

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Ahmed, H.	2023	Knowledge and perception of medical students towards the use of artificial intelligence in healthcare	Journal of the Pakistan Medical Association	Pakistan	APG	Assess the knowledge and perception of medical students regarding the utility and applications of artificial intelligence in medicine.	n=390; medical students; 31% first year, 31.3% second year, 7.7% third year, 18.7% fourth year, 11.3% fifth year	56.7% had a good familiarity with artificial intelligence, and 57.9% agreed that the biggest advantage of using artificial intelligence in healthcare was its ability to speed up processes. No differences noted by gender or year of study.
Ahmed, Z.	2022	Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey.	Annals of Medicine and Surgery	Pakistan, Qatar	APG	Evaluate the knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan through a cross-sectional online survey.	n=470, doctors 223, medical students 247	74% doctors and 68.8% medical students had a basic knowledge of AI but only 27.3% doctors and 19.4% students were aware of its medical applications. 76.7% of participants supported AI's inclusion in curricula, and 78.3% and 64.9% acknowledged its necessity in radiology and pathology. The majority of doctors and medical students lacked detailed knowledge about AI and its applications in healthcare, but had a positive view about it and were willing to practically adopt it.
Al Saad, M.	2022	Medical Students' Knowledge and Attitude Towards Artificial Intelligence: An Online Survey	The Open Public Health Journal	Jordan	APG	Estimate the level of knowledge about AI and ML among medical students in Jordanian Universities. Investigate the different views about AI and whether AI will influence students' careers and if AI is considered as a positive addition to this field or is considered a threat for replacing physicians.	n=900 medical students	89% of the students believed in the importance of AI in the medical field, and 71.4% believed in the beneficiary of teaching AI in the medical career. 47% of the students had an understanding of the basic principles of AI, 68.4% of the students believed that it is mandatory for medical students to receive knowledge of AI. Students who received teaching/training in AI were more likely to consider radiology as a career given the advancement in AI. Medical students in Jordanian universities appreciate the importance of artificial intelligence and machine learning in medical advancements. Adding courses and training related to artificial intelligence and machine learning to the study plan should be considered.
Al-Ani, A.	2024	Evaluating the understanding of the ethical and moral challenges of Big Data and AI among Jordanian medical students, physicians in training, and senior practitioners: a cross-sectional study	BMC Medical Ethics	Jordan	APG	Examine the understanding of the ethical dilemmas associated with Big Data and artificial intelligence (AI) among Jordanian medical students, physicians in training, and senior practitioners.	n=466 medical students 38%, interns and residents 50.2%, clinical fellows 11.8%	Jordanian medical students, physicians in training and senior practitioners have limited awareness of the ethical risks associated with Big Data and AI. Institutions are responsible for raising awareness, especially with the upsurge of such technology
Al-Qerem, W.	2023	Exploring knowledge, attitudes, and practices towards artificial intelligence among health professions' students in Jordan	BMC Medical Informatics and Decision Making	Jordan	APG	Examine the knowledge, attitudes, and practices (KAP) of health professions' students in Jordan towards artificial intelligence, focusing on their preparedness and barriers to AI integration in medical education and practice.	n=483 health professional students	Moderate level of AI knowledge among students, with varied attitudes. While students recognized AI's value, skepticism existed about AI replacing human roles. Barriers to AI integration included lack of knowledge, time constraints, limited access, and curriculum gaps. The study highlights the need to enhance AI-related education in the medical curriculum to prepare future healthcare professionals.
Alghamdi, S., Alashban, Y.	2024	Medical science students' attitudes and perceptions of artificial intelligence in healthcare: A national study conducted in Saudi Arabia	Journal of Radiation Research and Applied Sciences	Saudi Arabia	APG	Explore and assess the attitudes and perceptions of medical science towards the integration of artificial intelligence (AI) in healthcare within the context of Saudi Arabia.	n=263 medical students	Most Saudi Arabian medical students hold positive attitudes towards AI in healthcare. However, a gap was identified in their understanding of AI principles, indicating a need for improved AI education in medical schools. While many students believe AI will play a significant role in healthcare, only a small percentage have received formal education in AI.
Ali, A.	2022	Medical Student's Attitudes and Perceptions Toward Artificial Intelligence Applications	Journal for Educators, Teachers and Trainers	Saudi Arabia	APG	Evaluate medical students' perceptions of AI in radiology and medical applications of artificial intelligence (AI).	n=265 recently graduated medical students	The majority of students had heard about AI and deep learning in radiology. However, they were unaware of the current details about AI in radiology. Students suggested that more focus should be placed on AI education in medical curricula to better prepare them for its future applications in healthcare.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Alkhaaldi, S.	2023	Medical Student Experiences and Perceptions of ChatGPT and Artificial Intelligence: Cross-Sectional Study.	JMIR Medical Education	United Arab Emirates	APG	Explore the experiences and perceptions of postgraduate medical students on ChatGPT and artificial intelligence in their medical education and future clinical practice.	n=4492 medical students	The surveyed medical students had minimal formal and informal experience with AI tools and limited perceptions of the potential uses of AI in health care but had overall positive views of ChatGPT and AI and were optimistic about the future of AI in medical education and health care. Structured curricula and formal policies and guidelines are needed to adequately prepare medical learners for the forthcoming integration of AI in medicine.
Allam, A.	2023	Knowledge, attitude, and perception of Arab medical students towards artificial intelligence in medicine and radiology: A multi-national cross-sectional study.	European Radiology	Libya, Egypt, Iraq, Jordan, Syria, Sudan, Algeria, Palestine, Yemen	AG, APG, WEOG	To assess undergraduate medical students' knowledge, attitude, and perception regarding artificial intelligence (AI) in medicine and radiology.	n=293, medical students 211, doctors 82	Participants exhibit a notable deficit in their knowledge and training pertaining to AI. Despite this, they hold a positive perception of AI implementation in medicine and radiology, demonstrating a clear understanding of its significance for the healthcare system and medical curriculum.
AlZaabi, A.	2023	Are physicians and medical students ready for artificial intelligence applications in healthcare?	Digital Health	Oman	APG	To evaluate physicians and medical students' attitudes and perceptions of AI applications in healthcare.	n=281 medical students	Physicians and medical students showed positive attitudes and willingness to learn about AI applications in healthcare. Introducing AI learning objectives or short courses in medical curriculum would help to equip physicians with the needed skills for AI-augmented healthcare system.
Barreiro-Ares, A.	2023	Impact of the Rise of Artificial Intelligence in Radiology: What Do Students Think?	International Journal of Environmental Research and Public Health	Spain	WEOG	Analyze the perception that undergraduate medical students have about the current situation of AI in medicine, especially in radiology.	n=172 medical students	The majority of students acknowledged the importance of AI in radiology and viewed it positively. While students recognized AI as a supportive tool rather than a replacement for radiologists, they stressed the need for proper ethical principles in AI usage and supported the inclusion of AI training in medical education.
Biri, S.	2023	Assessing the Utilization of Large Language Models in Medical Education: Insights From Undergraduate Medical Students.	Cureus	India	APG	Explore medical students' awareness, their attitudes toward LLMs, and their actual engagement with these AI-driven tools.	n=3,133 medical and dental students	While there is a generally positive attitude toward their incorporation, concerns about overreliance and potential inaccuracies are evident. LLMs offer the potential to enhance learning resources and provide accessible education, but their integration requires careful planning, faculty development, and the cultivation of critical thinking skills.
Bisdas, S.	2021	Artificial Intelligence in Medicine: A Multinational Multi-Center Survey on the Medical and Dental Students' Perception.	Frontiers in Public Health	United Kingdom, Romania, Ecuador, Germany, Libya, Indonesia, Jordan, Egypt, Pakistan	AG, APG, EEG, LAC, WEOG	Explore: (1) sources of information about AI, (2) AI applications and concerns, (3) AI status as a topic in medicine, and (4) students' feelings and attitudes.	n=245 medical students	Most students showed a positive attitude towards AI in medicine and dentistry, viewing it as a partner rather than a competitor. They expressed interest in incorporating AI into their future practice and recognized the need for AI education within their medical and dental school curricula.
Blacketer, C.	2021	Medical student knowledge and critical appraisal of machine learning: a multicentre international cross-sectional study.	Internal Medicine Journal	Australia, United States, New Zealand, Malaysia	APG, WEOG	To evaluate medical students' knowledge of key machine learning (ML) concepts, their ability to critically analyze ML research articles, and their opinions on the relevance of ML in their future careers.	n=252 medical students	Medical students had difficulties in understanding and critically appraising key aspects of ML research, particularly concerning study design weaknesses, model performance analysis, and the stages of model development. However, they were generally able to interpret the conclusions and statistical significance of ML research. Most students believed that ML would be relevant to their future careers and expressed a strong interest in learning more about the topic, favoring small group teaching sessions and online lectures.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Blease, C.	2022	Machine learning in medical education: a survey of the experiences and opinions of medical students in Ireland.	BMJ Health & Care Informatics	United States, Sweden, United Kingdom, Ireland	WEOG	To assess the experiences and opinions of final-year medical students in Ireland regarding their exposure to artificial intelligence and machine learning (AI/ML) during their medical education.	n=207, medical students 102, doctors 105	Among respondents, 66.5% reported zero hours of teaching on AI/ML during their degree with 62.4% anticipating zero hours during the remainder of the degree programme, 43.4% (95% CI, 37.1% to 49.6%) had not heard of the term 'machine learning'. Without a solid curriculum focused on AI and machine learning advancements, students might develop extreme viewpoints. They could either underestimate the influence of technology on primary care due to an overly optimistic bias or fall victim to excessive hype about its capabilities. Such biases could have harmful effects on healthcare.
Boillat, T.	2022	Readiness to Embrace Artificial Intelligence Among Medical Doctors and Students: Questionnaire-Based Study	JMIR Medical Education	United Arab Emirates	APG	To capture medical students' and doctors' level of familiarity toward artificial intelligence in medicine as well as their challenges, barriers, and potential risks.	n= 56, medical students 28, lay people 27	The results revealed no significant difference in the familiarity of artificial intelligence between medical doctors and students (P=.91), except that medical students perceived artificial intelligence in medicine to lead to higher risks for patients and the field of medicine in general (P<.001). A rather low level of familiarity with artificial intelligence (medical students=2.11/5; medical doctors=2.06/5) as well as a low attendance to education or training was found. Only 2.9% (3/105) of medical doctors attended a course on artificial intelligence within the previous year, compared with 9.8% (10/102) of medical students.
Breeding, T	2024	The Utilization of ChatGPT in Reshaping Future Medical Education and Learning Perspectives: A Curse or a Blessing?	The American Surgeon	United States	WEOG	To assess how medical students and laypeople evaluate information produced by ChatGPT compared to an evidence-based resource on the diagnosis and management of five common surgical conditions.	n=352 medical students	Amongst third- and fourth-year U.S. medical students, ChatGPT was perceived to have significantly more clarity and better organization than evidence-based sources regarding the pathogenesis, diagnosis, and management of 5 common surgical pathologies. However, medical students also found information from evidence-based sources to be significantly more comprehensive than that produced by ChatGPT. These results highlight that ChatGPT should be considered as an adjunct tool in medical education.
Buabbas, A.	2023	Investigating Students' Perceptions towards Artificial Intelligence in Medical Education.	Healthcare	Kuwait, Taiwan, Saudi Arabia	APG	To investigate students' perceptions of adopting AI systems in medical education and their readiness to adopt AI systems in their learning within Kuwait University's Faculty of Medicine.	n=758 medical students and doctors	Students have positive perceptions towards AI systems, showing optimism towards learning more about AI in their medical education. Therefore, we recommended to the curriculum makers at KU FoM that AI teaching or training should be embedded into KU FoM's undergraduate medical program.
Chen, M.	2022	Acceptance of clinical artificial intelligence among physicians and medical students: A systematic review with cross-sectional survey	Frontiers in Medicine	China, United Kingdom	APG, WEOG	To investigate the acceptance of clinical artificial intelligence among physicians and medical students, combining insights from a systematic review and cross-sectional survey.	n=100 medical students	Most physicians and medical students appear aware of the increasing application of clinical AI, but lack practical experience and related knowledge. Overall, participants have positive but reserved attitudes about AI. In spite of the mixed opinions around clinical AI becoming a surrogate physician, there was a consensus that collaborations between the two should be strengthened. Further education should be conducted to alleviate anxieties associated with change and adopting new technologies.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Cho, S.I.	2021	Perceptions and attitudes of medical students regarding artificial intelligence in dermatology	Journal of the European Academy of Dermatology and Venereology	Korea	APG	To assess the perceptions and attitudes of medical students toward artificial intelligence in dermatology.	n= 3018 medical students	The majority of students agreed AI will be used in dermatology (95%), and 84% indicated they would use AI as doctors. However, only 6% believed AI would replace dermatologists. There is a gap between students' interest in AI and the level of AI education they have received. Therefore, the discrepancy between the degree of interest among medical students and their level of AI education requires a resolution. Medical school curricula should equip students with the skills and knowledge required to understand and apply AI
Civaner, M.	2022	Artificial intelligence in medical education: a cross-sectional needs assessment.	BMC Medical Education	Turkey	WEOG	The aim of the study was to examine the perceptions of future physicians on the potential influence of AI in medicine and determine educational needs for incorporating AI in the medical curriculum.	n= 44 faculty	The study found that Medical students perceive AI as an assistive technology with potential benefits for clinical practice but have concerns about its impact on employment and the patient-physician relationship. The participants expressed a need for an update on the medical curriculum, according to the necessities in transforming healthcare driven by artificial intelligence. The update should revolve around equipping future physicians with the knowledge and skills to effectively use artificial intelligence applications and ensure that professional values and rights are protected.
Cross, J.	2023	Transforming Medical Education: Assessing the Integration of ChatGPT Into Faculty Workflows at a Caribbean Medical School	Cureus	Antigua, United States	LAC, WEOG	Assess the integration and usage of ChatGPT in faculty workflows at the American University of Antigua College of Medicine and to gauge its acceptance and utility for medical education purposes.	n= 206 medical students	ChatGPT has been quickly adopted by a subset of the college faculty, demonstrating its growing acceptance. Given the level of approval expressed about the program, we believe ChatGPT will continue to form an important and expanding part of faculty workflows at AUA and in medical education in general.
Doumat, G.	2022	Knowledge and attitudes of medical students in Lebanon toward artificial intelligence: A national survey study.	Frontiers in Artificial Intelligence	Lebanon	APG	To assesses the knowledge, attitudes and perspectives of medical students in Lebanon toward Artificial Intelligence (AI) in medical education.	n= 144, 62.5% were radiologists and 37.5% radiology residents	When assessing AI knowledge sources (81.1%) got their information from the media as compared to (9.7%) from medical school curriculum. However, Students who learned the basics of AI as part of the medical school curriculum were more knowledgeable about AI than their peers who did not. Students in their clinical years appear to be more knowledgeable about AI in medicine. The advancements in AI affected the choice of specialty of around a quarter of the students (26.8%). Finally, only a quarter of students (26.5%) want to be assessed by AI, even though the majority (57.7%) reported that assessment by AI is more objective.
Dumić-Čule, I.	2020	The importance of introducing artificial intelligence to the medical curriculum - assessing practitioners' perspectives.	Croatian Medical Journal	Croatia	EEG	To assess the attitude about the importance of introducing education on artificial intelligence (AI) in medical schools' curricula among physicians y impacted by AI.	n= 172 medical students	A large majority of participants – 89.6% agreed on the need for education on AI to be included in medical curricula. Answers revealed a very high support across age groups and regardless of subspecialty area. A slightly higher support was present among physicians working in university hospitals compared with those in primary care centers, and among radiology residents compared with radiologists – but these estimated differences are uncertain, and the support levels were clearly high across the considered variables.
Emir, B.	2024	Artificial Intelligence Readiness Status of Medical Faculty Students	Konuralp Medical Journal	Turkey	WEOG	To examine the knowledge level and awareness of medical students about artificial intelligence technologies and their readiness to use these technologies in healthcare.	n= 502 medical students	Students' awareness level about medical artificial intelligence is high, and they have the skills to use artificial intelligence technologies. However, it was observed that their self-confidence in technical matters was not very high. The idea has arisen that Education on these issues should be emphasized and the self-confidence of medical students should be increased in artificial intelligence skills.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Ghalibaf, A.	2023	Psychometric properties of the Persian version of the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS).	BMC Medical Education	Iran	APG	To investigate psychometric properties of a Persian version of the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS) developed by Karaca, et al. in 2021.	n= 542 medical students	The Persian version of MAIRS-MS was fairly equivalent to the original one regarding the conceptual and linguistic aspects. Validity and reliability of the Persian version of MAIRS-MS established. Therefore, the Persian version can be a suitable and brief instrument to assess Iranian Medical Students' readiness for medical artificial intelligence.
Güven, G.	2024	Determining medical students' anxiety and readiness levels about artificial intelligence.	Heliyon	Turkey	WEOG	To determine the levels of anxiety and readiness among medical students regarding artificial intelligence (AI) and examine the relationship between these factors.	n= 211 medical students	The findings of the study indicate that medical students have a moderate level of readiness and a high level of anxiety regarding AI. Furthermore, an inverse relationship was found between AI readiness and AI anxiety. These results highlight the importance of increasing the preparedness of medical students for AI applications and reducing their anxieties.
Hadithy, Z.	2023	Knowledge, Attitudes, and Perceptions of Artificial Intelligence in Healthcare Among Medical Students at Sultan Qaboos University.	Cureus	Oman	APG	To investigate the knowledge, perceptions, attitudes, and preparedness of clinical-year medical students at Sultan Qaboos University in Oman towards the use of artificial intelligence in healthcare.	n= 393 medical students	Medical students possess basic knowledge of AI but need a more in-depth understanding, indicating a need for greater AI education in the medical curriculum. While they recognize AI's potential to enhance healthcare, they remain cautious about its ability to replace human skills in certain tasks and have concerns about job prospects and ethical implications.
Hind, B.	2023	Artificial Intelligence: Perception, Attitudes and Use Among Students at the Casablanca Faculty of Medicine	IEEE International Conference on Cloud Computing and Artificial Intelligence: Technologies and Applications	Morocco	AG	To describe the knowledge, attitudes, and use of artificial intelligence among students at the Faculty of Medicine in Casablanca, Morocco.	n= 152, medical students 88, graduate professionals 64	Medical students demonstrated moderate knowledge of the basics of AI.
Hu, J.	2023	Health Care Trainees' and Professionals' Perceptions of ChatGPT in Improving Medical Knowledge Training: Rapid Survey Study	Journal of Medical Internet Research	Taiwan	APG	To investigate the perceptions of healthcare trainees and professionals on ChatGPT-assisted training, using biomedical informatics as an example.	n=216 medical students	Most trainees and professionals were enthusiastic about the ChatGPT-assisted knowledge transfer. They agreed that ChatGPT could help them gain more knowledge and ease their training. However, they thought that experts were still required to provide guidance.
