Received: November 27, 2025
Revised: December 08, 2025
Accepted: December 15, 2025
Published: December 27, 2025

Elicit Journal of Education Studies
eISSN: 3121-8474
pISSN: 3093-0472

https://elicitpublisher.com

EMPIRICAL PAPER

Redesigning Learning Spaces in Higher Institutions for the Post-Pandemic Era: A Systematic Review

Retselisitsoe Lebona[1*], Maboi Zacharia Mphunyane[1], Mapulane Mochekele[1], Lipolelo Thamae[1]

Affiliations
[1]Faculty of Education, National University of Lesotho

ORCID Identifiers

Retselisitsoe Lebona
0009-0009-3484-3704

Maboi Zacharia Mphunyane
0000-0002-0379-0066

Mapulane Mochekele
0009-0004-6384-6844

Lipolelo Thamae
0000-0001-7805-0460

DOI

10.65820/ejes-4vol1-issue1-2025

Abstract

Purpose: This systematic review examined how higher education institutions redesigned learning spaces in response to the COVID-19 pandemic, focusing on student engagement, institutional challenges, flexibility, and the role of redesigned spaces in fostering community and collaboration.

Methodology: Using PRISMA guidelines, the study systematically searched Scopus and Google Scholar for peer-reviewed articles published between 2020 and 2025. Forty-one met the inclusion criteria. A descriptive analysis and cluster-based keyword mapping were used to identify thematic patterns related to learning space redesign.

Result: Findings show that redesigned learning spaces, particularly online, hybrid, flexible, and technology-enhanced formats, significantly shaped engagement and participation by improving interaction, accessibility, and communication. Institutions, however, faced substantial challenges, including digital inequities, limited infrastructure, insufficient faculty training, and uneven student readiness for technologically mediated learning. Flexibility emerged as a core strategy for coping with uncertainty, enabling continuity through blended, asynchronous, and multimodal learning designs. Redesigned spaces also played a central role in rebuilding community and supporting collaboration through digital platforms, hybrid classrooms, and inclusive technologies.

Novelty and contribution: The study provides a comprehensive synthesis that integrates design principles, pedagogical strategies, and technological affordances shaping post-pandemic learning spaces. It contributes a global perspective on how learning spaces, both physical and virtual, can be redesigned to support engagement, equity, and collaborative learning.

Practical and social implications: The review provides actionable guidance for policymakers, administrators, and educators to develop resilient, inclusive, and student-centred learning environments by investing in hybrid formats, digital infrastructure, flexible spaces, and continuous faculty development.

Keywords: Learning space, Higher institutions, Covid-19, Systematic review, PRISMA, Learning experiences, post-pandemic

*Corresponding author

E-mail address: lebonaretselisitsoe@gmail.com

How to cite this article:

Lebona, R., Mphunyane, M.Z., Mochekele, M. & Thamae, L. (2025). Redesigning Learning Spaces in Higher Institutions for The Post-Pandemic Era: A Systematic Review. *Elicit Journal of Education Studies, 1* (1), 44-60.

1 Introduction

The Coronavirus Disease 2019 (COVID-19) epidemic has caused an impending change in our society, affecting the way we think, act, and communicate. Within the realm of higher education, numerous establishments have had to adjust to the advent of online learning, which has involved navigating intricate technological systems, creative methods of instruction, learning, and evaluation, and adjusting to the reality of work-from-home settings, which have become a prominent aspect of many people's lives (Saladino et al., 2020; Hosseinzadeh et al., 2022; Alizadeh et al., 2023). The Covid-19 pandemic began in 2020 and led to the closure of most schools worldwide, the discontinuation of traditional learning, the cancellation of examinations, the suspension of academic seminars and workshops, and disruptions to distance learning (Al Ansi & Al Ansi, 2021). This effect has prompted several inquiries concerning the difficulties, possibilities, and fixes for this kind of issue.

The education sector was among the industries most affected. The effects of COVID-19 on schools, instructors, students, and pedagogy present issues for the educational system. Within a few months of COVID-19's birth, 83% of schools worldwide had closed by late April, severely impairing the educational experience for almost 1.4 billion kids and their families (United Nations Educational, Scientific and Cultural Organisation, Education: From disruption to recovery, 2020). Stress symptoms, less time spent studying, lack of interaction with peers, difficulty adjusting to a new learning environment that is constrained and unable to provide the necessary resources, and, for some, even lack of internet access, are just a few of the problems that students face and which negatively impact the quality of their education (Organisation for Economic Co-operation and Development, 2020).

Teachers, on the other hand, were affected by the pandemic through job loss, salary cuts, and a significant increase in working hours. That, in addition to their own personal struggles. They also share responsibility for compromising students' learning quality due to a lack of training in online learning methods, limited experience interacting with students virtually, and other obstacles inherent to online learning. (Espino-Díaz et al., 2020).

These days, workplaces are viewed as learning environments where people come to learn from their colleagues, particularly in the aftermath of COVID-19. In the meantime, academic labour has always allowed flexibility to work from home (or anywhere, anytime), but this hasn't always applied to campus workspaces ("don't touch my room"). (Ninnemann et al., 2020; Wheele et al., 2023). Brick-and-mortar learning spaces have been replaced by online learning environments with ICT and internet access (Weller, 2007; Al-Ansi et al., 2019). A socially interactive learning environment has replaced the previous one entirely (Wheele et al., 2023). By examining these areas more rigorously, it is also possible to understand the consequences of higher education's increasing digital focus for the overall learning and academic employment experience (Lahti et al., 2021).

In higher education, existential problems have surfaced both during and after the COVID-19 crisis (Jacques et al., 2023; Singh et al., 2021). Eringfeld (2021) examines the utopian and dystopian imaginaries that have emerged in response to the COVID-19 crisis in higher education. Through a podcast series and research interviews at Cambridge University, the study reveals significant concerns among students and academics regarding the shift to online learning. The loss of embodied and communal educational experiences is a common fear, emphasising the importance of maintaining face-to-face interactions and a sense of community in higher education.

With an emphasis on teaching, learning, and research outcomes, researchers are examining the layout and use of spaces in higher education. The literature outlines several criteria for assessing spaces in higher education, including the effects of technology on space use, speciality space requirements, campus architecture, and community support from the university. Different learning settings can have a significant impact on students' learning results, according to empirical data (Temple & Fillippakou, 2007; Park & Choi, 2014).

The COVID-19 pandemic has led to a global outbreak, resulting in the implementation of quarantine measures in many parts of the world. This has turned thriving cities into ghost towns, and educational institutions such as colleges and universities have felt the repercussions (Dhawan, 2020). The education sector quickly shifted from traditional offline teaching to online learning as physical campuses closed. The requirement to adjust to new health and safety regulations, remote learning techniques, and the changing nature of education created the need to rethink learning environments (World Bank, 2021; Zhao & Xue, 2023). By using online learning platforms, academic institutions can reach a wider audience and teach many students worldwide at any time (Aslam 2021). Many universities completely digitalised their operations in reaction to the pandemic, realising the value of online education

given the circumstances. However, significant obstacles had arisen as a result of the change to online learning, including scale, distance, and individualised instruction (Tosto et al., 2023; Masalimova et al., 2022).

Nonetheless, institutions could address these issues in creative ways (Farnel et al., 2021). At this point, improving the quality of online teaching and learning is essential since academic institutions need to drastically adjust to the changes (Korkmaz & Toraman, 2020). Opposition to change won't benefit any educational program worldwide. Rather, their standing will be assessed based on how quickly they can adapt to the changes and how well they preserve quality (Carey, 2020).

