

The Roles of Artificial Intelligence in Interprofessional Healthcare Education: A Systematic Scoping Review

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Background: Artificial intelligence (AI) is increasingly being introduced into healthcare education, with emerging applications that may support interprofessional education (IPE). However, current evidence on the use of AI in IPE remains limited, and the distinction between AI-enabled technologies and other digital educational approaches has not been consistently described.

Objective: This scoping review aimed to map the existing evidence on the application and roles of AI in interprofessional healthcare education and to identify current research trends, educational outcomes, and knowledge gaps.

Methods: This review followed the Joanna Briggs Institute (JBI) methodology for scoping reviews and is reported according to PRISMA-ScR guidelines. Five databases (PubMed, Scopus, CINAHL, ERIC, IEEE Xplore) were searched for studies published between 2014 and 2024. Eligible studies included those examining AI applications in IPE involving healthcare students or professionals. Data were extracted, charted, and synthesised using descriptive and thematic analysis.

Results: Fifteen studies met the eligibility criteria. Most studies evaluated immersive virtual reality or simulation-based educational environments, while only a subset incorporated explicit AI functionalities, such as intelligent virtual agents or adaptive AI systems. Reported educational outcomes included improvements in communication, teamwork, collaborative learning, and learner confidence. However, the evidence was heterogeneous with respect to study design, intervention characteristics, and outcome measures, and most studies evaluated short-term educational outcomes rather than long-term competence or patient-related outcomes. Limited methodological rigor, inconsistent reporting of AI components, and ethical considerations were also identified.

Conclusion: Current evidence suggests that AI-enabled technologies may support interprofessional healthcare education, particularly when integrated into immersive learning environments. Nevertheless, the available evidence remains limited and heterogeneous. Future research should clearly distinguish AI from other digital educational technologies, employ more rigorous study designs, evaluate long-term educational and clinical outcomes, and address ethical considerations to support responsible implementation in healthcare education.

Keywords: artificial intelligence, interprofessional education, healthcare education, virtual reality, machine learning, scoping review

Introduction

Artificial intelligence (AI) refers to computational systems capable of performing cognitive functions commonly associated with human intelligence, including learning, reasoning, problem-solving, decision-making, and pattern recognition.^{1,2} Machine learning (ML), a major subfield of AI, enables algorithms to learn from data and improve performance without being explicitly programmed for every task.³ These technologies have accelerated digital

transformation across healthcare by supporting clinical decision-making, predictive analytics, patient monitoring, work-flow optimisation, and administrative efficiency.⁴

As healthcare systems increasingly adopt AI-enabled technologies, educational institutions are expected to prepare future healthcare professionals with the competencies required to work effectively in digitally supported clinical environments. AI has created new opportunities for healthcare education through intelligent tutoring systems, adaptive learning, automated feedback, learning analytics, and decision-support training.⁵ These approaches have the potential to complement conventional teaching strategies while promoting more personalised and data-informed learning experiences. If this technology is incorporated into the curriculum, it will embrace innovation and provide high-quality care in the digital era.⁶

Interprofessional education (IPE), in which learners from two or more health professions learn with, from, and about one another to improve collaboration and the quality of patient care, remains a cornerstone of healthcare professional education.⁷ Despite its recognised importance, implementing IPE continues to present challenges, including limited opportunities for authentic collaboration, scheduling constraints, faculty availability, and access to realistic learning environments. Emerging digital technologies may help address some of these barriers by providing scalable, immersive, and collaborative educational experiences.

Although AI is increasingly discussed within healthcare education, its implementation in IPE frequently overlaps with other advanced digital educational technologies, including virtual reality (VR), virtual patients, simulation-based learning, and intelligent learning environments. Importantly, these technologies are not inherently AI-based; however, many contemporary educational platforms integrate AI functionalities such as adaptive feedback, intelligent virtual agents, natural language processing, or automated performance analysis. Consequently, distinguishing explicit AI applications from broader digital educational technologies remains challenging within the current literature and has contributed to conceptual inconsistency across published studies.

Previous reviews have primarily examined AI in healthcare education in general, with limited attention to its application within interprofessional healthcare education. Furthermore, evidence describing AI-supported IPE remains dispersed across studies employing varying digital technologies and educational approaches. Therefore, this scoping review aimed to comprehensively map the existing literature on the roles of AI and related intelligent digital educational technologies in interprofessional healthcare education, identify their educational applications, and synthesise current evidence to inform future educational practice and research.