Jha, N.	2022	Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine.	Advances in Medical Education and Practice	Nepal, Malaysia, United Arab Emirates	APG	To explore medical students' and interns' knowledge of artificial intelligence (AI), perceptions of the role of AI in medicine, and preferences around the teaching of AI competencies.	n= 367, medical students 212, doctors 155	The median AI knowledge score was 11 (interquartile range 4), and the maximum possible score was 25. The score was higher among final year students ($p = 0.006$) and among those with additional training in AI ($p = 0.040$). Over 49% strongly agreed or agreed that AI will reduce the number of jobs for doctors. Many expect AI to impact their specialty choice, felt the Nepalese health-care system is ill-equipped to deal with the challenges of AI, and opined every student of medicine should receive training on AI competencies.
Kansal, R.	2022	Differences in Knowledge and Perspectives on the Usage of Artificial Intelligence Among Doctors and Medical Students of a Developing Country: A Cross-Sectional Study.	Cureus	India	APG	The study aimed to evaluate the knowledge of basic principles, limitations, and applications of AI in healthcare among medical students and doctors in a developing country.	n= 58 health sciences students	Gender disparities and a clear lack of knowledge found in medical students and doctors regarding AI in healthcare.
Kimmerle, J.	2023	Medical Students' Attitudes Toward AI in Medicine and their Expectations for Medical Education.	Journal of Medical Education and Curricular Development	Germany	WEOG	Investigate medical students' understanding of AI in medicine, their perception of AI's role, and their expectations for AI education in medical curricula.	n=24 medical students	Medical students are interested in learning more about AI in medicine, especially the ethical aspects, modes of operation, and areas of application. However, they showed moderate faith in AI, perceiving it as technically competent but lacking in reliability and trustworthiness. Medical students need to be equipped with the knowledge and skills to use AI effectively and ethically in their future practice.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Laupichler, M	2022	Effect of a flipped classroom course to foster medical students' AI literacy with a focus on medical imaging: a single group pre-and post-test study.	BMC Medical Education	Germany	WEOG	The aim was to evaluate a flipped classroom course designed to give undergraduate medical students an elaborate first impression of AI and to increase their "AI readiness," mainly focusing on AI applications in medical imaging.	n= 377 medical students	To test the effectiveness of the course, the "MAIRS-MS" instrument by Karaca et al. was used. The results showed that the course (called "KI-LAURA") significantly improved participants' AI readiness, with a particularly high increase in AI vision. This illustrates that even entry-level AI courses can increase medical students' AI readiness, preparing them to collaborate with AI in their future careers.
Laupichler, M	2024	Medical students' AI literacy and attitudes towards AI: a cross-sectional two-center study using pre-validated assessment instruments	BMC Medical Education	Germany	WEOG	Investigate medical students' AI literacy and attitudes towards AI using two validated self-assessment scales to measure AI literacy and attitudes towards AI at two German medical schools.	n= 1, 243, medical students 830, postgraduate students 413	It was found that Medical students' technical understanding of AI was relatively low compared to their confidence in critically evaluating and practically using AI applications. This study sheds crucial light on the AI literacy landscape among medical students, emphasizing the necessity for tailored programs.
Li, Q.	2023	AI in medical education: medical student perception, curriculum recommendations and design suggestions.	BMC Medical Education	China	APG	The study Utilized the Unified Theory of Acceptance and Use of Technology model to identify key factors that influence the acceptance and intention to use medical AI.	n= 274 medical students	Findings indicated that Medical postgraduate students had a higher level of awareness in using medical AI than undergraduate students. The intention to use medical AI is positively associated with factors such as performance expectancy, habit, hedonic motivation, and trust. Therefore, future medical education should prioritize promoting students' performance in training, and courses should be designed to be both easy to learn and engaging, ensuring that students are equipped with the necessary skills to succeed in their future medical careers.
Li, X.	2022	Understanding Medical Students' Perceptions of and Behavioral Intentions toward Learning Artificial Intelligence: A Survey Study.	International Journal of Environmental Research and Public Health	China	APG	Investigate medical students' perceptions of and behavioral intentions toward learning artificial intelligence (AI) in clinical practice based on the Theory of Planned Behavior (TPB).	n=844 medical students	Knowledge of medical AI did not predict students' behavioral intention to learn medical AI, indicating that focusing solely on teaching medical knowledge may not directly promote medical students' intention to learn and use medical AI technologies. Rather, to raise their behavioral intention to learn medical AI, practitioners and researchers in medical education need to help students realize that AI technology used for clinical practice is exceedingly relevant in their future careers and demonstrate in their clinical practice that medical AI is conducive to their practising medicine and conducting research as a doctor. Meanwhile, they need to help medical students foster stronger self-efficacy in using medical AI in their clinical practice.
McLennan, S.	2022	German medical students' views regarding artificial intelligence in medicine: A cross-sectional survey.	PLOS Digital Health	Germany, Switzerland	WEOG	This study aimed to explore German medical students views about AI in medicine.	n=163 faculty	Two thirds (64.4%) did not feel well informed about AI in medicine. Just over a half (57.4%) of students thought that AI has useful applications in medicine, particularly in drug research and development (82.5%), less so for clinical uses. Male students were more likely to agree with advantages of AI, and female participants were more likely to be concerned about disadvantages. The vast majority of students thought that when AI is used in medicine that it is important that there are legal rules regarding liability (97%) and oversight mechanisms (93.7%), that physicians should be consulted prior to implementation (96.8%), that developers should be able to explain to them the details of the algorithm (95.6%), that algorithms should use representative data (93.9%), and that patients should always be informed when AI is used (93.5%).

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Mohammadhiwa, A., Afsaneh, D.	2024	Adopting artificial intelligence driven technology in medical education	Interactive Technology and Smart Education	Iran	APG	To identify the determinant factors in adopting AI-driven technology in medical education amongst faculty members	n=29 faculty	"Technology characteristics," "task characteristics" and "task-technology fit" (TTF) showed direct and significant effects on AI adoption in medical education. TTF is an appropriate model to explain faculty members' intentions for adopting AI. The model can help the authorities and policymakers facilitate the adoption of AI in medical education.
Mosch, L.	2022	Artificial Intelligence in Undergraduate Medical Education	Studies in Health Technology and Informatics	Germany	WEOG	Investigatd the inventory of AI-related courses at German medical schools.	n= 1,003, medical students 708, lecturers 294	AI-related learning content is mainly present in voluntary courses, but hardly in the compulsory curriculum of medical studies. However, dynamic development in this area noted, with the majority of medical schools planning to introduce AI courses and a large proportion of learning opportunities introduced in the last two years.
Oluwadiya, K.	2023	Exploring Artificial Intelligence in the Nigerian Medical Educational Space: An Online Cross-sectional Study of Perceptions, Risks and Benefits among Students and Lecturers from Ten Universities	Nigerian Postgraduate Medical Journal	Nigeria	AG	This study aimed to explore the perceptions of medical students and faculty members from ten universities across Nigeria regarding AI.	n=433 healthcare students	Most students and lecturers had an average knowledge of AI, were receptive to its use, and had previous exposure to AI, especially through social media and grammar checkers. Despite these factors, there was a lack of training opportunities for both students and lecturers. Furthermore, they recognized the potential risks and believed ethical regulation was necessary to ensure its safe application.
Pallivathukal, R.	2024	ChatGPT for Academic Purposes: Survey Among Undergraduate Healthcare Students in Malaysia.	Cureus	Malaysia	APG	To assess healthcare university students' knowledge, attitude, and practice regarding ChatGPT for academic purposes. It explored chatbot usage frequency, purposes, satisfaction levels, and associations between age, gender, and ChatGPT variables.	n=322 medical students	A significant proportion participants possessed suboptimal knowledge and favorable viewpoints concerning ChatGPT's concept and practical application. Students with a more positive attitude toward ChatGPT were more inclined to employ it for academic purposes. The majority of students are familiar with Chat GPT and are knowledgeable about its various applications, which function as supplements to conventional resources and enhance their efficiency and productivity when completing daily university tasks.
Paré, G.	2022	Predicting Medical Students' Intention to Integrate Digital Health into their Medical Practice: A Pre-and Post-COVID-19 Survey in Canada	Proceedings of the 55th Hawaii International Conference on System Sciences	Canada	WEOG	To validate a theoretical model that hypothesizes relationships between medical students' individual background, experimentation with digital Health (dHealth), perceived dHealth education needs, and openness to AI-related innovations.	n=25 medical students	Sampled students had little occasion to experiment with dHealth technologies and applications in the course of their medical studies. They were uncertain as to their dHealth education needs, and y their attitude toward the use of AI-related technologies ambiguous. The combination of these three factors explains why medical students are rather uncertain as to their eventual integration of dHealth into their medical practice.
Pizzolla, I.	2023	Integrating Artificial Intelligence into Medical Education: Lessons Learned From a Belgian Initiative	Journal of Interactive Learning Research	Belgium	WEOG	Analyze the results, advantages, and limitations of an AI education program which used Ai to provide students with real-time feedback, adaptive learning paths, and interactive simulations that replicate real-world clinical scenarios. To create a more engaging and effective learning experience.	n=73 medical students	The Program successfully provided medical students with a foundational knowledge of AI and its use in the medical field. Positive feedback from students, indicating that the integration of AI education in the medical curriculum is both timely and relevant.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Robleto, E.	2024	Medical students' perceptions of an artificial intelligence (AI) assisted diagnosing program.	Medical Teacher	United States	WEOG	This study aimed to assess medical students' perceptions of an AI-assisted diagnostic tool known as 'Glass AI.'	n=401 medical students	73/202 (36.10%) of students completed the survey. 96% of the participants noted that Glass AI increased confidence in the diagnosis, 43% thought Glass AI lacked sufficient explanation, and 68% expressed risk concerns for the physician workforce. Students expressed future positive outlooks involving AI-assisted diagnosing systems in healthcare, provided strict regulations, are set to protect patient privacy and safety, address legal liability, remove system biases, and improve quality of patient care.
Sachdev, R.	2021	Awareness and education of medical students toward artificial intelligence and radiology: A cross-sectional multicenter survey at Kanpur, Uttar Pradesh	Dentistry and Medical Research	India, Australia	APG, WEOG	The aim of the study was to understand medical students views, understanding and level of confidence in working on AI and explore if AI influences their career intentions with specific regard to radiology.	n=1,212 medical students	89.11% response rate. Majority (30.9%) of medical students strongly agreed about the awareness of AI. Nearly 36.3% of the medical students disagreed that they were less likely to consider a career in radiology due to AI. Around 29% of medical students strongly agreed for the scope of integration of AI in medical education of India.
Sharma, V.	2023	Artificial Intelligence (AI) Integration in Medical Education: A Pan-India Cross-Sectional Observation of Acceptance and Understanding Among Students	Scripta Medica	India	APG	To assess the acceptance and understanding of AI integration among students in medical education across different regions of India through a cross-sectional observation.	n=730 medical students	Medical students in India display a keen interest in AI and its integration into medical education. Students are aware of the challenges and opportunities, emphasizing the importance of balanced AI adoption in medical practice and education.
Sit, C.	2020	Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey.	Insights into Imaging	United Kingdom	WEOG	To explore the attitudes of United Kingdom (UK) medical students regarding AI, their understanding, and career intention towards radiology and level of education relating to AI amongst this cohort.	n=484 medical students	Eighty-eight percent of students believed that AI will play an important role in healthcare, and 49% reported they were less likely to consider a career in radiology due to AI. Eighty-nine percent of students believed that teaching in AI would be beneficial for their careers, and 78% agreed that students should receive training in AI as part of their medical degree. Only 45 students received any teaching on AI; none of the students received such teaching as part of their compulsory curriculum. Statistically, students that did receive teaching in AI were more likely to consider radiology ($p = 0.01$) and rated more positively to the questions relating to the perceived competence in the post-graduation use of AI ($p = 0.01-0.04$); despite this, a large proportion of students in the taught group reported a lack of confidence and understanding required for the critical use of healthcare AI tools.
Stewart, J.	2023	Western Australian medical students' attitudes towards artificial intelligence in healthcare.	PLOS One	Australia	WEOG	To assess Western Australia (WA) medical students' attitudes towards AI in general, AI in healthcare, and the inclusion of AI education in the medical curriculum.	n=134 medical students	Medical students in WA appear to be interested in AI. However, they have not received education about AI and do not feel they understand its basic computational principles or limitations. AI appears to be a current deficit in the medical curriculum in WA, and most students surveyed were supportive of its introduction.
Swed, S.	2022	Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Syria: A cross-sectional online survey	Frontiers in Artificial Intelligence	Syria, Egypt, Algeria, Qatar, Jordan, Germany, Sudan, India	AG, APG, WEOG	This study aims to identify the level of doctors' and medical students' carried perceptions of AI and its implications in Syria and evaluate their understanding of various AI practices.	n=1,507, medical students 1,252, doctors 255	A significant proportion of the respondents said they do not use artificial intelligence in their professional lives. Other than that, many people have a favorable attitude toward its utilization in the medical profession owing to its advantages in enhancing the diagnostic process and how patients are treated.
Tangadulrat, P.	2023	Using ChatGPT for Clinical Practice and Medical Education: Cross-Sectional Survey of Medical Students' and Physicians' Perceptions.	JMIR Medical Education	Thailand	APG	To evaluate the perception of physicians and medical students toward using ChatGPT in the medical field.	n=239, medical students 124, interns 46, residents 37, and attending staff 32	Medical students generally had a positive perception of using ChatGPT for guiding treatment and medical education, whereas graduated doctors were more cautious in this regard. Nonetheless, both medical students and graduated doctors positively perceived using ChatGPT for creating patient educational materials.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Teng, M.	2022	Health Care Students' Perspectives on Artificial Intelligence: Countrywide Survey in Canada.	JMIR Medical Education	Canada	WEOG	To explore and identify gaps in the knowledge that Canadian health care students have regarding AI, capture how health care students in different fields differ in their knowledge and perspectives on AI, and present student-identified ways that AI literacy may be incorporated into the health care curriculum.	n=2,167 healthcare students	A total of 2167 students across 10 different health professions from 18 universities across Canada responded to the survey. Overall, 78.77% (1707/2167) predicted that AI technology would affect their careers within the coming decade and 74.5% reported a positive outlook toward the emerging role of AI in their respective fields. Attitudes toward AI varied by discipline. Students, even those opposed to AI, identified the need to incorporate a basic understanding of AI into their curricula.
Tran, A.	2021	Determinants of Intention to Use Artificial Intelligence-Based Diagnosis Support System Among Prospective Physicians.	Frontiers in Public Health	Vietnam, United States, Singapore	APG, WEOG	To develop a theoretical model to explore the behavioral intentions of medical students to adopt an AI-based Diagnosis Support System.	n=211 medical students	Positive behavioral intentions in using an AI-based diagnosis support system among prospective Vietnamese physicians, as well as the effect of social influence on this choice.
Truong, N.	2023	Healthcare students' knowledge, attitudes, and perspectives toward artificial intelligence in the southern Vietnam.	Heliyon	Vietnam	APG	To explore the understanding, attitudes, and perspectives of Vietnamese medical students toward AI and its consequences, as well as their knowledge of existing AI operations in Vietnam.	n=1,142 medical and pharmacy students	The majority of the participants expressed positive attitudes and views and were excited to learn more about the fundamentals and applications of AI in medicine. Students' eagerness to learn about AI might be interpreted as a positive indicator on which to capitalize. On the basis of our research and earlier surveys conducted in other countries, we emphasize the critical need to include AI-related issues in medical school curricula.
Tung, A., Dong, L.	2023	Malaysian Medical Students' Attitudes and Readiness Toward AI (Artificial Intelligence): A Cross-Sectional Study.	Journal of Medical Education and Curricular Development	Malaysia, United Kingdom	APG, WEOG	This study aims to survey Malaysian medical students' attitudes toward AI and evaluate their readiness to work with medical AI technology.	n=301 medical students	Malaysian medical students demonstrated awareness about AI and showed a willingness to learn more about it, similar to the sentiments shared by students from the United Kingdom, Germany and the United States. In terms of readiness to work with AI, the study showed gaps in all 4 domains, particularly the cognitive and ability domain, where Malaysian medical students rated the lowest scores on the MAIRS-MS scale.
Wagner, G.	2023	Understanding Prospective Physicians' Intention to Use Artificial Intelligence in Their Future Medical Practice: Configurational Analysis.	JMIR Medical Education	Canada, Germany	WEOG	Study medical students' knowledge, experience, attitude, and beliefs related to AI and to understand whether they are necessary conditions associated with behavioral intentions to use AI in their future medical practice.	n=322 medical students	Intention to use AI is only observed when students have a strong belief in the role of AI (individually necessary condition). Certain AI profiles (combinations of knowledge and experience, attitudes and beliefs, and academic level and gender) are also associated with intentions to use AI. Profiles associated with non high intentions cannot be inferred from profiles associated with high intentions (causal asymmetry). A strong belief in the role of AI in the future of medical professions is a necessary condition for behavioral intentions to use AI. Preparation of medical students should go beyond teaching AI competencies and that educators need to account for the different AI profiles associated with high or nonhigh intentions to adopt AI.
Weidener, L., Fischer, M.	2024	Artificial Intelligence in Medicine: Cross-Sectional Study Among Medical Students on Application, Education, and Ethical Aspects.	JMIR Medical Education	Germany, Austria, Switzerland	WEOG	To explore how medical students from Germany, Austria, and Switzerland perceive the use of AI in medicine and the teaching of AI and AI ethics in medical education in accordance with their use of AI-based chat applications, such as ChatGPT.	n=487 medical students	Pronounced discrepancy between the use of AI-based (chat) applications, such as ChatGPT, among medical students in Germany, Austria, and Switzerland and the teaching of AI in medical education.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Wood, E.	2021	Are We Ready to Integrate Artificial Intelligence Literacy into Medical School Curriculum: Students and Faculty Survey.	Journal of Medical Education and Curricular Development	United States	WEOG	To assess medical student and faculty attitudes toward AI, in preparation for teaching AI foundations and data science applications in clinical practice in an integrated medical education curriculum.	n=173, medical students 121, faculty 52	Comparable student and faculty attitudes and responses toward AI in medicine and medical education. There is limited time available for AI literacy discussions but there is an agreement on the need to integrate AI technologies in medical education and training. Both students and faculty have a broad and deep AI topic interest and more positive than negative attitudes toward AI in medicine. Clinicians and students have an interest in different aspects of AI (application vs teaching), and are differently knowledgeable about it.
Xuan, P.	2023	Readiness Towards Artificial Intelligence Among Undergraduate Medical Students in Malaysia.	Education in Medicine Journal	Malaysia	APG	To evaluate medical AI readiness among undergraduate medical students.	n=105 medical students	Medical AI readiness among medical students studying in the university was adequate. The majority of the students reported a broad and deep interest in AI topics and were optimistic about AI applications in medicine. There was a significant correlation between age, study year, and previous training with the medical AI readiness.
