Airo International Journal
Peer-Reviewed
Multidisciplinary

ISSN: 2320-3714
Volume:2 Issue:2
May 2026
Impact Factor:11.9
Subject: Journalism, Mass Communication, Media Studies

DIGITAL TRANSFORMATION IN HIGHER EDUCATION: A REVIEW OF ONLINE LEARNING SYSTEMS, LEARNER ENGAGEMENT, AND INSTITUTIONAL READINESS

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ABSTRACT

The use of ICT, online learning systems, blended learning and digital educational platforms has dramatically altered Higher Education. Coronavirus (COVID-19) pandemic has increased the adoption of e-learning technologies and virtual education across the globe. This review investigates the learner engagement, the readiness of the institutions and the online learning systems in higher education institutions. Major problems that the study found are digital divide, lack of ICT infrastructure, lack of internet connection, lack of digital literacy, lack of engagement of learners, technological barriers, and lack of training of faculty. It also underscores the importance of government initiatives such as SWAYAM, DIKSHA, NPTEL and E-Pathshala in the field of digital education in India. The review proposes a set of solutions such as the improvement of ICT infrastructure, faculty development, the blending of learning approaches, interactive teaching methods and the use of Artificial Intelligence (AI) to improve the learning experience. The results show that while digital transformation has contributed to educational accessibility and flexibility, there is a need for institutional support, technology readiness, and learner-centered educational practices to ensure digital transformation is implemented successfully.

Keywords: *Digital transformation, Higher education, E-learning, Online learning systems, Learner engagement.*

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ISSN: 2320-3714
Volume:2 Issue:2
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1. INTRODUCTION

This is because digital transformation in higher education has emerged as a key trend with the rapid growth of Information and Communication Technology (ICT), internet connectivity, AI and digital learning systems (Singh et al., 2021). Digital technologies are increasingly used across all levels of education, ranging from the classroom to administration, with the aim of making education more accessible, flexible, efficient and engaging for learners worldwide (Van Cappelle et al., 2021). Traditional classroom education has been transformed and adapted to become technology-based through the use of e-learning systems, virtual classrooms, blended learning, Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs) (Khan & Viswanathan, 2023).

This pandemic has greatly contributed to the growth of the online learning system since universities and colleges have rapidly moved from classroom teaching to online platforms like Zoom, Google Meet, Microsoft Teams, Moodle, etc. The emergence of initiatives like SWAYAM, DIKSHA, NPTEL, E-Pathshala, and SWAYAM Prabha by the government of India further bolstered the expansion of digital learning and e-education in the country.

The digital transformation has brought a number of advantages, including flexible teaching environments, education tailored to the individual, broader access to educational materials, and better teacher-student communication. The integration of emerging technologies such as Artificial Intelligence (AI), adaptive learning systems, and blended learning models is also improving the quality of education and engagement of learners.

However, there are various issues that are still hindering the success of online learning such as insufficient ICT infrastructure, weak Internet connection, digital divide, lack of digital literacy, insufficient training of faculty, lack of engagement of learners, and technological barriers. There are significant challenges to accessing digital learning resources for students from less privileged and rural backgrounds. Thus, the current review paper examines online learning systems, student engagement, institutional preparedness, discussing the key challenges, solutions, and future trends of the digital transformation of higher education.

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Multidisciplinary

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Volume:2 Issue:2
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1.1 Background of Digital Transformation in Education

The term "digital transformation in education" is used to describe how digital technology is being utilized in the fields of teaching, learning, assessment, and academic administration. The introduction of Information and Communication Technology (ICT), internet connectivity, Cloud computing and mobile technology has transformed the learning environment from a traditional classroom to a technology-based learning environment. Digital platforms are gaining traction on the higher-education stage globally to enhance access to education, flexibility, engagement with learning, and the sharing of knowledge (Kundu & Bej, 2021).

Figure 1: Digital Transformation in Education (Chahal & Rani, 2022)

In the past, higher education teaching was primarily based on classroom teaching and teacher-centered teaching methods. But the advent of digital technologies has revolutionized education into more interactive, learner centered and flexible learning models. The notions of e-learning, online learning systems, blended learning, virtual classrooms, Learning Management Systems (LMS), and Massive Open Online Courses (MOOCs) are all playing significant roles in today's higher education. The technologies provide opportunities for students to learn from educational resources whenever and wherever they want with the encouragement of self-directed learning and learning in groups.