Methods

Study Design

This study employed a scoping review methodology to systematically map and synthesize the available evidence on the use of artificial intelligence (AI) and related intelligent digital educational technologies in interprofessional healthcare education (IPE). The review followed the methodological framework proposed by Arksey and O'Malley and further refined by Levac et al,^{8,9} These frameworks provide a systematic approach for identifying, selecting, and synthesizing diverse forms of evidence within emerging research fields.

A scoping review was considered appropriate because AI in healthcare education is a rapidly evolving field characterized by heterogeneous technologies, educational approaches, and research designs. Moreover, the current literature frequently integrates AI with broader intelligent digital learning environments, including virtual reality, virtual patients, and simulation platforms incorporating varying levels of intelligent functionality. Therefore, this review aimed to comprehensively map the current evidence while distinguishing explicit AI applications from related intelligent digital educational technologies within IPE.

Search Strategy

A comprehensive literature search was conducted in five electronic databases (PubMed, Scopus, CINAHL, ERIC, and IEEE Xplore) to identify studies published between January 2014 and December 2024. This time frame was selected to

capture the rapid expansion of AI and digitally enabled educational technologies in healthcare education during the last decade.

The search strategy combined controlled vocabulary and free-text keywords related to artificial intelligence (eg, “artificial intelligence”, “machine learning”, and “AI”) together with concepts related to interprofessional healthcare education (eg, “interprofessional education”, “healthcare professional education”, and related terms). Complete search strategies for each database are provided in [Supplementary Tables 1A](#) and [B](#) to ensure transparency and reproducibility. In addition, the reference lists of all eligible studies were manually screened to identify potentially relevant publications not retrieved during database searching.

The free full-text filter was applied only to facilitate full-text retrieval because institutional access to subscription databases was limited. Potentially eligible studies identified through other databases or manual searching were also assessed to minimize the risk of excluding relevant evidence. To maximize the identification of relevant evidence, the reference lists of all eligible articles were also manually screened for additional studies.

Study Selection

Studies were eligible if they investigated the application of artificial intelligence or related intelligent digital educational technologies within interprofessional healthcare education involving undergraduate or postgraduate healthcare students or healthcare professionals. Eligible educational technologies included AI-enabled systems as well as advanced digital learning environments incorporating intelligent functionalities, such as adaptive feedback, intelligent virtual agents, learning analytics, or AI-supported simulation.

Original empirical studies reporting educational implementation or evaluation were eligible for inclusion. Review articles, editorials, commentaries, conference abstracts, letters, protocols, case reports, and other non-empirical publications were excluded. Detailed eligibility criteria are presented in [Supplementary Table 2](#).

Data Extraction

All records retrieved from the database searches were imported into the Rayyan web-based platform to facilitate study management and screening. The screening procedure was conducted in two sequential stages. Initially, three reviewers (H.R.A., N.M., and K.S.) independently evaluated the titles and abstracts of 3994 records after duplicate removal and preliminary filtering during the identification stage. Following this assessment, 3742 records were excluded because they did not meet the predefined eligibility criteria. The remaining 252 articles underwent full-text review, of which 237 were subsequently excluded. Consequently, 15 studies met the eligibility criteria through database searching. An additional relevant study was identified by manually screening the reference lists of the included articles, resulting in a final sample of 15 studies. Any disagreements encountered during the screening process were discussed among the reviewers until consensus was reached.

Data from the eligible studies were subsequently charted using a standardized extraction form specifically developed for this review. The standardized data-charting form was piloted using a sample of the included studies before full data extraction to ensure consistency among reviewers. Following extraction, studies were grouped according to the primary educational technology employed and subsequently categorized based on whether they incorporated explicit AI functionality or broader intelligent digital educational technologies. This categorization was performed through discussion and consensus among the review team according to the description of the educational intervention reported in each study.