Higher education institutions have experienced a sudden and significant shift to online and remote learning due to the COVID-19 pandemic. This has created issues concerning scale, distance, and individualised instruction. The need to reconsider campus learning spaces and their functions in the post-pandemic environment has been highlighted by the sudden digitisation (Leijon et al., 2022; Papaioannou et al., 2023). Higher education's traditional learning environments are often designed using passive learning approaches and fixed row-by-column seating arrangements that are incompatible with technology-enabled, active, and collaborative learning (Casanova, 2014). More people are beginning to view these rigid formal venues as unsuitable for encouraging the innovation, creativity, and personalisation that contemporary pedagogies and student demands require (Leijon et al., 2022; Casanova, 2014). Hence, the primary aim of this systematic review is to explore and synthesise existing research on how learning spaces in higher education can be redesigned to enhance the student experience in the post-COVID-19 era. This involves examining various design principles, technologies, and pedagogical approaches that can be integrated into physical and virtual learning environments. By doing so, this systematic literature review plans to answer the following research questions.

i. How do the changes in learning space design impact student engagement and participation in the post-COVID-19 era?
ii. What role does flexibility in learning space design play in adapting to uncertainties and changes in the post-pandemic education landscape?
iii. What are the challenges faced by educational institutions in implementing and sustaining changes in learning space design post-COVID-19, and how are these challenges being addressed?
iv. To what extent do the redesigned learning spaces contribute to fostering a sense of community and collaboration among students in the post-pandemic educational environment?

By understanding how to create environments that support diverse learning needs and preferences, institutions can improve student engagement, satisfaction, and success. This research will provide valuable insights for educators, administrators, and policymakers as they adapt to the new educational landscape.

2 Methodology

The present study utilises a systematic literature review approach to illuminate the obstacles encountered by higher education institutions, teachers, and students during the redesign of the learning environment following the pandemic, as well as the strategies implemented to ensure inclusivity and accessibility for all stakeholders. According to Higgins et al. (2019), a systematic review is a research process that attempts to present an accurate and up-to-date summary of primary research to answer particular research questions. The PRISMA statement's guidelines are followed when performing a systematic review (Page et al., 2021). The PRISMA 2020 checklist, designed specifically for conducting systematic literature reviews, was used by the study's researchers (Tugwell & Tovey, 2020).

2.1 Search Strategy

Journals discussing the move from traditional classroom settings to the "new normal" in higher education as a result of COVID-19 are the main subject for consideration in this review. Published articles from 2020 to 2025, during the global epidemic, were considered. Keywords such as “learning space”, "post-pandemic education," "collaborative learning," "teaching and learning," "COVID-19," "student engagement," and "higher education institution" were utilised to search for relevant articles on Scopus. At the same time, additional articles were also sourced from Google

Scholar. To ensure a thorough examination of the topic, additional searches were conducted using terms such as "blended learning," "online learning," and "distance learning."

2.2 Eligibility Criteria

To identify studies that support the goals of the current research and to ensure accurate data collection from the sources, inclusion and exclusion criteria were used. Using the predetermined inclusion criteria, the titles and abstracts of the identified publications were first evaluated as part of the screening process (Author et al., 2023; Fajrie et al., 2024). From the search, conference papers, articles with results inconsistent with the research inquiries, duplicate publications, and articles from before the pandemic on the subject matter were excluded from the findings (Table 1). The articles that met the inclusion criteria were then carefully read in full. Furthermore, the study focuses on English-language publications to ensure consistency throughout the evaluation process.

Table 1: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Year	2020 – 2024	Below 2020
Language	English	Non-English
Paper type	Peer-reviewed scholarly articles	Conference, books, book chapters, and news.
Level of education	Higher education	K-1, primary school and high school

Following this drawn-out procedure, a total of forty-one publications were evaluated and included in the review based on how well they addressed the research topics. Applicable using a standardised data extraction form, information including author names, publication year, country of origin, study title, research methods, conclusions, and the journals in which the studies were published was extracted from the eligible publications. For clarity and simplicity of the study, the data were arranged in a consistent, methodical format (Rus et al., 2023; Utaminingsih et al., 2023). By doing a descriptive analysis of the gathered data set, the analysis sought to discover and display frequencies, percentages, as well as the themes, concepts, and meanings that surfaced from the data (Salisu et al., 2024). This methodology facilitated a thorough understanding of the subject matter and enabled significant analysis of the results. The PRISMA flow diagram for the literature search is shown in Figure 1

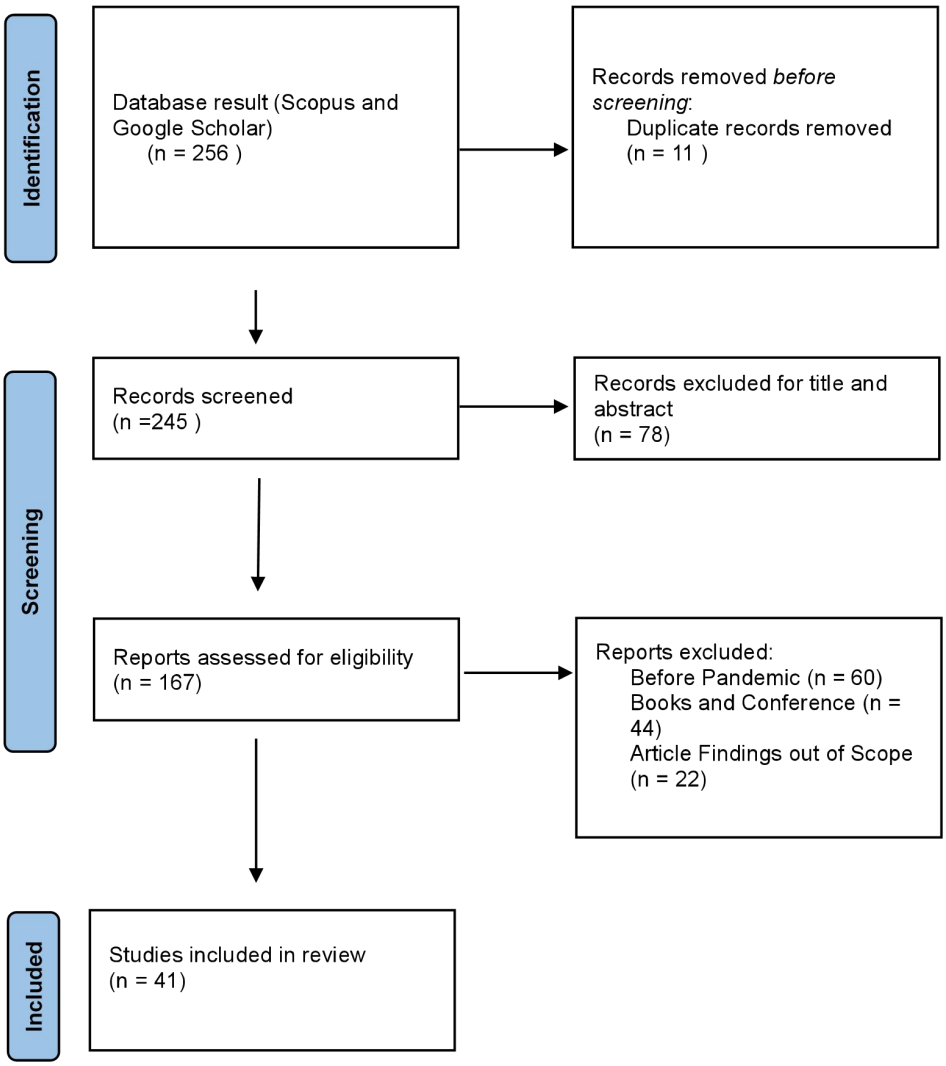

Figure 1 PRISMA flow diagram

3 Results

Findings from the review provided insight into potential challenges in the academic space since the advent of COVID-19, including their impact on academic institutions and instructors. Student concerns about participation and focus in using the solutions provided by institutions were addressed. To create a sense of inclusivity, community, and accessibility in the educational environment, many journals focused on flexibility and blended learning, which were implemented during and after the crisis. This evaluation provides relevant information on the research questions, including study attributes such as publication year, author affiliations, contributions from indexing services, and contributions by country. Table 2 shows the data extraction table.