In the world, universities have invested massively in digital infrastructure and learning technologies, with the aim of modernizing the teaching-learning model. The use of ICT has

ISSN: 2320-3714
Volume:2 Issue:2
May 2026
Impact Factor:11.9
Subject: Journalism, Mass Communication, Media Studies

made interacting with the teacher easier, made digital content delivery easier, and provided access to educational resources from around the world. Innovative teaching and learning practices have been enabled by technologies like video conferencing tools, online assessment systems and cloud-based learning platforms.

The penetration of the internet and the use of smart phones in India along with the government initiatives like SWAYAM, NPTEL, DIKSHA, E-Pathshala and SWAYAM Prabha, have driven this digital transformation in the field of higher education. The programs seek to enhance accessibility, quality, and digital inclusion in education in urban and rural areas. MOOCs and blended learning models have further reinforced the concept of online learning in the country. Despite these developments, there are challenges to digital transformation, particularly in developing countries such as India. There are still problems related to the effectiveness of online learning systems, including insufficient infrastructure of ICT, lack of internet connectivity, limited digital literacy, lack of teachers' training, and socioeconomic inequalities. Urban-rural gap in access to educational opportunities is a key challenge for breaking the digital divide among learners.

1.2 Impact of COVID-19 on Higher Education

The COVID-19 pandemic introduced significant disruption in higher education globally and has pushed digital learning systems into the fast lane. The COVID-19 lockdown and the closure of educational institutions illustrated the need for quick adaptation to online learning platforms, while the universities and colleges moved from classroom-based learning (Vanitha & Alathur, 2021). The universities and colleges had to rapidly pivot into online learning tools following the lockdown and closure of institutions. A large number of students across the country of India, and indeed the world, were impacted. In the pandemic, online learning took the place of regular classrooms, to the extent that the platforms Zoom, Google Meet, Microsoft Teams, and Learning Management Systems (LMS) became the main platforms for online teaching. The Government initiatives such as SWAYAM, DIKSHA, NPTEL and E-Pathshala helped in ensuring continuity in education by providing digital learning resources and online content.

Digital transformation in higher education was an important driver of the pandemic, as it pushed higher education institutions, teachers, and students to look at online teaching-learning

ISSN: 2320-3714
Volume:2 Issue:2
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Impact Factor:11.9
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practices. It also revealed some of the problems, including poor Internet connectivity, absence of digital devices, low technological skills and digital divide, poor learner engagement, and insufficient institutional readiness. Some students also faced problems such as fatigue from the screen, stress, limited interaction and challenges to practical learning. Notwithstanding this obstacle, the COVID-19 event has helped drive long-term trends in higher education, such as the investment in digital infrastructure, integration in ICTs, blended learning and online education systems. As the pandemic underscored, technological readiness, institutional resilience, and flexible learning settings are vital components of present-day higher education.

1.3 Objectives of the Review

- To review the evolution and adoption of online learning systems in higher education.
- To analyze factors affecting learner engagement and e-learning effectiveness.
- To examine institutional readiness for digital transformation.
- To identify challenges and opportunities associated with online education.
- To suggest future directions for sustainable digital higher education systems.

1.4 Research Problems

The studies reviewed have highlighted a series of major problems that have arisen with respect to digital transformation and online education in higher education. The digital divide, poor internet connectivity, no digital devices and access to online education due to socioeconomic inequalities were key issues. In addition, many institutions were not well equipped with ICT infrastructure, trained faculty staff, and effective digital education policies, which in turn impacted their capacity to engage in online teaching. The issue of learner Engagement was a significant concern resulting from the lessened interaction, low levels of motivation, difficulty to focus and concentrate, and less collaborative learning.

Lack of digital literacy and challenges in navigating online platforms further stunted learning effectiveness, as did technological barriers. Furthermore, online assessment systems were also plagued with monitoring problems, technical faults and cheating. The practical training in medical education and engineering education also faced challenges in online practical

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education. In addition, extended screen time resulted in health and psychological issues such as stress, fatigue, anxiety and eyestrain.

