







PAPER

Role of Information Systems and Mobile Technology in Optimizing Organizational Learning Effectiveness

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ABSTRACT

The main purpose of this work is to understand the role of information systems (IS) and mobile technologies (MT) in improving the effectiveness of organizational learning (OL). Increasingly, organizations are changing their learning paradigms to incorporate new technologies, which is the focus of this study. This study is primarily qualitative and uses a mixed-methods approach. In the first of the two phases of the study, a systematic literature review (SLR) was used, and in the second phase, a bibliometric review was conducted using the software VOSviewer. To contextualize and understand current practices, the researcher conducted interviews with senior executives in both the public and private sectors, i.e., multinational and national organizations. The findings of this study reveal that IS and MT impact the effectiveness of OL by facilitating the flow of knowledge and the accessibility of learning materials, as well as improving collaboration within an organization. The bibliometric review demonstrated the importance, themes, and emerging trends of such technologies in the field of modern organizational learning. The qualitative study also confirmed that IS and MT foster a culture of continuous learning and development. The study applied a mixed-methods approach to uncover the role of IS and MT in the organizational learning effectiveness (OLE) and found that IS and MT play a role in streamlining knowledge-sharing processes, enhancing accessibility to educational resources, and fostering organizational collaboration.

KEYWORDS

organizational learning effectiveness (OLE), information system (IS), mobile technology (MT), process of organizational learning

1 INTRODUCTION

In the age of modern technology, individuals and organizations are learning and working with the latest technological tools and their allied tools and software [1], [2]. The most widely used devices are information systems (IS) and mobile technology (MT), which have penetrated every office and have reshaped the working and

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learning mechanisms. MT and IS have proved their efficacy in storing, disseminating, and applying knowledge [3], [4]. These tools have optimized the processes of sharing information in the correct form, correct order, suitable form, quality, and quantity, which has improved organizational learning (OL) [5]. Additionally, they have maintained competitiveness, fostered innovation, and assured sustainability in the changing market. Enterprise Resources Planning (ERP), learning management systems (LMS), and many other allied tools have managed to empower organizations to implement real-time learning and improved access to collaboration and resource management [6], [7], [8].

Mobile technology has improved market productivity and engagement and has led to better learning outcomes. It has streamlined business processes and improved communication. It has enabled remote working, which has boosted overall production and operational efficiency [9], [10]. Similarly, IS has enhanced productivity by providing flexible, mobile access to knowledge sharing, as well as opportunities for employees to participate in learning processes anytime, anywhere, that occur through personalized micro-learning, enabling continuous learning [11]. Likewise, real-time notifications and updates keep employees engaged, motivated, and responsive to organizational goals [12], [13].

In the same way, IS provides a centralized platform for knowledge management through the integration of data analytics and knowledge-sharing tools. Organizations collect real-time data, refine it, process it, and disseminate it for improved performance [14], [15]. It helps with personalized and adaptive learning pathways, identifies skill gaps, and provides tailored opportunities. Furthermore, real-time feedback helps organizations to adjust their strategies that lead to organizational adaptability, knowledge retention, and innovation [16], [17].

However, besides these facilitations, many organizations are struggling to effectively integrate MT and IS into learning processes to maximize operational efficiencies and improve learning effectiveness, and the issues regarding scalability and adaptability remain unresolved due to the use of standardized content delivery [18], [19]. Therefore, to comprehend the context, the first comprehensive systematic literature review (SLR) was applied with bibliometric analysis to explore the trends, patterns, and uses of the MT and IS for organizational learning effectiveness (OLE). In the 2nd phase, interviews were planned to assess the role of MT and IS for OLE from the employees' (knowledge workers) perspectives to assess how these technologies can be synergistically deployed to create a seamless, adaptive, and integrated learning framework [20]. In light of these gaps, the purpose of the current study focuses on the role of IS and MT in OLE, its critical aspects, and how IS and MT improve organizational learning effectiveness.

The paper is organized as follows. First, it has an introduction with gaps and suggestions. The next section includes an extensive literature review and theoretical underpinning for the study. The 3rd section explains the mixed methods in depth. The 4th section has bibliometric and interview analyses, followed by discussion and recommendations, conclusions, and suggestions for future work.

2 LITERATURE REVIEW

a) Organizational Learning Effectiveness: Organizational learning effectiveness signifies the capability of the system to accurately collect, incorporate, distribute, and utilize knowledge to increase the system's effectiveness and proficiency to a greater degree [21]. OLE additionally empowers a system to create, innovate,

and modify to suit the system's surroundings. It helps an organization to breed an environment of continuous enhancement capabilities, improvement, elaborated feedback, and knowledge transfer [21], [22]. To make it even more effective, OLE should be coupled and integrated with the system's strategic objectives. Furthermore, it encourages transparency and interdisciplinary cooperation as well as eases the enhancement of the system's learning capacity [23].

In addition, the OLE is evaluated based on the degree to which an organization efficiently systematizes the knowledge and the degree to which an organization customizes the knowledge to fulfill the needs and requirements of the organization [24], [25]. This knowledge can be more useful if it is applied methodically, utilized to address sophisticated issues, and dynamic to the modifications in the market's needs and requirements [26], [27]. In this context, leadership plays an important role in nurturing the culture of continuous learning, encouraging experimentation, accepting failures, and promoting the mindset of continuous learning. These processes will bring long-term success, resilience, and organizational ability to handle challenges in the best possible way [24], [27], [28].

- b) Role of IS in OLE:** Information systems provide a technological foundation for organizational learning. Its processes and tools enable organizations to access and assess critical information quickly and efficiently and facilitate better decision-making [29], [30]. It manages to eliminate inefficiencies, mitigate the gaps in knowledge, and offer a key perspective for future concerns. It allows onsite and remote teams to communicate simultaneously and collaborate across several interfaces and assists in the delegation of tasks to a team working from different locations [29], [31].

Currently, all or almost all firms are adopting IS technologies such as ERP, KMS, and other specialized systems to optimize the processes, synchronize the targets, and supervise the learning processes of the organization [32], [33]. Today, the incorporation of analytics enhances creativity, anticipates challenges and opportunities, and empowers organizations to make evidence-based choices. By creating a feedback loop, the IS accelerates knowledge transfer and optimizes learning outcomes [34], [35].

