The Impact of Educational Technology on Distance Learning in The Era of Post-Covid-19

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ABSTRACT

E-learning is a type of electronic educational technology that enables online or distance learning to become the norm even before the COVID-19 era. It is a depiction of convergent products, services, and activities that have emerged in the digital media space and are thought to be more efficient at delivering learning and content, resulting in time and cost savings, and having a smaller negative impact on the environment. Based on existing research, the problem area of this study is to understand how technological convergence provides opportunities to promote the convenience of distance learning and its effect on society, as well as the barriers to the idea remaining implemented post-COVID-19. This paper collects data through semi-systematic literature review based on similar theme which are educational technology, distance learning and education during and post COVID-19. The primary objectives of this article are to analyse and discuss the impact of educational technology, as well as to discuss the implications of distance learning, particularly after the world was compelled to embrace it during the COVID-19 lockdown. In summary, it appears that educational technology is growing more interactive, mobile, immersive, and ubiquitous in the second decade of this twenty-first century. The development of digital platforms and tools, the availability of digital content to adult professionals, and self-paced continuous learning appear to be the key components of the learning of the future. Although there are numerous challenges such as infrastructure and internet accessibility that must be addressed, distance learning has a bright future, and e-learning is the most effective tool for achieving it. More research is needed to shed light on educational technology as a product of technological convergence, which are not only about unification and commonality, but also about divergence in various aspects and opportunities.

Keywords: e-learning, distance learning, educational technology, online education during pandemic, post COVID-19

INTRODUCTION

Educational technology or also known as e-learning, along with Moodle and online library database are ones of the many forms of electronic educational technology that have been implemented in most higher education institutions (HEIs). They have become an important part of society today especially when COVID-19 hits the world in 2020 (Schneider & Council, 2021). The definition of educational technology has evolved in response to changes in socio-economic structures, with different evolutionary stages identified: instructional design, message design, simulation, and a focus on learning environments (Bozkurt, 2020). Research within educational technology focuses on technology integration, attitudes towards emerging technologies, and learning environments, with technology serving as a tutor, teaching aid, and learning tool. As an extensive selection of digitization approaches, mechanisms, and delivery techniques, students are now required to have at least

fundamental information technology literacy, a constant Internet accessibility, and a functional electronic device as a tool for a more convenient learning experience. The popularisation of the Internet has brought all these aspects; mainly computing, information and communication technology (ICT), communication networks, and media content into a whole new level of development in educational technology. Hence, e-learning is one of the examples of convergent products, services and activities that have arisen in the digital media space which is believed to be more effective in learning and content delivery, time and cost saving, and cause less environmental impact (Singh et al., 2021).

With the convergence of traditional and new media, the entire process and outcome has changed not only the technology but also its application (Blakeborough, 2014). We have become so reliant on digital media and its devices that keeping up with the rapidly changing technological innovation is essential in order to unlock better opportunities in life that we might have missed if we turned our backs on the digital realm. However, there is a limitation in ensuring that all media consumers can afford or access the luxury of easy Internet access (Tang & Chaw, 2015). Even within the same country, due to geographical conditions and local demographic background, it is not guaranteed that the total population will benefit from such infrastructure. There is a lack of exposure to technology and computer literacy in some low-income countries. This kind of community is often left far behind by more sophisticated higher socioeconomic communities, and the highly advanced technology we are served today will widen the gap between them and us.

Besides addressing consumer accessibility, organizations and institutions must enhance their digital capabilities to keep pace with today's technological demands, especially in the post-COVID-19 era where virtual and distance learning, remote work, and digitalization have become the norm. Research is essential to understand current trends, acceptance, and effectiveness in distance learning (Serrano-Santoyo & Cabrera-Flores, 2014), and this study examines the impact of technological convergence and divergence on educational technology and its implications for distance learning. Through a semi-systematic literature review (SSLR), the study explores key aspects of distance learning and the application of educational technology resulting from digital and technological convergence during and after the COVID-19 pandemic. The SSLR methodology is particularly valuable for investigating complex topics like digital convergence and divergence in educational technology, allowing researchers to identify key themes and gaps in the literature. This SSLR allowed us to conduct research on these topics by answering the following research questions:

- What are the current debates in educational technology and distance learning literature?
- What are the concerns identified in the literature on distance learning and educational technology during and after COVID-19 pandemic?