3.1 Literature Distribution

Publication by Year

The yearly distribution of the studies included in this review shows a clear pattern reflecting the evolving focus on learning space redesign in the post-pandemic era. Publications peaked in 2021, with 15 articles (figure 2), indicating an immediate scholarly response to the educational disruptions caused by COVID-19 and the urgent need to explore alternative learning environments. This surge was followed by a decline in 2022 (6 articles) and a moderate rise in

2023 (9 articles), suggesting continued but more focused interest as institutions stabilised and adapted to hybrid learning systems. The years 2020, 2024, and 2025 recorded 4, 4, and 3 articles, respectively, reflecting the early stages of the pandemic and the later period when research began to diversify into other post-pandemic educational issues. Overall, the distribution highlights that the most intensive scholarly engagement with learning space redesign occurred during the first two years following the pandemic, with sustained but gradually diminishing research activity in subsequent years.

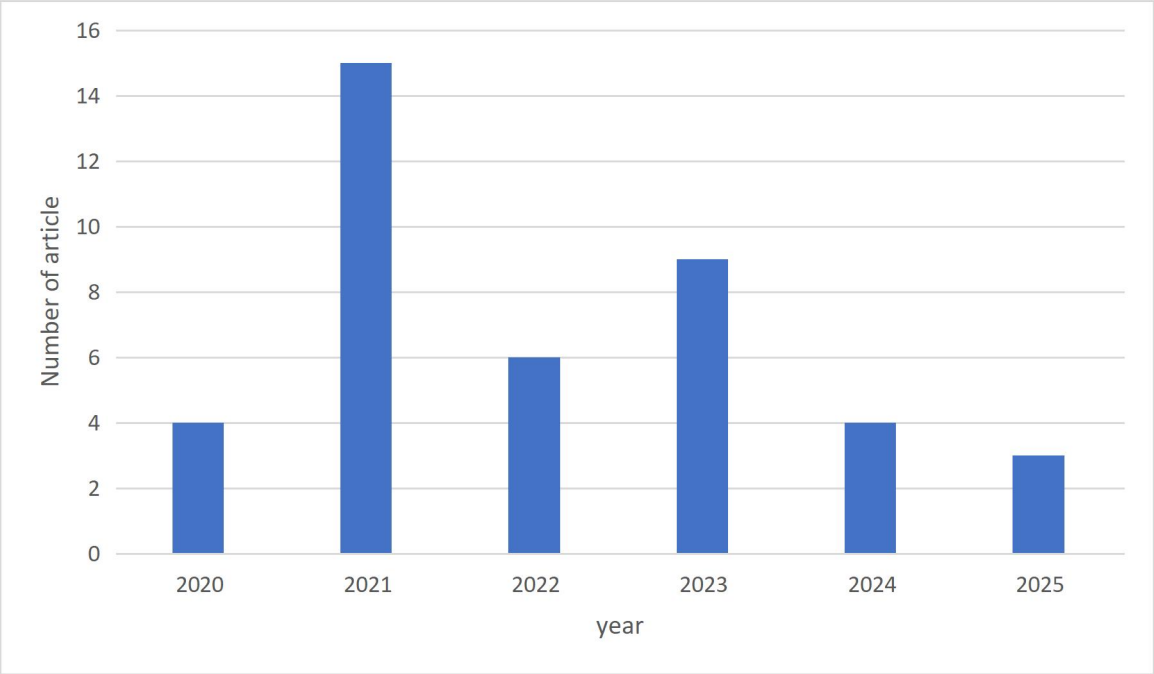

Figure 2 Publication year of reviewed articles

Author's Affiliation

Table 2: Data Extraction Table

S/N	Author (Year)	Method	First Author Country	Journal
1	Whelehan (2020)	Qualitative	Ireland	AISHE-J
2	Sato et al. (2024)	Qualitative	Spain	MDPI
3	Al Ansi & Al Ansi (2021)	Mixed-method	Indonesia	Solid State Technology
4.	Wester et al. (2021)	Qualitative	USA	Journal of Microbiology & Biology Education
5.	de Klerk & Palmer (2021)	Qualitative	South Africa	Perspectives in Education
6.	Korkmaz & Toraman (2020)	Qualitative	Turkey	IJTES
7.	Rasli et al. (2022)	Qualitative	Malaysia	Frontiers in Education
8.	Neuwirth et al. (2021)	Qualitative	USA	Journal of Adult and Continuing Education
9.	Jacques et al. (2023)	Qualitative	France	MDPI
10.	Pelayo & Pelayo (2020)	Quatitative	Philippines	International Journal of Innovative Science and Research Technology
11.	Passos et al.(2022).	Qualitative	Brazil	International Journal for Innovation Education and Research

12.	Papaioannou et al. (2023)	Qualitative	Greece	Trends in Higher Education
13.	Khan et al. (2021).	Qualitative	China	Frontiers of Psychology
14.	Gopinathan et al. (2022).	Quantitative	Malaysia	Sustainability
15.	Zarzycka et al. (2021).	Quantitative	Poland	Cogent Arts and Humanities
16	Yang et al. (2023)	Qualitative	China	Smart Learning Environment
17	Amro (2022)	Qualitative	UAE	iJADE (International Journal of Art & Design Education)
18	Bashir et al. (2021)	Qualitative	UK	Frontiers in Education
19	Porter et al. (2021)	Qualitative	USA	International Journal of Multicultural Education
20	Peruzzo & Allan (2024)	Qualitative	UK	Routledge Taylor & Francis Group
21	Letzel-Alt et al. (2022)	Qualitative	Germany	Frontiers in Education
22	Singh et al. (2021)	Qualitative	USA	Journal of Educational Technology Systems
23	Guzzo et al. (2023)	Qualitative	Italy	MDPI
24	Deka (2021)	Qualitative	India	Journal of Management in Practice
25	Hollister et al. (2022)	Qualitative	USA	Frontiers in Education
26	Rapanta et al. (2021)	Qualitative	Portugal	Post-Digital Science and Education
27	Dayagbil et al. (2021)	Mixed-Method	Philippines	Frontiers in Education
28	Javaid et al. (2023)	Qualitative	India	BenchCouncil Transactions on Benchmarks, Standards and Evaluations
29	Ulanday et al. (2021)	Qualitative	Philippines	Asian Journal of Distance Education
30	Saha et al. (2023)	Qualitative	Bangladesh	Humanities And Social Sciences Communication
31	Kedraka & Kaltsidis (2020).	Quantitative	Greece	European Journal of Education Studies
32	Edmunds & Little (2025)	Quantitative	Canada	The Canadian Journal for the Scholarship of Teaching and Learning
33	Dayagbil et al. (2021)	Mixed method	Philippines	Frontiers in education
34	El Galad et al. (2024)	Quantitative	Canada	Frontiers in education
35	McCorkle (2021)	Qualitative	USA	Journal of Learning Spaces
36	Ifeanyi (2023)	Qualitative	South Africa	Social Sciences & Humanities Open
37	Wang et al. (2024)	Quantitative	China	BMC Medical Education
38	Fedeli & Taylor (2023)	Quantitative	Italy	Tuning Journal for Higher Education
39	Dulfer et al. (2025)	Quantitative	Australia	Teaching in Higher Education
40	Kearney et al. (2025)	Qualitative	United Kingdom	Innovations in Education and Teaching International
41	Geary et al. (2023)	Quantitative	Australia	Journal of University Teaching and Learning Practice

3.2 Cluster Analysis

Following the study methodology proposed in this literature, the final stages of data processing were cluster analysis, visualisation, interpretation, and reporting, which preceded the discussion of the results. The goal of this step was to find primary sets of correlated patterns and common trends in a network of keywords (Rosário & Raimundo, 2024). As a result, utilising the primary keywords, a bibliometric analysis was conducted in Figure 4 to identify indicators of

the dynamics and evolution of scientific material. Using the VOSviewer scientific program, the bibliometric results were analysed.