- c) Role of MT in OLE:** Mobile technology is becoming a pivotal tool in enhancing OLE. It offers flexibility and accessibility in the learning processes. With smartphones, organizational processes are enhanced, and collaboration with peers and contributions to OL have become manifold [36]. It has made OL dynamic and ubiquitous, where the knowledge workers are retrieving relevant information in no time. Furthermore, social media tools and video conferencing regarding emerging opportunities enhance OL flow and promote a promising culture of continuous learning [37]. Similarly, adaptive and personalized learning improves individual and organizational performance and needs and contributes to overall organizational learning, which keeps OL more agile, innovative, and competitive [9], [23].

2.1 Theoretical support for the study

The organizational learning context is broader and vast; therefore, many theories were found relevant to the context. However, to remain focused and specific, the study integrated the following three theories, which are given in the following section.

- a) Cognitive learning theory:** Cognitive learning theory (CLT) focuses on the process of learning, how individuals and organizations learn to develop new knowledge, and how they maintain and disseminate it for organizational efficiency [38], [39]. In the organizational setting, this theory proclaims that IS and MT can be used as instruments in enhancing organizational performance and learning effectiveness [35], [40]. Knowledge workers use these tools for real-time data accumulation, which facilitates decision-making, helps in problem-solving, and optimizes learning inside the organizations [9], [36].

This theory can also be extended to the cognitive load theory, which postulates that IS and MT reduce the organizational load by presenting information in manageable chunks [41]. Tools like dashboards, analytic platforms, and other mobile applications offer ways to simplify complex themes and processes and present them in a contextual form, which remains easy to understand. Furthermore, these days, artificial intelligence (AI) tools are embedded in MT and IS, which amplify organizational cognitive processes, help predict learning needs, and offer personalized and contextual learning materials to ensure comprehension [42]. Additionally, IS and MT create seamless channels for knowledge transfer and make the organizational and contextual information available through cloud-based LMS, which helps to track, analyze, and disseminate information widely [43].

- b) Socio-technical theory:** Socio-technical theory (STT) explains the interdependencies among social systems, i.e., the people and the technical system (MT and IS technology) inside the organization. STT postulates that an organization can be effective and efficient if there is close collaboration and coordination among these elements [44], [45]. Organizational processes and structure should be supported by the latest technological system to optimize the operations and processes while keeping the employees engaged and even motivated. Likewise, the social aspects of the STT postulate that employees interact better with the latest technological tools (Slack, Teams, etc.) and promote virtual collaboration among knowledge workers [46], [47]. These technological tools are used to capture, store, analyze, and support OL through ERP and knowledge management systems (KMS). Not only this, STT admits that the latest technological tools and customizations tailor and fulfill specific learning needs and provide real-time assistance and promote organizational support for learning [48], [49].
- c) Experiential learning theory:** Experiential learning theory (ELT) was coined by David Kolb, who postulates that learning occurs through experiences, reflections, and their application. In the organizational setting, ELT proclaims that learning experiences can be improved with MT and IS [50], [51]. These technologies enable organizations to document, analyze, and apply knowledge from experiences and create structured processes for OL [52], [53].
- ELT consists of four stages. OL moves from concrete experiences, reflective observation, and abstract conceptualization to active experimentation [54], [55]. During these processes, KMS learning can be embedded in work processes, which enhances both individual and organizational learning. In the same way, technology promotes immersive learning environments like virtual stimulation, which engage knowledge workers in real experimentation. These processes remain very effective, and the workers learn from the errors and make their approach better cooked in the real setting. Similarly, real-time feedback on performance refines OL [12], [53], [54].
- d) Triangulation of the theories:** The study explored the integration of these theories, i.e., CLT, STT, and ELT, a multi-faceted and multi-layered approach to

understand how IS and MT facilitate and optimize OLE. The triangulation of these theories provides a comprehensive framework for how the individual and organizational cognitive processes and the interaction of the social and technical systems positively contribute to OLE. Additionally, the mix of these theories not only fulfills the cognitive needs but also the social and behavioral aspects of the OLE, and one promising exploration is that the OLE is not only a cognitive process but it also involves social and technical (behavioral) processes and systems. Such perspectives view OL as a non-linear and dynamic process, which should be flexible and iterative.

In reviewing these perspectives, the study postulates that IS and MT act as a social, cognitive, and technical glue. Particularly, MT and IS play a major role in large processes and operations, which break down these processes and render them visible through simulation and augmented reality. Furthermore, both IS and MT maintain databases for OL and disseminate them according to the organization's needs and requirements. They provide real-time feedback and enhance collaboration.

3 RESEARCH DESIGN

Based on the multi-layered objectives, the study is based on mixed methods. In the first phase, the study adopted SLR to review the literature in-depth. SLR is considered a better technique to get an unbiased and comprehensive summary of the existing research on a specific topic. SLR analyzes and synthesizes previous studies in a structured manner and showcases a high level of predictability and reliability. It follows structured protocols for selecting and evaluating relevant studies. Moreover, SLR highlights trends, patterns, and certain themes of the domain and showcases areas for improvement. The study followed the following criteria for inclusion.

a) Inclusion criteria

- a. Relevance to the topic (IS and MT in OL effectiveness)
- b. All articles, books, proceedings, and reviews are published in English.
- c. The time frame was made open; however, more attention was given to the latest articles.
- d. All kinds of qualitative and quantitative studies were considered for inclusion.
- e. There were no geographical considerations in the study.
- f. Articles with full-text accessibility were considered for inclusion.

b) Exclusion criteria

- a. Duplicated records were excluded from the study.
- b. Irrelevant studies, not focusing on information and MT in the OL context, were excluded from the study.
- c. All other records published in a non-English language were excluded from the study.
- d. Studies with incomplete data were excluded from the study.
- e. More technical and pure engineering papers were not included in the study.

The details regarding inclusion and exclusion are provided in the PRISMA diagram given in Figure 1.

