces the search results to 936. Furthermore, the systematic literature review is interested in studies focussing on education, so "educational research" was used as a filter. To ensure quality and reliability, only peer-reviewed journal articles were considered, reducing the search to 389 papers.

Further screening was carried out based on a set of inclusion and exclusion criteria (refer to Table 1). A further 250 papers were excluded from the sample. This study focusses primarily on the learners' experience; thus 41 papers focussing only on the instructor/teacher experience were excluded.

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Publications from 2019 to March 2022	*Publications prior to 2019*
Focus on Technology Acceptance	*Does not focus on Technology Acceptance*
Focus on HE	*Does not focus on HE (e.g. pre-university, pre-service teachers)*
Focus on empirical research	*Focus on systematic literature review*
Peer-reviewed	*Not peer-reviewed*
English language	*Not in English language*
Educational research specific journals	*Non-subject specific Journals*
Relevance to the research question	*Non-relevance to research question*
Access to full-text paper	*Inaccessible*
Focus on learner/both learner and teacher	*Focus only on the teacher/instructor*

The review was carried out in January and April 2022 by three authors. The most recent publications included were published in March 2022. Initial filters produced 179 papers that further underwent cleaning based on the full-text review of the papers. During the reviews, Author 1 moderated the list in conversation with Authors 2 and 3. At this stage, the authors considered whether the paper met the inclusion criteria, relevance to the study question, and quality of the paper. This further eliminated 53 papers, bringing the sample size to 126, as illustrated in Figure 1. Therefore, 126 peer-reviewed articles were full-text reviewed by the authors. A final moderation of the papers revealed four duplicates that were then removed from the sample, producing a final sample of 122 studies (see Figure 1).

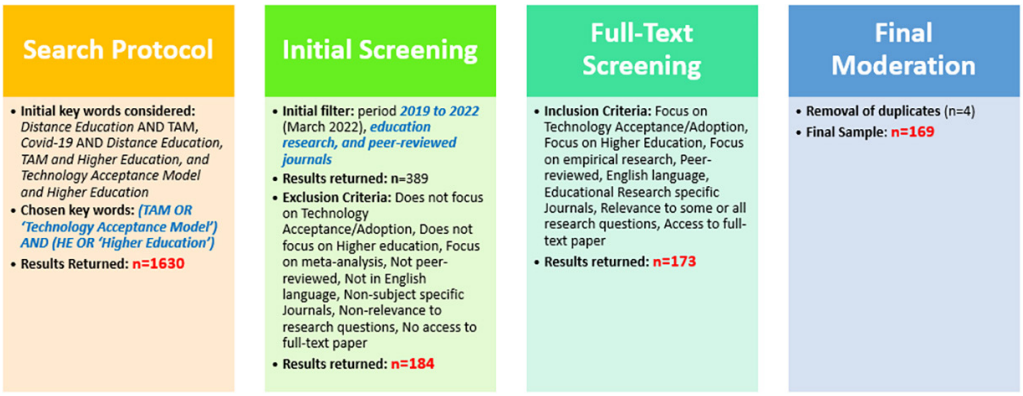

Fig. 1. Screening process

The final sample was then used to carry out a thematic analysis of the findings to answer the study question. The data analysis was carried out using NVivo 12. The first cycle of coding drew on holistic coding, initial coding, and descriptive coding to produce 255 codes. The second cycle of coding followed pattern coding, focused coding, and axial coding to produce 56 code categories and underwent further refinement to produce 3 aggregated code categories (refer to Table 2), namely: The user, education technology, and the role of institutions. Within these themes, it was evident that the findings centred around the motivations to use education technologies, barriers to adoption, and benefits of adopting education technologies. Following Newman and Gough (2020), the findings were anchored to the primary study question of this study. *What influences the learners' acceptance and continuation of use of education technologies during forced emergency conditions such as the COVID-19 pandemic?* The following sections will lay out the findings based on the emerging themes of the thematic analysis.