1.5 Solutions Found

The analyzed studies suggested a number of solutions to enhance digital transformation and the efficiency of online learning systems in HEL. The establishment of robust ICT infrastructure including the expansion of internet connectivity, availability of cheap digital devices and online learning platforms, particularly for those in rural and economically disadvantaged areas was one of the key solutions called for. Institutions were invited to support their digital readiness through investments in technology-enabled learning environments, developing an online education policy, and introducing Learning Management Systems (LMS). Staff development and e-skills enhancement were also highlighted as effective solutions towards effective online teaching.

The research emphasized the importance of on-going professional development programs that will enable teachers to enhance their digital pedagogy, virtual classroom management, content development, and online assessment methods. In the same way, enhancing students' digital literacy and technological adaptability was deemed necessary to support their successful online learning. The literature reviewed indicated that the application of interactive teaching methods, collaborative learning activities, discussion forums, the use of multimedia and blended learning (combination of online and traditional learning in classroom) can be used to enhance learner engagement.

It was also suggested that personalised learning systems, frequent feedback mechanisms and student-centred learning methodologies could be used to enhance student participation and motivation. The importance of the initiatives of the government like SWAYAM, DIKSHA, NPTEL, E-Pathshala and SWAYAM Prabha in the context of accessibility and affordability of digital education in India was highlighted in a number of studies. The use of secure online assessment platforms, AI-driven monitoring systems and regular assessments were also recommended to boost transparency and reliability in virtual exams.

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2. DIGITAL DIVIDE AND ACCESSIBILITY ISSUES

Rapid development of E-learning has spurred flexibility and accessibility in Education but also raised significant digital divide and accessibility concerns in Higher Education (Singh et al., 2021). The issue of access to the Internet is one of the biggest problems, as many students, especially those in rural or remote areas, lack stable and high-speed internet connections to enable them to attend online classes, participate in video conferences or complete online assignments. The urban–rural divide also makes this gap even wider, as students in urban areas are better equipped with technological facilities, greater connectivity, and more convenient access to digital services than those in rural areas.

The other is availability of the device. There are many learners who do not have access to their own laptop, tablet or smartphone that is appropriate for online learning and must share them with a family member or use their own older technology. The quality of participation is also impacted by bandwidth constraints and regular disconnections, which may interrupt lectures, make it challenging to access study materials, and limit the amount of interaction with teachers and classmates. These issues became more pronounced during the Covid-19 Pandemic when learners relied completely on online educational platforms to ensure continuity of learning (Kundu & Bej, 2021).

The socioeconomic disparities play a significant role in digital participation. Economically disadvantaged students may have difficulties with Internet data plans, digital devices, Internet software subscriptions, and electricity bills. This consequently results in lower participation, engagement and stress of many marginalised learners in school. Poor infrastructure, such as weak telecommunications systems, constrained institutional support and absence of digital learning facilities exacerbates accessibility issues further. The above issues identify the need for the advancement of technologies and inclusive policies, and accessibility to the technology and infrastructure improvements to provide equal educational opportunities for all learners in the implementation of successful e-learning.

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3. LEARNER ENGAGEMENT CHALLENGES

Maintaining learner engagement in e-learning virtual environments is one of the major challenges of E-learning in the Higher Education sector. However, online learning can limit interactions between students and instructors, which can lead to communication gaps that can diminish participation, collaboration, and learning involvement from the instructor (Das & Bhattacharyya, 2023). For many students, learning is passive, in the sense that they hear lectures or listen to or read digital information, but have little opportunity for discussion, hands-on activity, or meaningful interaction with peers. Such disengagement may have a negative impact on comprehension, motivation and achievement.

Other issues in online education that frequently occur are motivation and attention issues. Many students are distracted at home, are experiencing screen fatigue, and/or have trouble focusing over extended virtual classes. There is low participation in discussions online, low attendance and limited joint activity. The lack of in-person interaction can also result in a sense of isolation and disconnection, especially for students needing frequent academic monitoring and socialization.