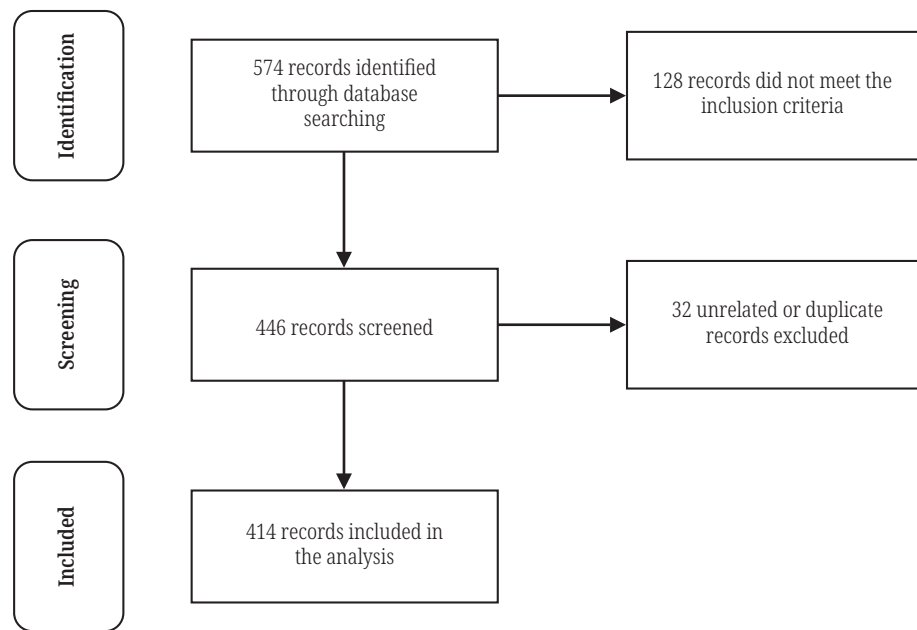


Fig. 1. PRISMA flowchart

For the interview analysis, the study followed structured protocols. Data was collected from 13 professionals from academia and 17 professionals from leading organizations who are working on digital transformations in their organizations and who have digitized learning and working mechanisms in their systems. Professionals for interviews were accessed through professional networks such as LinkedIn and personal contacts. Moreover, the study followed both snowball and purposive sampling techniques to reach the responsible and representative respondents. Through snowball sampling, more than 40 professionals were approached; however, some of them did not have the required skills, qualifications, and experiences and, therefore, were not selected for inclusion in the study.

Additionally, all the interviewees were approached in advance to decide the timing, venue (online or in person), and other formalities of the interview. They shared all the objectives of the interview and were assured of confidentiality. All the questions related to the structured interview were shared in advance with the interviewees, and they confirmed that there were no redundancies or duplications.

The interview started with a formal welcome and a review of the study objectives for reconfirmation. The interviews were audio-recorded with their permission. Every interview took around forty (40) minutes on average. The interviews were transcribed in three stages. In the first flow, interviews were transcribed and shared with the interviewees for confirmation. In the second stage, anonymous responses to the same questions were shared with them, and they could affirm, add to, or even confront some information. Their opinion from the 2nd stage was added to the study, and the combined responses were compiled in the third stage with the confirmation of all the respondents.

In the second stage, the responses were codified, and themes were developed. The study came with nine themes. Themes, codes, and descriptive responses were developed in a systematic way to link queries and themes. Their underlying themes were identified and distributed into nine themes, based on the queries asked. Later on, each theme was assigned to represent its essence to reflect practical scenarios

and ensure coherence. Moreover, sub-themes were also explored and placed in the code to highlight their significance with their priorities.

4 FINDINGS FROM BIBLIOMETRIC ANALYSIS

The bibliometric analysis investigates the influence of IS and MT on OL effectiveness, using a strategically designed query to extract 568 relevant articles from the Web of Science Core Collection. The query incorporated a structured combination of keywords across three critical dimensions: IS (e.g., “information system,” “IT,” “management information system”), MT (e.g., “mobile devices,” “smartphones,” “m-learning”), and OL effectiveness (e.g., “knowledge management,” “learning performance,” “knowledge sharing”). Boolean operators “AND” and “OR” were employed to establish logical relationships between these dimensions, enabling a comprehensive retrieval of literature that examines the interplay of these domains in enhancing OL outcomes.

The study addresses several key research questions: (RQ1) What are the publication trends in mobile and digital learning research from 2003 to 2024, including annual growth rates and citation metrics? (RQ2) Which journals have been most influential in the field of MT and IS in organizational learning, and how do their publication patterns align with Bradford’s law of scattering? (RQ3) What are the most influential articles in this domain, as measured by local and global citations, and what themes do they address? (RQ4) Who are the most productive authors in the field, and what collaborative networks exist among them? (RQ5) What are the most cited references in the literature, and how do foundational theories shape current research directions? (RQ6) Which countries have been most influential in the research on OL effectiveness through mobile technologies, and how do these trends reflect global research dynamics?

a) Publication trends: According to the bibliometric analysis of the publications between 2003–2024, there has been an annual growth of 12.1% in digital and mobile learning due to a steady increase as well. From 2003–2010, the early years had very small output, which represented a field that had just begun to grow in interest.

Between 2011 to 2015, there was an even larger output, and that is due to the positive advancements made in mobile and IS technologies. The peak years of growth occurred between 2016 to 2019, with more than 50 articles documented every year. The years after 2020 had a noticeable decline due to COVID-19. But overall, there is a great positive trend of growth. As for the citation metrics, annual citation records slowly increased starting in 2007, with peak years in 2019 due to growth in technology. In the last couple of years, there has been a slight growth as well, and that is due to an increase in interest in the field. The data fundamental to bibliometrics for the years 2003 to 2024 shows considerable growth and interest in the field (see Figure 2). This is evidenced by the 526 documents made across 372 documents, with an annual growth of 12.1%, which shows great growth. According to the documents, the predominant age was 5.97 years. This is evidenced by an average of just 13.53, and it proves a great small, moderate impact.

Contributions come from 1,547 authors, including 78 papers with a solo author; however, co-authorship remains the predominant trend, with an average of 3.22 co-authors per paper; 19.01% of papers have international co-authors.

Several types of documents represent the field, with 284 articles, 215 conference papers, 19 review papers, a handful of types with lower frequencies, such as retracts and editorials, and more. About the themes of the documents, 1,663 authors and 593 from Keywords Plus authored the keywords. The 16,614 citations provide evidence of a large and diverse citation network. All evidence shows a dynamic and growing globally connected research community, with an intense collaborative focus.