This research is structured as follows. In Section 2, the research methodology is presented. The review results are summarized in Section 3. In Section 4, the discussion, the limitations of this research, and propositions for further research are provided. Finally, in Section 5, the main conclusions are summarized.

MATERIALS AND METHODS

The first step of the SSLR was the selection of the keywords. The aim for the keywords included was to comprehensively cover the topic and research questions, considering the complexity of consequence of educational technology and the fact that it affects distance learning within the parameters of during and after COVID-19 pandemic. Therefore, the keywords were defined in a broad sense to include other possible factors such as environmental, demographical, social, and economic aspects of educational technology as a product of digital convergence and all areas and activities of distance learning and e-learning and the divergence effects. One significant benefit of employing this interdisciplinary approach is the enhanced understanding of these issues through robust cognitive skills and critical reasoning (Mohamad Noor et al., 2023). The literature was identified from Google Scholars with keyword search string of "educational technology" and "e-learning" and "distance

learning" and additional of "COVID-19" for the second phase. The filter for the year of publication is from 2019 to 2021. To ensure that the literature was accessible, the literature chosen was limited to English only. Since peer-reviewed scientific journal articles were believed to be the most useful, we also focused primarily on them. As a result, the source types for the search were restricted to journals, and the document types to articles, reviews, and conference papers. The process flow is presented in Figure 1 and the result is presented in Figure 2. Ten research papers were chosen for this conference paper based on their relevance to the theme.