Finally, another significant issue is the lack of opportunities for collaborative and practical learning. Laboratory courses, field training courses, demonstration courses, or group work courses are not easily and effectively represented in virtual environments. Confidence and satisfaction of learners can be undermined by gaps between teacher and student, by a lack of feedback, and by less academic support. Moreover, extended online learning can also cause emotional and psychological issues like stress, anxiety, digital fatigue, and loss of motivation. The problems suggest that in the e-learning environment, interactive pedagogy, cooperative learning activities, active communication and emotional support systems for learners are needed to improve the level of engagement.

4. TECHNOLOGICAL READINESS PROBLEMS

One of the key technological readiness challenges identified was how effective digital transformation and online learning systems can be in higher education. The reviewed studies showed that the students and faculty members were poorly equipped with digital literacy and

ISSN: 2320-3714
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Impact Factor:11.9
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technical skills which were essential for the successful implementation of online education (Nimavat et al., 2021). Poor awareness of computer applications, online learning materials, virtual classroom and digital communication systems posed challenges to the smoothness of teaching-learning processes. The students from disadvantaged socio-economic and rural backgrounds were more challenged as they had low exposure to digital technologies and little experience with e-learning systems.

Many institutions did not have adequate technical support systems to enable students and teachers to support during online learning. Many technical problems like software issues, login issues, connectivity issues, platform outages, and IT support issues adversely impacted the quality of online education. There were frequent challenges faced by the faculty in managing virtual classrooms, developing digital learning materials, conducting online assessment and effective use of Learning Management Systems (LMS). These challenges were compounded by the rapid shift to online learning due to the COVID-19 pandemic, as many teachers were not fully equipped to teach in a virtual classroom (Jarial et al., 2025).

Table 1: Technological Readiness Problems in Higher Education (Turnbull et al., 2021)

Technological Readiness Issues	**Description**	**Impact on Online Learning**
Limited Digital Literacy	Lack of knowledge regarding digital tools and online platforms	Reduced participation and learning efficiency
Inadequate Technical Skills	Difficulty in operating software and virtual classroom tools	Problems in teaching-learning processes
Lack of Technical Support Systems	Insufficient IT assistance and troubleshooting facilities	Frequent disruptions during online classes
Adaptation Difficulties	Challenges in using Zoom, Moodle, Google Meet, and LMS platforms	Reduced confidence and engagement
Resistance to Technological Change	Preference for traditional classroom teaching methods	Slow adoption of digital learning systems

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Poor Connectivity and Platform Issues	Internet failure, software glitches, and login problems	Interrupted learning continuity
Faculty Training Deficiencies	Lack of training in digital pedagogy and online assessments	Reduced effectiveness of online teaching
Low Self-Efficacy	Lack of confidence in using digital technologies	Lower learner motivation and participation

Challenges to adapt with e-learning platforms were also another major concern that was found in the literature reviewed (El-Sabagh, 2021). Learners and teachers faced difficulties in comprehension and utilization of digital learning applications like Zoom, Google Meet, Microsoft Teams, Moodle and other online tools for learning. The lack of familiarity with virtual teaching methods decreased confidence and participation, and had a negative impact on the effectiveness of learning. Some faculty members and students also expressed their resistance to technological changes in education and wished to return to the traditional teaching and learning methods rather than digital education systems to be able to express this, some studies were conducted (Zakir et al., 2025).

- **Digital Literacy Gaps**

The lack of digital literacy became one of the major problems in the effectiveness of online learning systems in higher education. Based on the reviewed studies presented it was concluded that the technical knowledge and ICT skills of many of the students and faculty members were not sufficient for successful participation in digital learning environments. Insufficient awareness of computer applications, e-learning platforms, digital communication devices and virtual classroom systems posed challenges in accessing and effectively utilizing online educational resources. The students from rural and economically weaker classes had more difficulties due to their lesser exposure to digital technologies and inadequate prior experience with e-learning systems (Karabatak et al., 2026). The impact of poor digital literacy was on the participation, confidence, adaptability and academic performance of learners in the online education (Bashir & Lapshun, 2025).