Figure 3 displays the related keywords, making it easier to understand the network of keywords that appeared together or were linked in each scientific paper, anticipate future research trends, and identify the themes that have been researched. Most of the network nodes are shown in this figure. The number of times a keyword occurs, or its occurrence, is represented by the size of a node. The connections between the nodes indicate the co-occurrence of keywords, and the thickness of each link indicates the frequency of co-occurrence of those keywords. Therefore, a keyword's occurrence is more common the larger the node, and its simultaneous occurrence is more common the thicker the connection between nodes. Each hue represents a thematic cluster, and its subject (nodes) can be explained using both the cluster's nodes and links. Furthermore, it illustrates the connections (links) among the subjects (nodes).

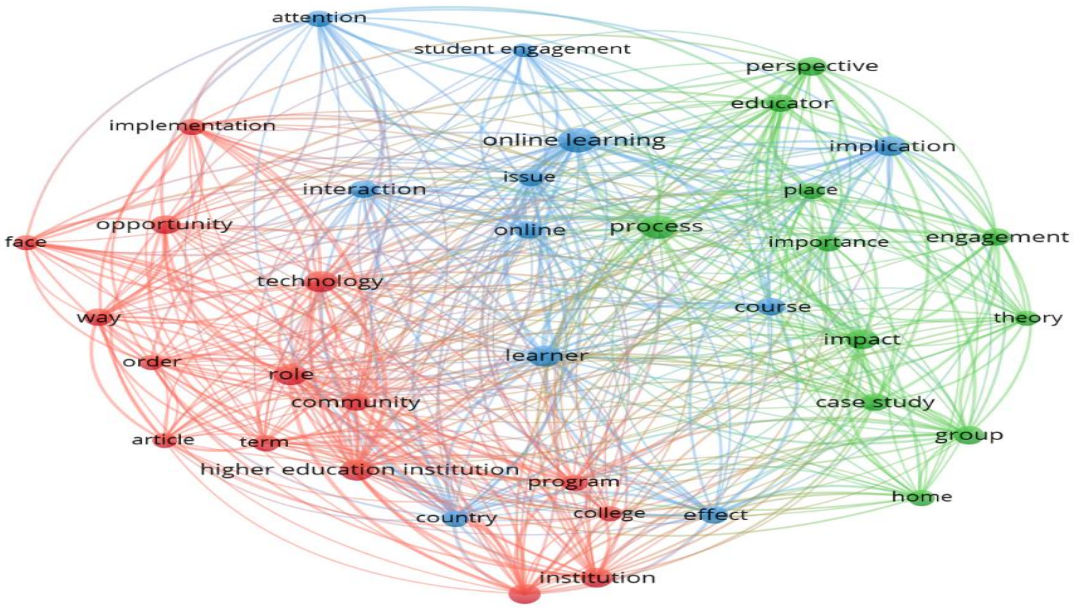

Figure 3 Network of Keywords

Therefore, under the themes of online learning, impact, and higher education institutions (HEIs), the Vos viewer Keyword Development Map outputs were split into three main clusters of terms. To record conversations about study issues first identified in the review, the three clusters were selected from the keyword map. Online learning encompasses the redesign of learning spaces from physical to virtual, while the impact discusses implications for student participation, community building, collaboration, and post-pandemic flexibility. The issues that Higher Education Institutions (HEIs) face in revamping their learning spaces, solutions, HEI communities, technology uptake, and related areas are included in the higher education cluster.

4 Discussions

4.1 Impact of Learning Space Design on Student Engagement and Participation

Based on findings from the included studies, we deduced that some authors were precise in their research, providing the medium and type of new design investigated. We noticed that most of the new designs discussed were centred on online and virtual learning, as shown in Table 3. The review revealed that redesigned learning spaces, especially online, hybrid, and flexible environments, have significantly influenced student engagement and participation. Across studies, digital platforms such as Google Classroom, Zoom, and social-media-supported learning spaces fostered improved immediacy, collaboration, and learner–content interaction (Ulanday et al., 2021; Gopinathan et al., 2022).

This aligns with Gopinathan et al.'s (2022) conclusion that digital collaboration tools were essential for sustaining participation during lockdown and remain relevant post-pandemic.

Student engagement was also linked to the design of online learning tasks and the quality of instructor presence. Zarzycka et al. (2021) and Hollister et al. (2022) observed that structured digital interactions increased peer collaboration and communication, helping students feel connected despite physical separation. Yang et al. (2023) further showed that strategies such as lecture recordings, clear course summaries, and screen sharing enhanced engagement in emergency remote teaching, thereby reaffirming earlier models of cognitive, behavioural, and emotional engagement.

Recent evidence also indicates that purpose-built active learning environments markedly boost student engagement. For example, Edmunds and Little (2025) compared students in a high-tech active-learning classroom with those in a traditional layout and found no difference in academic performance but significantly higher enjoyment and engagement in the high-tech space.

Table 3 Identified redesign space techniques from reviewed articles

S/N	Learning Space	Authors	No. of Journals	Platform
1	Digital Collaborative Learning	Whelehan (2020); Gopinathan et al. (2022); Khan et al. (2021);Yang et al. (2023); Bashir et al. (2021); Peruzzo & Allan (2024); Deka (2021); Hollister et al. (2022); M. Javaid et al. (2023)	9	Google Classroom & Google Meet, Social Media Blog, ChatGPT
2	Flexible Learning	de Klerk & Palmer (2021); Rasli et al. (2022); Pelayo & Pelayo (2020); Passos et al.(2022); Rapanta et al. (2021); Dayagbil et al. (2021); Ulanday et al. (2021); Saha et al. (2023).	8	Facebook, Google Meet, Google Class, Zoom
3	Distance Learning	Neuwirth et al. (2021); Zarzycka et al. (2021); Sato et al. (2024); Korkmaz & Toraman (2020); Amro (2022); Porter et al. (2021); Letzel-Alt et al. (2022); Guzzo et al. (2023).	8	Virtual Classroom, Online (FB & LinkedIn)
4	Blended Learning	Al Ansi & Al Ansi (2021); Sébastien et al. (2023); Wester et al. (2021); Papaioannou et al. (2023); Singh et al. (2021).	5	Physical classroom and online learning

4.2 Implementation Challenges and Institutional Responses

Resource inequity was particularly pronounced among students who lacked private study spaces, devices, and reliable internet access (Neuwirth et al., 2021). Instructors similarly reported workload intensification, insufficient training, and difficulty sustaining student interest in virtual settings (Hollister et al., 2022; Korkmaz & Toraman, 2020).