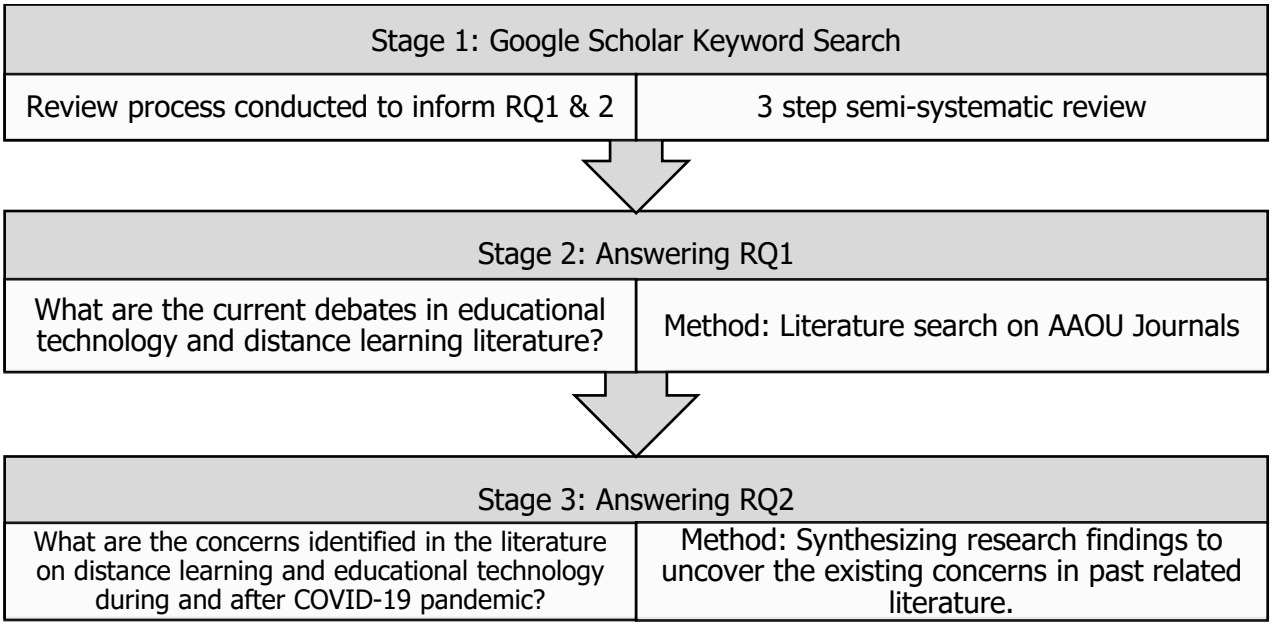

Figure 1 Outlining the semi-systematic three-stage review process

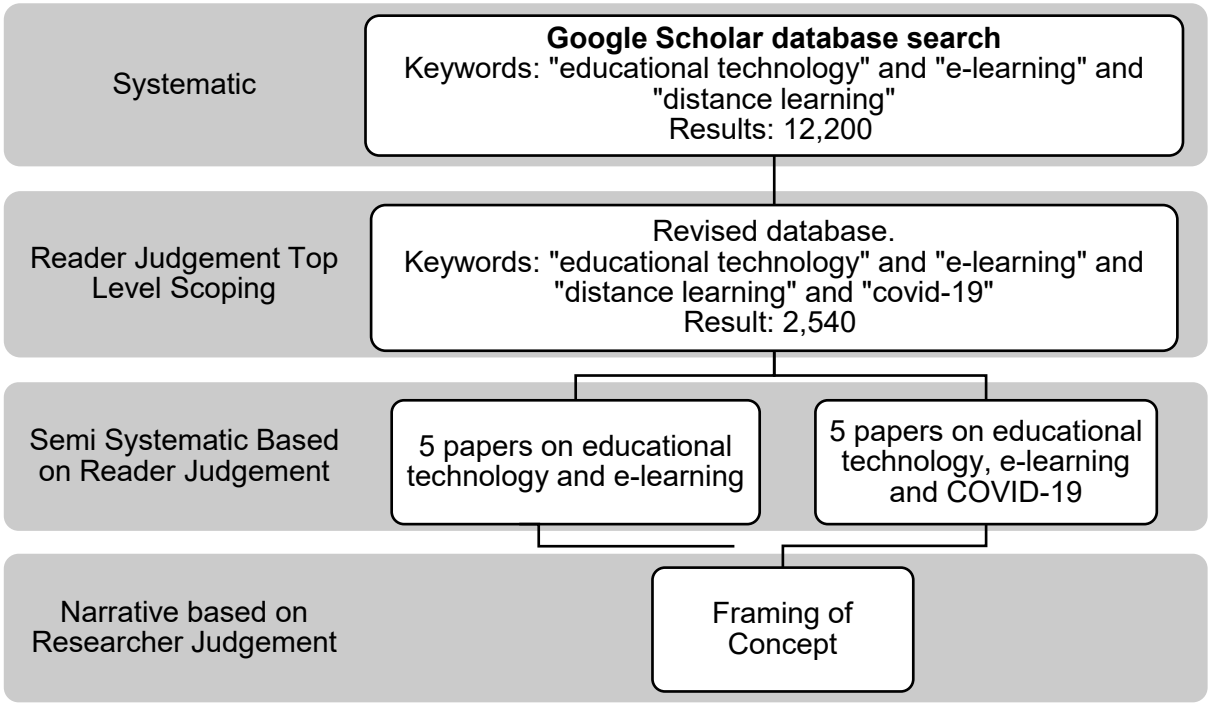

Figure 2 The result of the semi-systematic process.

RESULT

Based on the ten selected relevant research papers that this article has reviewed, the result is presented in the tables that highlight the title of the papers, the authors, the research topic or questions, and lastly the results along with its findings. The first five studies are reviewed to find answers to the first research question pertaining to relevant literature on educational technology and distance learning that can be found when investigating the impact of educational technology, while the other five studies are reviewed to answer the second research question which is to identify the concerns of distance learning and educational technology during and after COVID-19 pandemic.

Educational Technology and Distance Learning

Many scholars presented their models of convergence, which share similarities in presenting concepts such as cooperation, cross-promotion, content sharing, integration, or combination (Vukanovic, 2018). Combinations of components into a prospective common media instrument are brought together as a device because of the purposes that they provide when in use, not because of the technology that has been combined, yet in some cases, the components are the only combination to generate a new device. As a result, these multiplatform that combine features from several media, giving birth to new technological platforms. In the educational technology, e-learning is made possible as a whole different product that offers more convenience and accessibility in education and enable distance learning. Hence, educational technology field are required to continuously redefine their contents for them to continue their presence or availability online to meet the transformation of media consumers' trend. Therefore, we analysed the current relevant literature on the educational technology and distance learning from 2019 to 2022. Table 1 presents five studies that were found with the keyword "educational technology" and "e-learning" and "distance learning".