The second and seventh authors independently extracted the study data, while the first and fifth authors verified the completeness and accuracy of the extracted information. The extracted variables included publication characteristics (authors, year of publication, country, and study design), participant characteristics, descriptions of AI-based educational interventions, and reported outcomes related to the implementation of AI in interprofessional healthcare education. Any inconsistencies identified during the verification process were resolved through discussion until agreement was achieved. The finalized data were summarized in [Supplementary Table 3](#) and accompanied by a narrative synthesis describing the characteristics and applications of AI in interprofessional healthcare education.

Protocol and Registration

Methods and inclusion criteria were defined in advance, specified in a protocol, and registered on the Open Science Framework (OSF). Registration at the link: <https://osf.io/rt7fq> on 15 April 2025.

Data Analysis

Owing to the substantial heterogeneity in study designs, educational interventions, participant populations, and reported outcomes, quantitative synthesis or meta-analysis was not considered appropriate. Instead, findings were synthesized narratively.

The analysis consisted of two stages. First, studies were categorized according to the principal educational technology employed (eg, AI-enabled systems, virtual reality-based learning environments, intelligent virtual agents, natural language processing applications, or adaptive learning platforms). Second, educational outcomes were inductively grouped into common interprofessional competency domains, including communication, teamwork, collaborative decision-making, role clarification, knowledge acquisition, and learner confidence.

Descriptive frequencies reported in the Results section represent the proportion of included studies reporting each educational outcome. Each study contributed only once to each outcome category regardless of the number of outcome measures reported. This approach was intended to provide an overall descriptive summary rather than quantitative effect estimation.

Results

Literature Search Results

The search strategy identified 13,616 records across the five databases. During the identification stage, records were removed according to the predefined criteria, including publication date ($n = 4189$), publication type ($n = 2913$), non-English language ($n = 48$), other reasons ($n = 2334$), and duplicate records ($n = 138$), leaving 3994 records for title and abstract screening.

During screening, 3741 records were excluded, and 253 articles underwent full-text assessment. Following eligibility assessment, 239 articles were excluded because they did not meet the inclusion criteria. Fourteen studies met the eligibility criteria through database searching, and one additional study was identified through manual reference screening, resulting in a total of 15 included studies. The study selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1) and [Supplementary Table 4](#).

Description of the Studies

A total of 15 studies published between 2019 and 2024 met the eligibility criteria and were included in this review. The studies were conducted across 12 countries, with Singapore and China contributing the highest number of publications. Research designs included randomized controlled trials, quasi-experimental studies, mixed-methods research, qualitative studies, cross-sectional surveys, scoping reviews, descriptive studies, and secondary evidence syntheses. Participants comprised undergraduate students, postgraduate trainees, and healthcare professionals from nursing, medicine, pharmacy, physiotherapy, occupational therapy, and other allied health disciplines. Detailed study characteristics are presented in [Supplementary Table 3](#).

Among the included studies, virtual reality (VR) and immersive simulation represented the dominant educational platforms. However, only a proportion of these studies explicitly incorporated AI technologies, such as intelligent virtual agents, natural language processing (NLP), machine learning algorithms, automated feedback systems, or adaptive learning functions. The remaining studies evaluated digital simulation environments that supported interprofessional learning but did not describe explicit AI functionality. Accordingly, the findings of this review should be interpreted as representing both AI-enabled educational interventions and AI-adjacent digital learning technologies, rather than AI applications alone.

Descriptively, most included studies reported improvements in teamwork or collaboration, while several studies also described enhanced communication skills, knowledge acquisition, and learner confidence. These findings represent