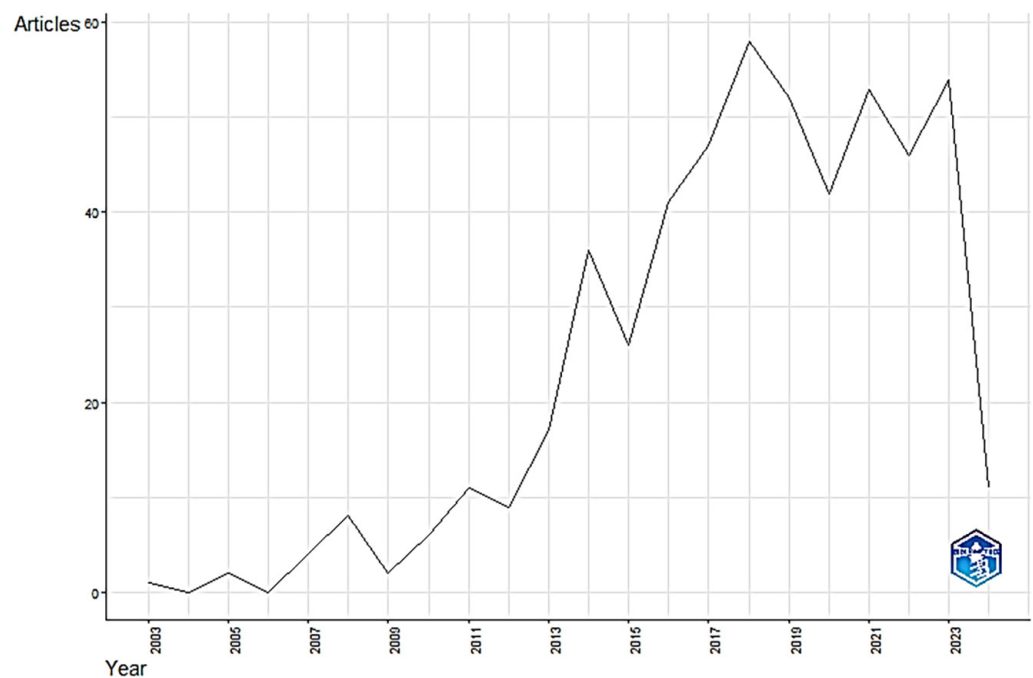


Fig. 2. Annual scientific production from 2003 to 2024

b) Keyword trends and emerging research topics: To further understand the temporal evolution of research themes, a trend topic analysis was conducted using keyword co-occurrence data extracted from the bibliometric dataset. Figure 3 illustrates the distribution of the most prominent research terms across time, mapped according to their first quartile (Q1), median, and third quartile (Q3) of publication years, with bubble size reflecting term frequency. The figure reveals a clear progression in research focus. Foundational topics such as implementation, framework, knowledge, and teachers dominated the early literature (median years around 2016–2017), reflecting the initial focus on establishing conceptual and pedagogical foundations for mobile and information system-based learning. Intermediate-period topics, including education (frequency: 44), students (frequency: 39), technology (frequency: 34), and performance (frequency: 32), emerged with peak concentrations between 2018 and 2020, underscoring the growing scholarly interest in measuring the effectiveness of digital tools in educational settings. More notably, recent emerging topics, particularly engagement, achievement, and augmented reality, display median years of 2022, with their third quartiles extending beyond 2022, signaling their status as frontier areas of active and growing inquiry. These findings confirm that the field of mobile learning and OL effectiveness is dynamically shifting toward more immersive, technology-enriched, and learner-centered research paradigms, with implications for both academic research and organizational practice.

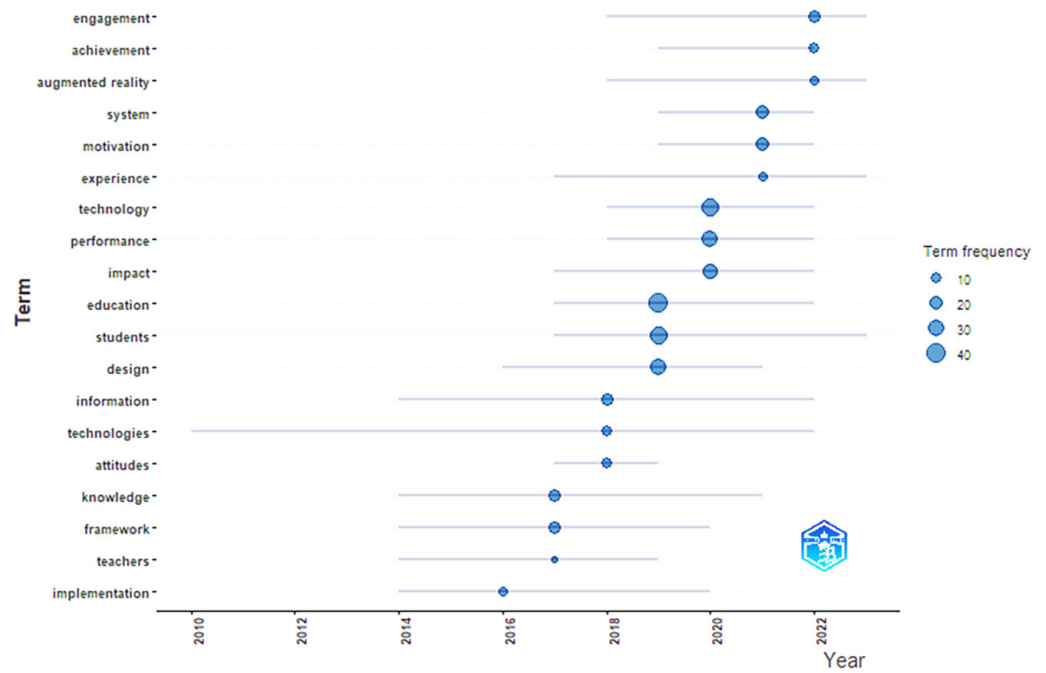


Fig. 3. Trend topics in mobile learning and IS research (2010–2022)

Notes: Bubble size represents term frequency; horizontal span reflects temporal distribution from Q1 to Q3 publication years.

c) Influential journals: Industry leaders, such as *Computers & Education* and *Interactive Learning Environments*, are the preeminent journals in the sector in both publication and citation counts. Based on Bradford’s Law of Scattering, a limited number of these primary journals can produce a significant amount of the relevant publications. Core journals are at the center of a distribution of journals with a declining number of publications and contributions. This is evident in Table 1 and Figure 4. This is the evidence that the distribution of research is largely contained in these journals, classifies the journals as core, and is significant to researchers in the coverage and complexity of the field.

