Educational Technologies, Student Engagement and Challenges in Blended Learning During the Recovery Phase of the COVID-19 Pandemic: A Scoping Review

Takawira Munyaradzi Ndofirepi
University of South Africa, South Africa
endopftm@unisa.ac.za

Purpose: This scoping review explores the relationship between educational technologies and student engagement in blended learning environments during the post-acute phase of the COVID-19 pandemic. It seeks to identify the most effective technologies, their impact on engagement, and the challenges institutions face when implementing these tools.

Study design/methodology/approach: The review adheres to the PRISMA-ScR guidelines and follows the Arksey and O'Malley (2005) framework, which has been enhanced by Levac et al. (2010). A systematic search was conducted across the prescribed journals using keywords such as "blended learning," "student engagement," and "Covid-19." The inclusion criteria focused on peer-reviewed articles published between 2019 and 2024, yielding 17 selected studies.

Findings: The review emphasises key technologies such as Learning Management Systems (LMS), video-conferencing tools, and interactive multimedia resources that promote flexibility, active learning, and collaboration. Challenges included the digital divide, technical skill gaps, and alignment issues in pedagogy. Social and emotional support emerged as essential for maintaining engagement.

Originality/value: The study provides universities with insights to optimise blended learning by addressing technological and pedagogical challenges. It underscores the need for inclusive strategies to support diverse student needs, fostering equitable and engaging learning experiences in the post-pandemic era.

Keywords: Blended learning, student engagement, educational technologies, Covid-19 pandemic

Introduction

The advent of the COVID-19 pandemic in 2019 created substantial challenges for universities, forcing them to rethink how they teach (van Schalkwyk, 2020). Most, if not all, universities worldwide reduced face-to-face sessions and migrated most teaching and learning activities online, effectively accelerating the adoption of blended learning (Guppy et al., 2023; Yang & Huang, 2021). In the study, the term blended learning refers to the intentional and educationally meaningful combination of online and in-person classroom activities, in which some traditional face-to-face instruction is replaced with digital learning experiences (Stefanic et al., 2020). Student engagement refers to the level of interest, attention, curiosity, and active participation that students demonstrate in their learning process (Venn et al., 2020). Although this transition enabled institutions to continue fulfilling their primary mandate throughout the acute and recovery phases of the pandemic, it is essential to acknowledge that teaching and learning

involve dynamic interactions between educators and learners. Many universities were forced to incorporate digital learning environments and tools alongside face-to-face activities, without always fully understanding how this blending affected student experiences and learning outcomes (Huang et al., 2022; Yang & Huang, 2021). Although COVID-19 accelerated the adoption of blended learning, universities are now entering a phase in which they must refine and optimise these models. Also, not all educational technologies adopted improve engagement equally. Some may be effective in fostering interaction and motivation, and others may create cognitive overload or passive learning experiences. Thus, a review of existing research can clarify whether blended learning has sustainably improved student engagement or whether its benefits were temporary and context dependent.

In the evolving landscape of higher education, increasingly driven by market demands and customer satisfaction (Ashwin et al., 2024; Nixon et al., 2018; Sanchez-Campos et al., 2024), it is surprising that students' experiences with blended learning at universities have not been exhaustively explored. This is particularly notable in the post-acute phase of the COVID-19 pandemic (Yang & Huang, 2021). In fact, most studies have focused mainly on general online learning rather than blended learning in the post-pandemic phase. In other words, while there is extensive research on online learning during the pandemic, there is a need for more studies on how blended learning is evolving in the new normal. Preliminary studies suggest that the blended learning model offers students great flexibility, accommodates diverse learning styles, and provides opportunities for collaboration and peer learning, thereby enhancing overall student learning experiences (Ayesha, 2024; Venn et al., 2020).

Previous studies on students' experiences of teaching and learning at universities suggest that student engagement is critical to the effectiveness of the process (Kearney et al., 2024; Martin, 2023; Palmer et al., 2022; Yang & Huang, 2021). Student engagement encompasses cognitive (participation and effort), behavioural (interest and sense of belonging) and emotional dimensions (investment in deep learning and critical thinking). Student engagement has implications for academic outcomes. However, the researcher's real-life experiences with blended learning suggest that some students rarely contribute to online discussions/forums/group chats and are reluctant to ask questions or seek clarification during synchronous/live sessions. Other students frequently miss classes or log in late to online lessons, suggesting difficulties with committing to a regular schedule. Moreover, cases of irregular logins to LMSs and slow or no responses to announcements and discussion prompts have been observed.