Yun, D.	2020	Attitudes towards medical artificial intelligence talent cultivation: an online survey study	Medical Artificial Intelligence Research	China	APG	To investigate the attitude and formal suggestions on talent cultivation in the field of medical artificial intelligence (AI).	n=710, high school students 82, specialized college 43, undergraduate bachelors degree 352, masters 117, medical students 116	Medical related professions demonstrated higher level of perception and stronger willingness for medical AI educational events. Merging subjects as radiology and clinical laboratory subjects are preferred with broad talents demands and bright prospects.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Asghar, A.	2022	The potential scope of a humanoid robot in anatomy education: a review of a unique proposal	Surgical and Radiologic Anatomy	India	APG	A review explore the current use of humanoid robots in education, their potential roles and functions in teaching anatomy, and challenges with their use. Search period: not stated	The usage of artificial intelligence in the form of humanoid robots is quite common. However, literature citing its usage in medical education is rare. Humanoid robots as a teacher or teaching assistants are predominantly used in learning foreign languages. Primarily, a humanoid robot can discharge five functions as a potential teacher. Humanoid robots can effectively fulfill numerous educational goals in medicine since they can replicate human responses, work relentlessly regardless of students' repeated mistakes, be loaded with innovative teaching methodologies, and be upgraded with more current information.
Baigi, S.	2023	Attitudes, knowledge, and skills towards artificial intelligence among healthcare students: A systematic review	Health Science Report	Iran	APG	Systematic review of studies examining healthcare students' attitudes, knowledge, and skills in Artificial Intelligence (AI). Search period : till August 3, 2022.	n = 38 studies included. In 29 studies, healthcare students had a positive and promising attitude towards AI in the clinical profession and its use in the future. In 9/38 studies (24%), students considered AI a threat to healthcare fields and had a negative attitude towards it. 26/38 studies evaluated the knowledge of healthcare students about AI. 18/26 studies found low levels of student knowledge (< 50%). In 6 students' knowledge was high. Some students had never worked with AI.
Burney, I., Ahmad, N.	2022	Artificial Intelligence in Medical Education: A citation-based systematic literature review	Journal of Shifa Tameer-e-Millat University (JSTMU)	Oman	APG	Systematic review to describe the existing and emerging role of Artificial intelligence (AI) in medical education. Search period: till October 2020	218 articles included. . Articles describing surgical skills training, case-based reasoning, physicians' role in the evolving scenario, and the attitudes of medical students towards AI in radiology were cited frequently. Of the 50 top-cited papers, 16 (32%) were 'commentary' articles, 13 (26%) review articles, 13 (26%) articles correlated usefulness of ML and AI with human performance, whereas 8 (16%) assessed the perceptions of students toward the integration of AI in medical practice.
Echelard, J.	2020	Medical Student Training in eHealth: Scoping Review.	JMIR Medical Education	Canada	WEOG	Scoping Review to evaluate the extent and nature of the existing literature on medical student training in eHealth. To examine what this education consists of, the barriers, enhancing factors, and propositions for improving the medical curriculum. Focuses primarily on some key technologies such as mobile health (mHealth), the internet of things (IoT), telehealth, and artificial intelligence (AI). Study timeline: studies published since 2014 -2020	Results: 25 articles included. The most studied aspect was mHealth. eHealth as a broad concept, the IoT, AI, and programming were least covered. A total of 52% (13/25) of all studies contained an intervention, mostly regarding mHealth, electronic health records, web-based medical resources, and programming. The findings included various barriers, enhancing factors, and propositions for improving the medical curriculum

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Ghaffarizadeh, A.	2023	Artificial Intelligence Education for Medical Students: A Systematic Review	The Canadian Medical and Biological Engineering Society Conference	Canada	WEOG	Systematic review to identify and compile the existing evidence-based recommendations as key steps towards an AI curriculum in undergraduate medical education. Study timeline: not stated.	Six key themes identified: ethics, theory and application, communication, collaboration, quality improvement, and perception/attitude. These themes can serve as a framework for building AI curricula in UGME.
Gordon, M.	2024	A scoping review of artificial intelligence in medical education: BEME Guide No. 84	Medical Teacher	United Kingdom, United States	WEOG	Scoping review to map the literature regarding AI applications in medical education, core areas of findings, potential candidates for formal systematic review, and gaps for future research. Search timeline: till August 2023	Literature spans a wide array of stages, specialties, purposes, and use cases, primarily reflecting early adaptation phases. The FACETS framework is proposed for future research and practice. 278 publications included; majority (68%) from North American and European regions. The studies covered diverse AI applications in medical education, such as AI for admissions, teaching, assessment, and clinical reasoning. The review highlighted AI's varied roles, from augmenting traditional educational methods to introducing innovative practices, and underscores the urgent need for ethical guidelines in AI's application in medical education.
Grimaud, L.	2024	Integrating Artificial Intelligence Ethics Education into the Undergraduate Medical Curriculum-a Scoping Review.	JMIR Medical Education	United Kingdom	WEOG	Scoping review to map the key concepts related to the integration of AI ethics into the undergraduate medical curriculum, including the rationale for curricular reform, recommended strategies, and challenges involved, and gaps in the literature. Search period: 2013-2023	The concept of medical professionalism needs to encompass the ethical implications of AI. Whilst many studies defined the desired competencies related to AI ethics in the curriculum, there is a need for a structured, validated framework, supported by high quality research. Overcoming the challenges facing curricular change requires the engagement and commitment of all stakeholders, with medical students also playing a role in this reform.
Grunhut, J.	2021	Educating Future Physicians in Artificial Intelligence (AI): An Integrative Review and Proposed Changes.	Journal of Medical Education and Curricular Development	United States	WEOG	Integrative Review to review the current literature that covers the attitudes of medical students towards AI, and the implementation of AI in the medical curriculum. Search period: 2010 to 2020	n= 39 articles included. Primary assessments of medical students attitudes were identified in n=5, plans to implement AI in the curriculum for the purpose of teaching students about AI in n=6, and articles reporting actual implemented changes n=2. 26 articles described the need for more research on this topic or calling for the need of change in medical curriculum to anticipate AI in healthcare.
Iqbal, S.	2021	Review Article: Impact of artificial intelligence in medical education	MedEdPublish	Saudi Arabia	APG	(Type of review not stated). To explore the current role of artificial intelligence in medical education. Search period: Jan 2019 to July 2020	Majority of articles published on the role of AI in medical education highlight the demand for major curriculum reforms based on the latest technologies in education. Computer-based decision support systems will make a difference in the traditional medical curriculum and changes in the student's knowledge, problem-solving, and information-seeking skills. There is apprehension that in the future e-learning may impact negatively the students who benefit from human-human interaction.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Kirubarajan, A.	2022	Artificial Intelligence and Surgical Education: A Systematic Scoping Review of Interventions	Journal of Surgical Education	Canada	WEOG	Scoping review to synthesize peer-reviewed evidence related to the use of artificial intelligence in surgical education. Search period: Databases were searched from inception until the date of search on April 13, 2021.	49 studies included found diverse interventions related to the evaluation of surgical competency, personalization of surgical education, and improvement of surgical education materials across surgical specialties. Many studies used existing surgical education materials, such as the Objective Structured Assessment of Technical Skills framework or the JHU-ISI Gesture and Skill Assessment Working Set database. Though most studies did not produce outcomes related to the implementation in medical schools (such as cost-effective analyses or trainee feedback), there are numerous promising interventions. In particular, many studies noted high accuracy in the objective characterization of surgical skill sets. These interventions could be further used to identify at-risk surgical trainees or evaluate teaching methods. There are promising applications for AI in surgical education, particularly for the assessment of surgical competencies, though further evidence is needed regarding implementation and applicability.
Komasawa, N.	2023	Learner-centered experience-based medical education in an AI-driven society: a literature review	Cureus	Japan	APG	To explore the significance of experience-based medical education (EXPBME) in the context of an AI-driven society. Search period not stated. Search methods not described.	Number of articles included not stated. Authors' conclusions: A learner-centered approach in EXPBME, integrating modules focused on professional development and career orientation into the medical curriculum, can improve students' preparedness in effectively planning their future careers and adopting AI.
Lee, J.	2021	Artificial Intelligence in Undergraduate Medical Education: A Scoping Review	Academic Medicine	Canada	WEOG	Scoping review to identify gaps and key themes in the peer-reviewed literature on AI training in undergraduate medical education. Search period: January 2000 to July 2020.	22 full-text articles included. The literature addressed: (1) a need for an AI curriculum in UME, (2) recommendations for AI curricular content including machine learning literacy and AI ethics, (3) suggestions for curriculum delivery, (4) an emphasis on cultivating "uniquely human skills" such as empathy in response to AI-driven changes, and (5) challenges with introducing an AI curriculum in UME. However, poor consensus across studies regarding AI curricular content and delivery. Little consensus on what and how to teach AI in undergraduate medical education (UME).
Mir, M.	2023	Application of Artificial Intelligence in Medical Education: Current Scenario and Future Perspectives	Journal of Advances in Medical Education & Professionalism	Saudi Arabia, India	APG	To review present the implications of AI in medical education from the past twenty years, its present scenario, and its future applications. Search period not stated.	Artificial intelligence has fixed various issues in education during the last decade, including language processing, reasoning, planning, and cognitive modelling.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Nagi, F.	2023	Applications of Artificial Intelligence (AI) in Medical Education: A Scoping Review.	Healthcare Transformation with Informatics and Artificial Intelligence	Qatar	APG	Scoping Review to explore the current application and classifications of AI in medical education. Search period: not stated.	22 articles included. Three AI branches were identified across different domains in the medical education field. Machine learning algorithms and virtual reality were the most commonly used ML and DI methods (n=11), followed by Virtual Reality (n=9) and robotic skills training (n=2). These AI methods were applied across various medical education domains, with the majority found in training labs (n=10), followed by the surgery domain (n=7), orthopedics (n=2), ophthalmology (n=1), surgery/medicine (n=1), and behavioral health (n=1).
Pupic, N.	2023	An evidence-based approach to artificial intelligence education for medical students: A systematic review.	PLOS Digital Health	Canada	WEOG	Systematic Review is to synthesize evidence-based recommendations for incorporating artificial intelligence (AI) education into the global undergraduate medical curriculum. Includes evaluating existing programs, identifying challenges, and offering insights Search period: Inception to April 2022	34 articles included. Identified six recurring themes needed for a successful implementation of AI in medical school curricula: ethics, theory and application, communication, collaboration, quality improvement, and perception and attitude. The themes of ethics, theory and application, and communication were further divided into subthemes, including patient-centric and data-centric ethics; knowledge for practice and knowledge for communication; and communication for clinical decision-making, communication for implementation, and communication for knowledge dissemination.
Rabie, R.	2023	The Role of Artificial Intelligence and Personalized Education in Medical Curriculum: A Systematic Review of Applications and Challenges	Faculty of Education Journal - Alexandria University	Egypt	AG	Systematic review to identify: Role of Artificial Intelligence in Medical Curriculum; Role of Personalized Education in the Medical Curriculum; application of AI and PL in the Medical Curriculum; and Challenges using AI and PL . Search period: 2013-2023	The role of AI and PE in Medical curricula is multifaceted and can be applied in various ways; such as improving students' understanding of complex medical concepts, leading to better learning outcomes, developing Intelligent Tutoring Systems; that provide personalized feedback and guidance to medical students, analyzing student data, providing recommendations for individualized instruction and supporting assessment and evaluation processes.
Sapci, A. H., Sapci H. A.	2020	Artificial Intelligence Education and Tools for Medical and Health Informatics Students: Systematic Review	JMIR Medical Education	United States	WEOG	Systematic Review to investigate peer-reviewed publications focused on AI education and to determine objective assessment methods for AI skills and competency training for medical and health informatics professionals. Search Period: Inception to 2019	26 articles included. Main conclusion was that publications recommend the integration of AI training into medical and health informatics curricula.
Stamer, T.	2023	Artificial Intelligence Supporting the Training of Communication Skills in the Education of Health Care Professions: Scoping Review	Journal of Medical Internet Research	Germany	WEOG	Scoping review to evaluate how AI may support communication skills training in the academic training of health care professionals. Search period: Inception to February 2023	Organized into 3 distinct categories: studies using AI and ML for text analysis and information extraction, studies using AI and ML and virtual reality, and studies using AI and ML and the simulation of virtual patients. AI was also used for the provision of feedback. The motivation of the involved agents played a major role in the implementation process. Reported barriers to the use of AI and ML in communication skills training revolved around the lack of authenticity and limited natural flow of language exhibited by the AI- and ML-based virtual patient systems.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Sun, L.	2023	Artificial intelligence for healthcare and medical education: a systematic review.	American Journal of Translational Research	China	APG	Systematic review to explore the current situation and problems of "AI+medicine/medical" education. Search Period: 2017 to July 2022	25 articles included. (1) While AI+medicine/medical education has become a trend after the pandemic, AI courses are not yet part of medical student education; (2) There is a lack of accreditation standards of AI applications in healthcare, and the effectiveness of AI is uncertain; and (3) Using the Oxford Evidence Scale, most of the studies were classified into categories 4 and 5, indicating the poor quality of current research.
Varma, J.	2023	The Global Use of Artificial Intelligence in the Undergraduate Medical Curriculum: A Systematic Review.	Cureus	United Kingdom	WEOG	Systematic review to evaluate the role of AI in undergraduate medical curricula worldwide and compare AI to current teaching and assessment methods. Search period: inception to March 2021	11 studies included. Studies categorized into three domains: teaching (n = 6), assessing (n = 3), and trend spotting (n = 2). AI was shown to be highly accurate in studies that directly tested its ability. The mean overall MERSQI score for all selected papers was 10.5 (standard deviation = 2.3; range = 6 to 15.5) falling below the expected score of 10.7 due to notable weaknesses in study design, sampling methods, and study outcomes.
Weidener, L and Fischer, M.	2023	Teaching AI Ethics in Medical Education: A Scoping Review of Current Literature and Practices.	Journal of the Netherlands Association of Medical Education	Austria	WEOG	Scoping review to represent and synthesize the literature on teaching AI ethics as part of medical education. Search period; 2000 to June 2023	12 publications included. A scarcity of literature on teaching AI ethics in medical education was found. Most of the available literature was All 12 publications recommended teaching AI ethics in medical curricula due to the potential implications of AI in medicine. Anticipated ethical challenges such as bias were identified as the recommended basis for teaching content in addition to basic principles of medical ethics. Case-based teaching using real-world examples in interactive seminars and small groups was recommended as a teaching modality. More empirical studies and foundational definitions of AI ethics needed.
Xu, X.	2024	Opportunities, challenges, and future directions of large language models, including ChatGPT in medical education: a systematic scoping review.	Journal of Educational Evaluation for Health Professions	China	APG	Scoping review on ChatGPT use medical education. Search period: Jan 2022 to Nov 2023.	113 articles included. The existing literature theoretically speculates on the prospects of ChatGPT in medical education, but there is still a lack of sufficient empirical research to guarantee its effectiveness and rationality in medical education. ChatGPT exhibits various potential applications in medical education, such as providing personalized learning plans and materials, creating clinical practice simulation scenarios, and assisting in writing articles. However, challenges associated with academic integrity, data accuracy, and potential harm to learning were also highlighted in the literature. The paper emphasizes certain recommendations for using ChatGPT, including the establishment of guidelines. Based on the review, 3 key research areas were proposed: cultivating the ability of medical students to use ChatGPT correctly, integrating ChatGPT into teaching activities and processes, and proposing standards for the use of AI by medical students.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Zhang, W.	2024	AI in Medical Education: Global situation, effects and challenges	Education and Information Technologies	China	APG	Systematic review to analyse the global situation, effects, and challenges associated with applying AI at the different stages of medical education. Search period: 1990 to Dec 2022	42 articles included. Three teaching stages where AI can be applied in medical education (n=39), including teaching implementation (n=24), teaching evaluation (n=10), and teaching feedback (n=5). Many studies explored the effectiveness of AI adoption with questionnaire survey and control experiment. The challenges are performance improvement, effectiveness verification, AI training data sample and AI algorithms. In teaching implementation, the combination of AI and VR is an important trend to provide immersive training environment and realtime feedback; adopted in anatomy, surgical skills training and clinical thinking training. In teaching evaluation, AI is mainly used to assess the skill level of surgical trainees with binary classifications, namely the novice and the specialist. AI is also conducive to the quality improvement of medical teaching in teaching feedback. The main challenges identified are AI system performance, effectiveness verification, AI training data sample, and AI algorithms.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Araji, T.	2024	Evaluating The Role of ChatGPT as a Study Aid in Medical Education in Surgery.	Journal of Surgical Education	United States	WEOG	Crossover study to assess how ChatGPT compares to Google search in assisting medical students during their surgery clerkships.	n=19 Third-year medical students during their surgery rotation at the Perelman School of Medicine, University of Pennsylvania	Even though ChatGPT was comparable to Google search in finding answers pertaining to surgery questions, many students were reluctant to use ChatGPT for learning purposes during their surgery clerkship.
Aronovitz, N.	2024	The effect of real-time EF automatic tool on cardiac ultrasound performance among medical students.	PLOS One	Israel	WEOG	RCT to explore how an AI based quality indicator tool can serve as a teaching device for improving cardiac point-of-care ultrasound (POCUS) performance among medical students.	n= 60 4th year medical students assigned to one of two groups: intervention group using the AI-based quality indicator tool and the control group.	Integrating the quality indicator tool into the pre-clinical cardiac ultrasound course for 4th-year medical students. The intervention group (used the AI-based quality indicator tool) improved cardiac ultrasound performances compared to the control group, even in cardiac views in which the indicator was inactive. Performance scores, as well as image quality, were better in the AI-based group.
Beketov, V.	2023	The use of artificial intelligence in teaching medical students to increase motivation and reduce anxiety during academic practice	Current Psychology	Russia	EEG	To study the use of artificial intelligence in teaching medical students to increase their motivation and reduce anxiety during academic practice.	n=246 medical students	Intelligent learning support system led to a statistically significant increase in student motivation and a decrease in anxiety levels in the experimental group compared to the control group. The findings suggest that AI-based learning support can create a more effective and positive educational environment for medical students.
Cheng, C.	2020	Artificial intelligence-based education assists medical students' interpretation of hip fracture.	Insights into Imaging	Taiwan	APG	The paper aims to assess the impact of AI-assisted education on medical students' ability to interpret hip fractures using an AI-based medical image learning system.	n=30 medical students, divided into an AI-assisted learning group and a conventional learning group.	The study demonstrated that AI is viable for augmenting medical education and can shorten the learning curve in learning to read PXR's. With AI assistance, students can learn to efficiently read medical images. In addition, AI-based training can elevate diagnostic accuracy even further for students whose performance is initially poor. The next generation of students may learn how AI technologies are used in practice, and similar tools will also be used to enrich their education.
Coşkun, Ö.	2024	ChatGPT to generate clinical vignettes for teaching and multiple-choice questions for assessment: A randomized controlled experiment.	Medical Teacher	Turkey	WEOG	The study aimed to evaluate the real-life performance of clinical vignettes and multiple-choice questions generated by ChatGPT compared to those written by human authors, specifically in a medical education setting.	n=74 4th year medical students	The study found that medical students could not distinguish between clinical vignettes generated by ChatGPT and those written by human authors, and some multiple-choice questions generated by ChatGPT had acceptable psychometric characteristics, suggesting potential for AI-generated content in medical education.