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- **Faculty Competency Issues**

The other significant concern indicated by the studies reviewed was that of faculty competency. Lack of training on digital pedagogy, online teaching methods, online classroom management and online assessment methods (Holm, 2025). When forced to move from classroom instruction to online learning during COVID-19, faculty members faced challenges that were not anticipated in the switch to online learning. Teachers faced challenges such as developing online teaching materials, teaching interactively online, maintaining students' attention with online teaching, and implementing traditional teaching methods in online situations. Lack of professional development and institutional support also hindered faculty readiness for effective digital teaching (Aslan, 2021).

- **Technology Acceptance Barriers**

In higher education, other important barriers to the adoption and effectiveness of online learning systems were technology acceptance issues. Some of the reviewed studies found that students and teachers were resistant to digital learning and were more interested in the traditional face-to-face learning approach than in the virtual approach. Students found online learning tools to be more complex, challenging, and less effective than the traditional classroom experience. Low self-efficacy and low confidence in dealing with digital technologies also contributed to the decrease in participation and engagement in online learning activities. The lack of motivation to use the new technology, technological failures, and lack of familiarity with the online education systems prevented the acceptance and successful implementation of digital learning in higher education institutions.

5. CONCEPT OF ONLINE LEARNING SYSTEMS

Online learning systems are any educational technologies that enable the use of the internet to support learning, teaching, communication, assessment, and academic interaction. These systems allow students and teachers to engage in educational activities remotely, without the constraints of physical classrooms. The use of online learning systems has emerged as an essential part of higher education today due to their flexibility, accessibility and the opportunities for lifelong learning they offer (Rajabalee & Santally, 2021).

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There are different types of online learning including e-learning, virtual learning, blended learning, hybrid learning, and mobile learning. It leverages digital platforms like Learning Management Systems (LMS), video conferencing software, MOOCs, digital repositories, and cloud-based educational solutions to provide educational material and engagement. The platforms such as Zoom, Google Meet, Microsoft Teams, Moodle, Coursera and SWAYAM are used widely for online teaching & learning.

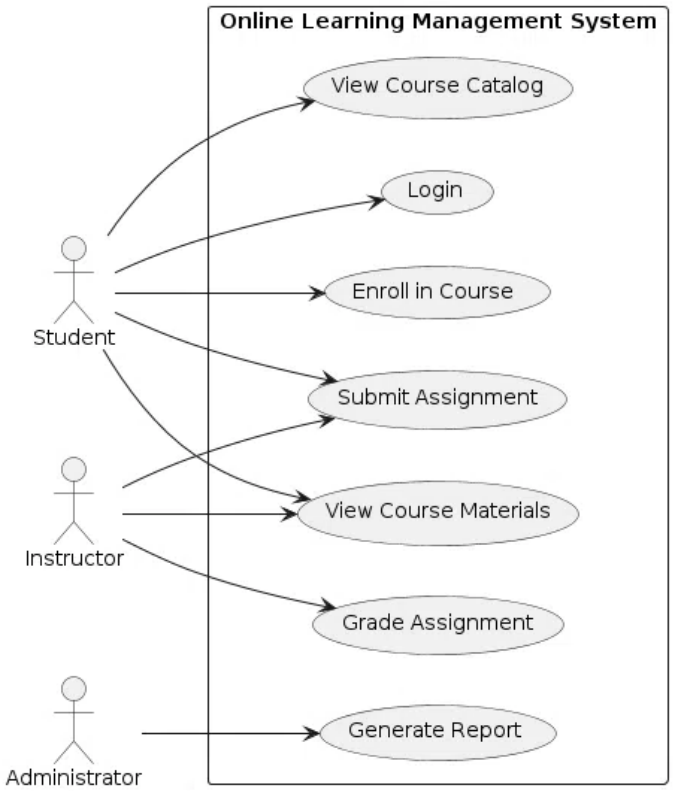

Figure 2: Online Learning Management (Kolakowski et al., 2020)

There are two types of online learning systems: synchronous and asynchronous. Synchronous learning requires live online classes, webinars and virtual discussions between the teacher and students. Asynchronously, students can watch lectures, download and read study notes, complete assignments, and participate in the discussion forums when they choose without the presence of other students. Blended learning is also implemented in many higher education institutions as a mixture of the traditional classroom and the online environment. Some of the key benefits of online learning systems include the flexibility of time and place, access to more

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learning resources, customization of learning opportunities, cost-effectiveness and the use of digital communication tools for better collaboration. These systems also facilitate self-directed learning, ongoing assessment and life-long learning opportunities.