Against this background, there is limited clarity on whether newly incorporated digital learning tools in blended learning adequately support the diverse dimensions of student engagement required for student learning. Some studies have found a strong association between student learning engagement and improved academic achievement (Martin, 2023; Venn et al., 2020). This emphasises the importance of focusing on implementing technology that increases student engagement (Adamson & Sloan, 2021; Verdonck et al., 2018). Moreover, other studies emphasise the need to align technology integration to pedagogical requirements (Marshall et al., 2024). This will help ensure that technology in blended learning serves learners, rather than being an end in itself.

Given the diversity of educational technologies, it is essential to identify the most effective technologies and any associated challenges, so that universities do not waste resources on technologies that do not adequately support the desired educational outcomes, including student engagement and academic achievement. Failure to support these may lead to a lack of motivation, lower retention rates, and poor academic outcomes. Beyond the negative effects on students, suboptimal student engagement and academic performance have repercussions for the reputations of academic programmes and institutions offering blended learning.

Therefore, this scoping review seeks to address a clear research gap in the literature. While research exists on online learning during the peak of the Covid-19 pandemic, there is limited synthesised evidence, primarily focused on the post-acute phase, examining which educational technologies within blended learning environments effectively foster the various dimensions of student engagement at universities. Moreover, there is a lack of clarity regarding the challenges impeding implementation. This review assembles this evidence and provides actionable insights for universities striving to improve their blended learning strategies beyond emergency remote teaching.

Methodology

A scoping literature review is employed to systematically map the available research on how the educational technologies used by universities worldwide in the COVID-19 and post-COVID-19 era have impacted student engagement. It follows the methodological framework outlined by Arksey and O'Malley (2005) and later enhanced by Levac et al. (2010). The process incorporates the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines. The Arksey and O'Malley (2005) framework that was used to map the literature comprises five stages, namely: (a) identification of the research questions, (b) identification of relevant research, (c) study selection, (d) organising the data in a structured format, and (e) collating, summarising, and reporting results.

Identification of the research questions

The scoping review focused on exploring literature on the most common educational technologies used in blended learning and their effects on student engagement, as well as the challenges of operationalising the technologies. The following research question(s) were posed:

- *In the post-acute phase of the Covid-19 pandemic, how are frequently utilised educational technologies within university blended learning environments perceived or associated with student engagement?*
- *What are the primary challenges associated with the implementation of these technologies within a blended learning environment?*

Identification of the relevant studies

A systematic search was conducted across the following journal list drawn from the Sabinet and Scopus databases to identify relevant literature: *Higher Education; Higher Education Research and Development; Studies in Higher Education; Innovations in Education and*

Teaching International; Journal of Higher Education in Africa; Teaching in Higher Education; South African Journal of Higher Education; Research in Higher Education; Transformation in Higher Education; Journal of Praxis in Higher Education.

The selected journals focus on higher education pedagogy, thereby enhancing the study's relevance. The search strategy combined keywords and Boolean operators. The following keywords were used: hybrid learning, blended learning, mixed-mode learning, student engagement, academic engagement, participation, motivation, and COVID-19. The Boolean operators were used either to narrow or widen the literature search, whichever was applicable: (“AND", "OR"). The following search strings were used: *("Blended learning" OR "hybrid learning") AND learners OR "student engagement" AND ("higher education" OR university) AND covid-19. Given the time constraints, inclusion and exclusion criteria were applied. Only studies published between 2019 and 2024 were considered, and only peer-reviewed articles from the journal list were included. Studies that focused on hybrid learning in the COVID-19 and post-COVID-19 era were considered. Only those articles written in the English language were included. Thus, studies that did not focus on university contexts, non-peer-reviewed literature (e.g., opinion pieces), other grey literature, conference proceedings, or studies published before 2018 were excluded. However, the exclusion of the foregoing literature sources limited the range of potential practical insights and real-world data on blended learning implementations which the sources provide. Also, there is a risk of underrepresentation of context-specific studies, as many case studies and pilot projects in developing countries or underfunded institutions are not published in high-impact journals but appear in the grey literature.