Fazlollahi, A.	2023	AI in Surgical Curriculum Design and Unintended Outcomes for Technical Competencies in Simulation Training.	JAMA Network Open	Canada	WEOG	To assess the pedagogical value of AI-selected technical competencies and their extended effects in surgical simulation training.	n=60 medical students 46, neurosurgeons 14	In this cohort study of medical students, an AI-enhanced curriculum for bimanual surgical skills resulted in unintended changes that improved performance in safety but negatively affected some efficiency metrics. Incorporating AI in course design requires ongoing assessment to maintain transparency and foster evidence-based learning objectives.
Fazlollahi, A.	2022	Effect of Artificial Intelligence Tutoring vs Expert Instruction on Learning Simulated Surgical Skills Among Medical Students A Randomized Clinical Trial	JAMA Network Open	Canada, Saudi Arabia	APG, WEOG	RCT to determine how Virtual Operative Assistant (VOA) and remote expert instruction compare in learners' skill acquisition, affective, and cognitive outcomes during surgical simulation training.	n=70 medical students	The findings of this randomized clinical trial suggest that performing simulated brain tumor resections was more effective with feedback from an AI tutor compared with learning from remote expert instruction. VOA significantly improved Expertise Scores and OSATS scores in a realistic procedure while fostering an equivalent affective and cognitive learning environment
Hershberger, P.	2024	Motivational interviewing skills practice enhanced with artificial intelligence: ReadMI.	BMC Medical Education	United States	WEOG	The purpose of this study was to employ ReadMI as a means to both assess skill development and evaluate the extent to which its use affected the acquisition of MI-relevant skills.	n=125 3rd year medical students during Family Medicine Clerkship	While students in both conditions improved their MI approach from the first to the second role-play, those in the intervention condition used significantly more open-ended questions and fewer closed-ended questions and had a higher ratio of open to closed questions. Conclusion MI skills practice can be gained with a relatively small investment of student time, and artificial intelligence can be utilized to measure MI skill acquisition and as an instructional aid.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Hsu, M.	2023	Termbot: A Chatbot-Based Crossword Game for Gamified Medical Terminology Learning	International Journal of Environmental Research and Public Health	Taiwan	APG	To assess the effectiveness of Termbot, a chatbot-based learning tool designed to help students practice and learn medical terminology through crossword puzzles.	n=60 nursing students divided into 2 groups, experimental and control	The study showed that students who trained with Termbot made significant progress in learning medical terms, demonstrating the potential of chatbots to improve learning outcomes. Termbot is an excellent choice for self-learning, and future research will focus on expanding the available user interfaces and integrating them with a recommendation system to make it even more effective. The combination of crossword puzzles and chatbot technology creates a unique and enjoyable way for students to learn and retain information.
Hsu, M.	2023	Mastering medical terminology with ChatGPT and Termbot	Health Education Journal	Taiwan	APG	This study intended to examine whether the utilization of ChatGPT and Termbot enhances students' understanding of medical terminology.	n= 60 nursing students -- that were divided into an experimental (ChatGPT or Termbot) and a control group (traditional text books)	The study found that participants in the experimental group had significantly improved learning outcomes compared to participants in the control group. The results showed a substantial increase in post-test scores for both ChatGPT and Termbot groups, indicating that using these tools as learning assistants can assist students in the learning process.
Li, Z.	2023	Application of artificial intelligence and internet of things in medical imaging teaching	Journal of Biotech Research	China	APG	This study explored the applications of artificial intelligence and Internet of Things in medical imaging teaching.	n= 200 medical students	The results showed that the medical image recognition system demonstrated remarkable results in improving students' learning enthusiasm and learning effect. The results suggested that the development of medical imaging teaching should follow the strategies of (1) students become the main body of the classroom; (2) encourage interactive learning; (3) provide rich teaching resources.
Lippitsch, A.	2024	Development and evaluation of a software system for medical students to teach and practice anamnestic interviews with virtual patient avatars.	Computer Methods and Programs in Biomedicine	Germany	WEOG	An interactive software system (ViPATalk) was developed in which the student can train to pose questions to virtual patient avatars in free conversation in which the student receives feedback on the completeness of the questioning and an explanation of the essential items. The use of this software was compared to the traditional format of student role play in a randomized trial.	n= 163 medical students	It was found that practicing with ViPATalk was mostly equivalent to the students' role play. In the subsequent survey of the students, the wish was expressed that the ViPATalk software should also be used as an online tool for self-study and that there should be more cases for practicing.
Sanchez-Gonzalez, M., Terrell, M	2023	Flipped Classroom With Artificial Intelligence: Educational Effectiveness of Combining Voice-Over Presentations and AI	Cureus	United States	WEOG	The present educational research study examined the effectiveness of voice-over-style lectures and AI in facilitating learning outcomes as assessed by test scores after participating in basic science lectures in a medical school setting.	n= 42 medical students	Students using PPT+AI obtained statistically significant higher quiz scores under challenging questions and less time spent in lectures in the PPT+AI compared with the PPT group. Conclusions: The PPT+AI strategy could be the difference between a pass and a fail, as the PPT+AI strategy is particularly efficient in improving difficult question test scores. At the same time, students may learn the material in less time (efficiency). Research on the application of AI as part of educational strategies for improving satirized test scores, including boards, is warranted.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Wu, D.	2020	Artificial intelligence-tutoring problem-based learning in ophthalmology clerkship	Annals of Translational Medicine	China	APG	This study aimed to evaluate the effectiveness of AI-tutoring problem-based-learning (PBL) in ophthalmology clerkship and to assess the student evaluations of this module.	n= 38 students in ophthalmology clerkship at Sun Yat-Sen University were randomly assigned to two groups	The post-lecture scores were significantly higher than the pre-lecture scores in both groups. The improvement of group A in the part of sign and diagnosis test (Part I) was more significant than that of group B. However, there was no difference in the improvement in the part of treatment plan test (Part II) between two groups. Overall, all respondents were satisfied and agreed that AI-tutoring PBL was helpful, effective, motive and beneficial to help develop critical and creative thinking. Conclusions: The application of AI-tutoring PBL into ophthalmology clerkship improved students' performance and satisfaction. AI-tutoring PBL teaching showed advantage in promoting students' understanding of signs of diseases.
Zhao, C.	2023	Comparison of case-based learning using Watson for oncology and traditional method in teaching undergraduate medical students.	International Journal of Medical Informatics	China	APG	To establish a novel teaching and learning method with Watson for Oncology (WFO) in undergraduate medical students and evaluate its efficiency and students' satisfaction compared with traditional case-based learning model.	n= 72 (36 in the WFO-based CBL group and 36 in the traditional CBL group).	The study found that the WFO-based method was effectively translated into practical benefits by empowering students with enhanced learning experiences and equipping them with the novel tool for clinical practice. Additionally, this study suggests that further multicenter studies and more rigorous evaluating tool in teaching assessment are required in the future.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Abid, A.	2024	AI Education for Fourth-Year Medical Students: Two-Year Experience of a Web-Based, Self-Guided Curriculum and Mixed Methods Study.	JMIR Medical Education	United States	WEOG	This study aims to evaluate the success of this elective in improving self-reported confidence scores in AI and ML for 4th-year medical students.	n=19 4th year medical students	Most students entered the elective with minimal previous experience in AI and ML and were successful in completing self-guided research and proposing creative and realistic AI and ML projects.
Araujo, S.	2024	Incorporating ChatGPT in Medical Informatics Education: Mixed Methods Study on Student Perceptions and Experiential Integration Proposals.	JMIR Medical Education	Portugal, Switzerland	WEOG	The aim of the study is to explore the perceptions of students regarding the use of ChatGPT as a learning tool in their educational context and provide professors with examples of prompts for incorporating ChatGPT into their teaching and learning activities, thereby enhancing the educational experience for students in medical informatics courses.	n= 25 medical students	The results of the questionnaire suggest that students perceive ChatGPT as a valuable tool for enhancing learning experiences and academic tasks, although they also emphasize the importance of informed and responsible use. Additionally, the study provided a description of the learning outcomes of the 2 courses proposed for the incorporation of ChatGPT in the classroom.
Blease, C.	2023	Computerization of the Work of General Practitioners: Mixed Methods Survey of Final-Year Medical Students in Ireland.	JMIR Medical Education	Ireland, United States, United Kingdom, Sweden	WEOG	To describe the opinions of final-year medical students in Ireland regarding the potential of future technology to replace or work alongside general practitioners (GPs) in performing key tasks.	n= 252 medical students	The paper cautions that without a firm curricular foundation on advances in AI/ML, students may rely on extreme perspectives involving self-preserving optimism biases that demote the impact of advances in technology on primary care on the one hand and technohype on the other. Ultimately, these biases may lead to negative consequences in health care. Improvements in medical education could help prepare tomorrow's doctors to optimize and lead the ethical and evidence-based implementation of AI/ML-enabled tools in medicine for enhancing the care of tomorrow's patients.
Ejaz, H.	2022	Artificial intelligence and medical education: A global mixed-methods study of medical students' perspectives.	Digital Health	United Kingdom, United States, The Netherlands, Switzerland	WEOG	To provide the first report on the state of artificial intelligence in medical education globally by exploring the perspectives of medical students.	n= 128 medical students	Support for incorporating teaching on artificial intelligence into core curricula was ubiquitous across the globe, but few students had received teaching on artificial intelligence. Students showed knowledge on the applications of artificial intelligence in clinical medicine as well as on artificial intelligence ethics. They were interested in learning about clinical applications, algorithm development, coding and algorithm appraisal. Hackathon-style projects and multidisciplinary education involving computer science students were suggested for incorporation into the curriculum.
Gillissen, A.	2022	Medical Students' Perceptions towards Digitization and Artificial Intelligence: A Mixed-Methods Study.	Healthcare	Germany	WEOG	To explore attitudes of 2020 medical students' generation towards various aspects of eHealth technologies with the focus on AI using an exploratory sequential mixed-method analysis. Data from semi-structured interviews with 28 students from five medical faculties were used to construct an online survey sent to about 80,000 medical students in Germany.	n= 1053, medical students 438, graduate students 615	While the attitudes towards digitization in medicine were well-balanced between curricula groups, gender, and training stage, perceptions regarding AI were not. Although in comparison to other studies, AI illiteracy was lower, still, up to almost 40% of participants could not answer AI-related questions although differences in subgroups exist.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Gin, B.	2024	Assessing supervisor versus trainee viewpoints of entrustment through cognitive and affective lenses: an artificial intelligence investigation of bias in feedback	Advances in Health Sciences Education	The Netherlands, United States	WEOG	To develop and utilize NLP tools based on LLMs to systematically compare the thematic content and sentiment of feedback dialogs from observed clinical encounters documented either by supervisors or trainees.	n= 5478, medical students 552, clinical supervisors 4926	On average, trainees used more negative language compared to supervisors, while documenting higher entrustment ratings. We also found biases tied to demographic characteristics: trainees' documentation reflected more positive sentiment in the case of male trainees and of trainees underrepresented in medicine. Entrustment ratings did not appear to reflect these biases when documented by the trainee or supervisor. As such, bias seemed to influence the native language trainees used to document entrustment more than the degree of entrustment they experienced. Mitigating these biases is important because they may affect trainees' assimilation into their roles and forming trusting relationships.
Hanfati, K.	2023	Application of mixed reality and artificial intelligence to assist medical students in learning injection technique	Bali Medical Journal	Indonesia	APG	To evaluate the application of mixed reality and artificial intelligence to assist medical students in learning injection technique.	n= 40 medical students	The study's outcomes are presented in software testing (FPS, CPU, GPU, and load scene) in the form of user testing utilizing the PIECES Framework (Performance, Information and Data, Economy, Control and Security, Efficiency, and Service), which evaluates the application's utility or significance as well as the satisfaction of its users. Conclusion: The system was able to develop a combining application of artificial intelligence and mixed reality for detecting objects in laboratories to assist learning students.
Holderried, F.	2024	A Generative Pretrained Transformer (GPT)-Powered Chatbot as a Simulated Patient to Practice History Taking: Prospective, Mixed Methods Study.	JMIR Medical Education	Germany, United States	WEOG	To explore the feasibility of a GPT-driven chatbot to practice history taking, one of the core competencies of communication.	n= 28 medical students	Our data showed that LLMs, such as GPT, can provide a simulated patient experience and yield a good user experience and a majority of plausible answers. Our analysis revealed that GPT-provided answers use either explicit script information or are based on available information, which can be understood as abductive reasoning. Although rare, the GPT-based chatbot provides implausible information in some instances, with the major tendency being socially desirable instead of medically plausible information.
Hudon, A.	2024	Using ChatGPT in Psychiatry to Design Script Concordance Tests in Undergraduate Medical Education: Mixed Methods Study	JMIR Medical Education	Canada	WEOG	Primary goal: to explore how SCTs generated by ChatGPT compared to SCTs produced by clinical experts on 3 major elements: the scenario (stem), clinical questions, and expert opinion. Secondary goal: to assess whether blind evaluators can distinguish between an SCT generated by ChatGPT and one crafted by experts. Additionally, another sub objective aims to identify the advantages and limitations of the clinical vignettes under examination.	n= 102 clinical educators and residents	There were no significant distinctions between the SCTs generated by ChatGPT as compared to those developed by experts in the field for the evaluated components. The strengths and weaknesses were similar across the 2 types of SCT. Respondents reported that the SCTs generated by ChatGPT were well aligned with the DSM-5 but were also too caricatural.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Karaca, O	2021	Medical artificial intelligence readiness scale for medical students (MAIRS-MS) - development, validity and reliability study.	BMC Medical Education	Turkey	WEOG	To describe the development of a valid and reliable psychometric measurement tool for the assessment of the perceived readiness of medical students on AI technologies and its applications in medicine.	n= 991, medical students 897, experts 94	The newly developed Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS) was found to be valid and reliable tool for evaluation and monitoring of perceived readiness levels of medical students on AI technologies and applications. Medical schools may follow 'a physician training perspective that is compatible with AI in medicine' to their curricula by using MAIRS-MS. This scale could be benefitted by medical and health science education institutions as a valuable curriculum development tool with its learner needs assessment and participants' end-course perceived readiness opportunities.
Li, J.	2023	Artificial Intelligence-based online platform assists blood cell morphology learning: A mixed-methods sequential explanatory designed research.	Medical Teacher	China, United Arab Emirates	APG	To evaluate the effectiveness of learning blood cell morphology by learning on our Artificial intelligence (AI)-based online platform.	n= 31 medical students	The AI-based online platform could assist medical students in blood cell morphology learning. The AI system could function as a more knowledgeable other (MKO) and guide the students through their zone of proximal development (ZPD) to achieve mastery. It could be an effective and beneficial complement to microscopy learning. Students had very positive perspectives on the AI-based online learning platform. It should be integrated into the course and curriculum to facilitate the students.
Liu, D.	2022	Perceptions of US Medical Students on Artificial Intelligence in Medicine: Mixed Methods Survey Study.	JMIR Medical Education	United States	WEOG	To survey US medical students on the need to incorporate artificial intelligence in undergraduate medical education and their preferred means to do so to assist with future education initiatives.	n= 385, medical students 377, PhD students 8	The results of this study indicate that current US medical students recognize the importance of artificial intelligence in medicine and acknowledge that current formal education and resources to study artificial intelligence-related topics are limited in most US medical schools. Respondents also indicated that a hybrid formal/flexible format would be most appropriate for incorporating artificial intelligence as a topic in US medical schools. Based on these data, we conclude that there is a definitive knowledge gap in artificial intelligence education within current medical education in the US. Further, the results suggest there is a disparity in opinions on the specific format and topics to be introduced.
Moldt, J.A.	2023	Chatbots for future docs: exploring medical students' attitudes and knowledge towards artificial intelligence and medical chatbots.	Medical Education Online	Germany	WEOG	To understand the state of knowledge and perceptions of medical students regarding AI and chatbots in medicine.	n= 12 medical students	The participants (N = 12) were able to develop an understanding of how AI and chatbots will affect their future daily work. Although basic attitudes toward the use of AI were positive, the students also expressed concerns. There were high levels of agreement regarding the use of AI in administrative settings (83.3%) and research with health-related data (91.7%). However, participants expressed concerns that data protection may be insufficiently guaranteed (33.3%) and that they might be increasingly monitored at work in the future (58.3%). The evaluations indicated that future physicians want to engage more intensively with AI in medicine. In view of future developments, AI and data competencies should be taught in a structured way during the medical curriculum and integrated into curricular teaching.
Pucchio, A.	2022	Exploration of exposure to artificial intelligence in undergraduate medical education: a Canadian cross-sectional mixed-methods study.	BMC Medical Education	Canada	WEOG	To examines undergraduate medical students' perceptions of AI, educational opportunities about of AI in medicine, and the desired medium for AI curriculum delivery.	n= 474, medical students 465, doctors 9	A lack of educational opportunities about AI in medicine were identified across Canada in the participating students. As AI tools are currently progressing towards clinical implementation and there is currently a lack of educational opportunities about AI in medicine, AI should be considered for inclusion in formal medical curriculum.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Gin, B.	2021	Exploring how feedback reflects entrustment decisions using artificial intelligence	Medical Education	United States, The Netherlands	WEOG	To explore how feedback provided by clinical supervisors reflects their entrustment decisions for medical students. To determine the association between feedback characteristics and entrustment ratings using natural language processing (NLP) and artificial intelligence (AI).	n= 1,671, medical students 216, clinical supervisors 1455	There is a focus on performance details related to trainees' clinical competency as opposed to nonspecific feedback on trainee qualities. The entrustment framework reflected in feedback appeared to guide specific goal-setting, combined with details necessary to reach those goals. The NLP methodology can also serve as a starting point for future work on entrustment and feedback as similar assessment datasets accumulate.
Kaur, A.	2021	Qualitative exploration of digital chatbot use in medical education: A pilot study.	Digital Health	United Kingdom	WEOG	To explore the views of medical students and academic staff regarding the suitability and limitations of using a chatbot to support medical education.	n= 16, medical students 13, doctors 3	Chatbots could potentially support clinical simulations and revision tools, especially in resource-limited environments and during disruptions such as the COVID-19 pandemic.
Moldt, J. A.	2024	Assessing Artificial Intelligence Awareness and Identifying Essential Competencies: Insights from Key Stakeholders in Integrating Ai into Medical Education	JMIR Medical Education	Germany	WEOG	To explore stakeholder perceptions and expectations regarding AI in medicine and examines their potential impact on the medical curriculum. This study project aims to assess the AI experiences and awareness of different stakeholders and identify essential AI-related topics in medical education to define necessary competencies for students.	n= 38, healthcare students 10, lecturers 6, clinicians 9, AI experts 6, and institutional stakeholders 7	The qualitative content analysis revealed 6 primary categories with a total of 24 subcategories to answer the research questions. The evaluation of the stakeholders' statements revealed several commonalities and differences regarding their understanding of AI. Crucial identified AI themes based on the main categories were as follows: possible curriculum contents, skills, and competencies; programming skills; curriculum scope; and curriculum structure.