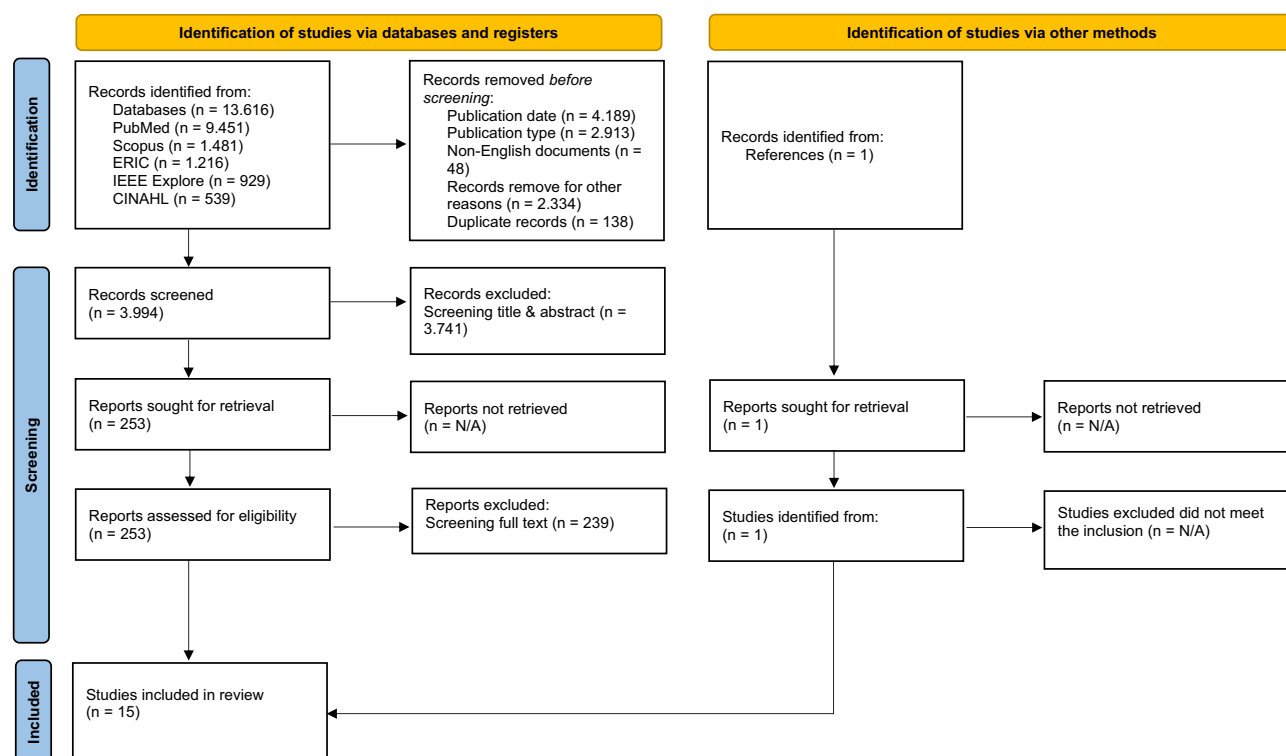


Figure 1 PRISMA 2020 flow diagram illustrating the study selection process for the scoping review.

simple frequencies across the included studies and should not be interpreted as pooled estimates of intervention effectiveness because the studies differed substantially in design, intervention characteristics, and outcome measures.

Discussion

This scoping review synthesized the available evidence regarding the use of Artificial Intelligence (AI) and AI-adjacent digital technologies in interprofessional healthcare education (IPE). Across the 15 included studies, virtual reality (VR) and immersive simulation were the most frequently reported educational approaches. However, only a subset of these studies explicitly incorporated AI functionalities, such as intelligent virtual agents, natural language processing (NLP), machine learning algorithms, adaptive feedback, or automated decision support. Therefore, the findings should be interpreted cautiously, as the current evidence reflects both AI-enabled educational interventions and digital simulation technologies that support interprofessional learning but do not necessarily employ AI.

Immersive virtual reality environments were widely used to facilitate collaborative learning experiences by providing realistic clinical scenarios in which learners from multiple health professions could practice teamwork, communication, and shared decision-making. Although many VR-based interventions reported positive educational outcomes, these benefits cannot be attributed solely to AI because several studies evaluated conventional VR or simulation platforms without explicit AI functionality. Nevertheless, studies implementing AI-enabled features, including intelligent virtual agents and adaptive feedback systems, suggested that AI may further enhance learner engagement, role clarification, and individualized learning experiences.²⁵

AI-supported communication technologies also emerged as a promising area of educational innovation. Several studies evaluated conversational agents, AI-powered virtual patients, and NLP-based communication systems that allowed learners to practice clinical communication while receiving automated feedback.²⁶ These technologies appeared to facilitate repeated practice and personalized learning opportunities that are difficult to provide consistently through conventional educational approaches. However, the included studies also highlighted limitations in conversational

realism and contextual responsiveness, indicating that current AI systems still have limited capacity to replicate authentic human interaction during interprofessional communication.

