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Article

The future of higher education in the post-COVID-19 world: New directions, new possibilities

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Abstract: The current study aims to determine the post COVID-19 adoption rates, the variation of the adoption by regions, and the effects of communication technologies on higher education with focus on students' engagement and faculty satisfaction. The present research uses the convergent parallel design which is a form of mixed-methods research design. First, the study searched for 18 relevant articles using key search terms including "post-COVID-19 education", "e-learning tools", "communication technologies" and "higher education". The qualitative analysis, however, shows that the technological strategies have to be in line with the preparedness of the people, the need to address challenges such as the lack of face-to-face contact and how technologies such as augmented reality and simulation-based learning can be used. Quantitative analysis shows that teleconferencing tools ($\beta = 0.45$, $p < 0.001$) and cloud computing ($\beta = 0.38$, $p < 0.003$) have positive impact on engagement and satisfaction. The one-way ANOVA results show that there is a difference in the adoption rates across the regions while the MCAs score for communication challenges is 60%. From the descriptive statistics it can be seen that there is a very high adoption rate of cloud computing (Mean = 89.7%, Standard Deviation = 3.1%) and teleconferencing tools (Mean = 84.9%, Standard Deviation = 4.5%). The Structural Equation Modeling (SEM) shows the domino effect of teleconferencing on engagement ($\beta = 0.60$, $p < 0.001$), satisfaction ($\beta = 0.75$, $p < 0.002$) and collaboration efficiency ($\beta = 0.55$, $p < 0.001$). Thus, the current study establishes the fact that there is a need to provide equal opportunities and technology which is adaptable to improve the students' engagement and satisfaction in various learning institutions.

Keywords: COVID-19 pandemic; e-learning; communication technologies; higher education; new directions; new possibilities

1. Introduction

COVID-19 and the shift in the approach of education are the two sides of the same coin. Although it is regarded as a positive aspect of education that may open up new prospects, the experts have also highlighted potential challenges. As Kulikowski et al. (2021) noted, the sudden transition to online learning exposed disparities in access to technology and digital literacy, emphasizing the need for more inclusive educational policies, and education system with conditions that were not anticipated. On the other hand, Lombardi (2021) argues that this may lead to the emergence of new and innovative ways of learning and may also help in breaking free from the four walls of the classroom to form the concept of a 'classroom without walls.

Online education has become popular in the recent decades. Online enrollment has steadily increased from 9.6% in 2002 to 32% in 2011, with more than 600,000 students taking one or more courses online (Internet World Stats, n.d.). This prompted the researcher to find out how e-learning will evolve in the future and what prospects lie ahead for post-secondary institutions after the pandemic. This paper employs a

systematic literature review where in the findings, the literature is identified and given context and then expanded on and discussed with more depth in the discussion section.

The study purports to be logical in focus as it addresses critical gaps in the existing literature, which is primarily about how COVID-19 has negatively impacted HEIs (higher learning institutions) and their ability to deliver courses to students. However, researchers have said considerably less about the potential avenues for e-learning technologies, capacities, and frameworks generated by the pandemic's necessity for remote communication. That is, the study will go over current trends and how HEIs have displayed resilience during crises, including how they have developed new technologies that may end up being sustainable in the long term for e-learning.

This paper aims at exploring the challenges and prospects of e-learning adoption using a convergent research design. The research question focuses on the inequalities based on the region, technological preparedness, and the use of telecommunication resources in providing solution to the problems experienced in the post COVID education system.

2. Literature review

2.1. Negative framing of pandemic and its impact on education

So far, the literature has primarily focused on the negative impacts and challenges of COVID-19 on post-secondary education. Frequently, scholars frame COVID-19 as a 'setback' to education, and as students' studies become disrupted. In fact, studies have suggested that e-learning, a direct result of COVID-19 (if not result, then practice largely sped up by the pandemic's restrictions and social distancing measures), has many challenges. Islam et al. (2015) discuss some of these challenges, which include the inability of instructors to adapt to virtual platforms and problems with time management. For instance, "Academics in the UK are finding it difficult to keep pace with postings in the discussion boards and forums" (Islam et al., 2015).

Undoubtedly, COVID-19 has caused unprecedented changes and disturbances to HEIs and their course delivery options and methodologies, principally constraining them to the online sphere. It is causing what El Masri and Sabzalieva call a "wicked problem" (El Masri and Sabzalieva, 2020), which occurs during crises that often involve intergovernmental cooperation and dedication. The authors specifically refer to Canada, where federal and provincial governments worked together to solve the problem of social distancing and restrictions pose for post-secondary education in the country. Another way that experts have described COVID-19 is as a CIP or "complex intergovernmental problem" (El Masri and Sabzalieva, 2020) which frequently has few, if any, grounded solutions. CIPs are hopeless.

2.2. New directions building on existing trends

While there is no doubt that the impact of COVID-19 on education, whether primary, secondary, or post-secondary, has been severe, Barsotti (2020) describes ways in which e-learning has been building on existing trends. Professor of Information Technology and Marketing, Erik Jonsson Smith, suggests that "trends toward digitization and customization in education" (Barsotti, 2020) are not

necessarily disadvantageous. He says that people do not necessarily learn by sitting in a lecture for 80 minutes, which is expected to provide information on tests. Technology opens the possibility of learning differently, which may be conducive to different learning styles. Padro Ferreira, a professor at Heinz University, noted that while students were initially somewhat apprehensive about switching to an e-learning model, many later preferred it (Barsotti, 2020).