Table 1 Articles from the educational technology category focusing on distance learning.

Title	Author	Research Topic / Question	Results and Findings
A survey on educational technology in Saudi Arabia.	Abouelnaga et al., 2019	Investigation of the emerging e-learning in Saudi Arabia (KSA); highlighting the usage account of educational technology in this country since the mid-1900s.	Higher education in Saudi Arabia is rapidly expanding due to the use of educational technology that has improved the educational process as well as Internet usage in the country, which is expected to grow rapidly. This also helped Saudi universities climb the global university rankings.
Facilitating student engagement through educational technology: towards a conceptual framework	Bond & Bedenlier, 2019	Establishing a bioecological framework and the microsystemic facets of technology, based on the definition of student engagement.	Advanced educational technology can significantly influence student engagement in the K-12 and higher education classroom.
Educational technology research patterns in the realm of the digital knowledge age	Bozkurt, 2020	A systematic review of educational technology research patterns.	The educational technology field is dominated by three areas, social sciences, computer science, and engineering and it is more advanced in developed countries such as the US and UK.
Technology as infrastructure for change: district leader understandings of 1:1	Lamb & Weiner, 2021	Understanding and approaching technology programs in new and more effective ways.	The embedded 1:1 technology can foster a change in physical, cultural, instructional, and leadership infrastructures and has the

educational technology initiatives and educational change			potential to support changes to teaching and learning across the system.
The nature and building blocks of educational technology research	Valtonen et al., 2022	Analysis of how technology can support learning processes based on different learning theories and understanding of technology-related learning processes that focus on learners' characteristics, especially their learning skills, motivation, and self-efficacy.	Study goals and themes do not change rapidly as a result of new technology alone; more research should focus on the roles of different models built to understand the integration and use of educational technology

These studies yielded similar discussion and conclusions, emphasising the importance of technological advancement in the current educational settings to improve not only students' learning experiences through better students' engagement, but also the quality of the education system, which ultimately increases the rank or reputation of the said universities. It is also essential to remember that, even if technology is seen as a crucial aspect in progressing education, it should not be considered a replacement for in-person training (Abouelnaga et al., 2019). Nevertheless, technology should be viewed as a means of achieving the desired learning outcomes, with educational technology usage intended to improve learning environments and students as a vital component in the teaching and learning processes. The definition of student engagement is also influenced by a range of internal and external factors (Bond & Bedenlier, 2019). Understanding the range of influences on student engagement is also helpful in focusing on how certain factors such as cognitive engagement, critical thinking, and learning from peers, affect engagement. Students are more likely to participate in the learning when they feel empowered in their learning community, which will then reflect in the activities and learning environment through their energy, effort, and engagement.

Decision-makers represented by district leaders in one of the literature have identified technology as a mechanism of systemic change embedded in the physical, cultural, instructional, and leadership infrastructures that adopted the 1:1 programme approach to educational change (Lamb & Weiner, 2021). This programme refers to the concept of schools providing every student with their own computing device for learning purpose. The use of 1:1 device led to changes in the instructional infrastructure as district leaders pushed instructors to modify their curricula and teaching methods, boost student support, and alter their roles in the classroom. For instance, new chances for communication and collaboration increased as district leaders improved the cultural and educational infrastructure by strengthening their wireless networks, and teacher-student interactions and the curriculum also underwent changes. However, this approach also transformed teachers' responsibilities from being information providers to facilitators, making adults become guides who assist students in understanding and applying new information rather than information providers. The role of a teacher is considerably diminished by students having easy access to the Internet and information through their devices.

One of the literature also presents a review on past research and concluded that most of the educational technology studies emphasise learning processes, be it face-to-face or online learning; the users' readiness in integrating technology into teaching and learning, which particularly focuses on teachers; the users' skills in using technology, which comprises of self-efficacy, motivation, engagement; and finally, the instructional design and approach based on the commonly used learning taxonomies (Valtonen et al., 2022). However, the field of educational technology also has grown enormously where the tone and discourse surrounding educational technology have changed from earlier times of e-learning , and then to m-learning (mobile learning), and now u-learning (ubiquitous learning), where recent concerns have shifted from technology ontology and ongoing efforts to demonstrate the efficacy of educational technology to ethical and equity concerns (Bozkurt, 2020).