Table 2. Thematic analysis

Aggregate Codes	Secondary Codes	Primary Codes
The User	*Attitude on acceptance*	*Attitude on acceptance*
	Familiarity and usage	*Familiar and anxious means no impact*
		I am more aware of the technology I will use it
		Infrequent use means PEOU important
		The more I use the less PEOU is important
	Flow experience	*Enjoyment*
		Playfulness
		Satisfaction
		Student engagement
	Self-efficacy	*Self-efficacy not important*
		Skilfulness
	Personal and Psychological factors	*Personal and Psychological factors*
		Personal significance
	Continuous intention	*Continuous intention*
		Habit
	Users' barriers	*Self-regulated learning*

(Continued)

Table 2. Thematic analysis *(Continued)*

Aggregate Codes	Secondary Codes	Primary Codes
Education Technology	*Ease of use*	*Ease of use on task completion*
		Effort expectancy
		Learnability
		Effort requirement
		Visual design not important
	Usefulness	*Usefulness not important to casual users*
		Effectiveness
		Excuse difficulty for usefulness
		I use what I think will purposefully help me
		If it is beneficial I will use it
		Meaningfulness will promote usefulness
		No impact on attitude
	Subjective norms	*Private support*
		Subjective norm not important
		Tech not supporting communication affects impact of SN
	Collaboration and social interaction	*Collaboration overcome loneliness*
		Interaction with teacher
	Quality of the technology	*Quality of content*
		Service quality
		Superiority of technology
		System quality
		Trust
	Technology not a silver bullet	*Access inconsistencies in developing regions*
		Boredom
		Cyber bullying
		Difficulty concentrating
		Hardware issues
		Internet issues
		Low confidence in technology
		Over responsiveness stressful
		Technology is a distraction
		Unfamiliarity of technology in developing countries
Role of Institutions	*Mandatory use and choice*	*Mandatory use and choice*
		A solution to a need
	Institutional support	*Institutes lead adoption*
		Managing support
	Instructor readiness	*Instructor readiness*

4 RESULTS

The thematic analysis recognised three key clusters relating to factors surrounding the learners' experience: *user*, *education technology* and *role of institutions*. Following these key themes, this section provides an overview of the literature surrounding the learners' experience.

4.1 The user

Scholars have drawn on the learners' personal characteristics and internalised perceptions to understand the acceptance of education technologies. The findings show that such characteristics and internalised perceptions significantly shape the learners' attitude towards technology.

Flow experience. Within this cluster, 37 papers identify *flow experience* as influential. The thematic analysis shows that *enjoyment* while using the technology (26 papers), the *satisfaction* of achieving through the technology (10 papers), and the *playfulness* experienced when engaging with the technology (five papers) all contribute to the flow experience. Thus, to the user, the technology goes beyond a facilitating instrument that enables the learner to engage in the learning process. The *entertainment* aspect of the instrument shapes the learners' experience and has an impact on the *perceived usefulness* of the technology.

Familiarity and usage. In terms of familiarity with a technology (35 papers), previous experience using similar technology [10, 46, 70, 52] significantly influenced the acceptance of the technology. This is indicative of how an individual's confidence in using a technology creates a positive attitude towards the technology. Interestingly, Afacan Adanır and Muhametjanova [3] identify that the learners' awareness of the technology can also motivate usage. Yulianto et al. [73] further elaborate that the learners' familiarity with the technology reduces any anxiety towards the technology and eases adoption. An implication of these findings for practitioners is how familiar system features can ease the learners' transition into a new learning environment, thereby supporting acceptance.

Self-efficacy. [19] recognises that self-efficacy was a significant motivator for learners' acceptance of education technologies during the COVID-19 pandemic. Similarly, 21 papers recognised the positive effect of self-efficacy on technology acceptance [34, 54, 67]. Mahasneh [44] identifies that the learners' skill in using the technology creates confidence and shapes positive perceptions of self-efficacy. However, it can be questioned whether an individual's skill emerges from one's access to cultural and economic capital. For instance, would students who do not have access to such resources find the adoption of education technologies challenging?