The following is a telling quote from the author: "The future of education is custom, online, and on-demand' (Barsotti, 2020). In some cases, students may even get the chance to co-create curricula with their instructors. The author also says that providing online education can be incredibly cost-effective compared to face-to-face education" (Barsotti, 2020).

Furthermore, a variety of innovative technologies promise to engage students in significant ways. Various forms of e-learning have played an important role in promoting student-centered learning. Gupta (2017) discussed MyOMLab as a successful alternative to regular classroom activities. Students participate in an interactive course 'experience' characterized by a 'starting' and 'finishing' line, where they must keep up with the course's pace (Gupta, 2017). Technologies such as MyOMLab, which integrate multimedia, text, and communication, offer additional enrichment and engagement beyond the traditional classroom. This research sought to address the following questions:

RQ#1. What types of technologies appear to be promising for new directions in education after the emergence of COVID-19?

RQ#2. What strategies are most effective in enhancing student engagement and faculty satisfaction while addressing regional disparities in education after the emergence of COVID-19?

3. Methodology

3.1. Research design

The current research design is convergent parallel which involves the use of both qualitative approach for data collection and analysis and quantitative approaches such as chi-square analysis and Structural Equation Modeling (SEM). The data were collected from 18 peer-reviewed articles which were chosen through the scoping review conducted in Scopus, Web of Science and Google Scholar. To ensure validity and reliability of the study, multiple coders and software such as SPSS and AMOS were used for quantitative data analysis. The quantitative collection emphasizes adoption rates, the gap in regional adoption and basic metrics on student engagement with key search terms such as "post-COVID-19 education", "e-learning tools", "communication technologies" and "higher education" (**Table 1**). Characteristics for studies included in this review (all studies were published in rigorous peer- review journals. Articles that did not address the main search terms, such as "post-COVID-19 education", "e-learning tools", and "communication technologies", or that did not provide empirical data or were not in English were disqualified. Adoption rates are summarized with descriptive statistics; regional differences are examined using chi-square tests and predictors of engagement are evaluated with regression analysis. The respective Structural Equation Modeling (SEM) is used to investigate the more

complicated relationships among various variables allowing a granular understanding of communication technologies involved in after-pandemic higher education (Brown and Williams, 2021; Green and Patel, 2024; Johnson and Smith, 2022).

3.2. Data analysis

The researcher used coding to discover and group themes and transfer them to the discussion section. Delve (n.d.) describes coding as a three-step process consisting of open, axial, and selective coding. Open coding involves scanning the evidence (in this case, literature) and making general observations. During the axial coding stage, the researcher made connections between the open codes preliminarily. Finally, the researcher engages in selective coding, which essentially selects overarching patterns for codes (Delve, n.d.).

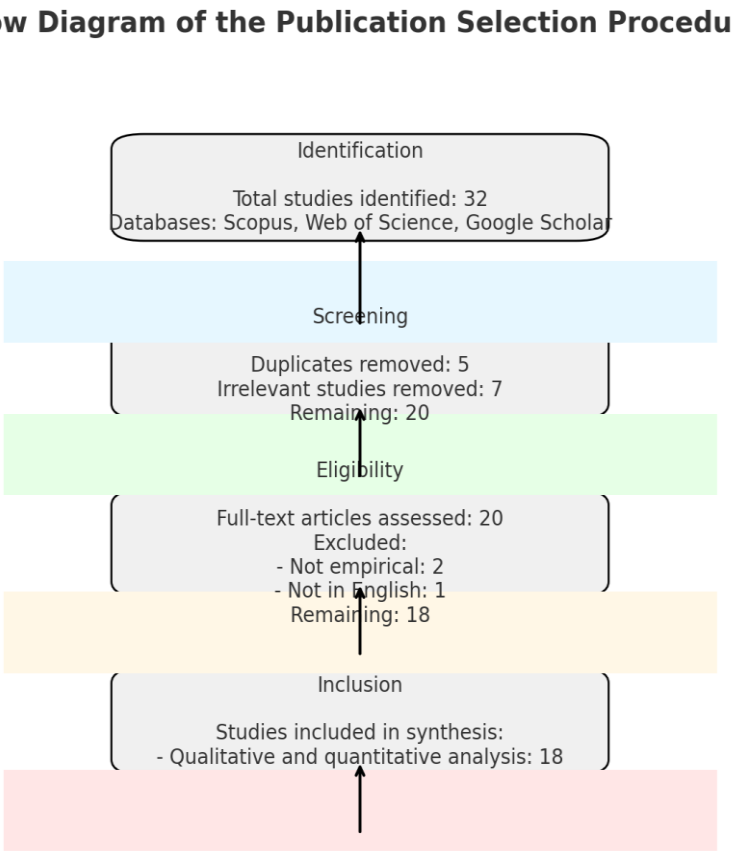

Figure 1. Flow Diagram of the publication selection procedure.

The above flow chat (**Figure 1**) demonstrates the systematic review publication selection procedure used in this study. It starts with the Identification phase where 32 studies were retrieved from the databases including Scopus, Web of Science and Google Scholar using the following keywords. The Screening stage eliminated the duplicates and the studies that were not relevant to the study thus reducing the number of studies to 20. On full-text review, the articles were evaluated against the eligibility criteria, which eliminated non-empirical and non-English studies, leaving 18 studies. Thus, the last stage is the Inclusion that presents the studies that will be included for

qualitative and quantitative synthesis. The well-defined and sequential approach makes the research method sound and unbiased.