Study selection and screening process

The process of selecting the relevant literature involved four stages. The first stage entailed identification, during which the articles retrieved from the searches were imported into EndNote. The initial process yielded 325 articles. Four duplicate records of the articles were then removed. Thereafter, the screening of titles and abstracts against the eligibility criteria followed. At this stage, 266 articles which had titles and abstracts that did not meet the inclusion criteria were removed. The reference lists of the remaining articles were further checked to identify additional relevant studies published in one of the listed journals. None were found. A further 249 articles were then removed because the target population did not meet the study criteria. At the fourth stage, 17 articles meeting the inclusion criteria were then reviewed in full. Final decisions on inclusion were made based on relevance to the research question. The process of selecting and screening the relevant literature was iterative, and where the search results were too broad or narrow, adjustments were made. Figure 1 summarises the stages of the selection and screening process.

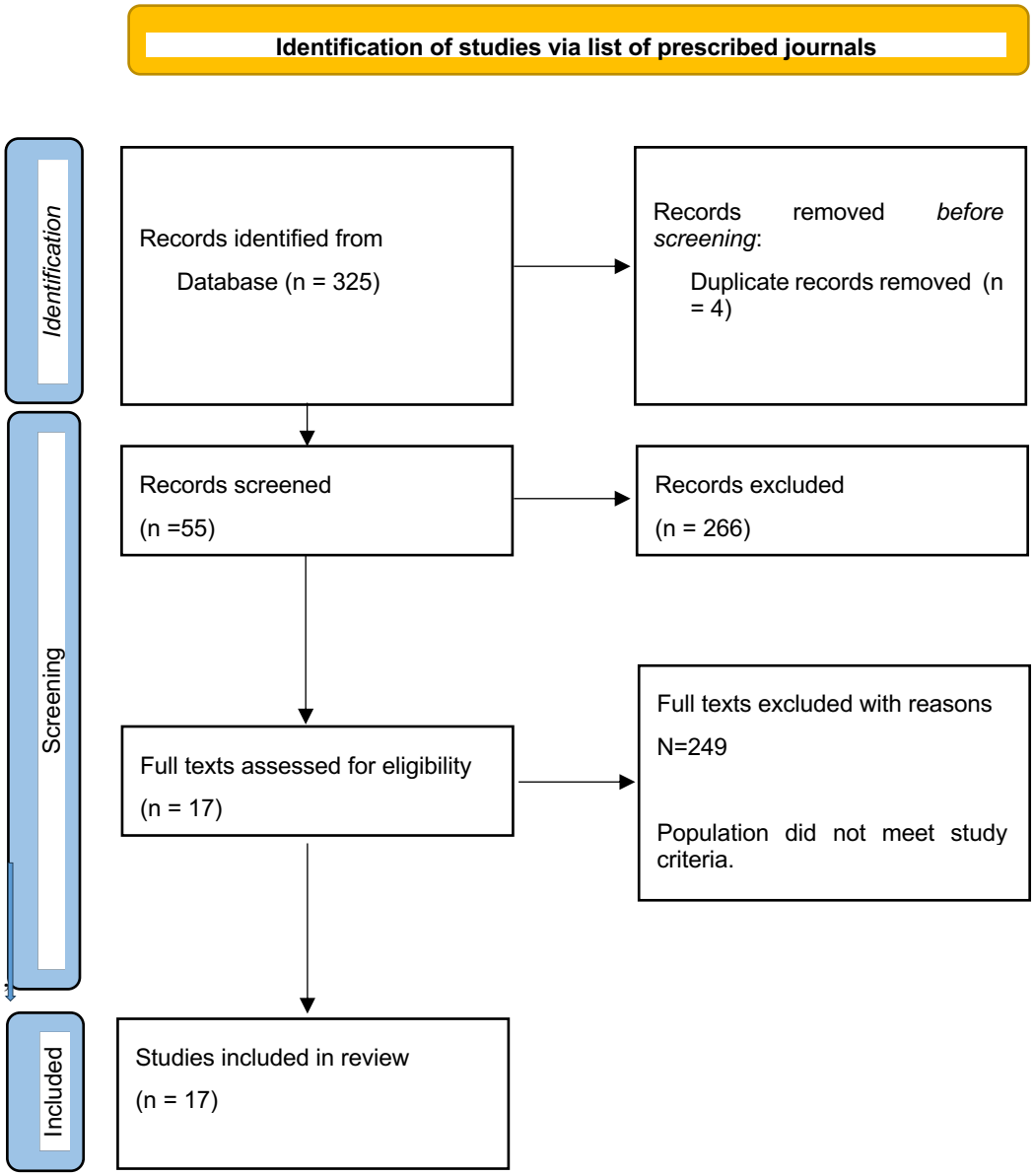

Figure 1: PRISMA flow diagram for the selection of articles

Data charting and collation

In line with Arksey and O'Malley's (2005) framework, the fourth stage entailed the charting of summaries of the chosen research articles. The summaries captured the following information per article: author name, year of publication, research method, and findings. The summaries of the 17 studies are presented in Appendix 1. The findings collated in Appendix 1 highlight diverse technologies, contextual factors and engagement outcomes which will be further synthesised in the results and discussion section.

Results and discussion

The extracted data were analysed using the thematic analysis, as proposed by Braun and Clarke (2006), to identify themes and gaps in the literature. The findings are presented and discussed below.

Educational technologies used in blended learning

The scoping review identified several educational technologies that were widely used in blended learning across universities worldwide during the COVID-19 pandemic and the period that followed. The technologies are grouped below by their pedagogical function, namely, collaboration, content delivery, assessment and feedback, and personalisation/AI. This function-based synthesis provides deeper insight into how different tool categories influence student engagement. These are expanded upon below.

Content delivery and management systems

