

Original article

The Impact of E-Learning on the Professional Skills Development of Employees: A Systematic Review

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Abstract

E-learning has become an important approach to workforce development, and this systematic review examines its role in supporting employees' professional skills development across organizational contexts. Rapid growth in new technologies and market changes drives the need for flexible, scalable, and efficient digital learning systems. Understanding how e-learning supports professional skill development and contributes strategic value can inform evidence-based organizational decision-making. This systematic review has the following specific objectives: (1) to summarize empirical evidence on e-learning's effectiveness in enhancing employees' professional skills; (2) to extract critical success factors that promote successful adoption of an e-learning solution into an organizational setting; and (3) to investigate the beneficial experiences of e-learning adoption in organizations. A PRISMA 2020-compliant systematic search of peer-reviewed articles was carried out. Articles were selected according to predetermined inclusion criteria and exclusion criteria: e-learning adoption, employee development, digital training effectiveness, and organizational learning. Data were abstracted and placed in a literature review matrix describing study details, predictors, and outcomes. It was found that e-learning effectiveness is influenced by technological readiness, digital literacy, instructional design quality, organizational support, motivation, and psychological aspects. Although the evidence is mixed and inconsistent, the review suggests that e-learning has a positive impact on skills development, job performance improvement, engagement with learning, continuing professional development participation rates, and organizational learning capability. However, hurdles such as poor infrastructure, lack of digital skills, and variability in the quality of training remain obstacles to best practice adoption. E-learning serves a transformative function in contemporary workforce development by providing accessible, engaging, and flexible learning trajectories. Developing infrastructure, enhancing digital abilities, and creating supportive organizational ecosystems are also important measures for increasing its impact on employee skills.

Keywords. E-Learning, Professional Skills Development, Digital Training, Workforce Development, Organizational Learning.

Introduction

E-learning has emerged as a core element in contemporary organizational development, providing modern professionals with flexible, continuous learning opportunities and helping them cope with an increasingly technology-driven workplace. As digital technologies progress, organizations increasingly depend on e-learning systems to facilitate workforce competency development, reduce training delivery time, and maintain flexible, self-paced learning environments beyond traditional time-and-place constraints (Belhaj & Moundib, 2025; Aali et al., 2020). This move towards digital learning has been further catalyzed by global crises such as COVID-19, which has forced many organizations to shift from face-to-face training to virtual approaches (Hashem et al., 2022; Ojanperä, 2021) and has emphasized the strategic value of technology-enabled professional development. Such transformations have not only increased learning opportunities, but also emphasized the necessity of strong digital infrastructures, employee preparedness, and organizational support systems that can help establish e-learning as an added advantage (Abdekhoda & Dehnad, 2023; Helmi et al., 2024). At the same time, the workplace skill set remains in transition as automation, robotics, virtual reality, data analytics, etc., are increasingly adopted within organizations, and along with it new opportunities for digital competencies and creativity emerge (Ghosh & Ravichandran, 2024; Rahmani et al., 2022). Published literature has found that creatively designed online learning environments are effective in enhancing professionals' competencies and instructional design skills and in encouraging learning engagement when supported by interactive, immersive, and pedagogically sound training structures (Bragg et al., 2021; Gameil & Al-Abdullatif, 2023; Aaltola, 2022). Additionally, the motivation of employees, their digital literacies, and the organizational culture are important factors in determining learning outcomes and success for training initiatives in e-learning (Nikou et al., 2022; Kulkarni et al., 2024; Kapo et al., 2021).

Despite the increasing literature, there are still knowledge gaps about how e-learning affects professional skills for different industries, especially in developing countries and industries undergoing digitalization, where challenges such as infrastructural constraints and organizational change persist (Abuali & Ahmed, 2025; Byungura et al., 2022). In view of these trends, the need for systematic evidence about how e-learning can both realize its potential to contribute towards

professional skills development and how determinants which potentiate or inhibit associated effects play out in relation to different workplace contexts is becoming increasingly important. This systematic review collates recent empirical studies to offer an overview of e-learning's impact on employees' professional skills development. Through the synthesis of research drawn from educational, technological, and organizational perspectives, the review pinpoints key drivers and emerging themes alongside strategic implications relating to the successful design and implementation of digital learning initiatives within contemporary workplaces.