Educational Technology During Covid-19

Due to the current COVID-19 pandemic, educational technology is now more crucial than ever because everyone must adapt to a virtual environment in both professional and educational settings. Critical societal functions and services may be significantly impacted by these sudden and unplanned changes where people had to work and study from home after COVID-19 and were placed in quarantines (Bergdahl & Nouri, 2021). The news was regularly reporting on the occurrences, informing about deaths, imposing limitations, and restricting civil rights, which also might have increased the scarcity of food and supplies (Abuhammad, 2020). Governments in many countries therefore resorted to declare that the compulsory education should make a shift into distance education as a result of school closures to stop the spread of this epidemic disease. The mandate for transitions into distance learning have shown that schools interpret the new conditions in a variety of ways, indicating that officials need to prepare for transitions and communicate guidelines clearly. Therefore, the following Table 2 presents five studies that were found with the keyword "educational technology" and "e-learning" and "distance learning" and "COVID-19". They are selected based on the relevance of the findings to suit the theme.

Table 2 Articles from the educational technology category focusing on COVID-19 pandemic

Title	Author	Research Topic / Question	Results and Findings
COVID-19 and Crisis-Prompted Distance Education in Sweden	Bergdahl & Nouri, 2021	Exploration on the transition from traditional teaching into distance teaching in Swedish schools enforced by COVID-19.	The school preparedness was mainly related to technical aspects, and that teachers lack pedagogical strategies needed in the emerging learning landscape of distance education. There are many challenges faced during the transition which should be improved in future in order to ensure continuity of distance education.
The transformation of education during the corona pandemic: exploring the perspective of the private university students in Bangladesh	Shahriar et al., 2021	Exploration on the practice of online-based distance learning in private universities of Bangladesh and the challenges associated with it.	Common symptoms of underdeveloped nations, such as inadequate technological infrastructure development, device or internet accessibility restrictions, and budgetary challenges, might sabotage the cohesion of the online learning experience. A great deal of tension and psychological stagnation have been brought on by the lack of computer literacy in both the teachers and the students.
Problems faced in distance education during Covid-19 Pandemic	Gül Özüdoğru, 2021	Investigation on the problems faced by pre-service teachers in the distance education process, which has been implemented during the Covid-19 pandemic.	The main problems faced by the pre-service teachers includes the lack of time spared for live courses regarding "implementation"; failure of establishing communication with friends regarding "student"; absence of internet regarding "impossibility", sound problems regarding "technical" and lack of communication regarding "instructor".

Title	Author	Research Topic / Question	Results and Findings
Enablers of technology agility in higher education	Menon & Suresh, 2022	Identifying and encapsulating the enablers in facilitating technology integration in higher education and understanding the interplay between technology agility enablers.	The COVID-19 pandemic has catalysed the diffusion of technology across the education sector in India, with eight technology agility enablers identified as the most significant enablers, particularly government initiatives and institutional commitment as enablers that can promote technology agility in higher education.
Barriers to distance learning during the COVID-19 outbreak: A qualitative review from parents' perspective	Abuhammad, 2020	Exploring the perceptions of parents regarding the challenges of distance learning faced by their children during the coronavirus outbreak in Jordan	There are four underlying themes; personal barriers, technical barriers, logistical barriers, and financial barriers. Parents daily routine are affected in order to help school in teaching students where there are challenges in assisting their children with distance learning during the pandemic.

These five studies do not share similar research objective, and therefore the findings are diversified. However, the common conclusion is set on the technical difficulties to adapt to the sudden change for virtual learning and classroom in such an abrupt manner due to the pandemic. Learning becomes increasingly complex as a result of the transition from the physical classroom to synchronous and asynchronous interactions across platforms, while social distancing and social isolation through digital technologies generates negative effects on general well-being regardless of age and context (Bergdahl & Nouri, 2021). Lack of time set aside for live classes and homework, an excessive workload from homework, a lack of implementation for major area courses, an unclear evaluation system, restricted access to registered courses, and lower interaction are among the issues with the implementation of distance education (ÖZÜDOĞRU, 2021).