Table 1. Top 20 journals with the most publications

| Sources | Articles |
|----------------------|----------|
| COMPUT EDUC | 882 |
| COMPUT HUM BEHAV | 345 |
| BRIT J EDUC TECHNOL | 233 |
| EDUC TECHNOL SOC | 207 |
| J COMPUT ASSIST LEAR | 171 |
| INTERACT LEARN ENVIR | 113 |
| PROCD SOC BEHV | 111 |
| MIS QUART | 109 |
| ANAT SCI EDUC | 102 |
| ETR&D-EDUC TECH RES | 101 |

(Continued)

Table 1. Top 20 journals with the most publications (Continued)

| Sources | Articles |
|-------------------------|----------|
| LECT NOTES COMPUT SC | 92 |
| INTERNET HIGH EDUCATION | 84 |
| EDUC INF TECHNOL | 76 |
| COMPUT ASSIST LANG L | 68 |
| INFORM MANAGE-AMSTER | 64 |
| J EDUC PSYCHOL | 64 |
| INT REV RES OPEN DIS | 62 |
| SUSTAINABILITY-BASEL | 57 |
| NURS EDUC TODAY | 54 |
| MED TEACH | 53 |

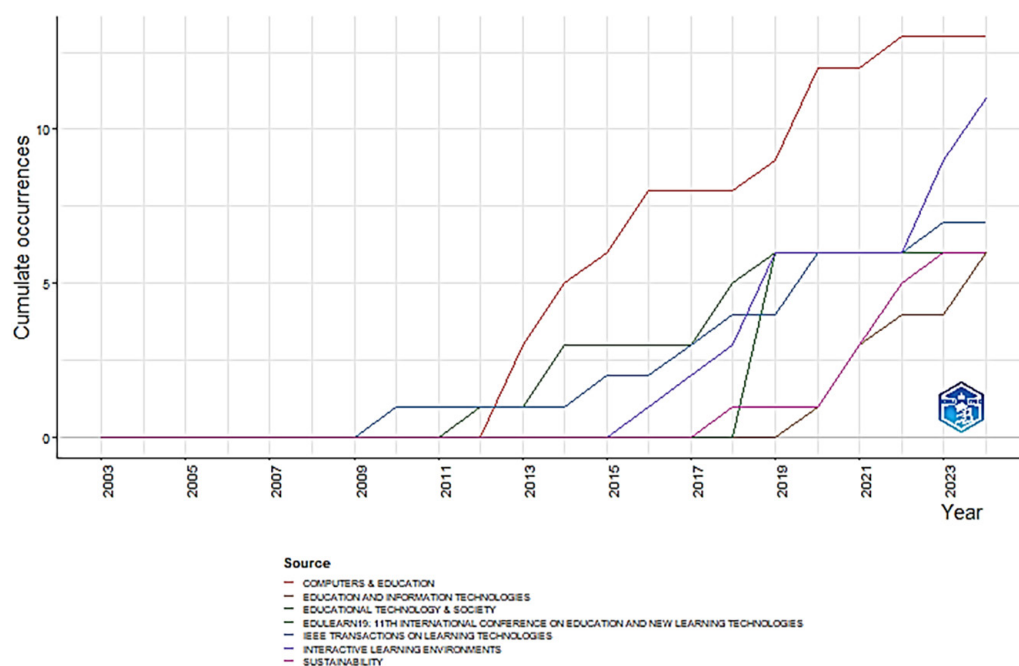


Fig. 4. Sources’ production

d) Key articles: The best of the best articles Evilancer has been trained on data up to October 2023, focusing on concepts and themes such as “knowledge sharing,” “mobile learning,” and “digital transformation.” One of the sources that has been cited the most about this topic has been cited 882 times, meaning that it accounts for nearly 50 percent of the total citations and is of primary monumental importance to this field of education. Other works of a similar nature that are amongst the most cited focus on themes of the convergence of MT and IS in education and are also contributing to the shaping of research in this field (see Figure 5).

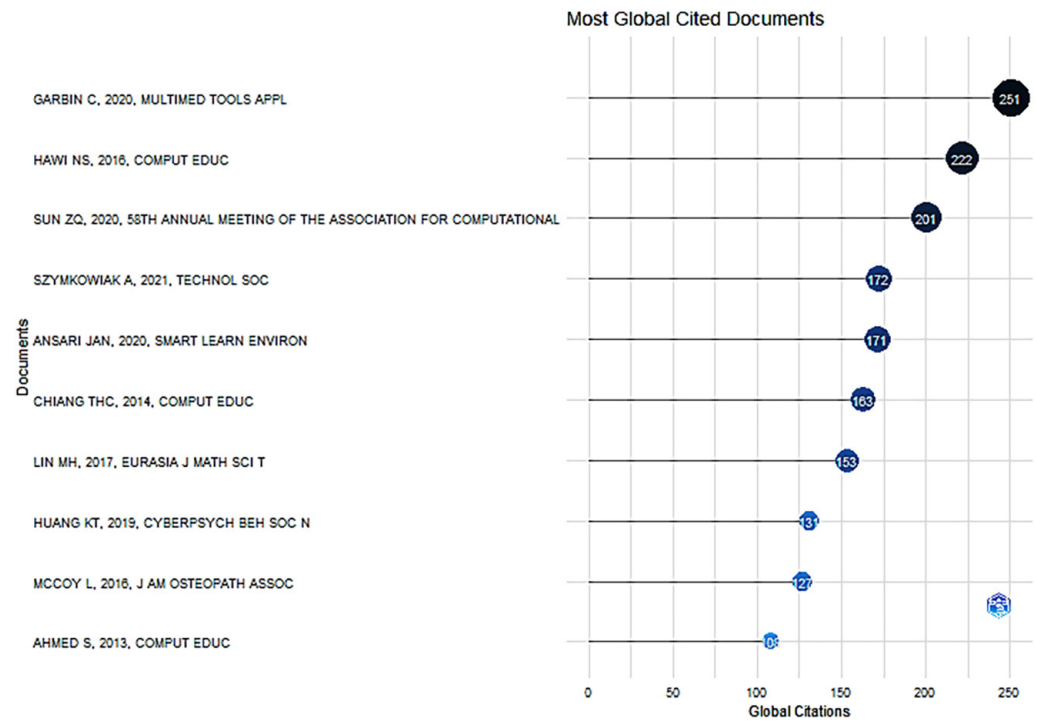


Fig. 5. Most globally cited documents

e) **Most productive authors and their collaborative networks:** In terms of productivity and citations, the foremost scholars, who presumably have the most influence, are Hwang GJ and Hwang K. Among GJ’s contributions, 14 highly cited papers represent a sizeable portion (30%) of the total (refer to Table 2). Equally evident in the data are ties of authorship and major contributions to the triangulated body of knowledge of mobile learning and organizational productivity, namely Yu ZG and Al-Emran M. These are collaborations of a mix of local and global natures.