A primary challenge cited in recent studies is the physical limitations of existing infrastructure when implementing hybrid models. McCorkle (2021) noted that retrofitting legacy classrooms for active learning is frequently hampered by unmet equipment needs and campus logistics, such as the lack of flexible furniture or inadequate power sources for student devices.

The integration of technology into physical spaces and the creation of smart campuses present their own set of barriers. While digital displays and wireless sharing capabilities are essential for collaborative learning, disparities in access to these technologies create an equity gap. Ifeanyi (2023) highlights that students in remote or under-resourced campuses often face technological constraints and a lack of learning devices, rendering high-tech classroom designs ineffective for a significant portion of the student body. This digital divide extends to the physical classroom, where students joining remotely may feel disconnected or "second-class" compared to their in-person peers due to poor audio-visual integration.

The successful implementation of new spatial designs is inextricably linked to faculty readiness. A recurring theme in the literature is the pedagogical friction that occurs when physical spaces change faster than teaching methods (McCorkle, 2021). Faculty members, often exhausted from the pandemic's demands, face increased workload and burnout when asked to master complex hybrid environments. Innovative spaces like Active Learning Classrooms (ALCs) require a shift from teacher-centred to student-centred pedagogies. Without adequate training, expensive active-learning spaces risk being used for traditional lecturing, thereby negating the investment (Fedeli & Taylor, 2023; Ifeanyi, 2023).

4.3 Flexibility in Learning Space Design for Uncertainty

Flexibility emerged as a core attribute of effective post-pandemic learning space redesign. Flexible learning accommodates multiple modalities, synchronous, asynchronous, in-person, hybrid, and experiential and allows students to participate under varying personal, technological, or health-related circumstances (Pelayo & Pelayo, 2020; Rasli et al., 2022). Passos et al. (2022) argued that flexible classroom design enables personalisation and supports different cognitive states, learning rhythms, and social needs. Rapanta et al. (2021) similarly emphasised that flexibility ensures continuity of instruction even during unexpected disruptions such as pandemics or political crises. The COVID-19 experience has underscored this: universities are urged to "migrate to flexible teaching and learning modality" by recalibrating curricula, training faculty, and upgrading infrastructure to sustain continuity.

From the student perspective, flexibility is highly valued. El Galad et al. (2024) found a clear post-pandemic preference for hybrid and asynchronous options; students increasingly want choices about where and when they learn. They conclude that flexibility "humanises teaching and learning" by accommodating diverse needs and offering broad access, though it also requires careful planning. In line with this, policy-makers and educators are now conceptualising learning environments that blend settings.

4.4 Fostering Community and Collaboration in Redesigned Spaces

A recurring theme across the reviewed studies was the need to rebuild a sense of community after prolonged isolation. Redesigned learning spaces, whether virtual, hybrid, or physical, played a major role in reconnecting students academically and socially. Digital collaboration platforms (e.g., Google Workspace, Microsoft Teams, Padlet, blogs, and social media) supported peer-to-peer interactions and collective problem-solving (Khan et al., 2021; Gopinathan et al., 2022). These platforms also reduced barriers for shy or marginalised students by offering alternative communication channels (Pelayo & Pelayo, 2020).

Redesigned learning spaces extend into the virtual realm as well. Recent studies highlight that online platforms and hybrid modalities can also foster belonging and teamwork when structured intentionally. Dulfer et al. (2025) report that in fully online postgraduate courses, thoughtful course architecture and pedagogy explicitly supporting learner–learner and learner–instructor interactions led to a markedly enhanced sense of belonging. Kearney et al. (2025) likewise demonstrate that an international online learning environment (OLE) connecting students at a UK university and its Chinese partner enabled active cross-campus engagement. When students were fully engaged with the platform, they co-created positive learning experiences and felt more connected to each other. Geary et al. (2023) further confirm that Australian university students who perceived a strong learning community and social connectedness in their online courses reported much higher course satisfaction. These studies collectively show that building virtual spaces for interaction through discussion forums, group projects, and synchronous video collaboration can replicate some benefits of an in-person community.

5 Conclusions

The COVID-19 pandemic accelerated an unprecedented transformation in the design and use of learning spaces in higher education. This systematic review demonstrates that redesigned learning environments spanning digital, hybrid, and flexible modalities have fundamentally reshaped how students engage, participate, and collaborate. Evidence across the included studies confirms that online platforms, active learning technologies, and flexible configurations improved interaction and supported continuity, especially when traditional classroom access was disrupted. At the same time, the review highlights significant challenges that institutions faced in implementing and

sustaining these changes. Unequal access to devices and internet connectivity, limited institutional infrastructure for hybrid delivery, and insufficient faculty preparedness emerged as major barriers. Despite these obstacles, universities adapted by investing in targeted technology, implementing digital literacy initiatives, and restructuring pedagogy. Flexibility was found to be essential for navigating prolonged uncertainty. Hybrid, blended, and asynchronous models offered learners greater autonomy and accessibility, enabling learning to continue across varying personal, health, and environmental conditions. Equally important, redesigned learning spaces helped rebuild a sense of community that was eroded during the pandemic. Digital collaboration tools, virtual communities, and interactive hybrid spaces enabled peer connection, group work, and shared learning experiences. Overall, the findings underscore that learning space redesign is not merely a response to crisis but a long-term strategic imperative. Higher institutions must continue to innovate, integrate inclusive technologies, and design environments that support diverse learners in a rapidly evolving educational landscape.

Social and Practical Implications

The redesigned learning spaces identified in this review have significant social implications for higher education. By expanding access through hybrid and digital formats, these spaces help reduce educational inequities and support students who face technological, geographical, or personal constraints. They also play a key role in rebuilding social connections after the pandemic, as flexible and technology-enhanced environments enable stronger peer interaction, collaboration, and a renewed sense of community among learners. Additionally, digital platforms now facilitate broader intercultural engagement, allowing students from different regions to work together more easily.

Practically, the findings offer clear guidance for institutions seeking to strengthen teaching and learning in the post-pandemic era. Universities must invest in reliable digital infrastructure, hybrid classroom technologies, and flexible physical layouts that support active learning. Faculty development is essential, as instructors require ongoing training to effectively use digital tools and manage hybrid learning environments. Policymakers and educational leaders should also address digital divides by ensuring equitable access to devices and learning resources. Overall, the review underscores that redesigning learning spaces is a long-term strategy for creating resilient, inclusive, and adaptable educational systems.

Implications for Policy Formation

The review underscores the need for policies that support the equitable and sustainable redesign of learning spaces in higher education. Policymakers should prioritise improved digital infrastructure, consistent standards for hybrid and flexible learning, and measures that reduce digital inequities. Institutions also require policies that mandate ongoing faculty training in digital pedagogy and allocate dedicated funding for technology upgrades and maintenance. Clear and proactive policy direction is essential to ensure that redesigned learning spaces remain effective, inclusive, and resilient in the face of future disruptions.

Counterintuitive Findings for Scholarly Discussion

Contrary to the common belief that remote work hinders collaboration, some studies suggest that digital tools can enhance it by providing more structured and inclusive communication channels. Tools like video conferencing, collaborative document editing, and project management software can foster real-time collaboration and ensure that all team members, regardless of location, have equal opportunities to contribute. This structured environment can lead to more organised and efficient teamwork, countering the notion that physical proximity is essential for effective collaboration.