LMSs such as Moodle, Blackboard, and others were reported in several studies (Cilliers & Pylman, 2020; Zhang et al., 2024). These platforms served as repositories of course materials, facilitated online discussions, managed student engagement, and tracked student progress. For example, Cilliers and Pylman (2020) underscored the use of LMS to present recorded lectures and other learning resources online. Recorded lectures, podcasts, and multimedia resources promoted cognitive engagement by encouraging independent study and preparation.

Collaboration and interaction tools

Several studies also highlighted the centrality of video conferencing, such as Zoom, Microsoft Teams (Evans et al., 2020; Stefanic et al., 2020) and collaborative applications such as Google Docs, WhatsApp, WeChat and discussion forums (Kearney et al., 2024; Yang et al., 2022) in facilitating asynchronous and synchronous interactions. These tools facilitated behavioural engagement by facilitating participation in discussions and emotional engagement by maintaining a sense of social connection.

Assessment and feedback

Some tools were implemented primarily for assessment and feedback purposes. These included online quizzes, plagiarism detection systems, and interactive simulations (de Freitas et al., 2021; Martin, 2023; Zhang et al., 2024). These technologies sustained behavioural and cognitive engagement by reinforcing accountability and providing immediate feedback.

Personalisation and emerging technologies

A noteworthy number of studies explored the integration of artificial intelligence (AI) and gamification into teaching and learning activities by some universities to personalise learning, increase student motivation, and participation in online activities (Marshall et al., 2024; Martin, 2023; Zhang et al., 2024). Gamified elements, such as badges and leaderboards, enhanced

emotional engagement by making learning more interactive and enjoyable. Moreover, AI-based personalisation supported cognitive engagement through tailored learning pathways.

Mobile technologies and equity

Some studies have shown that mobile platforms and technologies provide students with alternative avenues to access course materials and engage in learning activities beyond the classroom (Yang et al., 2022). Such tools proved especially valuable for learners who relied on smartphones for online participation, given the limited availability of laptops or personal computers (Islam et al., 2023). This applied to students, particularly in under-resourced settings. Through lowering barriers to access, mobile technologies supported behavioural engagement (consistent participation) and fostered cognitive engagement (continued interaction with course content despite resource constraints). Arguably, emotional engagement was enhanced by reducing students' sense of exclusion due to limited resources. Table 1 presents the frequencies of educational technologies across the 17 reviewed studies, helping clarify adoption patterns.