Table 2. Most productive author by H-index

| Author | h_index | g_index | m_index | TC | NP | Py_start |
|------------|---------|---------|------------|-----|----|----------|
| HWANG GJ | 10 | 14 | 0,76923077 | 626 | 14 | 2012 |
| HUANG RT | 6 | 8 | 0,46153846 | 151 | 8 | 2012 |
| AL-EMRAN M | 4 | 4 | 0,57142857 | 113 | 4 | 2018 |
| YU ZG | 4 | 5 | 0,66666667 | 96 | 5 | 2019 |
| HUANG YM | 3 | 3 | 0,23076923 | 148 | 3 | 2012 |
| KIM H | 3 | 3 | 0,33333333 | 98 | 3 | 2016 |
| MEZHUYEV V | 3 | 3 | 0,6 | 93 | 3 | 2020 |
| OSMANI V | 3 | 3 | 0,27272727 | 53 | 3 | 2014 |
| TANG TW | 3 | 3 | 0,375 | 35 | 3 | 2017 |
| WANG Z | 3 | 3 | 0,42857143 | 23 | 3 | 2018 |
| Xthe U J | 3 | 4 | 0,42857143 | 18 | 4 | 2018 |
| ADNAN M | 2 | 3 | 0,33333333 | 12 | 3 | 2019 |
| ASHARI ZE | 2 | 2 | 0,33333333 | 15 | 2 | 2019 |

(Continued)

Table 2. Most productive author by H-index (Continued)

| Author | h_index | g_index | m_index | TC | NP | Py_start |
|------------|---------|---------|------------|-----|----|----------|
| ASHRAF J | 2 | 3 | 0,33333333 | 12 | 3 | 2019 |
| BASHIR S | 2 | 2 | 0,33333333 | 8 | 2 | 2019 |
| CHANG SC | 2 | 2 | 0,5 | 29 | 2 | 2021 |
| CHANG YS | 2 | 2 | 0,22222222 | 20 | 2 | 2016 |
| CHEN NS | 2 | 2 | 0,16666667 | 61 | 2 | 2013 |
| CHEN SF | 2 | 2 | 0,33333333 | 27 | 2 | 2019 |
| CHIANG THC | 2 | 2 | 0,18181818 | 188 | 2 | 2014 |

f) Most cited references and their impact on current research: The most cited references in the literature often discuss foundational theories related to knowledge sharing, mobile learning, and digital transformation. Such theories remain at the forefront of guiding research as contemporary studies construct new analysis pillars on the foundations of older, more pioneering studies. The fusion of MT and IS into educational settings remains the central focus of concerns about how institutions can maximize the efficiency of their learning and continue to incorporate these technologies into the educational process (refer to Table 3).

Table 3. The top 20 most cited references

| Cited References | Citations |
|------------------|-----------|
| [56] | 25 |
| [57] | 24 |
| [58] | 17 |
| [59] | 17 |
| [60] | 15 |
| [61] | 15 |
| [62] | 14 |
| [63] | 13 |
| [64] | 13 |
| [65] | 13 |
| [66] | 11 |
| [67] | 11 |
| [68] | 11 |
| [69] | 10 |
| [70] | 10 |
| [71] | 9 |
| [72] | 9 |
| [73] | 9 |
| [71] | 9 |
| [74] | 9 |

g) Top countries in mobile learning research and global trends: China comes first with 279, then the USA with 99, and Indonesia with 57, Spain and the UK as well, and then the rest of the world next. The USA, then, is more integrated into international research networks, as shown through a larger share of multiple-country publications, while collaborations in China’s case are mainly domestic. These patterns, alongside China and the USA, correlate the world’s research interest and MT across continents (bibliometric analysis). Research also suggests a higher average citation rate per article in the USA, an indicator of the country’s influential research.

This then also indicates research in the USA should be of higher value to the rest of the world as impactful to the flow of ideas in more than one of their publications, which, in many of the USA cases, we have seen to be mobile technology.

The field’s evolution, research output, citation from research work, and thematic focus area are key points in this bibliometric analysis. The convergence of IS with MT and OL will continue to be pivotal and has a worldwide scholarly community that is innovatively engaged in knowledge construction. The field’s maturity provides scope for even deeper exploration to determine the effects of digital transformation on learning environments and organizational performance. (see Figure 6).

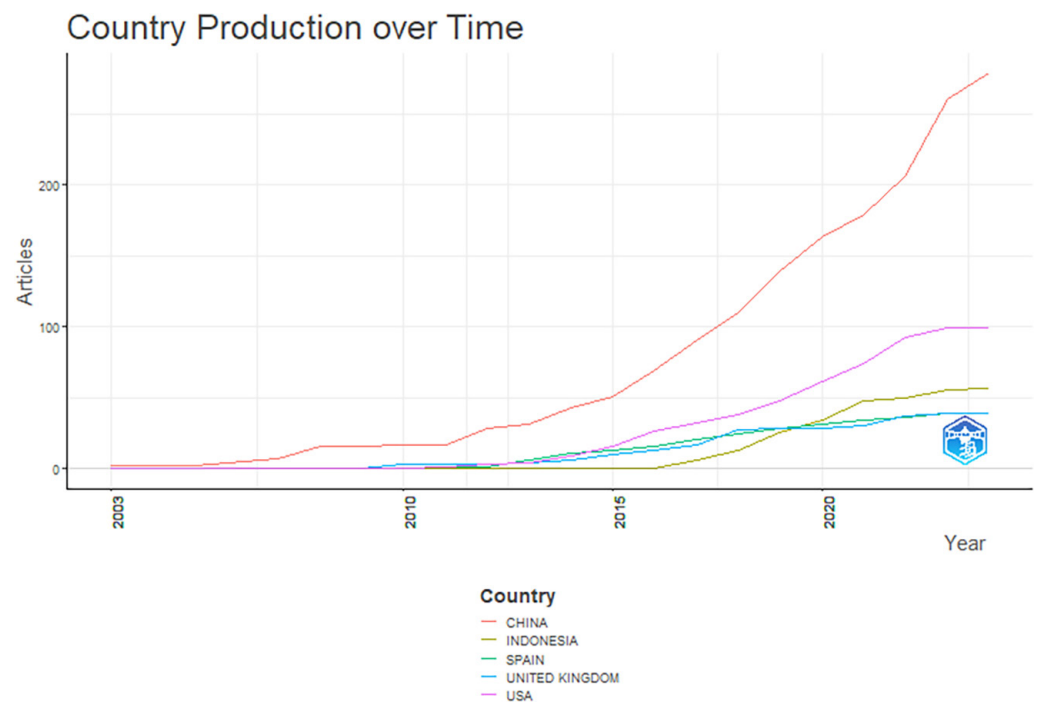


Fig. 6. Top Countries in mobile learning research and global trends

Beginning in 2003, China recognized the importance of mobile and digital technologies, learning the published output steadily and rapidly increased. Only two publications were recognized in 2003, but this output increased in a stepwise fashion, gaining 51 publications in 2015 and 139 in 2019. During the COVID-19 pandemic, this output increased. The COVID-19 pandemic was 164 in 2020 and 179 in 2021. The 2021 COVID-19 pandemic had 164 publications in 2020 and 179 in 2021. Subsequently, in 2020 and 2021, China successfully produced 279 publications. This output China produced is leadership in the field China is demonstrating. This is leadership in the field. With the support of national policies and a highly developed commitment to innovation and mobile and digital learning.