Rechowicz, K.	2023	The use of artificial intelligence to detect students' sentiments and emotions in gross anatomy reflections	Anatomical Sciences Education	United States	WEOG	Natural language processing, a nascent field of artificial intelligence that uses computational techniques for the analysis and synthesis of text, was used to compare health professional students' reflections on the importance of various regions of the body to their own lives and those of the anatomical donor dissected.	n= 132 health professionals	The data revealed an overall positive sentiment and shared emotional responses in self-reflections compared with reflections about donors. These similarities suggest a common view of humanization and person-centeredness of the donor. While still a maturing tactic, assessing reflective writings through natural language processing is a promising method for uncovering themes, the connectedness of student responses, and determining what areas warrant future investigations.
Shankar, P.	2023	Faculty perceptions regarding an individually tailored, flexible length, outcomes-based curriculum for undergraduate medical students.	KJME - Korean Journal of Medical Education	Malaysia, Pakistan	APG	To study perception of faculty members about an individually tailored, flexible-length, outcomes-based curriculum for undergraduate medical students. Their opinion about the advantages, disadvantages, and challenges was also noted. This study was done to help educational institutions identify academic and social support and resources required to ensure that graduate competencies are not compromised by a flexible education pathway.	n= 24 faculty	Respondents believed that it was feasible to offer a flexible-length individually tailored outcomes- based undergraduate medical curriculum at the two institutions and can provide a foundation to further the design and further develop CBME. Respondents agreed that this is an important concept but mentioned there were significant challenges. Online learning and AI are constantly progressing and can better support the creation of individualized student learning pathways. Students can study at a pace comfortable for them while developing the competencies required of a physician.
Shimizu, I.	2023	Developing Medical Education Curriculum Reform Strategies to Address the Impact of Generative AI: Qualitative Study	JMIR Medical Education	Japan	APG	This study analyzes the impact of generative AI (GAI) on medical education curricula and explores strategies for adaptation.	n= 55, medical students 6, faculty 49	Curricular response principles were broadly classified into "learning about GAI," "learning with GAI," and "learning aside from GAI." These principles will be the 3 pillars of medical education curriculum reform in the GAI era. Particularly, it is crucial to investigate how to maintain and promote learning aside from GAI.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Weidener, L., Fischer, M.	2023	Artificial Intelligence Teaching as Part of Medical Education: Qualitative Analysis of Expert Interviews.	JMIR Medical Education	Austria	WEOG	To explore the relevant knowledge and understanding of the subject of AI in medicine and specify curricula teaching content within medical education.	n= 12 AI experts in medicine	The analyzed expert interviews' results suggest that medical curricula should include the topic of AI in medicine to develop the knowledge, understanding, and confidence needed to use AI in the clinical context. The results further imply an imminent need for standardization of the definition of AI as the foundation to identify, define, and teach respective content on AI within medical curricula.

Lead Author	Year	Title	Journal	Country	Region	Aim	Participants	Conclusions
Çalışkan, S.	2022	Artificial intelligence in medical education curriculum: An e-Delphi study for competencies.	PLOS One	Turkey	WEOG	To provide consensus on AI related competencies required by medical graduates. Feb 2020 to Nov 2020,	128 Turkish academics and practitioners, plus medical students. Experts from different institutes with different backgrounds; (i) healthcare professionals/ academicians; (ii) computer and data science professionals/ academicians; (iii) law and ethics professionals/ academicians; and (iv) medical students. Round 1: n=75. Round 2:n=69. Round 3: n=60.	Following three rounds, there was a strong agreement on the 23 items and weak agreement on the 4 items. Strongest agreement was in areas of ethics and professionalism in use of AI, how to effectively use AI in learning and in practice. The weakest agreements were in areas related to how AI works.
Lee, Y.	2024	Defining Medical AI Competencies for Medical School Graduates: Outcomes of a Delphi Survey and Medical Student/Educator Questionnaire of South Korean Medical Schools.	Academic Medicine	Korea	APG	To define medical AI competencies and identify the essential competencies for medical graduates in South Korea. Initial Delphi conducted Aug to Oct 2022. Second with different experts early 2023,	Initial Delphi survey (2022)with 4 groups of medical AI experts (n = 28): (1) professors teaching medical AI-related courses in medical or health care profession schools (n = 14), (2) clinicians with practical experience in applying AI software (n = 3), (3) medical AI software developers (n = 4), and (4) experts from the medical AI industry (n = 9). 2nd Survey: 1,955 participants (1,174 students and 781 professors) from medical schools across South Korea. The second Delphi panelists were recruited using purposeful sampling techniques involving a professional network, the Korean Society of Medical Education, with snowball sampling and invitations to medical students.	The study identified 6 domains encompassing 36 AI competencies essential for medical graduates: (1) understanding digital health and changes driven by AI; (2) fundamental knowledge and skills in medical AI; (3) ethics and legal aspects in the use of medical AI; (4) medical AI application in clinical practice; (5) processing, analyzing, and evaluating medical data; and (6) research and development of medical AI, as well as subcompetencies within each domain.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Ali, M.	2020	A knowledge construction methodology to automate case-based learning using clinical documents	Expert Systems	Korea, Australia, Pakistan	APG, WEOG	To develop a knowledge construction methodology (KCM-CD) that uses clinical documents to construct domain knowledge ontology, thereby automating case-based learning (CBL) for medical students.	The developed knowledge construction methodology (KCM-CD) successfully automated the generation of domain knowledge ontology from clinical documents. The constructed ontological model was evaluated for quality and coherence, showing positive results in terms of correlation between words within the ontology branches.
Baglivo, F.	2023	Exploring the Possible Use of AI Chatbots in Public Health Education: Feasibility Study.	JMIR Medical Education	Italy	WEOG	To identify whether AI chatbots can be considered educational support tools for training in public health. The secondary objective was to assess the performance of different AI chatbots on complex multiple-choice medical questions in the Italian language.	The study demonstrated the efficacy of AI chatbots in answering complex medical questions related to vaccination and providing valuable educational support. Their performance significantly surpassed that of medical students in direct and scenario-based questions. The responsible and critical use of AI chatbots can enhance medical education, making it an essential aspect to integrate into the educational system.
Bajčetić, M.	2024	Comparing the Performance of Artificial Intelligence Learning Models to Medical Students in Solving Histology and Embryology Multiple Choice Questions.	Annals of Anatomy	Serbia	EEG	To assess the accuracy and consistency of various artificial intelligence language models (AI LMs) in answering multiple-choice questions (MCQs) related to histology and embryology taught during the first year of medical studies and to compare their performance with first-year medical students.	The study found that AI language models successfully answered the majority of MCQs and generally outperformed first-year medical students. However, the chatbots displayed inconsistency in responses over time, which raises concerns about their use as reliable educational tools.
Bakkum, M.	2024	Using artificial intelligence to create diverse and inclusive medical case vignettes for education	British Journal of Clinical Pharmacology	The Netherlands, Croatia, Spain, Italy	EEG, WEOG	To explore the potential of AI-assisted computer-generated clinical cases to expedite case creation and enhance diversity, along with AI-generated patient photographs for more lifelike portrayals in medical education.	The approach significantly accelerated case creation and improved diversity, although prioritizing maximum diversity compromised representativeness to some extent. While the optimized prompts are easily reusable, the process itself demands computer skills not all educators possess. To address this, the aim is to share all created patients as open educational resources, empowering educators to create cases independently.
Banerjee, A.	2023	Assessing the Efficacy of ChatGPT in Solving Questions Based on the Core Concepts in Physiology	Cureus	India	APG	To explore the efficacy of ChatGPT in solving various reasoning questions based on the five core concepts applied to different modules in the subject of physiology.	The study found that ChatGPT successfully answered most questions, with an overall mean score of 3.72 for modules and 3.68 for core concepts, highlighting an accuracy of 77%. However, significant differences in scores among various modules and core concepts suggest that further evaluation and training of AI tools are necessary to improve learning transfer in medical education.
Bulatov, S.	2021	Structural Model of a Training Computer Program for Improving Professional Skills of a Student in a Role of a District Polyclinic Physician	Journal of Robotics, Networking and Artificial Life	Russia	EEG	To create a computer program to improve the professional skills of medical students in primary care settings.	The program demonstrated that students showed improvement in clinical skills, including diagnosis and treatment planning, when utilizing the AI-based model.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Castellano, M.	2022	Gamified Educational Software Platform: Experience with Anatomy Students at Universidad de La Frontera	International Journal of Morphology	Chile	LAC	This study implemented a gamified educational software platform incorporating recommender systems and virtual assistants to provide feedback and strategies to support the acquisition of anatomy knowledge among medical students at Universidad de La Frontera (UFRO) in Temuco, Chile.	The main findings of this experience led to the conclusion that the use of gamified components for anatomy learning is a resource that can support student learning.
Chen, J.	2023	Assessing the performance of ChatGPT in bioethics: a large language model's moral compass in medicine	Journal of Medical Ethics	United States	WEOG	The study aimed to evaluate ChatGPT's performance in answering bioethics-related multiple-choice questions, commonly encountered by third- and fourth-year medical students, assessing its accuracy and identifying areas of strength and weakness.	ChatGPT showed an overall accuracy of 59.6% in answering bioethics questions at the level of third- and fourth-year medical students, performing best in categories like death and physician-patient relationships. However, it struggled in areas such as informed consent and abuse-related questions. Most errors were content or application-based.
Choi, J.	2022	Educational suitability of new channel-type video-laryngoscope with AI-based glottis guidance system for novices wearing personal-protective-equipment	Medicine	Korea	APG	To determine which of 4 laryngoscopes, including A-LRYNGO, a newly developed channel-type video-laryngoscope with an embedded artificial intelligence-based glottis guidance system, is appropriate for tracheal intubation training in novice medical students wearing personal protective equipment (PPE).	To prepare for an airway management of critically ill patients during the COVID-19 pandemic, a channel-type video-laryngoscope is appropriate for tracheal intubation training for novice practitioners wearing PPE. If the performance of the A-LRYNGO artificial intelligence glottis guidance system, a channel-type video-laryngoscope, is improved, it is thought that it can be recommended along with AWS as a device for novice practitioners.
Cianciolo, A.	2021	Machine Scoring of Medical Students' Written Clinical Reasoning: Initial Validity Evidence.	Academic Medicine	United States	WEOG	To explore the validity of machine learning technologies for scoring medical students' written clinical reasoning, specifically diagnostic justification essays.	Machine learning technologies may be useful for assessing medical students' long-form written clinical reasoning. Semantically based machine scoring may capture the communicative aspects of clinical reasoning better than faculty ratings, offering the potential for automated assessment that generalizes to the workplace. These results underscore the potential of machine scoring to capture an aspect of clinical reasoning performance that is difficult to assess with traditional analytic scoring methods. Additional research should investigate machine scoring generalizability and examine its acceptability to trainees and educators.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Dadon, Z.	2023	Empowering Medical Students: Harnessing Artificial Intelligence for Precision Point-of-Care Echocardiography Assessment of Left Ventricular Ejection	International Journal of Clinical Practice	Israel	WEOG	To evaluate the diagnostic accuracy of point-of-care ultrasound, POCUS, operated by medical students with the assistance of an AI-based tool for assessing the left ventricular ejection fraction (LVEF) of patients admitted to a cardiology department.	Medical students' utilization of an AI-based tool with a HUD for LVEF assessment achieved a level of accuracy similar to that of cardiologists. Furthermore, the use of AI by the students achieved moderate to substantial inter-rater reliability with expert echo cardiographers' evaluation.
Dhanvijay, A.	2023	Performance of Large Language Models (ChatGPT, Bing Search, and Google Bard) in Solving Case Vignettes in Physiology	Cureus	India	APG	To assess the performance of ChatGPT, Google Bard, and Microsoft Bing in answering case vignettes in physiology.	ChatGPT outperformed Bard and Bing in answering case vignettes in physiology. Hence, students and teachers may think about choosing LLMs for their educational purposes accordingly for case-based learning in physiology. Further exploration of their capabilities is needed for adopting those in medical education and support for clinical decision-making.
Ebina, K.	2022	Objective evaluation of laparoscopic surgical skills in wet lab training based on motion analysis and machine learning	Langenbeck's Archives of Surgery	Japan	APG	To build a skill assessment system, providing objective feedback to trainees based on the motion metrics of laparoscopic surgical instruments.	The result is a developed machine learning-based GOALS scoring system in wet lab training, with an error of approximately 1–2 points for the total score, and motion metrics that were explainable to trainees. The future challenges are the further improvement of onsite GOALS feedback, exploring the educational benefit of our model and building an efficient training program.
Esfahlani, S.	2020	Development of an Interactive Virtual Reality for Medical Skills Training Supervised by Artificial Neural Network	Advances in Intelligent Systems and Computing (AISC)	United Kingdom	WEOG	To develop an application of a "single Interrupted Suturing skill" that is used daily for various fields of surgery which is supervised by artificial intelligence (AI) algorithm.	The result has shown that the VR system offers a safe environment for training while the user could learn from the errors through the visual feedback and AI algorithm. It provided an environment that could enable the user to interact and practice as many time as they want in a safe environment while the actions were assessed with the AI algorithm.
Fareez, F.	2022	A dataset of simulated patient-physician medical interviews with a focus on respiratory cases	Scientific Data	Canada	WEOG	To present a high-quality dataset of simulated patient-physician medical conversations focused on respiratory cases, formatted for the development and training of NLP and AI models in medical education, diagnosis, and disease classification.	This article presents a comprehensive dataset of 272 simulated medical interviews between physicians and simulated patients, predominantly focusing on respiratory cases. The dataset includes high-quality audio files and manually corrected transcripts, making it suitable for training and evaluating NLP models in medicine. It addresses a major gap by offering well-documented conversational data, which is challenging to obtain, thereby supporting advancements in speech recognition, NLP model training, and medical education. This dataset could potentially increase the accuracy of AI models used in educational settings and clinical simulations, contributing significantly to the field of digital health.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Funk, P.	2024	ChatGPT's response consistency: A study on repeated queries of medical examination questions	European Journal of Investigation in Health, Psychology and Education	Germany, United States, The Netherlands, United Kingdom, China, Brazil	APG, LAC, WEOG	To evaluate the response consistency and accuracy of ChatGPT 3.5 and ChatGPT 4 when answering medical examination questions and assess its reliability in medical education and clinical decision-making.	This study demonstrated that ChatGPT 4 performs significantly better than ChatGPT 3.5 in both accuracy and consistency when tasked with answering medical examination questions. ChatGPT 4 achieved an accuracy rate of 85.7%, significantly outperforming the 57.7% accuracy of ChatGPT 3.5. Furthermore, ChatGPT 4 consistently provided correct answers across multiple queries, reinforcing its reliability for medical education and clinical settings. While AI can serve as an essential tool in medicine, human oversight remains critical, ensuring that the integration of AI technologies enhances care without compromising patient outcomes.
Furlan, R.	2021	A Natural Language Processing-Based Virtual Patient Simulator and Intelligent Tutoring System for the Clinical Diagnostic Process: Simulator Development and Case Study	JMIR Medical Informatics	Italy, Switzerland	WEOG	To develop a Virtual Patient Simulator (VPS) for clinical diagnostic reasoning that integrates interaction in natural language and an ITS. We also aimed to provide preliminary results of a short-term learning test administered on undergraduate students after use of the simulator.	The study demonstrated that Hepius, by combining (Intelligent Tutoring System) ITS and NLP technologies, improved short-term diagnostic reasoning in medical students, with significant improvements in test scores. By combining ITS and NLP technologies, Hepius may provide medical undergraduate students with a learning tool for training them in diagnostic reasoning. This may be particularly useful in a setting where students have restricted access to clinical wards, as is happening during the COVID-19 pandemic in many countries worldwide.
Ghorasi, N.	2023	AI-Powered Chatbots in Medical Education: Potential Applications and Implications	Cureus	United States	WEOG	To explore the applications and implications of AI-powered chatbots in medical education and provide a SWOT (strengths, weaknesses, opportunities, and threats) analysis for their integration into medical curricula.	While the integration of AI-powered chatbots in medical education presents numerous advantages, it is crucial for students to use these tools as assistive tools rather than relying on them entirely. Chatbots should be programmed to reference evidence-based medical resources and produce precise and trustworthy content that adheres to medical science standards, scientific writing guidelines, and ethical considerations
Hamdy, H.	2021	Virtual Clinical Encounter Examination (VCEE): A novel approach for assessing medical students' non-psychomotor clinical competency.	Medical Teacher	United Arab Emirates, Singapore, Lebanon	APG	To investigate the feasibility, acceptability, reliability and validity of an online Virtual Clinical Encounter Examination (VCEE) to assess non-psychomotor competencies(non-procedure or manual skills) of medical students.	Student and faculty surveys demonstrated satisfaction with the experience. Confirmatory factor analysis supported convergent validity of VCEE with Direct Observation Clinical Encounter Examination (DOCEE), a previously validated clinical examination. The observed sensitivity was 81.8%, specificity 64.1% and likelihood ratio 12.6, supporting the ability of VCEE to diagnose 'clinical incompetence' among students. Conclusion: Our results suggest that online AI-based virtual patient high fidelity simulation may be used as an alternative tool to assess some aspects of non-psychometric competencies

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Han, Z.	2023	An explorative assessment of ChatGPT as an aid in medical education: Use it with caution.	Medical Teacher	United States	WEOG	To explore the use of ChatGPT by educators and students in a medical school setting.	ChatGPT can be a useful tool to assist medical educators in drafting course and session content outlines and create assessment questions. At the same time, caution must be taken as ChatGPT is prone to providing incorrect information; expert oversight and caution are necessary to ensure the information generated is accurate and beneficial to students. Therefore, it is premature for medical students to use the current version of ChatGPT as a "know-it-all" information provider.
Ho, W., Koussayer, B., Sujka, J.	2023	ChatGPT: Friend or foe in medical writing? An example of how ChatGPT can be utilized in writing case reports	Surgery in Practice and Science	United States	WEOG	To assess the role of ChatGPT in medical writing, particularly in the creation of case reports, and to evaluate its benefits and limitations.	ChatGPT is a powerful medical writing tool that can be used to generate summaries, proofread, and provide valuable medical insight. However, it needs to be used with caution and an understanding of its limitations, and should not be used as a substitute for a study author. Undoubtedly, the impact we are seeing of NLP models such as ChatGPT on scientific research and medicine is only going to grow. Instead of fearing its effects, we should develop frameworks and guidelines on how to better utilize this technology to improve clinical research and medicine.
Hollis-Sando, L.	2023	Deep learning in the marking of medical student short answer question examinations: Student perceptions and pilot accuracy assessment	Focus on health professional education	Australia	WEOG	This project examined medical student opinion regarding computer-based marking and evaluated the accuracy of deep learning (DL), a subtype of machine learning, in the scoring of medical short answer questions (SAQs).	Medical students may be supportive of computer-based (machine learning) marking, in part due to its perceived objectivity. DL has the potential to provide accurate marking of written questions, although multi class classification tasks may require larger datasets.