Table 1: Frequency of educational technologies mentioned across reviewed studies

Technology category	Specific technologies mentioned	Number of studies mentioning (n=17)	Example studies (From Table 1)
LMS	Moodle, Blackboard, VLE	10	1, 10, 11, 14, 17
Video conferencing tools	Zoom, Microsoft Teams	7	6, 11, 15
Interactive/Collaborative tools	Google Docs, WhatsApp, WeChat, online discussion forums	6	3, 4, 6
Multimedia resources	Recorded lectures, podcasts, videos , interactive quizzes	6	1, 3, 6
Mobile applications/Platforms	Smartphone-based learning, mobile apps	3	1, 3, 17
Specialized software and AI	Plagiarism detection, AI, gamification tools	3	13, 17
Social media platforms	General social media for communication	2	4, 6
Hardware and infrastructure	Desktop computers, roving microphones, specific seating arrangements	2	3, 15
Platform-specific tools	Rain Classroom, MOOCs	1	9

Influence of technologies on student engagement

Mapping findings to engagement dimensions shows that technologies do not affect all forms of engagement equally. For instance, behavioural engagement was most strongly associated with collaborative tools and LMS, which structured student participation and attendance. Adaptive technologies and assessment systems that supported critical thinking and deeper learning enhanced cognitive engagement. Social interaction tools and gamification mitigated isolation and promoted motivation, thereby impacting emotional engagement.

Even though some studies reported that blended platforms promoted active participation (Ayesha, 2024; Kearney et al., 2024), others noted that poorly integrated or passive online tasks reduced motivation and contributed to disengagement (Lomer & Palmer, 2023). These differences appear to be context-dependent. This suggests that effectiveness is more dependent on pedagogical alignment and institutional support than on technology itself.

Challenges encountered

Despite the benefits, several challenges were identified in implementing educational technologies at some of the institutions covered in the literature. These included the issues relating to the digital divide, technical proficiency, engagement and motivation, and students' workload and time management (Cilliers & Pylman, 2020; Marshall et al., 2024).

The digital divide

The most frequently cited challenge was the digital divide. The literature highlighted that many students, particularly in developing countries, had limited access to reliable internet and personal computing devices (Islam et al., 2023; Van Schalkwyk, 2021). This digital divide created disparities in engagement, as students with limited access struggled to participate in online learning activities fully. This has direct policy implications, requiring universities to invest in infrastructure and provide students with the necessary devices and internet access to ensure that all students can participate fully in online learning activities (Van Schalkwyk, 2021; Islam et al., 2023).

Technical proficiency

Some studies' findings showed that both students and lecturers often lacked the necessary skills to use the technologies effectively, leading to frustration and disengagement (Venn et al., 2023; Brown et al., 2023). This is noted where some students reported difficulties navigating LMS platforms or using video conferencing tools. Institutional responses such as structured training programmes and continuous technical support are therefore essential to sustain engagement and ensure that technologies are used effectively (Brown et al., 2023).

Engagement and motivation

Isolation and work fatigue were recurring concerns in the studies covered. Many students reported feeling isolated and disconnected from their peers and instructors when using online learning environments (Lomer & Palmer, 2023; Guppy et al., 2023). This sense of isolation was particularly true for students who were accustomed to face-to-face interactions. Moreover, the increased workload associated with online learning was a common challenge. Some students struggled to balance their academic responsibilities with other commitments, leading to stress and burnout (De Freitas et al., 2022; Yang et al., 2022). Against this background, the social and emotional aspects of learning must not be overlooked. Institutions can mitigate these issues by designing interactive tasks, fostering online communities (Kearney et al., 2024; Stefanic et al., 2020), and offering psychosocial support services (De Freitas et al., 2022; Yang et al., 2022).

Pedagogical alignment

Some studies found that the use of technology was, in some instances, poorly aligned with pedagogical goals, leading to passive learning experiences rather than active engagement

(Lomer & Palmer, 2023). For example, some students reported that online tasks felt disconnected from the overall learning objectives. This calls for universities to embed technology adoption into coherent teaching strategies rather than treating it as an add-on to avoid passive learning experiences (Brown et al., 2023; Guppy et al., 2023; Stefanic et al., 2020), thereby making learning more engaging and enjoyable.

Conclusion

The scoping review highlights the importance of educational technologies in augmenting student engagement in blended learning environments. Synthesised evidence from 17 studies shows that technologies contribute differently to behavioural, cognitive, and emotional engagement. For example, collaborative tools such as videoconferencing sustain participation (behavioural), assessment tools promote deeper learning (cognitive), and gamification enhances motivation (emotional).

However, the effective operationalisation of these technologies requires addressing challenges related to the digital divide, technical proficiency, pedagogical alignment, and student well-being. Findings suggest that it is not technology itself, but its alignment with pedagogy and institutional strategies, that determines whether engagement is enhanced or undermined.