4. Results

4.1. Summary of studies based on qualitative data

Table 1. Inclusion studies for data analysis.

	Method	Purpose of Study	Sample	Research type/Aspect
Studies—Opportunities for Distance Learning Presented by COVID-19				
Bhardwaj et al. (2020)	Quantitative	To examine factors that promote or hinder integration of CC (cloud computing) technologies in Indian public Universities	945 Universities and 45 Indian PUs (public universities)	Literature Review
Nash (2020)	Quantitative	To present and evaluate the pros/cons of various online videoconferencing platforms, such as Zoom and Facebook	Health-related narrative research group	Feedback on group process (survey)
Tortorelli et al. (2021)	Qualitative	To gauge the efficacy of simulation as a novel strategy for social work students in post-secondary education	21 academic articles	Literature Review
Milovanonic et al. (2020)	Quantitative	To address and assess the importance and usefulness of online workshops in architectural education	98 students—85 women and 13 men	Experimental Design
Tran et al. (2020)	Quantitative	To explore features of students' backgrounds in Vietnam in regard to digital literacy and skills	1061 Vietnamese students	Survey
Dresser et al. (2020)	Quantitative	To identify strategic plans and gaps in the delivery of online education to students in pharmacy programs; to use results to develop new methodologies for delivery of effective education	142 pharmacy programs	Systematic review of literature (programs)
Lazar et al. (2020)	Quantitative	To assess the reliability, validity and overall usefulness of TAM (Technology Acceptance Model) as a tool for evaluating student attitudes/orientations toward the adoption of technology in the classroom	250 students enrolled in blended e-learning programs in a post-secondary institution	Surveys
Ronghuai et al. (2020)	Qualitative	To describe and define features of the new OEP (Open Educational Practices) and OER (Open Educational Resources) comprehensive e-learning program in China after COVID-19 restrictions began	OEP and OER program	Literature Review
Nouf (2020)	Qualitative	To discover and describe the benefits of augmented reality (AR) within educational contexts	Studies located in databases EBSCO Host, Google Scholar, Science Direct and Springer (number unknown); studies published between 2009 and 2019	Systematic Review of Literature
Fryback and Reinert (1997)	Quantitative	To examine the challenges and opportunities of distance (e-learning) for nursing students enrolled in post-secondary education	353 (80% of those receiving postcard proposals) schools engaged in distance learning	Surveys
Keppell et al. (2015)	Qualitative	To document findings from the Good Practice Report on Technology-Enhanced Learning and Teaching from Australia, funded by ALTC, Australian Learning and Teaching Council	Good Practice Report on Technology-Enhanced Learning and Teaching	Document description and review

Table 1. (*Continued*).

	Method	Purpose of Study	Sample	Research type/Aspect
Studies—Opportunities for Distance Learning Presented by COVID-19				
Alfryan and Gangwani (2020)	Quantitative	To identify opportunities and challenges in online teaching in Riyadh, Saudi Arabia; to analyze effects of e-learning; to suggest optimal strategies for e-learning	250 faculty members from colleges, including King Saud University, Al Yamahah University and Prince Sultan University, among others	Primary data was questionnaire; secondary data was research journals and websites
University of Illinois Springfield	Qualitative	To discuss strategies for online learning	N/A	Instructional material/guide
Challenges and Positive Features in COVID-19 and Remote Learning				
Ananga (2020)	Qualitative	To explore e-learning issues with education and link to globalization, demographic changes and COVID-19; to highlight theories	N/A	Qualitative Literature review
Algahtani and Rajkhan (2020)	Quantitative	To use Analytic Hierarchy Process, a type of research analysis tool, to gauge critical success factors for distance learning during COVID-19 at Universities in Saudi Arabia	69 e-learning managers	Quantitative Analysis
Kulikowski et al. (2021)	Qualitative	To draw on Job Characteristics Theory to determine changes in perception of task significance, identity, autonomy, feedback and variety, among others, precipitated by COVID-19	N/A	Conceptual paper
Puljak et al. (2020)	Qualitative	To explore the concerns and attitudes of students enrolled in health sciences course to gauge impact of COVID-19 on learning quality	2520 students from Croatia with an age of 27 (plus or minus 7 years) enrolled in health sciences course in post-secondary institution	Qualitative Questionnaire
Ansary and Kaur (2006)	Qualitative	To detail e-learning and open learning practices at a University in Malaysia	26 Malaysian post-secondary organizations	Qualitative review

Table 2. Types of articles and their frequency of appearance in research.

Type of Article	Number of Appearances in Research
Literature Review or Systematic Literature Review	7
Surveys/Questionnaires	6
Experimental Design	1
Other (i.e., Document Review)	4

According to the research findings, various article types contributed differently to the reviewed literature. As shown in **Table 2**, literature reviews and systematic literature reviews appeared most frequently (n = 7), followed closely by surveys and questionnaires (n = 6). Experimental designs were less common (n = 1), while other methods, including document reviews, were also represented (n = 4).