Methodology

The present systematic review adopted a structured, transparent, and reproducible methodological approach according to the PRISMA 2020 guidelines to ensure scientific rigour and credibility while synthesizing evidence on the effectiveness of e-learning for professional skills development. PRISMA also provides robust guidance that enhances clarity and supports reliable reporting in systematic reviews by specifying each stage of study selection from identification through inclusion (Giannakos et al., 2022; Byungura et al., 2022). The scope was limited to literature published between 2020 and 2025 to capture the rapid development of digital learning technologies and online pedagogical innovations, as well as post-pandemic workforce transformation, which placed e-learning at the center of organizational capability building (Deshpande et al., 2024; Hao, 2024). The Scopus, Web of Science, Google Scholar, ERIC and IEEE Xplore databases were searched for relevant publications using search strings including "e-learning", "digital training", "employee development", "professional skills", "online learning", "workplace learning" in combination with Boolean operators (AND or OR) and related terms such as competence-based learning, organisational/organizational learning, and digital readiness. These search terms were constructed around key constructs from previous digital learning adoption research and its impacts on performance, competencies, and engagement (Kapo et al., 2021; Hudaya et al., 2020). Reference lists of included studies were also hand-searched to ensure that all relevant papers were covered.

To maintain methodological clarity, inclusion criteria mandated that studies: (1) concentrated on e-learning, blended learning and online professional development; (2) engaged employees, working professionals or adult learners; (3) reported specifically on skills, competence, performance, engagement or learning effectiveness outcomes; and (4) were empirically based, involved systematic reviews or entailed mixed methods approaches. Exclusions consisted of studies that were not specific to professional skills development, those that did not have full text available, and articles limited to traditional face-to-face education. In this way, the review covered an extensive, high-quality body of evidence relating to organizational and sectoral differences in e-learning effectiveness (Ma et al., 2022; Al-Ghezawi & Megdadi, 2021).

The screening process consisted of three steps: deduplication, title/abstract screening, and full-text assessment of eligibility. The final group of studies used a variety of methods, including qualitative, quantitative, mixed-methods, and conceptual analyses, and this diversity provided a broad basis for synthesizing the emerging themes and factors affecting e-learning success. Aspects of digital infrastructure, learner motivation, satisfaction and engagement, as well as competency development and organizational outcomes were coded for each author's study (Deshpande et al., 2024; Mandaleeka et al., 2025). These contributing factors were subsequently used in the thematic synthesis to reflect both subjective and objective perspectives and examine professional skills within e-learning in an evidence-based manner.

A PRISMA 2020 Flow Diagram (Fig. 1) shows a synthesis of the systematic procedure followed for identification, screening, and selection of studies for inclusion. The number of records identified in the database search process and across deduplication, title/abstract screening, and full-text review to assess for eligibility is detailed in the diagram. It also indicates the final number of studies incorporated in the review. This visual depiction helps increase transparency regarding how the starting pool of studies was reduced to the final included set, which is important for maintaining confidence that the final selection represents the most relevant and methodologically strongest publications (the best evidence) in accordance with recommendations for systematic evidence synthesis.