While synchronous and asynchronous teaching should balance individual work with synchronous peer-peer or peer-teacher interaction, some educators go so far as to suggest that students should follow previously communicated instructions and that a minimum amount of time should be set aside for interaction (Bergdahl & Nouri, 2021). Not only teachers, students also reportedly encountered technical issues such as compatibility issues and browser crashes during online classes because they are unfamiliar with technology and online class procedures, which is confusing and inconvenient, especially when different classes require different software and Web portals (Shahriar et al., 2021). Students are also having problems communicating with friends and concentrating, not feeling the classroom environment, being unfamiliar to the system, lacking information, abilities, and attitudes, and feeling the urge to socialise while remaining passive.

The parents of the students were also affected when trying to help prepare their children for online and virtual learning with the challenges of lack of training and support, lack of technical expertise, inadequate communication with professionals and lack of qualifications (Abuhammad, 2020). These are regarded as personal barriers where they feel would affect the standard and quality of their children's distance learning experience. Some parents also raised the concern of logistic barriers and claimed that the introduction of distance learning was not fair as their children were not prepared to use distance learning as the main medium of education learning, and that their children lacked computer proficiency (Abuhammad, 2020). The financial barriers also existed where some parents could not afford compatible technological devices to meet the school requirements for distance learning. The requirement for the internet is also troublesome as it is not free and data usage is not unlimited.

This is where the crucial enablers, which are government policies and initiatives, and institutional commitment, should be rolled out and employed to facilitate the integration of technology into the education system, especially in HEIs, particularly during the COVID-19 pandemic (Menon & Suresh, 2022). These enablers are also essential for triggering the low driving force enablers, which include Gen Z learners with high dependence power and educators' beliefs and skills. At the institutional level, management must develop policies and procedures that support a common understanding of how to integrate technology and should give faculty members the time they need to develop their ICT skills, incorporate new information into their lessons, and meet predetermined objectives. The technical preparedness in terms of not only infrastructure, but the most important thing is human capital, and thus investment of both money and energy should be focused more.

Based on the findings from these past studies, it is apparent that educational technology is growing even before the COVID-19 era, and the momentum of the emergence of this technology somewhat helps the world adapt to distance learning when the pandemic hits the world in 2020 (Khuong, 2022). The advancement of technology, especially in the digital convergence and divergence perspective where various technological tools are produced and utilised in various sectors, has enabled educational technology to become more interactive, mobile, immersive, and ubiquitous. The advancement of digital platforms and tools in education, such as Moodle, Learning Management System (LMS), e-learning, and even Google products such as Google Classroom and Jamboard, has benefited not only young students but also adult professionals who enrol in part-time studies. These platforms and tools offer the availability of digital content to them and assist their self-paced continuous learning.

However, there is a growing concern that the literature shares, and that is the technology preparedness by the instructors or teachers, institutions or universities, and the learners. The lack of digital and technological skills by the teachers and their reluctance of practicing the online distance learning hinders the smooth implementation of this distance learning and virtual classroom. It affects the effectiveness of educational technology and the quality of education received by the students virtually. This also contributes to the sociocultural pressures that influence user identity and interaction within unfamiliar learning communities in digital language education (Bond & Bedenlier, 2019). If students find the use of instructional technology to be meaningful and applicable in their lives, it allows them to act without pressure. It is thus important to give students the chance to take an active role in their learning, activity, and technology selection, as well as through collaborative activities, which can only be achieved if the teachers as instructors are more technically skilled and tech savvy to teach and pass the skills to the students.

Apart from this, insufficient technological infrastructure growth, device or internet accessibility limitations, and economic challenges have also adversely affected the consistency of the online learning experience(Quyen, 2022). This concern allows the growth of the never-ending problem in the digital world called the digital divide. A digital divide is one of the convergences of undesirable products that describes a gap between two communities based on their accessibility to information and communication technology and their ICT literacy. Those who have ready access to information and communication technologies are mostly represented by higher socioeconomic communities in developing or developed countries, while those who do not have the access or skills to use those same technologies within a geographic area, society, or community are those with lower socioeconomic status or living in lower income countries.