While digital burnout is a concern in the remote work era, research indicates that well-designed digital learning environments with appropriate breaks and support can mitigate this risk. It challenges the idea that increased screen time inevitably leads to fatigue, suggesting that proper management and breaks can help maintain productivity and well-being. Additionally, low-tech or no-tech solutions may be more effective for specific learning objectives, particularly for students who struggle with digital literacy or have limited access to technology. This indicates that a balanced approach combining high-tech and low-tech solutions can better meet diverse learning needs.

Suggestions for Future Research

To advance our understanding of the impacts of remote and hybrid learning, it is crucial to conduct longitudinal studies that track student engagement, achievement, and well-being over time. Such research would provide valuable insights into how these learning environments affect students in the long term, helping educators and policymakers make informed decisions. Additionally, investigating the most effective digital literacy programs for diverse populations can identify best practices for teaching digital skills and reducing digital divides, ensuring all students have equal access to the benefits of digital learning.

Exploring the effectiveness of inclusive pedagogical practices in both physical and virtual classrooms is essential to understanding how these methods impact student engagement, retention, and success, particularly for underrepresented groups. Furthermore, studying the impact of work-life balance policies on employee productivity and well-being in remote and hybrid work settings can help organisations design supportive policies that promote health and organisational goals. Finally, researching technological integration in low-resource educational settings is necessary to identify cost-effective tools and strategies that enhance learning without significant financial investment, making quality education accessible to all students.

Acknowledgement

The authors wish to express their sincere appreciation to the reviewer and the editorial team for their valuable comments and constructive suggestions, which have significantly enhanced the quality and clarity of this work.

Funding

The authors declare that no financial support was received for the research, authorship, and publication of this article.

Conflict of Interest

The authors declare no conflicts of interest.

Declaration of Use of Generative AI

Generative AI tools were used exclusively for layout formatting, paraphrasing, and grammar correction.

References

Al Ansi, A. M., & Al-Ansi, A. (2020). Future of education post COVID-19 pandemic: reviewing changes in learning environments and latest trends. *Solid State Technology*, 63(6), 201584-201600. https://www.researchgate.net/publication/349692733_Future_of_Education_Post_Covid-19_Pandemic_Reviewing_Changes_in_Learning_Environments_and_Latest_Trends

Al-Ansi, A. M., Suprayogo, I., & Abidin, M. (2019). Impact of information and communication technology (ICT) on different settings of the learning process in developing countries. *Science and Technology*, 9(2), 19-28. https://doi.org/10.5923/j.scit.20190902.01

Alizadeh, H., Sharifi, A., Damanbagh, S., Nazarnia, H., & Nazarnia, M. (2023). Impacts of the COVID-19 pandemic on the social sphere and lessons for crisis management: a literature review. *Natural Hazards*, 117(3), 2139-2164.' https://doi.org/10.1007/s11069-023-05959-2

Amro, D. K. (2022). The impact of the COVID-19 lockdown on design students' performance: a case study in the UAE. *International Journal of Art & Design Education*, 41(1), 108-124. https://onlinelibrary.wiley.com/doi/abs/10.1111/jade.12378

Aslam, S. (2021). Platforms and Tools used for Online Learning all over the World during Covid-19: A Study. *Available at SSRN 4587912*. https://doi.org/10.2139/ssrn.4587912

Bamiro, N. B., Zakariya, Z. B., & Nasiru, B. A. (2023). Development of a halal entrepreneurship framework through business incubator service for sustainability using PRISMA. *Contemporary discourse of halal and Islamic entrepreneurship*, 79-97. https://doi.org/10.1007/978-981-99-6427-7_6

Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021, August). Post-COVID-19 adaptations: the shifts towards online learning, hybrid course delivery and the implications for biosciences courses in the higher education setting. In Frontiers in Education (Vol. 6, p. 711619). *Frontiers Media SA*. https://doi.org/10.3389/feduc.2021.711619

Carey, K. (2020). *The Future of College in a Post-Pandemic World*. The New York Times. https://www.nytimes.com/by/kevin-carey

Casanova, D. (2014, December). Redesigning learning spaces through students and academics contributions: the role of participatory design. In *SRHE Conference 2014: SRHE Annual Research Conference: Inspiring Future Generations; Embracing Plurality and Difference in Higher Education*. https://www.researchgate.net/publication/277881113_Redesigning_learning_spaces_through_students_and_academics_contributions_the_role_of_participatory_design

Dayagbil, F. T., Palompon, D. R., Garcia, L. L., & Olvido, M. M. J. (2021). Teaching and learning continuity amid and beyond the pandemic. In Frontiers in Education (Vol. 6, p. 678692). *Frontiers Media SA.* https://doi.org/10.3389/feduc.2021.678692

De Klerk, E. D., & Palmer, J. M. (2021). Resetting education priorities during COVID-19: Towards equitable learning opportunities through inclusion and equity. *Perspectives in Education*, 39(1), 12-28. https://doi.org/10.18820/2519593X/pie.v39.i1.2

Deka, P. K. (2021). Factors influencing student engagement in online learning during the COVID-19 pandemic period in India*. Journal of Management in Practice*, 6(1). https://www.researchgate.net/publication/372767971_Factors_Influencing_Student_Engagement_in_Online_Learning_during_the_COVID_-19_pandemic_period_in_India

Dhawan, S. (2020). Online learning: A panacea in the time of the COVID-19 crisis. Journal of *Educational Technology Systems*, 49(1), 5-22. https://doi.org/10.1177/0047239520934018

Dulfer, N., Gowing, A., & Mitchell, J. (2025). Building belonging in online classrooms: relationships at the core. *Teaching in Higher Education*, *30*(4), 1024-1040. https://doi.org/10.1080/13562517.2024.2346081

Edmunds, T. K., & Little, R. (2025). Impacts of the Active Learning Classroom on Student Learning and Engagement: The Role of Technology. *The Canadian Journal for the Scholarship of Teaching and Learning*, *16*(1). https://doi.org/10.5206/cjsotlrcacea.2025.1.16584

El Galad, A., Betts, D. H., & Campbell, N. (2024, April). Flexible learning dimensions in higher education: aligning students' and educators' perspectives for more inclusive practices. In *Frontiers in Education* (Vol. 9, p. 1347432). Frontiers Media SA. https://doi.org/10.3389/feduc.2024.1347432

Eringfeld, S. (2021). Higher education and its post-coronial future: utopian hopes and dystopian fears at Cambridge University during Covid-19. *Studies in Higher Education*, 46(1), 146-157. https://doi.org/10.1080/03075079.2020.1859687

Espino-Díaz, L., Fernández-Caminero, G., Hernández-Lloret, C. M., González-González, H., Álvarez-Castillo, J. L. (2020). Analysing the impact of COVID-19 on education professionals. Toward a paradigm shift: ICT and neuroeducation as a binomial of action. *Sustainability*, 12(14), 5646. https://doi.org/10.3390/su12145646

Farnell, T., Skledar Matijevic, A., & Ščukanec Schmidt, N. (2021). *The Impact of COVID-19 on Higher Education: A Review of Emerging Evidence. Analytical Report*. European Commission. Available from: EU Bookshop. https://doi.org/10.2766/069216

Fedeli, M., & Taylor, E. W. (2023). The impact of an active-learning designed faculty development program: A student's perspective of an Italian university. *Tuning Journal for Higher Education*, *11*(1), 151-174. https://doi.org/10.18543/tjhe.2513

Geary, E., Allen, K. A., Gamble, N., & Pahlevansharif, S. (2023). Online learning during the COVID-19 pandemic: Does social connectedness and learning community predict self-determined needs and course satisfaction?. *Journal of University Teaching and Learning Practice*, *20*(1), 1-26. https://doi.org/10.53761/1.20.01.13