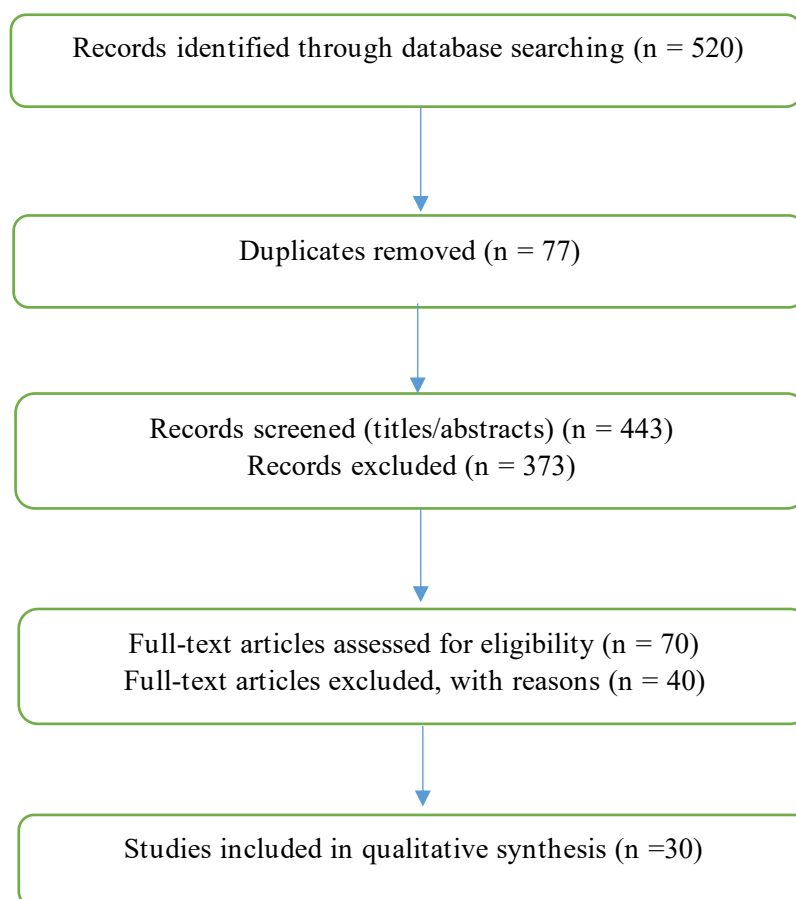


Figure 1: PRISMA 2020 Flow Diagram of the Study Selection Process

Results

Study Selection and Characteristics

The search and screening process yielded 30 eligible studies, which were included in the current systematic review. The authors of these studies were from a variety of employment settings such as banking, healthcare, public sector, manufacturing and automotive services, and higher education, illustrating the wide utility of e-learning in industry. The majority of the input studies were published after 2020, demonstrating the rapid transition to digital learning environments, triggered by COVID-19 and the increasing necessity for flexible, technology-supported professional development (Hudaya et al., 2020; Giannakos et al., 2022). Quantitative studies were predominant within the dataset, focusing particularly on survey research, which employed structural equation modelling, regression analysis, or mixed-method investigations of predictors and consequences of e-learning adoption (Deshpande et al., 2024; Mandaleeka et al., 2025). Qualitative and mixed studies provided further texture, helping to understand how users perceived the challenges to online learning, organizational preparedness, and contextual barriers (Byungura et al., 2022).

E-learning interventions were diverse across all studies, ranging from digital training modules, blended learning approaches, competency-based systems, and workplace learning systems with a focus on knowledge, performance, and engagement. They were mainly implemented as training courses via a learning management system, virtual classrooms, or integrated company and organization platforms, which represents a significant development in the design of training and digital infrastructures. The Literature Review Matrix, which summarizes the factors of each study (subject area, methods used, and variables reported), is presented in Table 1. This matrix offers an integrated picture of the base of evidence and highlights the clustering effect of themes widely studied: learner motivation, technological readiness, digital skills, and organizational support for learning (Kapo et al., 2021; Hao, 2024).

Table 1. Literature Review Matrix

No.	Author(s) & Year	Digital Infrastructure / ICT Readiness	Human Skills / Professional Competence	Organizational Support / Culture	Training Design / Pedagogy	Advanced Technologies (VR/AR/AI/ML/IoT)	E-Learning Effectiveness / Outcomes
1	Belhaj & Moundib (2025)	✓	✓	✓			✓
2	Ghosh & Ravichandran (2024)		✓			✓	
3	Hashem et al. (2022)	✓		✓			
4	Williams (2020)	✓	✓		✓		
5	Aaltola (2022)	✓	✓		✓	✓	
6	Aali et al. (2020)	✓	✓		✓		✓
7	Ojanperä (2021)	✓	✓		✓		✓
8	Bragg et al. (2021)		✓		✓		✓
9	Rahmani et al. (2022)	✓	✓		✓	✓	✓
10	Gameil & Al-Abdullatif (2023)	✓	✓		✓		✓
11	Abdekhoda & Dehnad (2023)	✓		✓			✓
12	Nikou et al. (2022)	✓	✓				✓
13	Kulkarni et al. (2024)		✓		✓		✓
14	Salari Jaeeni et al. (2021)	✓		✓	✓		✓
15	Helmi et al. (2024)	✓		✓		✓	✓
16	Abuali & Ahmed (2025)	✓					✓
17	Putri & Handayani (2021)			✓	✓		✓
18	Shang et al. (2025)		✓	✓			✓
19	Shahzad et al. (2023)	✓	✓	✓		✓	✓
20	Ibrahim (2020)	✓			✓		✓
21	Al-Ghezawi & Megdadi (2021)		✓		✓		✓
22	Kopp et al. (2020)			✓			✓
23	Mandaleeka et al. (2025)		✓		✓		✓
24	Ma et al. (2022)				✓		✓
25	Kapo et al. (2021)	✓		✓		✓	✓
26	Hao (2024)		✓		✓		✓
27	Deshpande et al. (2024)						✓
28	Giannakos et al. (2022)			✓		✓	✓
29	Hudaya et al. (2020)		✓				✓
30	Byungura et al. (2022)	✓	✓	✓			✓