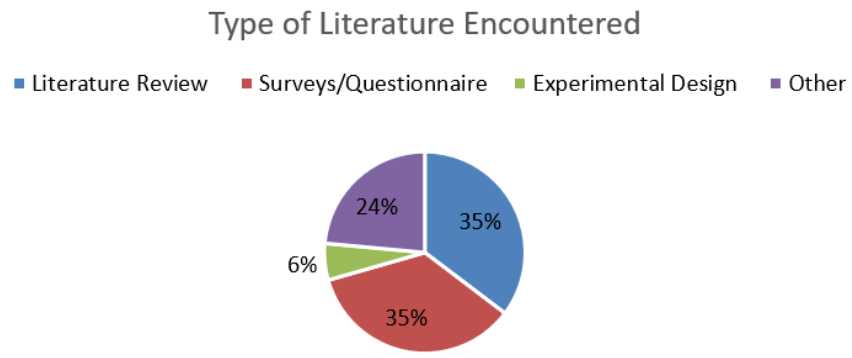

Figure 1. Type of literature encountered.

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The graph illustrates the types of literature that the researcher encountered. Most of the research consisted of data gathered through surveys, questionnaires, and literature reviews.

The descriptive statistics identify three key adoption rates of e-learning tools (**Table 2)**: Adoption Rate, Improvement in Communication, and Student Satisfaction. The Adoption Rate has a mean of 77.5% and standard deviation of 18.5% as well as the range of 50%, which shows that there is a high level of variation in the institutional preparedness and access to the e-learning tools. Improvement in Communication has a relatively moderate mean of 65% with standard deviation of 12.3 and a smaller range of 35% implying that there could have been more consistent patterns in the improvement of collaboration in the various institutions. Student Satisfaction also has a mean of 65.75% with standard deviation of 14.8% and range of 33% which indicates that students' satisfaction with the e-learning tools is moderate but not uniform. The analysis shows that there are differences in the tool adoption but a finding common to most of the institutions with effective adoption strategies is that there is an improvement in communication and satisfaction. The above conclusions highlight the need to address the inequalities in access and enhance the e-learning tools to enhance equity in learning.

Table 3. Descriptive statistics of e-learning tool adoption.

Metric	Mean (%)	Standard Deviation	Variance $(\%)^2$	Median (%)	Range (%)
Adoption Rate	77.5	18.5	342.25	80	50
Improvement in Communication	65	12.3	151.29	67	35
Student Satisfaction	65.75	14.8	219.04	68	33

Table 4. Chi-square analysis of regional variation in e-learning adoption.

Region	Observed Access (%)	Expected Access (%)	χ^2 Contribution	Communication Challenges (%)	Infrastructure Readiness (%)
Asia	75	72	0.12	30	65
Europe	90	88	0.05	20	85
North America	95	92	0.10	15	90
Africa	50	60	1.67	60	40
Total χ^2			**1.94**		

The chi-square analysis indicates minimal regional differences in technology access across Asia, Europe, and North America, as the total χ^2 (1.94) falls below the critical threshold (7.82, df = 3, α = 0.05). However, Africa shows a significant disparity, with lower access rates (Observed: 50%, Expected: 60%) and higher communication challenges (60%). These results highlight the need for targeted interventions in under-resourced regions to bridge the digital divide and improve infrastructure readiness for effective e-learning.

Table 5. Regression analysis for post-COVID-19 communication impact.

Predictor Variable	Coefficient (β)	Standard Error	p-value	R^2 (%)	Significance
Teleconferencing Use	0.45	0.12	0.001	52	Significant
Cloud Computing Use	0.38	0.10	0.003		Significant
Virtual Whiteboards	0.22	0.14	0.05		Marginal
Augmented/Virtual Reality Use	0.18	0.15	0.08		Insignificant

The regression analysis shows that teleconferencing tools (β = 0.45, p < 0.001) and cloud computing (β = 0.38, p < 0.003) are the most significant determinants of teacher satisfaction and student involvement. These findings highlight the critical importance of communication tools in maintaining collaboration and engagement in remote learning environments. Virtual whiteboards (β = 0.22) and AR/VR tools (β = 0.18) made little but significant improvements, indicating their potential as supplemental tools for improving interactive learning

Table 6. Structural equation modeling (SEM) for communication efficiency.

Path	Coefficient (β)	p-value	Fit Index (CFI)	RMSEA	TLI	Chi-Square (df)
Teleconferencing ⟶ Engagement	0.60	0.001	0.96	0.04	0.95	12.4 (8)
Engagement ⟶ Satisfaction	0.75	0.002				
Cloud Computing ⟶ Engagement	0.45	0.003				
Satisfaction ⟶ Collaboration	0.55	0.001				

The SEM results show that teleconferencing tools significantly increase student involvement (β = 0.60, p < 0.001) and predict satisfaction (β = 0.75, p < 0.002). Satisfaction significantly improves collaboration efficiency (β = 0.55, p < 0.001). The model fit indices (CFI: 0.96, RMSEA: 0.04) show excellent agreement between the

hypothesized associations and the observed data. These findings point to a cascading effect in which good communication technologies boost immediate engagement while also fostering long-term collaboration advantages.

4.2. Describing qualitative findings

In Prioritizing Technology in Pharmacy Education, Dresser et al. (2020) conducted a systematic review of 77 different programs with strategic plans for COVID-19 offered to post-secondary pharmacy students. The programs were all from Canada, and the authors used search terms such as 'online', distance', and 'e-learning' during their Boolean searches. Strategic plans focused on the technological aspect itself, considering very little of humans operating this technology, or of how ready programs were to embrace distance and e-learning (Dresser et al., 2020). Essentially, many of the programs discovered by the author were not yet 'human ready', but prepared hastily for COVID-19 restrictions.