Huang, Y.	2020	Innovative Training Model of Cross-Domain Digital ICT Talent Development for Training Application of Data Analysis in Medical Field	IEEE TALE (Teaching, Assessment, and Learning for Engineering) International Conference Proceedings	Taiwan	APG	To design and test a cross-domain digital courses for medical students. These Artificial Intelligence (AI) courses were made available throughout the semester via an innovative blended learning model.	The course not only helped students develop problem-solving skills but also strengthened the connections between academic subjects and AI-related technology. As a result of this research, medical university students achieved significant academic improvement after participating in the course. Students' rated their satisfaction levels for course contents and materials an average of four out of five.
Ignjatović, A., Stevanović, L.	2023	Efficacy and limitations of ChatGPT as a biostatistical problem-solving tool in medical education: a descriptive study	Journal of Educational Evaluation for Health Professions (JEEHP)	Serbia	EEG	To assess the performance of ChatGPT (GPT-3.5 and GPT-4) as a study tool in solving biostatistical problems and to identify any potential drawbacks that might arise from using ChatGPT in medical education, particularly in solving practical biostatistical problems.	The assessment of both versions of ChatGPT performance in 10 biostatistical problems revealed that GPT-3.5 and 4's performance was below average, with correct response rates of 5 and 6 out of 10 on the first attempt. GPT-4 succeeded in providing all correct answers within 3 attempts. These findings indicate that students must be aware that this tool, even when providing and calculating different statistical analyses, can be wrong, and they should be aware of ChatGPT's limitations and be careful when incorporating this model into medical education.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Jani, K.	2020	Machine learning to extract communication and history-taking skills in OSCE transcripts	Medical Education	United States, Canada	WEOG	The study aims as follows: (1a) to develop machine learning models (MLMs) capable of labeling student utterances in transcripts in one clinical scenario; (1b) to test these MLMs for transferability when labeling utterances in transcripts from a second clinical scenario; and (2) repeat aims 1a and 1b for six combinations of ML algorithms and sentence vector representations to compare their relative performance for methods-focused development.	The study demonstrated that machine learning can automate the labelling of OSCE transcripts for a range of interview content and some clinical communications skills. Optimized MLMs could provide an automated and accurate assessment of OSCEs and allow progress tracking. It is expected to impact the roles of SPs and evaluators, advance curriculum and research, and ultimately enhance clinical practice.
Jin, S.	2023	Development and Application of Teaching Model for Medical Humanities Education using Artificial Intelligence and Digital Humans Technologies	IEEE Eurasian Conference on Educational Innovation 2023	China	APG	To build a digital simulator and virtual simulation experiment system based on big data and to explore the possibility of its application in the actual teaching process and the practical application results.	The pedagogical model based on artificial intelligence and digital human technologies presented here provides a new opportunity for the effectiveness of medical humanities education. Integrating big data and artificial intelligence technologies in medical education facilitates the development of personalized and interactive teaching methods to improve student engagement and learning.
Khake, A.	2024	Role of ChatGPT 3.5 and Bard as self assessment tool for undergraduate level multiple choice questions level long answer questions in ophthalmology	International Journal of Academic Medicine and Pharmacy	India	APG	To evaluate the effectiveness of ChatGPT 3.5 & Google Bard as a tool for self-assessment of Long Answer Questions (LAQs) in ophthalmology for undergraduate students.	In this study though ChatGPT and Bard can provide answers to LAQs their answers cannot be relied on with confidence every time. Using ChatGPT or Bard alone for self-assessment while studying for LAQs by undergraduate students is not advisable. Students should use standard books or standard online resources for ophthalmology while preparing for LAQ problems
Kiyak, Y.	2024	ChatGPT for generating multiple-choice questions: Evidence on the use of artificial intelligence in automatic item generation for a rational pharmacotherapy exam.	European Journal of Clinical Pharmacology	Turkey	WEOG	To determine the feasibility of generating multiple-choice questions using ChatGPT in terms of item difficulty and discrimination levels.	The study found that ChatGPT-generated multiple-choice questions exhibited acceptable levels of item difficulty and discrimination. The findings showed that ChatGPT-generated questions exhibit psychometric properties that meet acceptable standards. It presents a significant opportunity to make test development more efficient. However, further research is essential to either corroborate or question these findings.
Klang, E.	2023	Advantages and pitfalls in utilizing artificial intelligence for crafting medical examinations: a medical education pilot study with GPT-4	BMC Medical Education	Israel, Poland	EEG, WEOG	To evaluate the performance of GPT-4, an artificial intelligence application, in generating multiple-choice questions (MCQs) for medical exams.	GPT-4 can be used as an adjunctive tool in creating multiple-choice question medical examinations yet rigorous inspection by specialist physicians remains pivotal
Lam, A.	2022	Professionalism and clinical short answer question marking with machine learning.	Internal Medicine Journal	Australia, United States, New Zealand	WEOG	To evaluate the performance of machine learning in the marking of short answer questions (SAQ) and very short answer questions (VSAQ) on: (i) professionalism content; and (ii) clinical content, in a diverse international cohort.	Machine learning has currently not been widely implemented as a tool for grading assessments in medical education, outside of limited proprietary software. However, it may be reasonable to trial the use of machine learning models in grading written clinical and professionalism assessments that are mainly comprised of 1-mark and 2-mark SAQ, using open-source software.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Lebhar, M.	2023	Dr. ChatGPT: Utilizing Artificial Intelligence in Surgical Education	The Cleft Palate Craniofacial Journal	United States	WEOG	This study sought to explore the unexamined capabilities of ChatGPT in describing the surgical steps of a specialized operation, the Fisher cleft lip repair.	Results show PRS residents were able to detect more inaccuracies of the ChatGPT response as well as prefer the CMF surgeon's prompt in performing the surgery. Residents with less expertise in the procedure failed to detect who wrote what procedure, and preferred the ChatGPT response in explaining the concept and chose it to perform the surgery. Conclusions: In applications to surgical education, ChatGPT was found to be effective in generating easy-to-understand procedural steps that medical personnel of all specialties can follow. However, it does not have expert capabilities to provide the minute details of measurements and specific anatomy required to perform medical procedures.
Ledwos, N.	2022	Assessment of learning curves on a simulated neurosurgical task using metrics selected by artificial intelligence	Journal of Neurosurgery	Canada, Saudi Arabia	APG, WEOG	The study objectives were to use artificial intelligence (AI)-derived metrics to determine the learning curves of participants in 4 groups with different expertise levels who performed a series of identical virtual reality (VR) subpial resection tasks and to identify learning curve differences among the 4 groups.	Learning curves created using AI-derived metrics, which enhance the precision of expertise classification during repeated VR-simulated subpial tumor resections, provide novel insights into technical skill acquisition. This insight will allow surgical educators to develop more focused formative educational paradigms to expedite neurosurgical trainee progress.
Luke, W.A.	2024	Is ChatGPT 'ready' to be a learning tool for medical undergraduates and will it perform equally in different subjects? Comparative study of ChatGPT performance in tutorial and case-based learning questions in physiology and biochemistry.	Medical Teacher	Singapore	APG	This study evaluated the performance of ChatGPT in tutorial and case-based learning questions in physiology and biochemistry for medical undergraduates. Our study mainly focused on the performance of GPT-3.5 version while a subgroup was comparatively assessed on GPT-3.5 and GPT-4 performances.	The mean score for physiology answers was 74.7. GPT-3.5 demonstrated a statistically significant superior performance in lower-order questions of Bloom's taxonomy in comparison to higher-order questions. Scores in biochemistry were relatively lower with a mean score of 59.3 for GPT-3.5. There was no statistically significant difference in the scores for higher and lower-order questions of Bloom's taxonomy. The subset of questions where the GPT-4 and GPT-3.5 were compared demonstrated a better overall performance in GPT-4 responses in both subjects. This difference between the GPT-3.5 and GPT-4 performance was statistically significant in biochemistry but not in physiology. Conclusions: The differences in performance across the two versions, GPT-3.5 and GPT-4 across the disciplines are noteworthy. Educators and students should understand the strengths and limitations of this technology in different fields to effectively integrate this technology into teaching and learning.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Maicher, K.	2023	Artificial intelligence in virtual standardized patients: Combining natural language understanding and rule based dialogue management to improve conversational fidelity	Medical Teacher	United States	WEOG	We describe herein the development of an artificial intelligence (AI) system for VSPs enabling students to practice their history taking skills.	System accuracy improved from 75% in 2018 to 90% in 2021 as refinements in algorithms and additional training data were utilized. Student feedback was positive, and most students felt that practicing with the VSPs was a worthwhile experience. Conclusion: We have developed a novel hybrid dialogue system that enables artificially intelligent VSPs to correctly answer student questions at levels comparable with human SPs. This system allows trainees to practice and refine their history-taking skills before interacting with human patients
Masikisiki, B.	2023	Investigating the Efficacy of Large Language Models in Reflective Assessment Methods through Chain of Thoughts Prompting	Proceedings of the 4th African Human Computer Interaction Conference	South Africa	AG	To assess how well four language models can grade reflective essays of third-year medical students. The assessment will specifically target the evaluation of critical thinking skills using chain of thought (CoT) prompting.	The results of the reflective essays using chain of thought prompting as an instructional approach for training LLM to carry out particular tasks reveal that Llama-7b performs the least effective and ChatGPT emerges as the superior model.
Mastour, H.	2023	Early prediction of medical students' performance in high-stakes examinations using machine learning approaches.	Heliyon - Cell Press	Iran	APG	To present a reliable framework for preparing data and developing and evaluating classic and ensemble ML models that can be adjusted to predict medical students' performance in a medical licensing examination, the Comprehensive Medical Basic Sciences Examination (CMBSE).	Governments and educational systems can save resources and time by developing ML models to predict students' performance on licensure exams, where these models can provide a suitable alternative for high-stakes exams in unforeseen circumstances (such as the COVID-19 pandemic). Furthermore, these models may be effective from an outcome-based perspective in medical education by facilitating proactive and knowledge-based decision-making, fostering academic success by tracking student progress, and preventing failures by early identification of at-risk students.
Meo, S.	2023	The Scientific Knowledge of Bard and ChatGPT in Endocrinology, Diabetes, and Diabetes Technology: Multiple-Choice Questions Examination-Based Performance.	Journal of Diabetes Science and Technology	United States, United Kingdom, Saudi Arabia	APG, WEOG	To investigate the knowledge level of Bard and ChatGPT in the areas of endocrinology, diabetes, and diabetes technology through a multiple-choice question (MCQ) examination format.	The overall MCQ-based performance of ChatGPT was slightly better than that of Google's Bard. However, both ChatGPT and Bard did not achieve appropriate scores in endocrinology and diabetes/diabetes technology. The study indicates that Bard and ChatGPT have the potential to facilitate medical students and faculty in academic medical education settings, but both artificial intelligence tools need more updated information in the fields of endocrinology, diabetes, and diabetes technology.
Meyer, A.	2024	Comparison of the Performance of GPT-3.5 and GPT-4 With That of Medical Students on the Written German Medical Licensing Examination: Observational	JMIR Medical Education	Germany	WEOG	To compare the performance of GPT-3.5 and GPT-4 with that of medical students on the written German medical licensing examination.	The study results highlight ChatGPT's remarkable improvement from moderate (GPT-3.5) to high competency (GPT-4) in answering medical licensing examination questions in German. While GPT-4's predecessor (GPT-3.5) was imprecise and inconsistent, it demonstrates considerable potential to improve medical education and patient care, provided that medically trained users critically evaluate its results. As the replacement of search engines by AI tools seems possible in the future, further studies with nonprofessional questions are needed to assess the safety and accuracy of ChatGPT for the general population.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Mirchi, N.	2020	The Virtual Operative Assistant: An explainable artificial intelligence tool for simulation-based training in surgery and medicine.	PLOS One	Canada	WEOG	This study aims to 1) introduce a new framework using explainable artificial intelligence for simulation-based training in surgery, and 2) validate the framework by creating the Virtual Operative Assistant, an automated educational feedback platform.	The Virtual Operative Assistant successfully classified skilled and novice participants using 4 metrics with an accuracy, specificity and sensitivity of 92, 82 and 100%, respectively. A 2-step feedback system was developed to provide participants with an immediate visual representation of their standing related to expert proficiency performance benchmarks. The educational system outlined establishes a basis for the potential role of integrating artificial intelligence and virtual reality simulation into surgical educational teaching. The potential of linking expertise classification, objective feed-back based on proficiency benchmarks, and instructor input creates a novel educational tool by integrating these three components into a formative educational paradigm.
Morjaria, L.	2024	Examining the Efficacy of ChatGPT in Marking Short-Answer Assessments in an Undergraduate Medical Program	International Medical Education	Canada	WEOG	To validate the use of ChatGPT for evaluating short-answer assessments in an undergraduate medical program.	Our study demonstrates that ChatGPT is a viable, though imperfect, alternative to expert human graders of short-answer formative assessments in a medical education program. However, its performance raises concerns of possible grade inflation and, without the use of supplementary grading criteria, may miss nuanced details resulting in scoring a student's response. In terms of incorporating such a system into a workflow, using ChatGPT as an assistant rather than an alternative in an LLM-human hybrid solution is an intuitive option to address the limitations of an LLM-only grading system. These hybrid solutions have yet to be formally explored, as well as potential opportunities for time and cost savings and scalability. Our findings open avenues for future research aimed at refining AI-based grading systems through multi-rater comparisons and algorithmic improvements.
Morjaria, L.	2023	Examining the Threat of ChatGPT to the Validity of Short Answer Assessments in an Undergraduate Medical Program.	Journal of Medical Education and Curricular Development	Canada	WEOG	This study evaluated the extent of the threat posed by ChatGPT to the validity of short-answer assessment problems used to examine pre-clerkship medical students in our undergraduate medical education program.	While ChatGPT was able to pass short answer assessment problems spanning the pre-clerkship curriculum, it outperformed only underperforming students. We remark that tutors in several cases were convinced that ChatGPT-produced responses were produced by students. Risks to assessment validity include uncertainty in identifying struggling students and inability to intervene in a timely manner. The performance of ChatGPT on problems requiring increasing demands of cognitive reasoning warrants further research.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Nagaraj, M.	2023	Developing artificial intelligence models for medical student suturing and knot-tying video-based assessment and coaching.	Surgical Endoscopy	United States	WEOG	To develop an Artificial Intelligence (AI) model to perform video-based assessment.	We aimed to create an AI model that would provide an automatic assessment tool for our previously reported suturing and knot-tying curriculum. Our preliminary data showed positive progress in accuracy of error detection by performance improvement methods including designing a multi-stream architecture and training it in end-to-end fashion. Identified needs include having additional videos with more errors for training, standardization of video capture, and balanced rating distribution for improved model training. We hope that this work will guide further efforts in automated assessment for summative as well as eventually formative training feedback. We anticipate that such innovations will help reduce the burden of relying on instructor support, while improving efforts in simulation-based education.
Padmanabhan, P.	2023	Exploring the Potential of ChatGPT in Obstetrics and Gynecology of Undergraduate Medical Curriculum	The Journal of Obstetrics and Gynecology of India	India	APG	To study at two levels with direct and case-based questions from Obstetrics and gynecology to assess the performance of ChatGPT in the medical field.	Overall, ChatGPT has performed well in the direct (non-case) type of questions. In context to case-based questions, ChatGPT had managed to pass the evaluation, but more improvements are needed to enhance the quality of answers. However, these results cannot be generalized as we restricted this evaluation to the undergraduate level and a small sample size. A significant update with major scientific findings, after 2021 (the year up to which ChatGPT's dataset has been updated) may not have been included in textbooks yet about the case scenarios used to converse with ChatGPT for this evaluation but in the realm of research, it is imperative to conduct long-term studies to continually assess ChatGPT's clinical accuracy and reliability, monitoring its performance over an extended period and updating its knowledge base to stay current with the latest medical advancements. A crucial aspect is establishing a feedback loop with medical practitioners to collect insights into ChatGPT's performance, address specific concerns, and make iterative improvements so that its application in medical education and clinical practices can be warranted with evidence-based information

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Park, S.	2024	Preparing healthcare leaders of the digital age with an integrative artificial intelligence curriculum: a pilot study.	Medical Education Online	United States	WEOG	To evaluate the effectiveness of a medical school digital health non-credit enrichment elective that focused on longitudinal integration of increasingly complex AI concepts into the preclinical education. Specifically, we aimed to assess whether medical students who receive AI education in the pilot digital health curriculum demonstrate an improvement in their self-reported confidence in explaining the elective's learning objectives (high-level knowledge, implications, and limitations of AI).	Our study demonstrates that a digital health enrichment elective that runs in parallel to an institution's preclinical curriculum and embeds AI concepts into relevant clinical topics can enhance students' confidence in describing the content objectives that pertain to high-level algorithmic understanding, implications, and limitations of the studied models.
Rezazadeh, H.	2023	Psychometric evaluation of Persian version of medical artificial intelligence readiness scale for medical students.	BMC Medical Education	Iran	APG	To translate and psychometric evaluation of the Persian version of the medical artificial intelligence readiness scale for medical students.	Considering the excellent reliability, appropriate convergent validity, and almost acceptable construct validity of the Persian version of the MAIRS-MS, as well as its conciseness and ease of implementation, it can be used to evaluate medical students' readiness for the use of artificial intelligence in medicine.
Rezigalla, A.	2024	AI in medical education: uses of AI in construction type A MCQs	BMC Medical Education	Saudi Arabia	APG	To assess the use of an AI tool to generate MCQs type A and evaluate its quality.	Items constructed using AI had good psychometric properties and quality, measuring higher-order domains. AI allows the construction of many items within a short time. AI can be used in item generation and the associated challenges into a multi-layered discussion that will eventually lead to improvements in item generation and assessment in general.
Roos, J.	2023	Artificial Intelligence in Medical Education: Comparative Analysis of ChatGPT, Bing, and Medical Students in Germany.	JMIR Medical Education	Germany	WEOG	To assess and compare the performance of 3 LLMs, GPT-4, Bing, and GPT-3.5-Turbo, in the German Medical State Examinations of 2022 and to evaluate their performance relative to that of medical students.	GPT-4 achieved the highest overall performance, correctly answering 88.1% of questions, closely followed by Bing (86.0%) and GPT-3.5-Turbo (65.7%). The students had an average correct answer rate of 74.6%. Both GPT-4 and Bing significantly outperformed the students in both examinations. When media questions were excluded, Bing achieved the highest performance of 90.7%, closely followed by GPT-4 (90.4%), while GPT-3.5-Turbo lagged (68.2%). There was a significant decline in the performance of GPT-4 and Bing in the fall 2022 examination, which was attributed to a higher proportion of media-related questions and a potential increase in question difficulty. Conclusions: LLMs, particularly GPT-4 and Bing, demonstrate potential as valuable tools in medical education and for pretesting examination questions. Their high performance, even relative to that of medical students, indicates promising avenues for further development and integration into the educational and clinical landscape.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Ruberto, A.	2021	The future of simulation-based medical education: Adaptive simulation utilizing a deep multitask neural network.	AEM Education and Training	Canada	WEOG	To test a novel simulation platform that utilized artificial intelligence to deliver a medical simulation that was adaptable to a participant's measured cognitive load.	Our research team developed a novel simulation platform that adapts augmented reality patient symptom severity modulation to participants' measured cognitive load. This represents a step forward in advancing medical simulation design and has the potential to enhance the way that simulation-based medical education is conceptualized, designed, and delivered.