Gopinathan, S., Kaur, A. H., Veeraya, S., & Raman, M. (2022). The role of digital collaboration in student engagement towards enhancing student participation during COVID-19. *Sustainability*, 14(11), 6844. https://doi.org/10.3390/su14116844

Guzzo, T., Ferri, F., & Grifoni, P. (2023). Lessons learned during COVID-19 and future perspectives for emerging technology. *Sustainability*, 15(14), 10747. https://doi.org/10.3390/su151410747

Higgins, J. P.T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M.J, & Welch, V.A. (eds.) (2019). Cochrane Handbook for Systematic Reviews of Interventions (2nd ed.). Chichester, UK: John Wiley & Sons https://www.cochrane.org/authors/handbooks-and-manuals/handbook

Hollister, B., Nair, P., Hill-Lindsay, S., & Chukoskie, L. (2022). Engagement in online learning: student attitudes and behaviour during COVID-19. In Frontiers in Education (Vol. 7, p. 851019). *Frontiers Media SA*. https://doi.org/10.3389/feduc.2022.851019

Hosseinzadeh, P., Zareipour, M., Baljani, E., & Moradali, M. R. (2022). Social consequences of the COVID-19 pandemic. A systematic review. *Investigación y educación en enfermería*, 40(1). https://doi.org/10.17533/udea.iee.v40n1e10

Ifeanyi, F. O. (2023). Barriers to learning linger into post-pandemic for multi-campus institutions in developing nations: A case of the University of the Free State. *Social Sciences & Humanities Open*, *7*(1), 100438. https://doi.org/10.1016/j.ssaho.2023.100438

Indergård, K., & Hansen, G. K. (2024). Academic work–something else?. *Journal of Corporate Real Estate*, 26(2), 113-130. https://doi.org/10.1108/JCRE-04-2023-0014

Jacques, S., Ouahabi, A., & Kanetaki, Z. (2023). Post-COVID-19 education for a sustainable future: Challenges, emerging technologies and trends. *Sustainability,* 15(8), 6487. https://doi.org/10.3390/su15086487?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle

Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through the ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, *3*(2), 100115. https://doi.org/10.1016/j.tbench.2023.100115

Kearney, T., Raddats, C., & Qian, L. (2025). Enabling international student engagement through online learning environments. *Innovations in Education and Teaching International*, *62*(4), 1291-1304. https://www.tandfonline.com/doi/full/10.1080/14703297.2024.2413435

Kedraka, K., & Kaltsidis, C. (2020). Effects of the COVID-19 Pandemic on University Pedagogy: Students' Experiences And Considerations. *European Journal of Education Studies*, 7(8). https://doi.org/10.46827/ejes.v7i8.3176

Khan, M. N., Ashraf, M. A., Seinen, D., Khan, K. U., & Laar, R. A. (2021). Social media for knowledge acquisition and dissemination: The impact of the COVID-19 pandemic on collaborative learning driven social media adoption. *Frontiers in Psychology*, 12, 648253. https://doi.org/10.3389/fpsyg.2021.648253

Korkmaz, G. & Toraman, Ç. (2020). Are we ready for the post-COVID-19 educational practice? An investigation into what educators think about online learning. *International Journal of Technology in Education and Science (IJTES)*, 4(4), 293-309. https://doi.org/10.46328/ijtes.v4i4.110

Lahti, M., Nenonen, S., Sutinen, E., & Pope, N. (2021). Radical innovation theory: Towards radical design of digital workplaces. In *A Handbook of Management Theories and Models for Office Environments and Services* (pp. 163-172). Routledge. https://doi.org/10.1201/9781003128786-14

Leijon, M., Nordmo, I., Tieva, Å., & Troelsen, R. (2022). Formal learning spaces in Higher Education–a systematic review. *Teaching in Higher Education*, 1-22. https://doi.org/10.1080/13562517.2022.2066469

Letzel-Alt, V., Pozas, M., Schwab, S., Schneider, C., Lindner, K. T., Dias, P., & Cadime, I. (2022). Exploring inclusive education in times of COVID-19: An international comparison of German, Austrian and Portuguese teachers. *In Frontiers in Education* (Vol. 7, p. 969737). Frontiers Media SA. https://doi.org/10.3389/feduc.2022.969737

Lohr, A., Stadler, M., Schultz-Pernice, F., Chernikova, O., Sailer, M., Fischer, F., & Sailer, M. (2021). On powerpointers, clickerers, and digital pros: Investigating the initiation of digital learning activities by teachers in higher education. *Computers in Human Behaviour*, 119, 106715. https://doi.org/10.1016/j.chb.2021.106715

Masalimova, A. R., Khvatova, M. A., Chikileva, L. S., Zvyagintseva, E. P., Stepanova, V. V., & Melnik, M. V. (2022, March). Distance learning in higher education during COVID-19. In Frontiers in Education (Vol. 7, p. 822958). *Frontiers Media SA*. https://doi.org/10.3389/feduc.2022.822958

McCorkle, S. (2021). Exploring faculty barriers in a new active learning classroom: A divide and conquer approach to support—Journal *of Learning Spaces*, *10*(2). https://www.researchgate.net/publication/351769872_Exploring_Faculty_Barriers_in_a_New_Active_Learning_Classroom_A_Divide_and_Conquer_Approach_to_Support

Neuwirth, Lorenz S., Svetlana Jović, and B. Runi Mukherji (2021). Reimagining higher education during and post-COVID-19: Challenges and opportunities. *Journal of Adult and Continuing Education* 27(2), 141-156. https://doi.org/10.1177/1477971420947738#

Ninnemann, K., Liedtke, B., den Heijer, A., Gothe, K., Loidl-Reisch, C., Nenonen, S., ... & Wallenborg, C. (2020). *Hybrid environments for universities*. Waxmann Verlag. https://doi.org/10.31244/9783830991793

OECD. (2020). Education and COVID-19: *Focusing on the long-term impact of school closures*. Retrieved July 14, 2024, from https://www.oecd-ilibrary.org/education/education-and-covid-19-focusing-on-the-long-term-impact-of-school-closures_2cea926e-en

Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews. *PLoS Med*. 2021, 18, e1003583 https://doi.org/10.1136/bmj.n71

Papaioannou, G., Volakaki, M. G., Kokolakis, S., & Vouyioukas, D. (2023). Learning spaces in higher education: a state-of-the-art review. *Trends in Higher Education*, 2(3), 526-545. https://doi.org/10.3390/higheredu2030032

Park, E. L., & Choi, B. K. (2014). Transformation of classroom spaces: Traditional versus active learning classrooms in colleges. *Higher Education*, 68, 749-771. https://doi.org/10.1007/s10734-014-9742-0

Passos, A. D. Q., Jorge, E., Moreira, J. A., Miranda, J. G., Sales, K., & Saba, H. (2022). Architectural design of classroom to stimulate learning in higher education: an approach connected with neuroeducation and neuroarchitecture. *International Journal for Innovation Education and Research*, 10(4), 87-102. https://doi.org/10.31686/ijier.vol10.iss4.3707

Pelayo, E., & Pelayo, L. (2020). Flexible learning: a new learning design in the time of the COVID-19 pandemic. *International Journal of Innovative Science and Research Technology*, 4(9), 76-79. https://doi.org/10.38124/IJISRT20SEP078

Peruzzo, F., & Allan, J. (2024). Rethinking inclusive (digital) education: Lessons from the pandemic to reconceptualise inclusion through convivial technologies. *Learning, Media and Technology*, 49(2), 244-258. https://doi.org/10.1080/17439884.2022.2131817