5 FINDINGS FROM INTERVIEWS

- a) **Demographic analysis:** The interviews' professional demographics information is given in Table 4. According to the statistics, all the interviewers had the required skills, qualifications, and experience to be part of the study.

Table 4. Demographics of the study

| Item | Characteristics | Percentage (%) |
|---------------|--------------------|----------------|
| Gender | Male | 55.00 |
| | Female | 45.00 |
| Age Group | 26 to 35 years | 41.00 |
| | 36 to 45 years | 25.00 |
| | Above 45 years | 18.00 |
| Qualification | High/Higher School | 33.00 |
| | Undergraduate | 43.00 |
| | Graduate | 14.00 |
| | Ph.D. | 8.00 |

- b) **Interview responses:** This section showcases combined responses. The combined responses were prepared in three rounds. In the first round, responses were transcribed, which were shared for confirmation with the respondents. In the second round, they also shared the opinion of the other responses so that, if anything is missing or anything needs to be added, it can be done. At this stage, we got certain recommendations, which were added to the responses, and in the third round, the combined responses were compiled.

Regarding the role of the IS in knowledge acquisition in the organization, the participant added, *“Our system encourages knowledge sharing, facilitates collaboration, and ensures knowledge is documented to maintain consistency in processes (acquisition, storage, and dissemination). Our system ensures that the knowledge is codified, accessible, and updated.”* Similarly, for the 2nd query regarding the MT integration for OL effectiveness, they responded that *“In our organization, the integration of mobile systems to the knowledge management system has improved efficacy, especially for field workers and engineers, who access real-time data and other learning resources. This integration has empowered the team to learn and respond appropriately.”*

Regarding the organization's digital transformation strategy, they reviewed that *“We have transformed our organization digitally, which has enabled learning processes from traditional and manual to automated solutions. This has dramatically optimized the learning and retention process and has reduced learning and communication gaps. We have an e-learning system which helps in acquiring new skills.”* Likewise, the role of IS and MT in personalized learning for different employee groups and their effectiveness—they added that *“In our organization, mobile technology with its applications helps in developing personalized learning paths and helps knowledge workers acquire specific skills and information needed for their roles.”* They also added that *“now our KMS system is highly effective. Its seamless*

integration with the mobile platform has ensured that knowledge is not only siloed but also readily available for learning and improvement. This integration ensures real-time knowledge, access, and contributions.”

Regarding challenges to align information and MT for OLE, they added that “The alignment of IS and mobile technology brings compatibility and collaboration among all stakeholders. It enhances security through multi-layer authentication processes and prevents data breaches. Moreover, we have KPIs and metrics for tracking learning progress, empowered by information and communication systems. It assesses both pre- and post-outcomes and satisfaction level, and the influence of mobile-enabled learning on employees; however, the system still needs to be matured to improve the scalability and compatibility issues and to better make the learning process more customized and personalized with the individual worker’s needs and requirements.” Furthermore, almost all workers added that “due to standardized content delivery, most of the workers fail to find customized and personalized material for their learning and progression.” The details of the themes are given in Table 5.

Table 5. Themes, codes, and priorities extracted from interviews

| Themes | Codes | Responses with Priorities |
|---|---|--|
| Knowledge Acquisition and Dissemination through IS | <ul style="list-style-type: none"> – Knowledge Acquisition – Knowledge Dissemination – Collaboration Tools – Standardization | P1: IS streamlines collaboration and ensures knowledge sharing across departments. P2: IS role in codifying and updating knowledge, recentralization, standardization, recording acquisition, and dissemination. P3: IS facilitates consistent communication and team collaboration. P4: IS’s role in capturing tacit knowledge. P5: IS’s role in bridging knowledge gaps across teams and modelling to fulfill. |
| Integration of MT with IS | <ul style="list-style-type: none"> – Learning system integration – Real-Time Access – Knowledge Sharing – Field Accessibility | P1: MT integration for real-time learning. P2: MT’s ability to access learning materials remotely for knowledge sharing and learning. P3: MT improves access for field workers and engineers’ communication, collaboration, and responsiveness. P4: MT integration promotes instant feedback and increases workers’ efficiency. |
| Impact of Digital Transformation on Learning Efficiency and Retention | <ul style="list-style-type: none"> – Automation of Processes – E-Learning Systems – Reduced Gaps – Improved Retention | P1: Transition from manual to automated systems improves learning efficiency and helps in upskilling workers. P2: E-learning systems eliminate communication gaps through interactive learning methods. P3: Automated system saves time, effort, costs, and other allied resources. P4: An automated system enhances consistency and accessibility in learning. P5: Automation reduces redundancy in processes. |
| Personalized Learning through IS and Mobile Technologies | <ul style="list-style-type: none"> – Personalized Learning Paths – Role-Specific Resources – Skill Development | P1: IS and MT help in creating tailored learning programs needed for role-specific modules. P2: Both IS and MT apps provide immediate access to role-relevant tools and materials. P3: MT and IS better track individual progress. P4: Both create customized learning and training programs. P5: Both IS and MT address the benefit of real-time feedback for employees. |
| Effectiveness of KMS and Mobile Platforms | <ul style="list-style-type: none"> – Seamless Integration – Knowledge Silos Reduction – Real-Time Updates | P1: Integration of MT and IS to enhance knowledge management system processes and operations and reduce knowledge silos. P2: They enhance access to stored knowledge and real-time collaboration. P3: They reduce knowledge duplication, redundancies, and anomalies. Suggested that mobile access fosters continuous knowledge-sharing |

(Continued)