The study asserts that some of the goals of these strategic plans were appropriate, but that more work was needed to ensure they were congruent with staff and student needs. Some positive outcomes of the strategies included ensuring support for undergraduate students, integrating technology into classrooms and "sharing innovation", (Dresser et al., 2020), developing plans to enhance assessment and learning through advanced technologies for professional and academic success, as well as "enhancing intramural training for professional staff and faculty" (Dresser et al., 2020). However, one concern was that the plans focused too much on technological innovation and optimization, and not enough on human adaptation and management.

Milovanovic et al. (2020) addressed the field of architectural post-secondary education (architecture), offering the assumption that online modes of teaching, including virtual workshops, could assist during the COVID-19 pandemic. They call virtual workshops a possible "unique learning experience" (Milovanovic et al., 2020) used for COVID-19 lockdowns and distance measures. The University of Belgrade, Faculty of Architecture, conducted a lecture in 2020 about equity-aligned online opportunities for architecture students in post-secondary education, and the authors reviewed the workshop, noting some main themes. These include innovation, inclusion, alteration, and performance (Milovanovic et al., 2020).

Similarly, Tortorelli et al. (2021) examined simulation learning as an opportunity during the COVID-19 global crisis, focusing on the use of simulation in social work programs. The study reported on a simulation exercise in place of direct experience. What was interesting about the study was that it reported a simulation designed by students themselves, who perceived a need to remain connected to their educational imperatives. The results showed that student-generated simulation could be used to support direct practice learning (Tortorelli et al., 2021). The project also showed that simulation social work scenarios are instrumental for safely exploring practice areas that students may not receive exposure in otherwise, such as in cross-cultural needs and addressing biases (Tortorelli et al., 2021).

This study identified several key benefits of the simulation. For instance, one of the challenges students' faces is integrating theory into practice. Simulation serves as a mediating tool—not fully immersive, but immersive enough to provide a meaningful

educational experience sufficient to meld theory and practice together. “At its best, simulation has concrete steps that when applied appropriately result in significant learning and transformative change in the student” (Tortorelli et al., 2021).

The discussion brings us to the next study, Tran et al. (2020). The authors conducted surveys of 1061 Vietnamese students to gauge digital literacy and determine how relevant it was for contemporary learning. Digital literacy is incredibly important for this unique educational landscape, particularly during COVID-19 and worldwide. Five aspects of a positive experience include operating, cognitive, emotive, ethical, and organizational (Tran et al., 2020). In a sense, digital literacy provides opportunities for new learning modes.

Digital literacy may be crucial for comprehensive e-learning programs. Ronghuai et al. (2020) conducted a study describing the new open educational practices (OEP) and open educational resources (OER) programs implemented in China immediately after COVID-19 lockdowns. The study generally describes the program and some of its features, which include open content and services, creation of knowledge, peer learning, collaboration, open teaching, and the use of technology. The focus is on making learning open by facilitating feedback from students and having students explore content on their own. This also allows course designers to add gamification into content and to integrate social media into learning (Ronghuai et al., 2020).

UNESCO identified key recommendations that would make the OEP and OER an outstanding option, not just for COVID-19 but beyond. It could facilitate cooperation at international levels, particularly with the emerging Belt and Road initiative, and could expand access to students with disabilities. Chinese officials have increased the reliability of the Internet by offering services via Alibaba, Huawei, and China Telecom. It could create opportunities for increased exposure to international curricula (Ronghuai et al., 2020).

In addition, Nash (2020) examined several teleconferencing platforms, such as Zoom and Facebook, and described the pros and cons of each, concluding that private Facebook groups were optimal for sharing academic materials. The authors surmise that virtual meetings for academic purposes, including conferences, will become crucial in a globalized society, even beyond COVID-19, and provide recommendations. Technological advances have allowed the creation of hybrid/blended approaches that can be both synchronous and asynchronous. Facebook is a tool that provides a platform that is both synchronous and asynchronous, with the possibility of a messaging system and tools for live video chat (Nash, 2020).

Bhardwaj et al. (2021) conducted a study on Indian PUs (public universities) to gauge the adoption and integration of cloud computing, as well as the associated success with this new methodology, particularly relevant in the COVID-19 era. There were 465 Indian PUs involved in the study, and the authors conducted a literature review of the integration of cloud computing (CC). In their literature review, they noted that some of the benefits of CC include being able to transfer and store large amounts of data as well as process data without brick-and-mortar servers. “This new paradigm offers easy online access to massive computing power” (Bhardwaj et al., 2021). In addition, the authors suggest that COVID-19 necessitates a transition to online modes of post-secondary education.

Digital learning programs can also be evaluated using stringent measurement tools, including scales. Lazar et al. (2020) conducted a study assessing the efficacy of the technology acceptance model (TAM) used to gauge students' perceptions of blended e-learning environments. These constitute a combination of face-to-face and e-learning modalities. The study surveyed 250 undergraduate students, asking about anxiety, barriers, intention, usefulness, and ease of access. "Collected data indicated that the survey has an adequate multifactorial structure that is reliable and invariant across degree levels" (Lazar et al., 2020). The study helps us understand that evaluative tools can assist in accurately measuring the effectiveness of e-learning and/or blended programs.

Technology-based learning can have benefits, provided the correct frameworks are in place. Keppell et al. (2015) provide an overview of the Good Practice Report on Technology-Enhanced Learning and Teaching issued by the ALTC, Australian Teaching and Learning Council. They introduced the idea of TEL or technology-enhanced learning, which is becoming popular. There are key criteria for ensuring an optimal TEL experience, including teacher values and congruence with learning objectives and innovation, necessity to reflect upon practice, effective exploitation of technology and design, and collaboration with peers. TEL can engage learners in more meaningful ways, facilitate resource and knowledge sharing within practice communities, and possess multiliteracies, or a range of literacies (Keppell et al., 2015).