Sallam, M.	2023	Assessing Health Students' Attitudes and Usage of ChatGPT in Jordan: Validation Study	JMIR Medical Education	Jordan, United Arab Emirates, Lebanon	APG	To develop and validate a TAM-based survey instrument called TAME-ChatGPT (Technology Acceptance Model Edited to Assess ChatGPT Adoption) that could be employed to examine the successful integration and use of ChatGPT in health care education.	The TAME-ChatGPT demonstrated good reliability, validity, and usefulness in assessing health care students' attitudes toward ChatGPT. The findings highlighted the importance of considering risk perceptions, usefulness, ease of use, attitudes toward technology, and behavioral factors when adopting ChatGPT as a tool in health care education.
Sangreman Aldeman, N.L.	2021	Smartpathk: a platform for teaching glomerulopathies using machine learning	BMC Medical Education	Brazil	LAC	To introduce and assess the effectiveness of the Smartpath platform in teaching glomerulopathies through machine learning techniques.	SmartPath was developed as a complementary tool for teaching nephropathology, showing an accuracy of 89.47%. It aims to increase the educational training capacity of medical professionals in renal pathology using machine learning.
Sauder, M.	2024	Exploring Generative Artificial Intelligence-Assisted Medical Education: Assessing Case-Based Learning for Medical Students.	Cureus	United States	WEOG	To assess the current capabilities of a GenAI (Chat Generative Pre-trained Transformer, ChatGPT), specifically within the framework of a pre-clerkship case-based active learning curriculum.	GenAI has the ability to answer questions, generate test questions, and appropriately respond to prompts in case-based learning scenarios. It performed well in addressing prompts related to epidemiology, diagnosis, and treatment but struggled to generate information on complex topics. It may fail to provide some key information, raising concerns about its suitability as a "search engine" for medical queries.
Scherr, R.	2023	ChatGPT Interactive Medical Simulations for Early Clinical Education: Case Study.	JMIR Medical Education	United States	WEOG	This paper models ChatGPT 3.5's ability to perform interactive clinical simulations and shows this tool's benefit to medical education.	ChatGPT is capable of creating simulations for early clinical education. These simulations let students practice novel parts of the clinical curriculum, such as forming independent diagnostic and therapeutic impressions over an entire patient encounter. Furthermore, the simulations can adapt to user inputs in a way that replicates real life more accurately than premade question bank clinical vignettes. Finally, ChatGPT can create potentially unlimited free simulations with specific feedback, which increases access for medical students with lower socioeconomic status and under resourced medical schools. However, no tool is perfect, and ChatGPT is no exception; there are concerns about simulation accuracy and replicability that need to be addressed to further optimize ChatGPT's performance as an educational resource.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Schneider, M.	2021	A machine learning algorithm supports ultrasound-naïve novices in the acquisition of diagnostic echocardiography loops and provides accurate estimation of LVEF	The International Journal of Cardiovascular Imaging	Austria	WEOG	To evaluate 1) if this new machine-learning algorithm can assist novice operators to acquire diagnostic image loops for calculating left ventricular ejection fraction (LVEF) and (2) if the AI based algorithm using these images provides LVEF calculations comparable to those obtained by expert.	This pilot study shows first evidence that a machine-learning algorithm can guide ultrasound-novices to acquire diagnostic echo loops and provide an automated LVEF calculation that is in agreement with a human expert. This has the potential to transfer the method and the parameter into other settings apart from a highly specialized echo lab.
Stokes, A.	2024	Machine learning and machine teaching in histopathology.	Pathology - Research and Practice	United Kingdom	WEOG	To create an AI model for a particular type of specimen an expert pathologist must label areas in hundreds of microscopic images to compile a training set. This is a laborious process that takes many hours and results in expert human knowledge being copied to a machine. In this report we describe how this knowledge can then be transferred to human students, "machine teaching" them to be histopathologists without any direct human assistance.	All the students improved during their training, from a mean accuracy of 13.7% in the first round to a mean accuracy of 77.1% in the sixth round ($p = 0.0011$). The student-deduced diagnostic features were mainly accurate. Some students learned more quickly than others. This project demonstrated how a human-machine-human symbiosis might allow a consultant pathologist to train many student pathologists with no direct contact between the pathologist and students. This approach could be applied to innumerable other training scenarios involving the classification of images.
Surapaneni, K.M.	2024	Evaluating ChatGPT as a self-learning tool in medical biochemistry: A performance assessment in undergraduate medical university examination.	Biochem Mol Biol Educ.	India	APG	To assess the performance of ChatGPT in medical biochemistry to evaluate its potential as an effective self-learning tool for medical students.	The evaluation of ChatGPT as a self-learning tool in medical biochemistry has yielded important insights. While it is encouraging that ChatGPT has demonstrated proficiency in this area, the overall score of 58% indicates that there is work to be done. To unlock its full potential as a self-learning tool, ChatGPT must focus on generating not only accurate but also comprehensive and contextually relevant content.
Tabuchi, H.	2024	Using artificial intelligence to improve human performance: efficient retinal disease detection training with synthetic images	Br J Ophthalmol	Japan, United Kingdom	APG, WEOG	To propose an AI-aided teaching method that leverages generative AI to train students on many images while preserving patient privacy. A web-based course was designed using 600 synthetic ultra-widefield (UWF) retinal images to teach students to detect disease in these images.	On average, students completed the course in 53min, significantly improving their diagnostic accuracy. For UWF images, student accuracy increased from 43.6% to 74.1% ($p < 0.0001$ by paired t-test), nearly matching the previously published state-of-the-art AI model's accuracy of 73.3%. For SF images, student accuracy rose from 42.7% to 68.7% ($p < 0.0001$), surpassing the state-of-the-art AI model's 40%. Conclusion Synthetic images can be used effectively in medical education. We also found that humans are more robust to novel situations than AI models, thus showcasing human judgement's essential role in medical diagnosis.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Totlis, T.	2023	The potential role of ChatGPT and artificial intelligence in anatomy education: a conversation with ChatGPT	Surgical and Radiologic Anatomy	Greece, France	WEOG	In the present study, an interview with ChatGPT was conducted to determine its capabilities and potential for use in anatomy education (AE) and anatomy research (AR).	ChatGPT-4 can be a valuable interactive educational tool for students in the field of anatomy, encouraging engagement and further questions. However, it cannot replace the critical role of educators and should be used as a complementary tool. Future research should establish guidelines for ChatGPT's optimal use and application in medical education.
Yhdego, H.	2023	Development of deep-learning models for a hybrid simulation of auscultation training on standard patients using an ECG-based virtual pathology stethoscope	Simulation: Transactions of the Society for Modeling and Simulation International	United States	WEOG	To develop a novel real-time simulation-based method for virtual pathology stethoscope (VPS) detection. The VPS system uses augmented reality (AR) to teach medical students how to perform cardiac examinations by listening to abnormal heart sounds in SPs who are otherwise healthy.	This work investigated the accuracy and validity of a DL-based VPS detection system. It involved collecting and examining ECG data from multiple subjects. The experimental analysis done on different subjects ensures good performance. The experimental results demonstrate that FCN, CNN-LSTM, and transformer encoder methods lead to better performance. Moreover, the leave-one-out subject-based validation, as well as different postures, helps us to determine the reliability of the system.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Abdellatif, H.	2022	Teaching, Learning and Assessing Anatomy with Artificial Intelligence: The Road to a Better Future	International Journal of Environmental Research and Public Health.	Oman	APG	To discuss the role of artificial intelligence in teaching, learning, and assessing anatomy, highlighting the advantages, current applications, and future directions.	To summarize, AI tools may not replace human interactions but can certainly change the face of Anatomy teaching and learning, prove a valuable resource for deep and logical learning and provide a three-dimensional virtual reality experience as close as possible to a real voyage of discovery of a living, breathing human being, thus ensuring a sound knowledge of Anatomy, the foundation of all clinical practice, medical or surgical. There are a few pertinent issues which may be raised, i.e., logistic issues such as cost of servers, training of faculty, development of tools, employment of trained technical personnel to run and maintain AI installations and apps, etc.
Abhee, S., Phillips, R.	2020	How artificial intelligence (AI) could have helped our medical education during the COVID-19 pandemic - A student's perspective	Medical Teacher	United Kingdom	WEOG	Comment on how AI could have helped in our individualized learning methods and how limited resources within healthcare could have been used more efficiently during the COVID-19 pandemic.	AI should be incorporated into medical education. AI should be used alongside, rather than to replace, some of the roles mentioned in the article. It should be seen as a bonus to add to our knowledge, after all man-made machines and we should not underestimate our capabilities.
Ahmad, O.	2024	AI Syndrome: an intellectual asset for students or a progressive cognitive decline.	Asian Journal of Psychiatry	Pakistan	APG	To investigate and to raise awareness about the influence of AI-powered software on the cognitive development of medical students, as well as the possible long-term ramifications.	AI-powered software in medical education has potential benefits and drawbacks. While it can improve medical diagnosis and treatment and provide access to learning resources, the misuse of AI as a shortcut may hinder cognitive development and have long-term implication.
Alam, F.	2023	Integrating AI in medical education: embracing ethical usage and critical understanding	Frontiers in Medicine	Malaysia, Brunei	APG	To explore the integration of artificial intelligence (AI) in medical education, focusing on embracing ethical usage and developing a critical understanding of AI applications for training future healthcare professionals.	The integration of AI in medical education is essential for preparing students and faculty to use AI ethically and critically. AI tools like ChatGPT can be valuable in enhancing understanding, but there is a strong emphasis on the need for ethical training to ensure responsible use in healthcare settings.
Alrassi, J.	2021	Technology Can Augment, but Not Replace, Critical Human Skills Needed for Patient Care	Academic Medicine	United States	WEOG	To discuss how technology, including artificial intelligence, can augment but not replace critical human skills needed for patient care, emphasizing the importance of maintaining the humanistic aspects of medicine.	It is shown that artificial intelligence has significant potential to augment human skills in medical practice but cannot entirely replace the essential human elements of care such as empathy, ethical decision-making, and communication. AI should be seen as complementary to, rather than a replacement for, critical human skills in healthcare.
Arachchige, A.	2023	Large language models (LLM) and ChatGPT: a medical student perspective	European Journal of Nuclear Medicine and Molecular Imaging	Italy	WEOG	As a 5th year medical student to share an opinion regarding the rapidly evolving field of AI-powered large language models.	The authors have clearly highlighted the limitations that this technology is currently facing. Further improvements could be made to these systems while also focusing on the effects it might have on our economies due to unemployment, etc. and we will accordingly have to change our education systems so that students will be trained for the vigilance of AI and for research and development of similar AI technologies rather than learning to do the same thing that a machine does.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Armitage, R.	2023	ChatGPT: the threats to medical education	Postgraduate Medical Journal	United Kingdom	WEOG	ChatGPT threatens to harm medical education significantly. Institutions that provide medical education must react to the existence, availability, and rapidly increasing competency of GPT models. This article suggests an intervention by which this could be, at least partially, achieved.	ChatGPT threatens harm to the educational establishment. A suggested intervention is for such institutions to reintroduce in-person written examinations—ideally that are handwritten, or at least that have no access to ChatGPT—in order to assess the extent to which students more accurately understand the work they submit.
Bansal, M., Jindal, A.	2022	Artificial intelligence in healthcare: Should it be included in the medical curriculum? A students' perspective.	The National Medical Journal of India	India	APG	The article's goals include advocating for AI education in medical curricula, addressing existing knowledge gaps, fostering interdisciplinary collaboration, and preparing students to effectively apply AI in their future medical practice.	The authors argue that AI has the potential to revolutionize healthcare outcomes through accurate diagnoses and treatment protocols. To harness this potential, medical students must be trained in AI technologies. The paper proposes a structured, step-wise integration of AI into medical education, beginning from the entrance level through to the core medical curriculum, with collaborations between medical and computer science faculties.
Benítez, T.	2024	Harnessing the potential of large language models in medical education: promise and pitfalls	Journal of the American Medical Informatics Association	United States, China, Canada	APG, WEOG	To provide a balanced consideration of the opportunities and challenges associated with integrating Large Language Models (LLMs) throughout the medical school continuum.	LLMs like OpenAI's ChatGPT can potentially revolutionize traditional teaching methodologies. LLMs offer several potential advantages to students, including direct access to vast information, facilitation of personalized learning experiences, and enhancement of clinical skills development. For faculty and instructors, LLMs can facilitate innovative approaches to teaching complex medical concepts and fostering student engagement. Notable challenges of LLMs integration include the risk of fostering academic misconduct, inadvertent overreliance on AI, potential dilution of critical thinking skills, concerns regarding the accuracy and reliability of LLM-generated content, and the possible implications on teaching staff.
Bhat, V.	2020	Empathy in the time of artificial intelligence: Fiction not fact may hold the key	Medical Journal of Dr. D.Y. Patil Vidyapeeth	India	APG	This is a perspective about clinicians' ability to empathize with their patients as a crucial component of adequate health care. Empathy must be taught in medical schools since AI cannot replace this aspect of a clinician.	While artificial intelligence can perform numerous tasks in the field of medicine, machines cannot be empathetic as a human being, hence necessitating the need for teaching empathy in medical schools.
Breeding, T.	2024	Letter re: "The Utilization of ChatGPT in Reshaping Future Medical Education and Learning Perspectives: A Curse or a Blessing?"	The American Surgeon	United States	WEOG	This letter addresses concerns and feedback on a study that evaluated the use of ChatGPT in reshaping medical education, specifically focusing on its evaluation in the context of surgical education.	To thank the authors for their comments and efforts to shed more light on the utilization of ChatGPT in surgical education.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Burney, I.	2024	Artificial Intelligence and the Gartner Cycle: Time to Introduce in Undergraduate Medical Education.	Journal of the College of Physicians and Surgeons Pakistan	Oman	APG	To highlight the importance of introducing AI into undergraduate medical education and to discuss the current state and future direction of AI in clinical practice, including medical education.	The article emphasizes the growing importance of AI in clinical medicine and the need for its integration into undergraduate medical education. As AI technologies, including ML and LLMs, continue to advance, they are transforming clinical reasoning, diagnostics, and medical training. They argue that medical curricula must evolve to equip future doctors with AI competencies, ensuring they can use these tools effectively while navigating the ethical, legal, and professional challenges of AI in healthcare.
Busch, F.	2023	Biomedical Ethical Aspects Towards the Implementation of Artificial Intelligence in Medical Education	Medical Science Educator	Germany, United States	WEOG	This commentary explores the biomedical ethical responsibilities of medical institutions in incorporating AI applications into medical education by identifying potential concerns and limitations, with the goal of implementing applicable recommendations. The recommendations presented are intended to assist in developing institutional guidelines for the ethical use of AI for medical educators and students.	While integrating AI in medical education has the potential to provide a more immersive, interactive, and personalized learning experience, it is essential to establish a biomedical ethical framework beforehand, which should be regularly reevaluated and optimized based on user feedback and the latest developments in the field.
Chaeyeong, I.	2022	Medical student's artificial intelligence education and research experiences	Korean Journal of Medical Education	Korea	APG	A sixth-year medical student sharing his research experience and discuss how medical students apprehend and utilize AI in the present era of AI.	The paper highlights the author's journey through AI education and research in medical school, emphasizing the need for incorporating AI into the medical curriculum. It also suggests the addition of computer programming courses and clinical research training to equip future medical students better to become doctors of the future.
Chang, B.	2023	Transformation of Undergraduate Medical Education in 2023	JAMA (Journal of the American Medical Association)	United States	WEOG	To explore the impact of generative AI tools on undergraduate medical education and discuss how these advancements are changing the teaching and learning priorities.	Medical students need to be trained to become physicians who are more intellectually incisive in complex clinical reasoning, more effectively compassionate in their communication, and more attuned to the physical observation and manipulation of the body—in other words, more human.
Chen, A.	2024	Impact of Democratizing Artificial Intelligence: Using ChatGPT in Medical Education and Training	Academic Medicine	China	APG	The paper aims to explore the potential of ChatGPT as a supplementary tool in medical education, enhancing clinical case learning, and democratizing AI research for students and clinicians.	Given generative AI's potential as both a learning tool and a research instrument for medical students and professionals, this democratization of AI could profoundly influence medical education and practice.
Cooper, A.	2023	AI and Medical Education - A 21st-Century Pandora's Box	The New England Journal of Medicine	United States	WEOG	To explore the disruptive potential of AI, particularly generative models like ChatGPT, in reshaping medical education and training, and to urge medical educators to take a proactive approach in integrating AI into medical curricula.	The article argues that medical schools should take an active role in shaping how AI is used in training and patient care.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Cornwall, J.	2023	Ethical concerns surrounding artificial intelligence in anatomy education: Should AI human body simulations replace donors in the dissection room?	Anatomical Sciences Education	United States, New Zealand	WEOG	To explore the hypothetical situation of human body donors being replaced by AI human body simulations and reflect on two separate ethical concerns: first, whether it is permissible to replace donors with AI human body simulations in the dissection room when the consequences of doing so are unclear, and second, the overarching ethical significance of AI use in anatomy education.	Donors and dissection room time must be protected and maintained. They should not be replaced by computational simulations or replications. The future of AI in anatomy education should, at the least, be shaped by close scrutiny, careful monitoring, and transparent assessment to help ensure that any adverse outcomes are identified and mitigated. Failure to do so would constitute careless disregard for valuable and experiential human connections, which are at the center of ethical health care.
Cutrer, W.	2021	Exploiting the power of information in medical education	Medical Teacher	United States	WEOG	The explosion of medical knowledge demands reconsideration of medical education, including what we teach and assess, how we educate, and whom we educate.	Effective care requires physicians to maintain a firm mastery of fundamental concepts coupled with the ability to access and utilize up-to-date information as needed. The modern medical learner and practitioner need to have a deep understanding of cognition and the interface of providers and information technology.
Daungsupawong, H., Wiwanitkit, V.	2024	ChatGPT and the Future of Medical Education: Correspondence	Journal of the College of Physicians and Surgeons Pakistan	Laos, India	APG	The publication is a perspective about a paper that investigated the possible impact of artificial intelligence (AI) language models such as ChatGPT on medical education.	ChatGPT and other AI language models have the potential to transform medical education by enabling interactive learning experiences and increasing access to high-quality instructional resources. However, difficulties with accuracy, emotional intelligence, and ethical problems must be properly addressed. AI language models can contribute to the future of medical education by utilizing possibilities and tackling problems, boosting the knowledge and abilities of healthcare workers while keeping the crucial human elements of patient care.