Personal characteristics. Among the 10 papers examining the personal and psychological characteristics of the learner, Pinho et al. [53] and Dalvi-Esfahan et al. [28] identify that if the learner finds personal significance in using a technology, they are more inclined to view the technology as valuable, which in turn encourages usage. Furthermore, characteristics such as *personal innovativeness* (e.g. [53], [63]), *entrepreneurial characteristics* (e.g. [62]), *openness to experience* (e.g. [28]), and *conscientiousness* (e.g. [72]) have been considered to encourage usage motivations. Such findings assert that individuals who possess these innate characteristics are more motivated to trial these technologies. However, it can be argued that such micro-level views fully consider the effects of social structures on embedding these traits in individuals. Especially in forced emergency conditions, it raises questions as to

whether individuals have a choice in adopting the learning environments made mandatory for them.

User's barriers. When considering barriers to acceptance and usage, the practice of self-regulated learning was a significant challenge for learners and often resulted in negative perceptions towards the learning environment [5, 6]. Alasmari and Zhang [13] further expand that the self-regulation required in eLearning environments often encouraged behaviours of laziness among the learners and resulted in a lack of learning [19, 29]. Furthermore, Stephan et al. [66] find that shifting the responsibility to the learner results in anger and anxiety as the technology causes the learner to feel isolated. These findings reflect the challenges faced when transitioning from a traditional classroom environment to an eLearning landscape. Thus, the design of eLearning environments must strike a delicate balance between supporting the learners' transition into a self-regulated learning environment while also overcoming the constraints of maintaining interactivity and engagement through a device screen.

4.2 The education technology

The findings show that scholars have examined the nature of technology to understand motivations for acceptance. 65 papers make specific reference to the perceived usefulness, and 63 refer to the perceived ease of use by examining the traditional constructs of predictive models such as the TAM [86, 87, 88]. Within this section, we wish to highlight unique findings that may motivate future practice and study.

Usefulness of the technology. 20 papers recognise that the learners' perceptions that the technology would improve their performance were a significant factor that shaped their perceptions of usefulness and, in turn, encouraged usage [11, 17, 9, 28, 50]. Particularly during the COVID-19 pandemic, students believed that e-education technologies would increase their learning efficiency and improve their academic performance [73]. Furthermore, Al-Adwan [6] found that the usefulness of the functionality can even encourage learners to be accepting of the technical difficulties.

Ease of using the technology. While scholars have recognised the importance of usability on acceptance, the learners' expectations that using the technology will be free of effort had an impact on their perceptions of the ease of use [41, 39, 63]. Furthermore, Yulianto et al. [73] draw a connection between usability and attainment and find that the learners' expectations that using the technology would reduce the effort required to study were a motivation for acceptance. Thus, the learnability of the system encourages acceptance and instils perceptions of ease of use [15, 24, 45]. In this regard, Al-Rahmi et al. [11] and Steger and Kizilhan [65] find that the trialability of the technology can also allow the learner to develop perceptions of ease of use through practice, thereby allowing the student to try out the technology in a low-risk environment, which can help reduce anxiety and generate positive attitudes.

Subjective norms. The influence of subjective norms, though well studied, provided mixed results in the context of education technologies (36 papers). While the views of the teacher and peers [46, 53, 28, 50] were found to be influential in some cases, Maphosa [45] finds that when learners are satisfied with the technology, they will recommend it to others and encourage others to use it. Contrary to these findings, scholars argue that the perceptions of others towards technology had little influence on the learners' decision to use technology [26, 49, 58]. Matarirano [46] further elaborates that there is a blurred connection between the effects of subjective norms

and acceptance, as one's perception of the ease of use or usefulness of the technology cannot be purely a function of the perception of others.