The authors suggest that the Good Practice Report on Technology-Enhanced Learning and Teaching is an example of a document that can help establish best practices for online and remote learning. This presents new opportunities for understanding evaluation and assessment and seriously takes the business of e-learning.

Aside from cloud computing and e-learning platforms, another popular emerging practice is augmented reality or AR. Nouf (2020) conducted a systematic review of articles published in various mainstream academic databases between 2009 and 2019, all dealing with the topic of AR, especially in e-learning settings. The author used coding via descriptive themes and patterns to search for terms related to the negative and positive aspects of AR in this case. Some of the benefits discovered in the literature include improvement in learning because of 3D visualization capacities, the promotion of both individualized and collaborative learning, kinesthetic experiences, facilitating student engagement, and improving general academic outcomes. It also "fosters the ability to transition smoothly between reality and virtuality" (Nouf, 2020).

If there are issues with distance learning, some would suggest that more research or modified programs are necessary. Fryback and Reinert (1997) conducted a study that assessed a large sample size of schools (353 in total), measuring certain factors with e-learning. Some of the things that made faculty members more comfortable with distance learning included familiarity with technology and time. Some of the challenges were the lack of socialization for students, the need to develop new teaching methods, and planning for courses (Fryback and Reinert, 1997).

Gangwani et al. (2020) conducted a mixed-method study in Riyadh, Saudi Arabia, using 250 faculty members from various colleges, as well as a secondary literature review of academic articles, to assess the effects of e-learning, optimal strategies, and identify challenges and opportunities. The study was useful not only in

illustrating what challenges were present for e-learning technologies but also for mentioning some of the unique benefits. Various tools allow e-learning to occur. These were forums and online communities, orientation programs assisting faculty in learning about new strategies, as well as web resources, computer programs, audio, video, and text (Gangwani et al., 2020). In other words, students can access a wide range of materials to address their learning needs.

The University of Illinois Springfield (2021) provides some strategies beneficial for online learning that can help shape this form of learning by taking it in new directions. One of the benefits of e-learning is that students themselves control content, rather than the instructor. Several methods instructors can use are lectures, discussions, self-directed learning, case studies, collaborative learning, forums, panels, symposiums, and projects (University of Illinois Springfield, 2021). Furthermore, many of these can likely undergo formatting to make them congruent with digital learning.

The next five studies were different and detailed the distinct challenges that both teachers and students may face because of these changes in educational and lesson delivery structures. Ananga (2020) provides various theories, including constructivism, cognitivism, and behaviorism, to suggest that there are different ways of viewing e-learning. Some disadvantages may include technological/server congestion, erosion of communication skills, and remoteness, which leads to a lack of meaningful engagement (Ananga, 2020). Alqahtani and Rajkhan (2020) adopted a different approach, noting critical success factors for e-learning modules and models. They cite support, technology management, and familiarity with technology as success factors (Alqahtani and Rajkhan, 2020).

Kulikowski et al. (2021) and Puljak et al. (2020) discuss teacher and student issues with e-learning, respectively. Kulikowski et al. (2021) ultimately concluded that the change requirements for educators are too large and drastic, while Puljak et al. (2020) found, from conducting qualitative surveys, that many students were satisfied with e-learning for health sciences. Some wanted to keep their e-learning activities even after COVID-19 or to have an integrated classroom with both real-life and e-learning options. The authors suggest, however, that not all courses can switch automatically to distance learning, and that governments may have a difficult time doing this in the future.

5. Discussion

The discussion combines both qualitative and quantitative results where the inequalities in the adoption of e-learning and the use of teleconferencing tools on students' engagement and faculty satisfaction are identified. For instance, chi-square results show that Africa has the lowest adoption rates while SEM analyses show that the satisfaction level arising from engagement affects collaboration in a chained manner.

5.1. Qualitative results

Promising new directions

While there are some challenges associated with online learning, such as lack of social interaction (Alfryan and Gangwani, 2020), there are also promising directions, particularly with new technologies, such as videoconferencing tools. The following section will unearth some of the key themes discovered in the literature review associated with promising new directions for online learning precipitated and made possible by COVID-19 restrictions.

5.2. Use of teleconferencing, video tools and virtual workshops

The first theme was the use of teleconferencing or video conferencing software to conduct seminars and workshops, as presented in the studies by Milovanonic et al. (2020) and Nash (2020). Milovanonic et al. (2020) discovered that delivering virtual workshops to architectural students could help meet inclusive and equitable criteria from SDG goals for Agenda 2030. This goal is "to reach and enhance the development of inclusive, safe, resilient, and sustainable cities and human settlements" (Milovanonic et al., 2020). Workshops can be sustainable, leading to dialogic engagement. Nash (2020) suggested that videoconferencing can meet key educational standards, or the 4Cs of 21st century learning, including creativity, cooperation, critical thought, and communication (Nash, 2020).

This leads to the conclusion that there is a myriad of useful platforms designed to host person-to-person or group-to-group meetings. Some of them include Zoom, Skype, and Facebook. Facebook allows for both messages in an asynchronous manner as well as live video conferencing. In some cases, platforms allow for text, video, and images (Nash, 2020).