The findings further suggest that AI-supported educational technologies may contribute to knowledge acquisition, clinical reasoning, and collaborative decision-making. Studies incorporating adaptive learning functions or intelligent virtual agents reported improvements in learners' confidence, knowledge, and perceived interprofessional competencies. Nevertheless, these findings should be interpreted cautiously because most studies evaluated short-term educational outcomes immediately following the intervention, frequently relying on self-reported perceptions rather than objective measures of clinical performance or patient outcomes.²⁷ Furthermore, considerable heterogeneity in intervention design, participant characteristics, and outcome assessment limited direct comparison across studies.

An important observation from this review is the considerable variability in how AI was defined and implemented across the included studies. Some studies clearly described AI technologies such as machine learning, natural language processing, or intelligent virtual agents, whereas others focused primarily on immersive digital learning environments without explicitly incorporating AI functionality. This conceptual inconsistency highlights the need for greater standardization in defining AI within healthcare education research and emphasizes the importance of transparently describing AI system characteristics, including algorithm type, data sources, adaptive mechanisms, and decision-making processes.

Another important finding concerns learners' perceptions of AI-supported education. Across several survey-based studies, healthcare students generally expressed positive attitudes toward AI and recognized its potential to enhance educational efficiency, teamwork, and clinical learning. At the same time, concerns regarding data privacy, algorithmic transparency, explainability, potential bias, and reduced human interaction were consistently reported. These findings emphasize that successful implementation of AI in IPE requires not only technological advancement but also appropriate governance, ethical oversight, faculty development, and institutional readiness.

Methodologically, the current evidence remains limited. The included studies encompassed randomized controlled trials, quasi-experimental studies, qualitative research, cross-sectional surveys, descriptive studies, and secondary evidence syntheses, resulting in substantial methodological heterogeneity. Consistent with the objectives of a scoping review, no formal critical appraisal of methodological quality was undertaken. Consequently, the findings presented in this review should be interpreted as a mapping of the available evidence rather than confirmation of intervention effectiveness. Future studies employing rigorous experimental designs, standardized outcome measures, and longer follow-up periods are required to establish the educational effectiveness of AI-supported interprofessional learning.

The review also identified several implementation challenges that warrant further attention. Technical limitations, including system instability, limited conversational realism, infrastructure requirements, and unequal access to advanced technologies, remain important barriers to widespread implementation, particularly in resource-limited educational settings. Furthermore, relatively few studies explicitly integrated established educational theories into AI-supported intervention design. Future research would benefit from aligning AI applications with established learning theories, such as experiential learning, cognitive apprenticeship, self-regulated learning, or social constructivism, to strengthen both educational design and interpretation of outcomes.²⁸

Overall, this review suggests that AI-supported educational technologies have promising potential to complement interprofessional healthcare education by providing immersive, adaptive, and personalized learning experiences. However, the current evidence remains limited by conceptual inconsistencies, methodological heterogeneity, and the relatively small number of studies implementing explicit AI technologies. Accordingly, stronger empirical research is needed before definitive conclusions regarding the effectiveness of AI in interprofessional healthcare education can be established.

Limitation of Study

This review has several limitations. First, the inclusion of English-language studies only may have excluded relevant research published in other languages. Second, the heterogeneity of study designs and outcomes limited the ability to perform quantitative synthesis. Third, many included studies lacked detailed reporting of AI system architecture and implementation, reducing reproducibility and critical appraisal. Finally, most studies focused on short-term educational outcomes, limiting insights into long-term clinical impact.

Another limitation is the inconsistent reporting of AI functionality across the included studies. Several studies described virtual reality or digital simulation environments without clearly specifying whether AI algorithms were implemented. This limited our ability to distinguish the educational effects attributable specifically to AI from those associated with digital simulation technologies more broadly.

Conclusion

This scoping review suggests that AI-supported educational technologies have the potential to strengthen interprofessional healthcare education by facilitating immersive and adaptive learning experiences. However, much of the current evidence is derived from digital simulation and virtual reality environments with varying degrees of AI integration. Consequently, stronger empirical evidence is required before definitive conclusions regarding the educational effectiveness of AI can be established. Future research should clearly define AI functionality, employ rigorous study designs, evaluate long-term educational and clinical outcomes, and address ethical, governance, and implementation considerations.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article. No additional datasets were generated during the current study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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