Determinants Influencing E-Learning Effectiveness

Highlights: Several drivers consistently appear to facilitate e-learning effectiveness and sustainability across the included studies. Learner motivation appeared as one of the most important predictors influencing engagement and persistence in e-learning, which has been repeatedly demonstrated throughout studies identifying motivational factors as a core success

factor in digital learning (Deshpande et al., 2024; Mandaleeka et al., 2025). Motivation was significantly related to self-efficacy, as the employees' confidence in their digital proficiency helped them use e-learning tools and apply learned skills to actual work (Mandaleeka et al., 2025). Technological readiness was also critical. Access to dependable digital infrastructure, access to devices, stable internet, and learning systems were also key considerations in promoting meaningful employee engagement with e-learning content (Byungura et al., 2022). The lack of digital infrastructure and connectivity in the contexts where these teachers worked also negatively affected access to technology-supported professional development. The usability and quality of learning platforms mattered too for satisfaction and participation, signaling that organizations should invest in intuitive user-centered digital environments rather than solely focusing on the technical system (Giannakos et al., 2022). The evidence also indicated that organizational support and culture were determinants of learning outcomes. Environments that supported continuous learning and had high levels of managerial support proved more successful in stimulating long-term e-learning adoption. The studies also indicate that training design, such as blended learning formats, competency-based content, and interactive modules fitting employees' job positions and performance targets, is important (Hao, 2024; Ma et al., 2022). These pedagogical components contributed to engagement by making learning meaningful, context-relevant, and applied in a practical manner. Together, these determinants comprised an embedded set of psychological, technological, and organizational facilitators of successful digital professional development.

Outcomes

The outcomes reported by the analyzed studies were positive and could be associated with the integration of e-learning in professional settings. The primary outcome was improved job performance, reflected in the scientific literature as increased competence, productivity, and workplace functioning due to digital training (Al-Ghezawi & Megdadi, 2021; Mandaleeka et al., 2025). The improvement was achieved through enhanced knowledge acquisition, technical skills, and job competence that helped individuals complete a range of tasks necessary for their work in alignment with organizational needs. From this perspective, the outcome was formulated for both efficiency and effectiveness and, with technological advancement, it enabled shorter learning times alongside more profound mastery of work-related skills (Ma et al., 2022; Hao, 2024). The second important outcome was increased engagement and satisfaction; many employees reported being more involved, excited, and connected to their work when exposed to accessible and efficient e-learning models (Hudaya et al., 2020). These outcomes were often influenced by perceived usefulness, perceived performance, platform satisfaction, and the perception of the relevance of the credentials to individual career goals (Deshpande et al., 2024). Moreover, corporate learning was associated with increased knowledge sharing, skill acquisition opportunities, and an overall increase in organizational capacity. Studies examining digital learning agreed that it was more scalable, affordable, and feasible for enabling comprehensive, continuous professional development that underlines adaptive learning cultures (Giannakos et al., 2022; Kapo et al., 2021). Evidence from healthcare indicated increased preparedness and knowledge supporting staff and service delivery, enhancing the facility's capacity in various ways (Byungura et al., 2022). Overall, the studies present a comprehensive view of e-learning as a means of improving organizational performance and innovative capacity.

Discussion

Interplay of Technological, Human, and Organizational Determinants

The results of this review indicate that the effectiveness of e-learning is formed by a complex mesh made up of technological, human, and network factors. At a technological level, research widely reports that digital infrastructure access, also referred to as pedagogical technologies, intuitive learning platforms, and the quality of online content support meaningful learner engagement (Giannakos et al., 2022; Byungura et al., 2022). Digital readiness, including device access, stable connectivity, and the usability of e-learning platforms, not only enables but also encourages learners to engage with e-learning systems. However, technology alone is insufficient; human factors also shape how receptive learners are to e-learning. Motivation, self-efficacy, satisfaction, and perceived usefulness were found to be significant psychological determinants in predicting engagement and continued usage (Deshpande et al., 2024; Mandaleeka et al., 2025). Together, these human factors help bridge the gap between the availability of information technology and its effective use, suggesting that learner-driven digital ecosystems require both cognitive and motivational support. At the organizational level, practices supporting a lifelong learning culture, digital transformation, and defined training programs contribute to e-learning initiatives' sustainability and impact (Al-Ghezawi & Megdadi, 2021; Kapo et al., 2021). Organizational support creates an environment in which employees are encouraged to accept, use, and transfer skills developed using digital platforms. Interventions, such as blended learning, competency-based curriculum design, and workplace learning analytics, also provide evidence of how pedagogical innovation intersects with organizational strategy to result in stronger learning and performance outcomes (Hao, 2024; Ma et al., 2022; Kopp et al., 2020). In this manner, the interaction between the

technological environment and social dynamics (or human characteristics) creates a human-technology-organizational learning system that drives the success and scalability of e-learning within professional domains.