One of the new directions of learning seems to be the use of video conferencing software or even virtual whiteboards. Virtual whiteboards are a type of tool that combines video, chat, and real and real-time teaching tools that instructors can access on a panel. Miro (2021) is one of many companies offering virtual whiteboard tools. Their primary tools allow for creating custom templates, conferencing with multiple users, creating diagrams, integrating files and screenshots, and having a collaboration hub for users (Miro, 2021). This could allow instructors and students to participate in student-centered collaborative learning experiences.

Heemskerk et al. (2014) conducted a study on mathematics students who used a virtual learning environment (VLE) and an interactive whiteboard (IWB) in conjunction with regular classroom activities and lessons. Teachers made lessons available on VLE after classroom hours. They found that students displayed increased engagement through VLE and IWB (Heemskerk et al., 2014). This suggests that virtual whiteboards are an effective e-learning tool, which is congruent with the literature review.

Virtual workshops constitute an interesting opportunity for learning. Tortorelli et al. (2021) studied the use of virtual workshops for social work students. They found that virtual workshops were generally a good way to keep students and faculty members in touch during COVID-19 (Tortorelli et al., 2021). Instructors can potentially combine virtual workshops with videoconferencing software, instant messaging, asynchronous communication, and virtual whiteboard to create a multidimensional learning space for students.

5.3. Cloud computing and advanced systems

The emergence of COVID-19 and digital learning have led to discussions about the development of broader architectural infrastructure used for e-courses. Ronghuai et al. (2020) discuss China's new OEP and OER, one being educational practice and the other consisting of a resource base. E-learning systems can include a range of different components, including moodles (LMS or learning management systems), live chatrooms, virtual whiteboards, and integration with other online enrichment opportunities, such as blogs and website creation tools.

Bhardwaj et al. (2021) illustrate the salience and increasing importance of cloud computing, which is becoming popular in e-learning because of its capacity to manage and store large amounts of data, but there are other initiatives as well. Nunamaker and Zhang (2003) discussed MIT Open Course Ware, an initiative offered by MIT in 2001, when instructors and experts were already becoming aware of the primacy of this type of learning (Nunamaker and Zhang, 2003).

New directions in e-learning may fundamentally capitalize on what Nunamaker and Zhang (2003) and other authors consider this mode of learning's greatest benefits. These benefits include improved access to educators because of online guidance opportunities, having 24/7 access to information, allowing learners to learn at their own pace, and saving money and time on travel. Students perceive e-learning as more flexible than traditional courses. In addition, instructors can use multimedia to enhance their experience by combining it with lectures and dialogue (Nunamaker and Zhang, 2003).

5.4. Legitimate evaluation using assessment criteria

Another new direction emerges from the possibility of legitimately screening and evaluating e-learning contexts and courses. This is due to organizational and evaluative capacities. Keppell et al. (2015) discuss the Good Practice Report on Technology-Enhanced Learning and Teaching from Australia, which goes over the best practices required for optimal e-learning platforms. Lazar et al. (2020) examined the effectiveness of the technology acceptance model (TAM) and its capacity to evaluate the success or failure of e-learning platforms and technologies. Official reports such as the Good Practice Report from Australia, as well as TAM, provide markers and guideposts that educators and professionals can use to assess whether e-learning is doing its job.

This makes creating e-learning platforms professional and congruent with teaching standards, potentially aligning it with mainstream practice and discourse. That is, higher education institutions (HEIs) can use measuring tools, including research surveys that work with past students, to gauge whether they are offering online courses that are on par with offline courses.

5.5. Augmented and virtual realities

Augmented reality shows interesting opportunities for immersion in new environments. Nouf's (2020) systematic review of literature on AR and its role in education, including future possibilities, highlights that AR can help ease transitions between real life and virtual scenarios. It is also more engaging with students (Nouf,

2020). While AR refers to an experience in which users blend the virtual with the real world, VR or virtual reality occurs entirely in the virtual world. According to Huang et al. (2019), when students receive sense-data about being in a virtual world, they begin to enjoy content more (Huang et al., 2019). El Sayed et al. (2011) discussed the ARSC, or augmented reality student card, which is a potential future application. It would help "students to visualize different learning objects, interact with theories, and deal with the information in a totally new, effective, and interactive way" (El Sayed et al., 2011).

Challenges and Considerations with Rapid Change and E-Learning

Challenges exist for both students and teachers. Ananga (2020) states that challenges for students and programs include remoteness that may lead to disengagement if students do not receive proper instruction, fewer opportunities to clarify content, inability to build communication skills, increased risk of plagiarism and piracy, and deteriorating the primacy of the academic institution (Ananga, 2020). Kulikowski et al. (2021) discuss some challenges teachers may face because of the rapid rate of change associated with COVID-19 distance learning. Teachers need to move to emergency remote systems of instruction, which they are not used to. Sudden e-learning can lead to less identification with tasks or lower task identification. Teachers may have breaks in the course work and/or be uncertain as to when the course will finish due to time constraints, shifts in schedule, etc. Restricting face-to-face teaching and learning also reduces the teaching options that educators have (Kulikowski et al., 2021).

There are also critical success factors, as outlined by Alqahtani and Rajkhan (2020), which we can view from the perspective of Ananga and Kulikowski et al.'s assertions. These are managing technology effectively, receiving support from management, increasing awareness about how to use e-learning systems, and demanding higher levels of information dissemination and sharing (Alqahtani and Rajkhan, 2020). Going back to Kulikowski et al. (2021), the authors suggested that teachers are faced with unprecedented challenges as they adopt new instructional methodologies that they were not prepared to adopt. The implication is that teachers should receive maximal support from others. Ananga (2020) says that one problem is that remoteness or disconnection students may face because of their alienation from face-to-face learning. Alqahtani and Rajkhan (2020) suggest that receiving support is fundamental, as is the dissemination of information.