Quality of the technology. We identified 27 articles that recognise the quality of the technology (attributed to quality of content, system quality, and service quality) and encourage acceptance of education technologies. Ashrafi et al. [20] find that the quality of the content provided by the learning system allows the learner to counter pre-judgement and form positive perceptions regarding the usefulness of the technology. Therefore, the quality of the technology perceived through content, system, or service quality [38], [49] can have a significant impact on the learners' intention to use it. Moreover, system availability and trust in the system [55], [8] further shape the perceived ease of use of the technology and intention to use. The technology's ability to fit in with the learners' aims, values, and expectations can also have a positive effect on encouraging acceptance [11], [53], [28]. Drawing on social capital theory, Alshurafat et al. [16] explain that *social trust* can shape the perceived ease of use and usefulness of the learning system. These findings reflect the nuances of how institutional practices and policies can instil a sense of collective trust in the user and further highlight the responsibility of institutions in enabling acceptance.

Technology is not a silver bullet. Though the transition into technology-driven learning environments has been followed by HE institutions globally to overcome the constraints of the COVID-19 pandemic, it must be noted that the learners' experiences in developing and developed nations vary significantly. Poor Internet connection, high cost of Internet, access to electricity and hardware issues [4, 30, 41, 43, 73, 20] all affect learner in developing nations and their ability to adopt education technologies. Thus, technology must not be viewed as a silver bullet. The learners' unfamiliarity with education technologies or technology in general can hinder their ability to use the technology and can create negative attitudes towards the learning environment [65], [15]. As a result, scholars have identified that unfamiliarity causes low confidence in using education technology [43, 47, 28]. Sendogdu and Koyuncuoglu [62] further explain that the low confidence towards learning technology observed among learners from underprivileged communities, may also be because of the individuals' own lives and the structures around them that, in turn, affect the access and continuity of computer use. This brings to light how individuals' social position impacts their ability to have access to such technologies in their everyday lives.

The thematic analysis reveals that both learners and teachers have raised concerns about how technology may be a distraction that can hinder the learning process [30], [55], [61]. Cyberbullying Sarwar et al. [61], and expectations of responsiveness resulting from eLearning environments may induce stress [60]. Thus, there is a higher dependency on institution-driven facilities, training, and support to help learners access, use, and understand how these technologies may be adapted to their needs [4, 52]. Though these findings particularly focus on the experiences of developing nations, their relevance to all universities stems from how eLearning environments have dissolved the boundaries of learning spaces and environments. As a result of this shift, learners may not be in the same region as the university. Therefore, it is important for practitioners to be mindful that the experience in their home country may not be the same as that of the learner, who is now forced to keep up with requirements and expectations that may be vastly different from their own reality.

4.3 The role of institutions

Particularly in forced emergency conditions such as COVID-19, institutions adopted education technologies to ensure operational continuation. In this case, it is

important to note that the technology acceptance was not a choice for the learner; rather, it was a mandatory condition imposed on the learner. However, it must also be noted that even prior to this emergency climate, many institutions had already made the decision to adopt education technologies. In this context, the institutional decision left little choice for the learner.

Mandatory usage and choice. In their work, [7] found that while the mandatory use of learning management systems (LMS) had reduced learner satisfaction, the degree of choice the learner had in using an education technology such as social media increased their satisfaction. Alternatively, Alowayr and Al-Azawei [14] find that the learners' ability to choose a technology on their own accord improved acceptance. This raises interest in whether the learners' ability to choose has any impact on how they perceive the technology. However, some scholars identify that the unique emergency climate imposed by the COVID-19 pandemic compelled the learner to accept education technologies as a viable means of continuing their learning without disruptions [19, 49, 56, 73]. This reflects an acceptance of the technology due to the purpose it serves within the forced emergency climate. Furthermore, Alshurafat et al. [16] find that the gradual transition into the eLearning environment during the pandemic helped to establish more acceptance of the technology among learners. Weerathunga et al. [70] provide further insight by explaining that though the acceptance may have been encouraged due to the emergency situation, in the case of developing countries where there are already significant infrastructure and access deficits, the acceptance may have also been hindered by emergency conditions where institutions had little time to prepare.