Policy, Practical, and Theoretical Implications

The findings provide important implications for policymakers, practitioners, and researchers. On the policy side, the growing use of digital training further points to the need for national and sectoral policies that enhance ICT infrastructure development, foster digital inclusion, and guarantee equitable access to learning technologies, especially in low-bandwidth work environments where gaps in digital capabilities restrict professional development opportunities (Byungura et al., 2022). Moreover, policymakers should also create the necessary frameworks enabling lifelong upskilling as per labor market demands, with e-learning being positioned as a tool to drive economic competitiveness and workforce agility. In practice, institutions will need to select digital learning solutions that are 'user-centric' and contextually tailored, supported by good digital pedagogy. Platform usability, learner support systems, and competency-based or blended learning can further enhance training effectiveness and the transfer of learning (Hao, 2024; Ma et al., 2022). When designing e-learning programs, human resource departments need to focus on motivational drivers that increase satisfaction and self-efficacy and contribute to enhanced job performance and employee engagement (Deshpande et al., 2024; Mandaleeka et al., 2025). The literature also indicates that companies that implement workplace learning analytics can gain insights into performance measurement and better alignment of digital training with strategic goals (Kopp et al., 2020). Theoretically, this review underlines the importance of social cognitive theory, self-determination theory, and competency-based education models in explaining digital learning behavior. Self-efficacy and intrinsic motivation are psychological correlates that closely correspond with social cognitive models and with the competence and autonomy tenets of self-determination theory (Mandaleeka et al., 2025; Hao, 2024). The review also underscores the necessity to develop comprehensive theoretical models that could explain cross-level interactions between individual, technological, and organizational antecedents that are under-theorized in the extant literature.

Comparison With Existing Reviews, Limitations, and Future Research

This paper synthesizes the determinants and effects of e-learning during the post-pandemic period across sectors in an updated literature review. Although previous reviews focused on the affordances of this technology and implementation barriers in adopting it, few studies directly addressed psychosocial factors such as motivation, satisfaction, and self-efficacy (SE), which critically contribute to the effectiveness of learning modalities. In line with the most recent developments between 2020 and 2025, this review also reflects on the increasing complexity of digital learning environments by tracking developments in blended learning, workplace learning analytics, country-specific trends in immersive learning, and continuous professional development (Giannakos et al., 2022; Aaltola, 2022). The multidimensional perspective presented here reflects and extends prior work in that it makes the implicit assumption of interaction between organizational learning culture, human factors, and technology factors with respect to training outcomes. Yet, the present review has some limitations. First, most studies were quantitative and cross-sectional in design, thus precluding causal inference about how the endpoints develop. Second, such limited diversity may not represent all regions of the world (particularly low-income countries), therefore implying that more global and comparative research is needed. Thirdly, concerning the heterogeneity and variability of e-learning systems and outcome measures, cross-study comparisons are more difficult. Nevertheless, those constraints also highlight opportunities for future work. Future research should also prioritize longitudinal and mixed-methods research to understand transfer of learning at different levels across the continuum from gaining digital competences to longer-term outcomes. Further research is needed to examine developments in the organizational value generated by technologies of higher maturity, including personalization through AI, learning analytics, and immersive environments (Giannakos et al., 2022; Aaltola, 2022). These developments highlight the growing importance of research on accessibility, e-learner inclusion, and efficacy, while considerable work remains to ensure that digital learning serves all segments of the workforce.

Conclusion

This systematic review shows how e-learning is emerging as a critical tool for upgrading employee skills in various organizational and sectoral environments. The synthesis identifies that successful e-learning results from the dynamic interaction between technological readiness, human psychological factors, and organizational support. When these dimensions are balanced, e-learning supports employees in developing new skills and performing their jobs more effectively. The review stresses the importance of well-designed digital learning systems, available infrastructure, and user-friendly platforms to promote effective learner involvement. Individual characteristics, on the other hand, play a key role in determining how employees can embrace and benefit from e-learning: motivation, satisfaction, and self-efficacy among the most explored factors. Corporate cultures that promote learning, foster digital transformation, and implement training

structures sharpen the long-term value of e-learning. Taken overall, the findings reinforce the message that e-learning is not just about technology; it is a strategic enabler of agile, informed, and future-proofed workforces. To ensure maximum benefit of e-learning for workforce development in the future, digital learning ecosystems will need to be reinforced, access made equitable, and pedagogical strategies further developed.

Conflict of interest. Nil

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