In the future, the following recommendations are made for institutions, educators, and policymakers:

- Institutions should invest in digital infrastructure to narrow the digital divide. Affordable internet access and device loan schemes are examples of such efforts.
- Universities should provide ongoing digital literacy training for staff and students to build confidence in using blended learning tools.
- To avoid passive or disconnected learning, lecturers and curriculum designers must incorporate technologies into coherent pedagogical design and align them with course objectives.
- Lecturers should also use adaptive and interactive tools to personalise learning and maintain motivation.
- Institutions can also prioritise student well-being and community. Peer-support forums, online mentorship, and access to counselling services are some of the possibilities for accomplishing this.

This review is subject to some limitations. These include the exclusion of grey literature, conference papers, and non-English studies, and thus, could have overlooked practical insights from developing regions or emerging innovations. Many case studies on blended learning in under-resourced settings appear in regional or non-indexed journals, which were excluded. Future research should expand database coverage and explore disciplinary or demographic variations in how blended learning technologies influence engagement.

In closing, universities in the post-pandemic era must shift from emergency-driven adoption of blended learning to purposeful and inclusive strategies that integrate technology, pedagogy, and support systems. Only then can blended learning deliver equitable, engaging, and long-lasting educational experiences for all students.

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Appendix 1: Studies included in the scoping review

AUTHOR(S) (YEAR) TITLE	LOCATION	METHOD/EXPERIMENT/APPROACH	FINDINGS/CONCLUSION
Cilliers and Pylman (2020)	South Africa	N=130, Quantitative survey, university students, Student Perception of Instruction Questionnaire	-Recorded lectures, podcasts, and online resources to prepare for class activities -Promoted active learning and communication among students - Enhanced students' understanding and application of concepts -Increased preparatory workload for lecturers --Resistance from some students -A lack of IT support, which can hinder effective implementation
Islam et al. (2023)	Bangladesh	N=394 students (44% response rate), 57 academic staff (55% response rate), and 54 support staff (66% response rate), mixed-methods survey	-All groups (students, academic staff, and support staff) preferred in-person lectures -Poor internet access, lack of resources, and power cuts -Students adapted to online learning but faced significant barriers - Academic staff struggled with engagement and delivery --Over-reliance on smartphones for online learning due to limited access to laptops -Connectivity issues hinder student engagement -Students appreciate the flexibility of online learning
3.Ayesha (2024)	Pakistan	N=150 students and 9 teachers through questionnaires and semi-structured interviews	-Online platforms, computers in labs, and social applications (e.g., WhatsApp, Google, YouTube) -Students engaged with English TV shows, radio, and online videos. -Limited engagement with university-provided digital content.

			-Greater student participation and engagement - Enhanced motivation and independence
Kearney et al. (2024)	UK and China	-N=250 Chinese students and N=320 UK students-Qualitative case study approach, utilising reflective accounts, focus groups, and educatorS	- Online Learning Environment (OLE) used - Messaging platforms e.g. WhatsApp and WeChat were used for communication, while Google Docs were noted as problematic due to accessibility issues in China. - Language barriers - Cultural differences - Preference for familiar technologies - OLEs that are accessible and user-friendly encourage active participation and positive engagement among international students
Venn et al. (2020)	Various countries, predominantly North America (41%) and Europe (27%)	An integrative review of 22 articles spanning from 2007 to 2019.	- Study highlights the complexity of understanding engagement due to the diversity of learning technologies and contexts - Main technologies used not specified - Inconsistency in engagement definitions across studies - Blended learning technologies can enhance student engagement by facilitating interaction both inside and outside the classroom - However, it also warns of the pitfalls, such as potential disengagement if the technologies are not used effectively or aligned with students' learning needs and motivations
Stefanic et al..(2020)	USA and Croatia	Quantitative University students	Integration of various technologies within the blended learning framework, including: • Online learning platforms • Video conferencing tools • Collaborative software for project work • LMSs • Multimedia resources for instructional content • Social media tools for fostering communication • Interactive learning spaces • Digital assessment tools for evaluating student performance. The article discusses several challenges faced by students, such as • Navigating the technology used for blended learning • Adjusting to different teaching styles from instructor.