Institutional support. Khlaisang et al. [41] and Ramdhony et al. [57] find that university support had a positive impact on encouraging the learners' technology acceptance. Furthermore, echoing Herodotou et al. [35] and Valencia-Arias et al. [68], Hoi and Mu [36] find that teacher preparedness had a positive influence on the learners' perceptions of the technology. Within this sample, we found only one study that claimed that there was no impact of teachers' readiness on acceptance [69]. Therefore, it is imperative that we acknowledge the power position of the institution in supporting acceptance and the responsibility of institutions in laying the foundation for this transition.

It is important to note that in the transition to technology-driven learning environments, institutions must be held accountable for both learners and teachers' competency development [10, 5], infrastructure [29, 30], institutional support [4, 30], and developing policies for usage [29]. Though studies recognise the responsibility of institutions in facilitating the transition (22 papers), those addressing the needs of the teacher, who has now transformed into the facilitator and primary content producer, are limited [59, 71]. This may be explained by the limited study focused on the teachers' experiences observed in the sample.

5 DISCUSSION AND CONCLUSION

The systematic literature review provides a comprehensive overview of technology acceptance study carried out between 2019 and 2022. A key aim of examining the study conducted during this period was to unravel the lessons learnt in the wake of the COVID-19 pandemic. To systematise the literature, we have examined key thematic findings from the learners' perspective. The findings reveal that, though technology-driven learning environments present many advantages, the transition into such environments requires careful institutional planning and support.

When considering the key motivators for technology acceptance study, we identified a significant focus on the experience in developing nations and disadvantaged communities [19], [46], [45], [52]. This is reflective of the distribution of papers included in the sample, as a significant number of publications within this period emerged from the global south. Interestingly, [4] raises concerns as to what degree the governments of developing countries can cope with the needs to establish and sustain the required resources for eLearning environments. Thereby, there is a need to also consider the role of institutional forces in the discourse surrounding technology acceptance in HE. As observed in the data set, it is evident that though scholars have examined the barriers to acceptance and adoption in developing nations, the learners' technological capital [27, 32, 25] is vastly overlooked. Technological capital refers to one's access to information and communication technology (ICT) and the ability to leverage these tools to fulfil individual interests. Therefore, by examining the learners' access to and use of education technologies, there is a benefit in also examining how the individual is socially positioned and the inequalities presented by access to personal networks, support, and skills.

The findings also show that scholars have recognised a need to expand technology acceptance study beyond the features and functions of the instrument to examine the experience of the user [37, 18, 36, 61, 66]. Echoing similar views, Aburub and Alnawas [2] argue that model-driven technology acceptance study focusses mainly on the characteristics of the system, ignoring the experience of the users. In their work, Aburub and Alnawas [2] seek to examine whether technical factors or experience are more important in influencing acceptance. Such studies shift attention from the instrument to the individual, and in doing so, provide a rich understanding of why individuals may be accepting of certain technologies.

Nistor et al. [51] further argue that technology acceptance models assume that users have clearly defined attitudes towards technology. As a result, the shifts in attitude resulting from frequent use of technology are not captured. To remedy this, Nistor et al. [51] propose the consideration of attitude strength to observe the relationship between attitude change and technology acceptance predictors. Among such studies, there is interest in exploring the experience as attributed to the societal forces within which the learner is located. For example, Álvarez-Marín et al. [18] consider the effects of social circles on technology optimism and innovation. A further expansion of this may be to unpack the power relations between the individual and the social circles, as well as the individual's social positioning within these circles in shaping their attitudes.