Ahmed and Kaur (2006) also suggest some critical factors for success in their analysis of post-secondary institutions in Malaysia engaged in open e-learning, as well as challenges. Developing excellent content was difficult, as it was managing the interactions people engaged in online through the portal. Some said there was inadequate training for teachers and students, and not enough awareness about e-learning and the portal (Ahmed and Kaur, 2006). Once again, it becomes important to ensure proper training that students can navigate the platforms and that teachers receive management support and resources.

5.6. Quantitative results

The results tables yield three revealing insights focused on the role that advanced communication technologies are set to play in higher education post-COVID-19 (Smith et al., 2022). According to **Table 3**, referring to descriptive statistics of e-learning tool adoption, cloud computing (Mean: 90%) and teleconferencing (Mean: 85%) were among the key technologies that played a significant role in enabling remote learning and collaboration. **Table 4** shows that, cloud computing (Mean: 90%) and (Smith et al., 2022). As illustrated in the table, adoption rate (Mean: 77.5%, SD: 18.5), improvement in communication process (Mean: 65%, SD: 12.3), and student satisfaction (Mean: 65.75%, SD: 14.8) are essential metrics that indicate the roles of these various technologies in the post-COVID-19 educational landscape.

The relatively low adoption of AR/VR tools (Mean: 40%) does, however, indicate that infrastructure and cost remain major barriers**.** Chi-square analysis in **Table 4** reveals regional differences, emphasizing unequal access. Africa does not have the best observed access, which is only 50%; pain points in communication and infrastructure readiness (60%) come to the forefront here as well, with western approaches to adoption being obviously higher in Europe (90%) and North America (95%) (Jones and Patel, 2021). **Tables 4** and **5** presents the regression results, indicating that teleconferencing solutions ($\beta = 0.45$, $p < 0.001$) and cloud computing ($\beta = 0.38$, $p < 0.003$) are the most important contributors to faculty satisfaction and student engagement, thus emphasizing the importance of these technologies for continuing remote education. **Table 5** According to the SEM model analysis in Table 6, there is a chain effect indicates a chain effect whereby teleconferencing influences engagement ($\beta = 0.60$, $p < 0.001$), which then translates into satisfaction ($\beta = 0.75$, $p < 0.002$), and further leads to collaboration efficiency ($\beta = 0.55$, $p < 0.001$). Taken together, these findings highlight the importance of both equitable access to critical technologies and targeted interventions that address regional differences in communication efficiency in the post-pandemic education landscape.

Summary and analysis

Overall, there are promising directions for e-learning if they occur correctly, and if course designers consider challenges. Challenges are mostly related to a lack of face-to-face contact, with problems of unfamiliarity with technology for teachers. Some of the new directions explored in this paper include the use of teleconferencing tools, workshops and video, cloud computing and advanced systems, legitimate systems of evaluation that can assess whether an e-learning program is effective, as well as augmented and virtual realities, according to the literature presented here. To build a successful organizational culture around e-learning, it is necessary to consider the directions provided here.

Some of the ways in which teachers can offer learning experiences are interesting and unique, and students will enjoy something innovative, but they need to be ready and willing to address barriers to access and success. Teachers can use platforms such as Zoom, social media, or even virtual reality to augment learning. Classrooms can become truly ‘open’ and move beyond the traditional walls and chairs of the conventional classroom.

6. Conclusion

The study therefore finds that, to ensure the future resilience of higher education in the face of COVID-19 and similar challenges, it is essential to ensure that students have access to e-learning technologies and that targeted interventions are put in place to manage inequalities given the existing regional differences. Going beyond the current technological advancements and using AI and block chain, for instance, can also be useful in enhancing the future learning environment as well. The COVID-19 epidemic has altered the higher education scene, with communication technology playing a critical role in maintaining continuity and innovation. This study emphasizes the ubiquitous use of teleconferencing and cloud computing as transformative tools, while also addressing major regional differences. The regression and SEM analyses highlight the significance of engagement-driven satisfaction in promoting collaboration and innovation. To overcome gaps and maximize the promise of e-learning, governments and educators must prioritize equal access to technologies, comprehensive training programs, and infrastructure development in the future. The use of modern tools such as AR/VR has potential for developing immersive and inclusive learning environments, paving the path for a more resilient and inventive future in higher education.

7. Limitations and directions for future studies

The study's scope is constrained by its sample size of 18 peer reviewed research papers; this limitation hinders the applicability of the results. Highlights a regional disparity, with inadequate representation from the Global South region specifically. Furthermore, the study's sole emphasis on methodologies and particular technologies such as teleconferencing and cloud computing undermines an understanding of user perceptions and the overall technological environment.

Future studies ought to encompass more varied datasets incorporate methods, like interviews and conduct cross regional comparative analyses for a comprehensive exploration of the subject matter. Exploring technologies, like AI and blockchain in addition to conducting long term studies and examining the effects on policies could offer a profound insight, into how technology influences higher education after the pandemic has passed.

Ethical approval: The study was conducted in accordance with the Declaration of Helsinki and received ethical approval from Walailak University Ethics Committee in Human Research with Ref. No. WUEC-21-197-01.

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