According to some communication researchers, the Internet accentuates social inequality, which has resulted in social structural division (Bozkurt, 2020; Park, 2017). The focus of the digital divide is not on the physical accessibility of the Internet connection but rather on the ability and creativity of the Internet connection. The ability to adapt to changes in educational technology in the learning and teaching environment as well as in the workplace is a skill that employers, instructors, and even teachers must possess. In order to manage information effectively, new skills, new channels for information communication, and great innovative categories that take advantage of these growing information structures are all needed. Remarkably, it was found that the COVID-19 epidemic was the most important enabler in changing the educational landscape, aiding in the establishment of a new

paradigm and accelerating the adoption of technology in higher education (Menon & Suresh, 2022). This prompted policymakers and educational institutions to review and revise their policies and procedures, which in turn led to the utilization of educational technology in higher education operations.

The digital gap should be addressed efficiently by the government and the community itself by using the top-down and bottom-up approaches respectively. By providing telecommunication infrastructure and identifying other factors that contribute to the digital divide in terms of demographics, age, gender, and other factors, the issue can be addressed (Bond & Bedenlier, 2019; Khuong, 2022; Shahriar et al., 2021). The effect is not only based on socioeconomic background but also based on varied mindsets and generations. Teachers and instructors from older generations tend to be digitally illiterate or refuse to learn and adapt to technological devices in education, intentionally digging the gap in the digital divide in educational technology. These marginalised groups are not just passing up a major opportunity for the accommodation, access to data, and rate of correspondence managed by advanced innovations; they are likewise passing up a major opportunity for the open doors that accompany them.

Another limitation for this educational technology is its guaranteed accessibility and implementation globally or nationally. The sophisticated network communication infrastructure that transmits the 5G LTE networks is usually not available nationwide in most countries. They are mostly focused on higher socioeconomic cities with demographics that can afford such service. The other concern is the affordability of this technology in lower socioeconomic communities. The challenge now is the convergence of networks initiated by the above discussion and the expansion of the concept of "electronic information superhighway", signifying a broadband-switched network infrastructure, but if it does not reach to all communities, there will be a social gap dividing humans instead of connecting them and bringing them closer.

CONCLUSION

Technological convergence has turn into an imperative component of life for most individuals these days. Due to interoperability and convergence with other media, they have enabled the educational platforms and tools we have today to combines content, provides variety of choices, and promotes social collectivity. Interoperability, the term used to explain compatibility between different devices running on different operating system; is what encourages even more connectivity and involvement in terms of social, education, work, and business. In empowering the employment of distance learning as an educational technological tool, the main actors of education, such as teachers, lecturers, and instructors, apparently are not allowed to lack any foundational skill in pandemics and school responses. Teachers and decision-makers cannot wait until the outbreak is over to make decisions as it is important for the educational sector to develop contingency plans to ensure safe and functional schooling in times of crisis. Information must be released in a timely manner in order to be effective. Digital divide should also be addressed in making sure educational technology and distance learning are reachable and beneficial to all walks of life.

Although physical access to online and distance education is inherently unequal between users throughout dissemination, it is essential that everyone in society have an equal chance to access it and benefit from it. The basic tenet is that individuals who do not integrate with educational technology may live in situations that are more unbalanced due to a lack of physical access as well as socioeconomic inequities. Despite the growing potential and advantages of online education access, digitally disengaged communities have a higher propensity to be isolated. In other words, those who cannot afford to use Internet-enabled technological tools cannot benefit from online resources and, as a result, are marginalised in society.

This semi-systematic review paper has several limitations. The review is based on ten past studies; therefore, the number of concerns or issues pertaining to the keywords and theme of educational technology, distance learning, and COVID-19 pandemics might be more than what is

found and discussed in this review. The literature also does not categorise the studies by geographical location to identify varied issues in different socioeconomic settings. Additional relevant literature should be reviewed in order to identify the alarming concerns about educational technology and distance learning that might hamper the rise of this positive and advantageous technology. The data collection was also limited to the selected literature and thus might not represent a larger group of users and practitioners in the educational technology and distance learning industry. Yet, the literature is diversified in terms of its research objectives and topics, so the review helps to synthesise the common shared research issues and gaps in this field. The optimization of this convergent technology depends highly on the researchers and scholars who scrutinise the application, the implementation, the impacts, and the advancement of educational technological platforms and tools that can enhance online and distance learning or ubiquitous learning (u-learning).

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