During the pandemic, there has been an increased focus on the forced transition to eLearning environments [19, 49, 56, 70]. Ramasamy et al. [56] explain that, as a result of COVID-19, the context of usage regulated the agency of the user and removed the degree of choice one had in using a technology by making it mandatory. Alshurafat et al. [16] recognise that in the case of adopting eLearning systems during the pandemic, there is disagreement between educators on what entails successful technology acceptance, resulting in a clear gap of knowledge in the successful adoption and use of online education technologies. Thus, technology acceptance-orientated study often does not take into account the social structures that may shape one's access to and familiarity with a given technology. Furthermore, developing nations and disadvantaged communities may be affected in how they view and relate to technology. As a result, understandings of traditional TAM variables, such as perceived usefulness and ease of use, may not be as straight-forward as seeing how well the technology fits in with the task at hand.

It is also important to reflect on how the virtual learning space is distinct from the physical space occupied by the learner and teacher. Though the virtual space may demand to be occupied as a learning space, we cannot disregard the realities that surround the physical environment that the learner and teacher now must operate within. In such cases, it may be insightful to examine the nuances of social protocol in how individuals engage with technology.

Though studies have considered the effects of culture (12 papers), age (eight papers), and gender (16 papers), the findings show that the primary purpose of these variables is to explain the difference or lack of difference in the study results. Often, the underlying complexities of structure and agency are left unaddressed. Though authors unravel some interesting findings, especially from developing nations, it can still be argued whether the learners' perceptions from these developing nations fully interrogate the unique climate that may adopt such perceptions.

The study centres its emphasis on the learner rather than the teacher, leading to a limited understanding of technology adoption in educational settings. This learner-focused approach, while valuable in highlighting the importance of student engagement and individual learning experiences, often overlooks the pivotal role teachers play in facilitating and integrating technology within the classroom. Furthermore, current study methodologies predominantly rely on quantitative methods to investigate the impact of technology on learner motivation and outcomes. These methods, such as surveys and statistical analyses, are undeniably useful for measuring the strength of the effects and identifying general trends across large populations. However, they fall short of providing a comprehensive understanding of the learners' lived experiences as they engage with new technologies.

Quantitative data, by its nature, is reductive and does not capture the depth of personal, contextual, and situational factors that influence how learners interact with and adopt technological tools. For instance, factors such as students' prior experiences with technology, their individual learning styles, and the specific educational contexts they are situated in are often glossed over. This over-reliance on quantitative data neglects the nuanced and subjective aspects of technology adoption, which are critical to fully grasping how learners navigate and integrate technology into their educational journeys.

Qualitative study, on the other hand, can provide richer, more detailed insights into these processes. Methods such as interviews, focus groups, and ethnographic studies allow studied to explore the complex, personal, and contextual dimensions of learners' interactions with technology. Such approaches can uncover how students perceive and experience the integration of technology in their learning environments, how they overcome challenges, and what specific factors facilitate or hinder their adoption of new tools. This deeper understanding is essential for developing more effective strategies for technology integration that are responsive to the actual needs and experiences of learners.

In the context of forced technology adoption during the COVID-19 pandemic, the systematic literature review discussed sheds light on the complexities and challenges faced by learners in transitioning to digital learning environments. The unique circumstances brought about by the pandemic have significantly impacted the dynamics of technology acceptance in education, necessitating a deeper understanding of how individuals engage with and adopt technology in this new normal. The findings highlighted in the literature review underscore the critical role of institutional planning and support in facilitating the smooth transition to digital learning environments, whereas the pandemic has accelerated the adoption of eLearning

systems, leading to a shift in the agency of users and the dynamics of technology acceptance. The mandatory nature of technology usage during the pandemic has forced the reshaping of user perceptions and experiences, emphasising the need to consider the social structures and contextual factors that influence technology acceptance in diverse settings, especially in developing nations and disadvantaged communities.

Furthermore, the literature points to the importance of examining the learner's experience beyond traditional technology acceptance models to capture the nuances of individual interactions with technology in virtual learning spaces. On a final note, the systematic literature review provides valuable insights into the multifaceted nature of technology acceptance during the COVID-19 pandemic, highlighting the need for a holistic approach that considers the interplay of institutional support, learner experiences, and contextual factors in shaping technology adoption in education.