6. RESEARCH GAPS IN EXISTING LITERATURE

The reviewed studies highlight the rapid growth of e-learning and digital education in higher education, particularly after the COVID-19 pandemic. The literature shows that online learning affected students differently based on factors such as gender, adaptability, and engagement. Studies also emphasize that learner behavior, digital competence, teacher preparedness, institutional support, and technological infrastructure play crucial roles in the success of e-learning systems.

Table 2: Studies on Digital Transformation and Learner Engagement in Higher Education

Author(s) & Year	**Study Focus**	**Key Findings**
Shahzad et al. (2021) (Shahzad et al., 2021)	Examined the effects of COVID-19 on e-learning among higher education students with gender-based comparison.	The study found that e-learning significantly affected students' academic experiences during the pandemic, with noticeable differences between male and female students in terms of satisfaction, stress, and adaptability toward online learning.
Qiu et al. (2022) (Qiu et al., 2022)	Investigated prediction of students' academic performance in e-learning using behavioral and learning process data.	The researchers reported that students' online learning behaviors, participation patterns, and engagement indicators could effectively predict academic performance in e-learning environments.
Lai, Wang, & Huang (2022)	Explored the relationship among TPACK, teacher	The study concluded that teacher beliefs, institutional support, and professional

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Volume:2 Issue:2
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(Lai et al., 2022)	beliefs, school culture, professional development, and technology adoption among EFL teachers.	development strongly influenced technology adoption and effective integration of digital tools in teaching.
Turnbull, Chugh, & Luck (2021) (Turnbull et al., 2021)	Analyzed how higher education institutions transitioned to e-learning during the COVID-19 pandemic.	The findings indicated that institutions rapidly adopted online teaching strategies, digital platforms, and virtual learning systems to ensure continuity of education despite multiple technological and pedagogical challenges.
Shwedeh (2024) (Shwedeh, 2024)	Examined the integration of Artificial Intelligence into decision support systems in higher education institutions.	The study highlighted that AI-based decision support systems improved academic administration, personalized learning, institutional planning, and data-driven educational decision-making processes.

Additionally, emerging technologies such as Artificial Intelligence are increasingly being integrated into higher education to improve decision-making, personalized learning, and academic management. Overall, the studies suggest that effective digital education depends on strong technological support, learner engagement, and continuous innovation in educational practices.

7. CONCLUSIONS DRAWN

The reviewed studies show that digital transformation in the domain of HE has been a significant game-changer as a result of the implementation of online learning systems, the integration of ICT, blended learning models and digital educational technologies. The Covid-19 pandemic has speeded up the shift towards online learning and underscored the need for technological preparedness, institutional readiness and flexible learning environment. The

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literature suggests that digital learning systems enhanced the accessibility, flexibility and continuity of education; however, there are still a number of challenges to be faced such as digital divide, lack of ICT infrastructure, lack of digital literacy, low engagement of learners, lack of faculty training and technological barriers which still impact the effectiveness of online education. The research also shows that engagement of the learners, faculty competency, institutional support, and technology acceptance are all key factors in successful digital transformation.

8. SCOPE FOR FURTHER WORK

Based on the reviewed studies, it can be said that there are some aspects that need to be studied and developed in digital transformation and online learning system in higher education institutions. Further research is recommended to investigate the long-term impact of online and blended learning models on academic performance, learner satisfaction, skill development and employability. Further research is required to understand how digital transformation affects rural, marginalized and economically challenged learners to help minimize digital inequality and enhance educational inclusion. Further research is needed to understand how emerging technologies like Artificial Intelligence (AI), machine learning, virtual reality, augmented reality, blockchain, and learning analytics can improve learner engagement, personalized learning, and institutional management systems. Further research is also needed to create reliable, secure and transparent online assessment systems to tackle academic dishonesty, monitoring and assessment reliability problems.

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AUTHOR'S DECLARATION

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