Table 5. Themes, codes, and priorities extracted from interviews (*Continued*)

| Themes | Codes | Responses with Priorities |
|--|---|--|
| Challenges in Aligning IS with Mobile Technologies: Compatibility Issues | <ul style="list-style-type: none"> – Security Concerns – Stakeholder Collaboration – Compatibility and Integration | P1: Compatibility is a critical challenge besides data security. P2: Collaboration among stakeholders, multi-layered authentication, and usability are the other challenges. P3: Matrices need to be developed for tracking learning effectiveness. P4: Challenges can be solved through stakeholder alignment. P5: Iterative testing for compatibility was suggested. P6: Agreed on multi-layer security module development. |
| Promoting Informal Learning through Mobile Technologies | <ul style="list-style-type: none"> – Technologies – Instant Knowledge Access – Social Learning – Informal Skill Development | P1: WhatsApp groups are used for knowledge sharing, collaboration, and peer learning. P2: MT provides on-the-go learning and informal learning through gamified platforms and moderated discussion boards. P3: Micro-learning modules for informal learning were suggested to foster a continuous learning culture. P4: A feedback loop was suggested for improving engagement and better learning. |
| Measuring Informal Learning through Mobile Technologies | <ul style="list-style-type: none"> – Learning Outcomes – Engagement Levels – User Satisfaction – ROI Metrics | P1: MT helps in tracking employees' learning outcomes and analyzing engagement and satisfaction surveys. P2: They suggested using completion rates of learning modules and feedback-based performance metrics. P3: It is better to conduct an employee satisfaction survey regarding MT and IS integration and the impact. |
| Future Role of MT and IS | <ul style="list-style-type: none"> – AI and Automation – Adaptive Learning – Data Analytics | P1: AI-driven adaptive learning solutions. P2: Big data in learning analytics. P3: Need for enhanced automation. P4: Customization in learning systems. P5: Predictive analytics in learning. P6: User-friendly interfaces. P7: Hybrid learning models integrating mobile and IS. P8: Cloud-based systems for learning scalability |

6 DISCUSSION

The bibliometric analysis of the study proclaims a remarkable increase in publications from 2003 to 2024 with a 12.1% annual growth, which is commendable and demonstrates the progressive adoption of mobile and IS in organizational learning. Similarly, a notable growth from 2011 to 2019 in technological advancement. However, a slight decline can be noticed during COVID-19; however, the resurgence and rebirth of the research activities and the citation frequency in the post-pandemic era reflect its acceptance in both formal and informal learning.

Many journals served in this context, especially *Computers & Education* and *Interactive Learning Environments*, and served not only as hubs of innovation but also anchored practical and theoretical development in MT and IS integration with OLE. Likewise, the citation analysis admits that the concentrated theme for the MT and IS was knowledge acquisition, sharing, and digital transformation. Moreover, foundational theories like Davis's Technology Acceptance Model and Vygotsky's Sociocultural Theory were cited to provide an understanding of learner engagement, knowledge storage, and dissemination for OL effectiveness.

Furthermore, the analysis postulates that many authors are collaborating to explore this study theme to drive innovation in knowledge sharing through digital platforms more effectively. Likewise, the international collaboration (19.01%) underlines the global nature of digital transformation, learning and research and further reinforces cross-disciplinary research to shape the future of learning in the digital age.

Additionally, the interview part proclaims that MT and IS help in codifying knowledge and ensure its accessibility, updating, acquisition, collaboration, and dissemination of valuable information. Furthermore, their ability to capture and codify tacit and Indigenous knowledge enhances decision-making processes in the organization, promotes OL and standardization, knowledge gap, and accordingly dissemination of the knowledge.

The integration of MT also enables remote field workers' productivity even more by improving access to real-time information. With this workflow, organizations are more able to provide immediate responses to work challenges, encourage moderated discussion and feedback, enable accessibility, and to continuous OL and workplace development. There is a shift from manual to automated processes that optimize learning, promote learning comprehensive skill development, reduce redundancies, and promote learning retention. Moreover, MT opens the provision of more sophisticated learning and development opportunities, providing role-specific, tailored learning and training programs that empower workers to acquire job-specific skills.

7 STUDY CONTRIBUTIONS

The last study provided a consolidation of information, the integration of mobile technology, and OL and development. It extended foundational educational theories and models like the Davis Technology Acceptance Model and Vygotsky's Sociocultural Theory. The study provides evidence-based insight to enable IS and MT to weak tacit and explicit knowledge codification and engineering, thereby improving the decision-making processes and organizational knowledge.

From a practical perspective, the study added how IS and MT can be used to enhance knowledge sharing, develop real-time collaboration, address field accessibility, and other challenges. Moreover, the rapid shift from manual to automated solutions designs personalized, role-specific, and custom learning paths to streamline the upskilling process and to facilitate ongoing learning development and efficacy. Additionally, the study provides policy recommendations for organizations to integrate MT and IS for OL effectiveness, address the challenges of scalability, compatibility, and security, and better develop KPIs and matrices for assessing the impact of digital learning solutions.

8 CONCLUSION AND RECOMMENDATIONS

The study admits the substantial increase in the IS and MT in OL effectiveness, and the transformation is taking place at a high speed. Researchers and practitioners are focusing on exploring the domain, both from theoretical and practical perspectives. Researchers are developing models, and practitioners are developing new models for acquiring, storing, and disseminating organizational learning. The theoretical underpinning confirms the necessity of information and mobile technology-based learning systems for achieving organizational objectives. The bibliometric analysis confirms the heightened marketing of the research, the collaboration among the authors, and the increased range of publications and journals. Also, these technologies bridge and foster real-time collaboration, facilitate personalized learning, and empower employees to self-upskill. This further digital transformation assists in the optimization of the learning process and the establishment of scalable learning systems that respond to various learning needs. However, this transformation comes

with certain challenges to ensure adaptability, security, and stakeholder cooperation, which can be solved with adequate research and learning systems.

This study, although thorough in its understanding of the major dimensions of the digital transformation of OL and the effectiveness of the same, has certain caveats that need to be discussed. Value-added research has to be done for the enhancement of the contribution of AI and big data to the formulation of flexible and user-centric models that are scalable to meet the requirements of organizations. Likewise, the cloud-computing platforms that can be useful in providing flexible and obtainable resolution for ongoing training, learning, and development can be investigated. In the same manner, informal OLE that can help in obtaining the sustainable objectives can be aided by the introduction of gamified learning models for micro-learning. Future research can focus on the challenges of digital inclusion and the digital divide and the infrastructural gaps as well.

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