5.1 Practical implications for higher education institutions

Based on the findings and insights from the systematic literature review, there are some practical implications for higher education institutions to improve technology acceptance among students, such as developing comprehensive plans that encompass infrastructure improvements, training programs, and ongoing support mechanisms to facilitate a smooth transition to digital learning environments. These plans should account for the diverse needs of students and educators, ensuring equitable access to resources and support systems. HE institutions should also emphasise the importance of student engagement. Institutions should also recognise the pivotal role teachers play in integrating technology within the classroom. Providing teachers with adequate training, resources, and support will enhance their ability to effectively utilise technology and support students in their learning journey. Institutions can consider the social and contextual dimensions that influence technology acceptance among students. This includes factors such as learners' technological capital, access to ICT tools, social positioning, and inequalities in access to resources and support networks. By acknowledging and addressing these factors, institutions can tailor their technology integration strategies to better meet the diverse needs of students. Therefore, by incorporating these practical implications into their strategic planning and initiatives, higher education institutions can enhance technology acceptance among students, promote effective technology integration, and create more inclusive and engaging learning environments.

6 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the conclusions drawn from the systematic literature review on technology acceptance in education, here are specific actionable recommendations for future studies:

Explore institutional planning and support: Future studies should delve deeper into the institutional planning and support required for a successful transition to digital learning environments. Study should focus on identifying best practices for infrastructure improvements, training programs, and ongoing support mechanisms to ensure the effective integration of technology in educational settings.

Targeted study in the global south and disadvantaged communities: Conduct study specifically tailored to understanding the unique challenges faced by learners in developing nations and disadvantaged communities regarding technology acceptance. Develop strategies that take into account the local context, resource constraints, and societal factors that may influence technology adoption in these settings.

Investigate technological capital: Further investigate learners' technological capital by examining their access to ICT and their ability to leverage these tools effectively. Explore initiatives to bridge the digital divide between different regions and ensure equal opportunities for all learners to benefit from digital learning environments.

Focus on user experience: Expand study beyond technical factors to focus on the user experience. Utilise qualitative methods such as interviews, focus groups, and ethnographic studies to capture the nuanced experiences of learners in adopting technology. Consider longitudinal studies to track changes in technology acceptance over time in the context of evolving educational paradigms.

Include teachers in the study: Recognise the essential role of teachers in technology adoption within educational settings. To complement the learner-focused approach, incorporate study that investigates how teachers facilitate and integrate technology in the classroom to gain a comprehensive understanding of technology adoption dynamics.

Balance quantitative and qualitative study: Emphasise the need for a balanced study approach that combines quantitative data with qualitative insights. While quantitative data is valuable for measuring trends and effects, qualitative study provides a deeper understanding of the personal, contextual, and situational factors that influence technology adoption in education.

By following these actionable recommendations, future studies can contribute to a more comprehensive understanding of technology acceptance in education, leading to the development of effective and equitable digital learning environments that cater to the diverse needs of learners worldwide.

By addressing these specific recommendations, future study can contribute to a more holistic understanding of technology acceptance in education, ultimately leading to more effective and equitable digital learning environments accessible to all and available equally to the global south and the global north.

7 LIMITATIONS

The identified limitation of this study is the specific timeframe it examines, covering the period from 2019 to March 2022. This timeframe captures a unique and unprecedented period in education, marked by rapid adaptation to novel learning environments due to the COVID-19 pandemic. While this period offers valuable insights into how learners adapt to sudden changes and the integration of technology in response to an emergency, it may not fully represent long-term trends or the post-pandemic stabilisation of educational practices. Future study extending beyond this period could provide a more comprehensive understanding of learner experiences as educational environments continue to evolve and stabilise. Longitudinal studies that track changes over a more extended period could also reflect how sustained technology adoption impacts learning outcomes and experiences, offering deeper insights into the enduring effects of these novel educational practices.

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