Porter, S. G., Greene, K., & Esposito, M. K. (2021). Access and inclusion of students with disabilities in virtual learning environments: Implications for post-pandemic teaching. *International Journal of Multicultural Education*, 23(3), 43-61. https://doi.org/10.18251/ijme.v23i3.3011

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2021). Balancing technology, pedagogy and the new normal: Post-pandemic challenges for higher education. *Postdigital Science and Education*, 3(3), 715-742. https://doi.org/10.1007/s42438-021-00249-1

Rasli, A., Tee, M., Lai, Y. L., Tiu, Z. C., & Soon, E. H. (2022). Post-COVID-19 strategies for higher education institutions in dealing with the unknown and uncertainties. In Frontiers in Education (Vol. 7, p. 992063). *Frontiers Media SA*. https://doi.org/10.3389/feduc.2022.992063

Rosário, A. T., & Raimundo, R. (2024). Sustainable Entrepreneurship Education: A Systematic Bibliometric Literature Review. *Sustainability*, 16(2), 784. https://doi.org/10.3390/su16020784

Rus, R. C., Salisu, M. A., Hussain, M. M., Kamal, M. M., Hanapi, Z., Idris, M. O., ... & Kayode, B. K. (2023). Systematic review of Malaysia's technical and vocational education (TVET) sustainability framework to increase the marketability of graduates using PRISMA. *Jurnal Kejuruteraan*, *6*(2), 51-63. https://doi.org/10.17576/jkukm-2023-si6(2)-06

Saha, B., Atiqul Haq, S. M., & Ahmed, K. J. (2023). How does the COVID-19 pandemic influence students' academic activities? An explorative study in a public university in Bangladesh. *Humanities and Social Sciences Communications*, 10(1), 1-10. https://doi.org/10.1057/s41599-023-02094-y

Saladino, V., Algeri, D., & Auriemma, V. (2020). The psychological and social impact of COVID-19: new perspectives on well-being. *Frontiers in psychology*, 11, 577684. https://doi.org/10.3389/fpsyg.2020.577684

Salisu, M. A., Ridzwan, C. R., Oyebamiji, Y. O., Usaizan, N., Abioye, A. E., Biola, I. F., ... & Luqman, H. (2024). Disruption of the Covid-19 pandemic on the agri-food sector: A systematic review of its implications in post-pandemic and the future of food security. *AIMS Agriculture & Food*, 9(1). https://doi.org/10.3934/agrfood.2024009

Sato, S. N., Condes Moreno, E., Rubio-Zarapuz, A., Dalamitros, A. A., Yañez-Sepulveda, R., Tornero-Aguilera, J. F., & Clemente-Suárez, V. J. (2023). Navigating the new normal: Adapting online and distance learning in the post-pandemic era. *Education Sciences*, 14(1), 19. https://www.mdpi.com/2227-7102/14/1/19#

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, & post-pandemic world. *Journal of Educational Technology Systems*, 50(2), 140-171. https://doi.org/10.1177/00472395211047865

Temple, P., & Fillippakou, O. (2007). Learning spaces for the 21st century. *Higher Education Academy,* 1-80. https://www.researchgate.net/publication/237472897_Learning_spaces_for_the_21st_century_A_review_of_the_literature

Tosto, S. A., Alyahya, J., Espinoza, V., McCarthy, K., & Tcherni-Buzzeo, M. (2023). Online learning in the wake of the COVID-19 pandemic: Mixed methods analysis of student views by demographic group. *Social Sciences & Humanities Open*, 8(1), 100598. https://www.sciencedirect.com/science/article/pii/S2590291123002036

Tugwell, P., Welch, V. A., Karunananthan, S., Maxwell, L. J., Akl, E. A., Avey, M. T., ... & White, H. (2020). When to replicate systematic reviews of interventions: consensus checklist. *BMJ*, 370. https://pubmed.ncbi.nlm.nih.gov/32933948/

Ulanday, M. L., Centeno, Z. J., Bayla, M. C., & Callanta, J. (2021). Flexible learning adaptabilities in the new normal: E-learning resources, digital meeting platforms, online learning systems, and learning engagement. *Asian Journal of Distance Education*, 16(2). https://doi.org/10.5281/zenodo.5762474

UNESCO. (2020). *Education: From disruption to recovery*. Retrieved July 14, 2024, from WWW.UNESCO.ORG. https://www.unesco.org/en/covid-19/education-disruption-recovery

Utaminingsih, S., Fajrie, N., Bamiro, N. B., & Azman, M. N. A. (2023). Teachers' and students' perceptions of technology and a sustainable adoption framework in the pedagogical process: A systematic review. *International Journal of Learning, Teaching and Educational Research*, *22*(12), 162-186. https://doi.org/10.26803/ijlter.22.12.9

Wang, X., Liu, J., Jia, S., Hou, C., Jiao, R., Yan, Y., ... & Liu, X. Y. (2024). Hybrid teaching after COVID-19: advantages, challenges and optimisation strategies. *BMC Medical Education*, *24*(1), 753. https://doi.org/10.1186/s12909-024-05745-z

Weller, M. (2007). The distance from isolation: Why communities are the logical conclusion in e-learning. *Computers & Education*, *49*(2), 148-159. https://doi.org/10.1016/j.compedu.2005.04.015

Wester, E. R., Walsh, L. L., Arango-Caro, S., & Callis-Duehl, K. L. (2021). Student engagement declines in STEM undergraduates during COVID-19–driven remote learning. *Journal of microbiology & biology education*, 22(1), 10-1128. https://doi.org/10.1128/jmbe.v22i1.2385

Wheele, T., Lindkvist, C., Weber, C., Windlinger, L., & Haugen, T. (2023, May). Studying the influence of technology on the social connectedness of students: a hybrid university learning environment (HULE). In *IOP Conference Series: Earth and Environmental Science* (Vol. 1176, No. 1, p. 012009). IOP Publishing. https://doi.org/10.1088/1755-1315/1176/1/012009

Wheele, T., Weber, C., Windlinger, L., Haugen, T., & Lindkvist, C. (2023). A narrative literature review using placemaking theories to unravel student social connectedness in hybrid university learning environments. *Buildings*, 13(2), 339. https://doi.org/10.3390/buildings13020339

Whelehan, D. F. (2020). Students as Partners: A model to promote student engagement in post-COVID-19 teaching and learning. *All Ireland Journal of Higher Education*, 12(3). https://www.researchgate.net/publication/344667120_Students_as_Partners_A_model_to_promote_student_engagement_in_post-COVID-19_teaching_and_learning

World Bank. (2021). *The impact of COVID-19 on education: Recommendations and opportunities for Ukraine*. World Bank. Retrieved July 14, 2024, from https://www.worldbank.org/en/news/opinion/2021/04/02/the-impact-of-covid-19-on-education-recommendations-and-opportunities-for-ukraine

Yang, D., Wang, H., Metwally, A. H. S., & Huang, R. (2023). Student engagement during emergency remote teaching: A scoping review. *Smart Learning Environments*, 10(1), 24. https://doi.org/10.1186/s40561-023-00240-2

Zarzycka, E., Krasodomska, J., Mazurczak-Mąka, A., & Turek-Radwan, M. (2021). Distance learning during the COVID-19 pandemic: students' communication and collaboration and the role of social media. *Cogent Arts & Humanities*, 8(1), 1953228. https://doi.org/10.1080/23311983.2021.1953228?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle

Zhao, X., & Xue, W. (2023). From online to offline education in the post-pandemic era: Challenges encountered by international students at British universities. *Frontiers in Psychology*, 13, 1093475 https://doi.org/10.3389/fpsyg.2022.1093475