			• Managing time effectively between face-to-face and online components • Overcoming language barriers in cross-cultural settings • Dealing with varying levels of digital literacy among peers • Adapting to collaborative learning with students from diverse backgrounds • Addressing the need for self-motivation in online learning environments - A positive relationship between the use of blended technology and student engagement,
Van Schalkwyk (2020)	South Africa	Qualitative reflection, drawing from media reports, policy documents, institutional responses, and personal observations by the author	• LMSs and online teaching platforms • Delays in procurement and distribution of laptops and other digital devices Challenges included: • Digital divide • Financial barriers • Psychosocial struggles Differences in access and preparedness for online education meant that engagement levels varied significantly
De Freitas et al. (2022)	Transnational (Australia and Singapore)	N=1,718 participating transnational students from an Australian university delivering education in Singapore. Quantitative survey method Data were collected across two survey rounds in 2017 and 2018.	- Virtual learning environment(VLE) incorporating video lectures, interactive quizzes, simulations, and other digital resources Challenges on the students' part - Difficulties in adapting to a new timetable, and varying levels of engagement with online resources - Work overload - Blended learning can enhance student engagement by providing greater flexibility - Students must be supported in accessing and utilising these resources effectively
Yang & Huang (2021)	China	Case study approach, qualitative study	- Rain Classroom platform including MOOCs, video conferencing, and interactive features like real-time Q&A and bullet screens for - Students faced several challenges, including: • Anxiety regarding the pandemic • Adjustments to online learning and maintaining focus • Limited access to resources, particularly for those in financial difficulty

			- Blended technology fosters greater student engagement by enabling interactive learning experiences and providing flexibility in learning
Lomer & Palmer (2023)	England	N=227 students across different disciplines and study levels (Foundation, BA/BSc, MA) Qualitative case study	- Main technologies used • VLE • E-tivities and online assessments • Flipped classroom approaches with online preparatory tasks - Challenges on the students' part included technological access perceived loss of direct teaching and increase in independent learning expectations, lack of clarity in online tasks and assessments, and disengagement due to passive online tasks - Effective scaffolding of tasks improved engagement - Perceived lack of value in online learning activities reduced participation - Consumerist attitudes (expecting direct teaching for tuition fees) affected engagement negatively - Integration between online and F2F components was crucial -- where online elements felt isolated, students disengaged
Brown et al. (2023)	England, Scotland, Wales, Nigeria, and South Africa.	N=10 educators from different disciplines across England, Scotland, Wales, Nigeria, and South Africa Case study approach	- Main technologies used were Zoom and equivalent video-conferencing tools, LMSs (e.g., Moodle, Blackboard), and online discussion forums and collaborative tools - Challenges include lack of immediate access to professional learning support, variability in digital literacy, difficulties in sustaining attention and engagement in fully online environments, and lack of social interactions compared to in-person learning - Careful design of online interactions improved engagement
Guppy et al. (2023)	Six countries	N=3,806, undergraduate students Quantitative approach	- Main technologies used were not explicitly mentioned - Challenges with transition to remote learning, included that that some students who felt connected to their learning community were more engaged and confident in blended learning environments
Zhang et al. (2024)	China	38 junior-year undergraduates from a Chinese university	- Academic Writing & Plagiarism Analysis System (AWPAS) - Moodle-based learning management system -Students initially struggled with understanding plagiarism and proper source use

			- blended learning increased student engagement by providing interactive and flexible learning opportunities
Evans et al. (2020)	Hong Kong	N=10 teachers from The Hong Kong Polytechnic University, experimental design, pre-post-test to analyse teachers' online behaviour and use of Blackboard tools	- Blackboard tools (LMS) - Course enhanced teachers' skills and confidence in using blended learning methods - Challenges for students were not explicitly mentioned - Increased use of Blackboard tools led to higher student engagement in online activities
Yang et al. (2022)	China	N=94 first-year college students Mixed-methods approach	- Blended learning classrooms with online course videos and collaborative activities -challenges in maintaining focus and communication in certain seating arrangements - Semi-circular seating arrangements, combined with blended learning technologies, enhanced student engagement
Huang et al. (2022)	Australia	N=10 Qualitative focus group interviews with academics	- Specific tools not mentioned - Challenges not explicitly mentioned - Academics' negative experiences with the institutional approach to blended learning may hinder their ability to effectively engage students
Marshall et al. (2024)	Pakistan	Literature review approach.	- Article discusses several technologies, including: • LMS • Artificial Intelligence (AI) • Blended Learning Tools • Digital Collaboration Platforms. - Challenges identified include • digital fatigue • disparities in access to technology and resources • adapting to new tools - Blended learning environments can enhance student engagement