Dave, M., Patel, N.	2023	Artificial intelligence in healthcare and education	British Dental Journal	United Kingdom	WEOG	To analyze the impact of AI in healthcare and education sectors, discussing its advantages, challenges, and its use in medical and dental education.	The use of AI in medical care has the potential to enhance the quality of care, improve the learning process of doctors, and promote continuous improvement in the field.
Divito, C.	2023	The tools of the future are the challenges of today: The use of ChatGPT in problem-based learning medical education	Medical Teacher	United States	WEOG	Investigating the role of ChatGPT in medical education, specifically in problem-based learning.	The study highlights the potential benefits and challenges of using ChatGPT in problem-based medical education, emphasizing its role as a learning tool and in personalized education.
Eysenbach, G.	2023	The Role of ChatGPT, Generative Language Models, and Artificial Intelligence in Medical Education: A Conversation With ChatGPT and a Call for Papers.	JMIR Medical Education	Canada	WEOG	To provide a snapshot of the current capabilities of ChatGPT and illustrates the vast potential for medical education, research, and practice but also hints at current problems and limitations.	While many of the capabilities of ChatGPT exhibited in this interview were impressive, perhaps the most disturbing aspect of this conversation (at least from an editorial perspective) is that ChatGPT invented references. However, it highlights the limitations, such as occasional inaccuracies and the potential for misuse in academic settings.
Feng, S., Shen, Y	2023	ChatGPT and the future of medical education	Academic Medicine	China	APG	To explore the potential benefits and challenges of using ChatGPT in medical education.	Medical educators can harness the power of ChatGPT to create innovative and effective learning experiences for future generations of medical students.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Frommeyer, T.	2022	The Desire of Medical Students to Integrate Artificial Intelligence Into Medical Education: An Opinion Article.	Frontiers in Digital Health	United States	WEOG	To argue for the inclusion of artificial intelligence education within medical school curricula to prepare future physicians for the evolving role of AI in healthcare.	Given the lack of education in digital medicine, medical schools need to start incorporating education about AI and its utility within healthcare into an upgraded curriculum.
Garg, T.	2020	Artificial Intelligence in Medical Education	The American Journal of Medicine	India	APG	A students point of view of the article by Noorbakhsh-Sabet et al., which focuses on the applications of artificial intelligence (AI) in medicine.	This student feels that AI can be utilized positively to help students and educators facilitate learning in medical education.
Gowda, V.	2022	Artificial Intelligence in Radiology Education: A Longitudinal Approach	Academic Radiology	United States	WEOG	Teaching AI to medical students would foster a richer physician experience with AI products, promote early ethical use, cultivate emerging scholarship, and contribute to a more robust integration between tool and practice.	It is incumbent upon training programs at the levels of both graduate and undergraduate medical education to equip learners with the wherewithal to navigate AI deployment in the future. Implementation of a standard AI curriculum for radiology residency programs nationwide will require action by professional societies and regulatory bodies, which may prove a time-intensive process.
Grunhut, J.	2022	Needs, Challenges, and Applications of Artificial Intelligence in Medical Education Curriculum.	JMIR Medical Education	United States	WEOG	The paper explores the role of AI in medical education, outline the challenges faced by medical schools in integrating AI into the curriculum, and propose steps to ensure medical students are adequately prepared for the AI revolution in healthcare.	The current and future advancements of AI in medicine oblige undergraduate medical educators to act and implement AI in the curriculum. Longitudinal research plans are necessary to effectively study how to best achieve these curricular changes. Medical education governing bodies, medical education deans, and medical education researchers should begin to implement AI in the undergraduate medical education curriculum.
Hswen, Y., Abbasi, J.	2023	AI will—and should—change medical school, says Harvard's dean for medical education	JAMA	United States	WEOG	This is an interview with Harvard's dean to discuss how AI, including tools like ChatGPT, is transforming medical education and how medical schools must adapt their curricula to integrate these AI tools effectively.	AI has the potential to significantly impact medical education by automating routine tasks, improving clinical decision-making, and helping to create more personalized learning experiences. AI can handle technical tasks, but empathy, critical thinking, and patient interaction will be core areas where medical students should excel. The challenge is to ensure that AI supports, rather than replaces, essential humanistic skills in medicine.
Hswen, Y., Nguyen, T.	2024	Generative Artificial Intelligence Should Not Compromise Traditional Medical Education	Journal of the Association of American Medical Colleges	United States	WEOG	To argue that Medical educators should strive to adopt AI advancements while retaining emphasis on traditional training to critically evaluate AI-generated information without compromising the focus on empathy and effective patient-doctor communication.	Medical educators should strive to adopt AI advancements while retaining emphasis on traditional training to critically evaluate AI generated information without compromising the focus on empathy and effective patient doctor communication. Generative AI holds the potential to augment clinical encounters and ultimately improve patient outcomes. Realizing this goal will require a new generation of well trained and competent medical graduates who can drive future improvements and the accuracy of AI algorithms over time.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Imran, N., Jawaid, M.	2020	Artificial intelligence in medical education are we ready for it?	Pakistan Journal of Medical Sciences	Pakistan	APG	To discuss the potential of artificial intelligence (AI) in medical education, examining how AI driven tools are likely to define the way medicine will be practiced in 21st century.	The role of AI in medical education is going to increase, and new roles for medical students and doctors will be opened in future based on competency in using AI. Medical education needs to move beyond traditional biomedical and clinical sciences focus and engage with technology enhanced learning and AI. It is time for medical institutions to consider curricular reforms, including content related to AI and Machine learning as part of their curriculum, alongside emphasis on empathy and integrity.
Jeyaraman, M.	2023	ChatGPT in action: Harnessing artificial intelligence potential and addressing ethical challenges in medicine, education, and scientific research.	World Journal of Methodology	India	APG	Chat Generative Pre-trained Transformer's potential applications span medicine, education, and scientific research, focusing on addressing its limitations and ethical concerns.	While ChatGPT holds great promise in transforming various industries and enhancing research and learning experiences, it is essential to adopt a cautious and responsible approach to its integration. By fostering interdisciplinary collaboration, ongoing research, and proactive policy development, the research community can ensure that conversational AI is utilized ethically, effectively, and responsibly, paving the way for innovative applications that positively impact society.
Karabacak, M.	2023	The Advent of Generative Language Models in Medical Education.	JMIR Medical Education	United States, United Kingdom	WEOG	This viewpoint aims to explore these dimensions, discussing the benefits, challenges, ethical considerations, and academic integrity issues associated with incorporating AI into medical education.	Incorporating GLMs and AI into medical education presents both opportunities and difficulties. GLMs can generate accurate, individualized content for students, allowing for more efficient learning experiences. To ensure the responsible application of these advanced technologies, it is necessary to address potential biases and ethical concerns. Educators, researchers, and practitioners must collaborate to create guidelines, policies, and best practices that promote the ethical and effective integration of GLMs and AI in medical education.
Karunathilake, I.M.	2023	Artificial Intelligence (AI) in Medical Education	South-East Asian Journal of Medical Education	Sri Lanka	APG	General overview and perspective on the positives and negatives of using AI in medical education.	The integration of AI into medical education offers substantial potential for advancing healthcare training. AI technologies can enhance personalized learning experiences, boost practical skills through immersive simulations, and streamline assessment processes. However, careful attention to ethical concerns, including bias, data privacy, and preserving humanistic qualities in medicine, is essential when embarking on this transformative journey.
Khan, M.	2023	The promise of AI in medicine: A call for greater education for Pakistani medical professionals	Journal of the Pakistan Medical Association	Pakistan	APG	To argue for more excellent AI education for Pakistan medical professionals and to introduce the basic levels of AI in the medical curriculum with a course spanning only around 1 week, including basics of coding and computational thinking will allow the first step towards a much more efficient and progressive healthcare system.	Pakistan's medical education system lags in AI integration, and there's a need for introducing basic AI education to bridge this gap and modernize healthcare.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Khurana, M.	2020	Keeping Pace: The Need for Digital Health Education in Medical Schools	Academic Medicine	Denmark	WEOG	To explain three main ideas the author believes should guide digital health literacy curriculum implementation.	The letter stresses the need to integrate more digital health into curricula. The onus is on both medical students to demand additions to the curricula and on curriculum directors to recognize this demand and act proactively.
Kitto, S.	2024	'Slowing down when you should': Optimising the translation of artificial intelligence into medical school curricula	Singapore Medical Journal	Singapore	APG	To call for a considered approach to the design and implementation of AI in medical education and to propose the use of Implementation Science (IS) frameworks.	In this article, it is proposed to adopt an approach to 'slowing down when we should' in AI teaching design and implementation. 'Slowing down' and adopting IS thinking and practice open up new ways of thinking that can optimise the process and outcomes of bringing AI into medical school curricula.
Kocabas, S.	2021	Deconstructing Canada's efforts to integrate artificial intelligence in medicine and medical education	McGill Journal of Medicine	Canada	WEOG	To analyze and review efforts made by Canadian institutions to integrate AI into medicine and medical education and provide policy recommendations.	Although AI policies are still in their infancy, there is a strong foundation for future iterations among the reports of the Canadian health task forces and medical associations. They provide a baseline of recommendations that could serve to develop further policies on data management, digital literacy, and ethical issues brought by AI in medicine.
Koga, S	2023	The Potential of ChatGPT in Medical Education: Focusing on USMLE Preparation	Annals of Biomedical Engineering Society	United States	WEOG	Comment on ChatGPT's potential to help and as well risks of use in undergraduate medical education.	The key message of the letter is that ChatGPT and other AI tools have the potential to enhance medical education by offering personalized learning experiences and generating self-assessment tools such as MCQs, helping students prepare for critical exams like the USMLE. Although it is a powerful educational tool, it cannot replace expert medical educators, who are crucial in guiding learners, curating relevant content, and promoting critical thinking skills that AI models may only partially replicate.
Lee, H.	2023	The rise of ChatGPT: Exploring its potential in medical education	Anatomical Sciences Education	Korea	APG	Perspective on ChatGPT and advice for medical educators to keep pace with technology's rapidly changing landscape and consider the implications for curriculum design, assessment strategies, and teaching methods. Continued research and evaluation are necessary to ensure the optimal integration of AI-based learning tools into medical education.	The application of ChatGPT in medical education holds significant potential for enhancing students' learning experiences and creating a more interactive and engaging educational environment. With its ability to provide detailed information, the potential for interactive simulations, and its utility as an educational resource, ChatGPT holds promise for many educational applications. Using this technology, in conjunction with traditional teaching methods, could benefit both students and teachers alike.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Leng, L.	2024	Challenge, integration, and change: ChatGPT and future anatomical education	Medical Education Online	China	APG	To discuss the application of ChatGPT in anatomy teaching and its various application levels based on our own teaching experiences, and discuss the advantages and disadvantages of ChatGPT in anatomy teaching.	For teachers, the human-computer mixed teaching environment is helpful for the design of teaching content, the optimization of teaching process, and the deepening of teaching evaluation. However, with the continuous evolution of ChatGPT, the key challenge for teachers is the problem of 'what to teach'. As it is difficult for learners and teachers to ignore the self-limitation of technological development, researchers need to study the new opportunities brought by new education and new laws, especially in the new 'teacher-ChatGPT-student' ternary education scene and environment, to promote the rapid development of intelligent education and intelligent pedagogy, which also leads to an important change in the paradigm of education research.
Londono, C.	2023	Harnessing Artificial Intelligence's potential in undergraduate medical education: an analysis of application and implication	Canadian Medical Education Journal	Canada	WEOG	To outline the current strategies used by undergraduate medical education programs for the implementation of AI as an adjuvant learning tool as well as the potential challenges that may follow.	AI is evolving at an exponential rate. Given its potential impact on medicine and medical education, there is a need for our systems to adapt to maximize the benefits for all parties involved and minimize many of its potential dangers. Undergraduate medical education trainees, in particular, could significantly benefit from AI technology. There is a need to incorporate education on AI into the medical education curriculum and to develop techniques for its use as an educational tool.
Mastour, H.	2023	What if We Replace Pass/Fail Grading with Decision Making by Machine? Toward Competency-based Medical Education	Shiraz E-Medical Journal	Iran, The Netherlands	APG, WEOG	To suggest applying artificial intelligence processes by machines in medical education will help prepare tomorrow's physicians, and advances in the role of AI-driven methods indicate that they could inevitably transform previously accepted assessment models.	Applying the intelligence processes by machines in medical education will help prepare tomorrow's physicians, and advances in the role of AI-driven methods indicate that they could inevitably transform previously accepted assessment models.
McCoy, L.	2020	What do medical students actually need to know about artificial intelligence?	npj Digital Medicine	Canada, United States	WEOG	To advocate for a dual-focused approach: combining robust, learner-centered AI additions to baseline curricula and extracurricular programs to cultivate leadership in this space.	Given the importance and potential impact of this technology, we must act both to ensure a base of artificial intelligence literacy among physicians at-large and to nurture the skills and interests of the future leaders who will drive innovation in this space.
Meng, L., Fu, J.	2020	Application of artificial intelligence technology in clinical pharmacy	Journal of Physics: Conference Series	China	APG	In this paper, the current technological level and characteristics of AI development are expounded, and the application of AI in clinical pharmacy teaching for medical students is explored preliminarily. The development prospect of AI technology in medical education is discussed.	As deep learning and neural network are further improved and matured, coupled with the construction and improvement of interconnected and AI-based medical databases, the role of AI technology in medical diagnosis and teaching will become increasingly prominent. It will definitely lead the new era of reform in the medical education information technology characterized by "Cross-border, integration, and innovation", providing tremendous opportunities and development room for medical education.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Nagirimadugu, N.	2021	Recommendations for Integrating the Fundamentals of Machine Learning into Medical Curricula	Academic Medicine	United States	WEOG	Perspective and response on the article by James and colleagues that the principles of ML be integrated into medical curricula.	The authors emphasize the importance of teaching machine learning in medical education not as an infallible tool but as one susceptible to bias and error. They recommend collaboration between physicians and ML experts to improve the efficiency of AI tools, combat biases, and ensure medical students learn to combine AI with clinical judgment.
Nagy, M.	2022	Why Machine Learning Should Be Taught in Medical Schools.	Medical Science Educator	United States	WEOG	While select medical schools have made effort to integrate ML didactics and practice into their curriculum, we argue that foundational ML principles should be taught broadly to medical students across the country.	The Association of American Medical Colleges has acknowledged the changing landscape of medicine through their initiative, "Accelerating Change in Medical Education," with focus on the health system science and health care delivery. For future clinicians to indeed be prepared to most effectively use the tools at their disposal to deliver high-quality health care, it would be prudent for medical schools to teach the fundamentals of ML and how it may influence their future role as physicians.
Naqvi, W.	2024	AI in Medical Education Curriculum: The Future of Healthcare Learning	European Journal of Therapeutics	India, United Arab Emirates	APG	To address the evolving, quantitative nature of healthcare in the twenty-first century, it is imperative to integrate artificial intelligence (AI) with healthcare education. To bridge this educational gap, it is imperative to impart practical skills for the utilisation and interpretation of AI in healthcare settings, integrate technology into clinical operations, develop AI technologies, and enhance human competencies.	Ultimately, incorporating AI training into the medical education curriculum is a transformative step that will shape the future of healthcare practitioners. This sequence provides enhanced diagnostic precision, personalized learning prospects, and heightened ethical awareness. These potential benefits surpass the obstacles, initiating a new era in medical education where human beings and technology collaborate to deliver optimal patient care.
Ngo, B.	2022	The Cases for and against Artificial Intelligence in the Medical School Curriculum.	Radiology: Artificial Intelligence	United States	WEOG	To present a balanced perspective on whether AI should be included officially in the medical school curriculum. After presenting the balanced point-counterpoint arguments, the authors provide a compromise.	Because of radiology's leading role in implementing AI systems, radiologists can offer important contributions to medical student education in AI. Despite the growing use of artificial intelligence (AI) in health care, there is a dearth of formal AI instruction in undergraduate medical education, the medical school years before students receive their professional medical degree
Nguyen, T.	2024	ChatGPT in Medical Education: A Precursor for Automation Bias?	JMIR Medical Education	United States	WEOG	In this editorial it is argued that a lack of AI education in the medical school curriculum cause automation bias.	To minimize the risk of students developing automation bias, we need to ensure that students receive proper AI education, in which the courses and lessons will teach them about the ethical issues surrounding AI technologies, as well as the problem of automation bias, and encourage the moderate use of AI. ChatGPT should only be used for certain tasks, and it should not be the default resource that students turn to, as this could cause a domino effect, where students develop the automation bias mentality as a result of developing the AI solutionism mentality. Therefore, training medical students to avoid falling into these traps of AI solutionism and automation bias starts in the classroom.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Ötles, E.	2022	Teaching artificial intelligence as a fundamental toolset of medicine.	Cell Reports Medicine	United States	WEOG	To propose that medical educators treat AI as a critical component of medical practice that is introduced early and integrated with the other core components of medical school curricula. Equipping graduating medical students with this knowledge will ensure they have the skills to solve challenges arising at the confluence of AI and medicine.	AI is a fundamental toolset of medical practice, understanding that its core concepts will touch all parts of medicine. Medical curricula should longitudinally integrate AI into the foundational, clinical, and system sciences students learn throughout their UME journey. This approach will prepare medical trainees to thrive in their future practice environments and will enable the medical profession to guide the development and incorporation of AI to the benefit of patients and populations.
Parsa, A.	2021	ChatGPT in Medicine; a Disruptive Innovation or Just One Step Forward?	The Archives of Bone and Joint Surgery	Iran, United States	APG, WEOG	Perspective on the tremendous potential to incorporate modern artificial intelligence including ChatGPT for medical education.	In the near future these tools will be widely adopted in the medical field with no doubt. It is critical to modify regulations of scientific writing and provide new control mechanisms to identify any unethical utilization of ChatGPT and upcoming tools in medicine.
Patra, NB., Ravi, K.	2022	Will artificial intelligence assume a role in anatomy education?	National Journal of Clinical Anatomy	India	APG	The author argues for an integration of AI into Anatomy studies.	There needs to be a beneficial and practical balance between human resources and AI usage. At the same time, it has to be considered that excess usage of automation should not pave the way for loss of critical thinking and deterioration of interpersonal relationships and communicational skills.
Piryan, R.	2024	Medical schools of South Asian countries need to incorporate artificial intelligence-powered chatbots in existing undergraduate medical curricula	Journal of Integrative Medicine and Public Health	Pakistan, France	APG, WEOG	Perspective on Chatbots use undergraduate medical education.	It is obvious that Chatbots have to play a vital role in transforming medical education and research and improving quality of healthcare and its delivery. These will become an integral part of medical curricula. Furthermore, AI-powered chatbots have to stay here and will have a long-lasting impact on medical education and healthcare.
Pucchio, A.	2021	Medical students need artificial intelligence and machine learning training	Careers & Recruitment	Canada	WEOG	To express the perspective that as the implementation of artificial intelligence and machine learning technologies progresses toward the clinic, the traditional roles of physicians will change.	The urgency for healthcare education to incorporate teaching of AI, ML, big data and digital technologies is growing. However, there is limited exposure to this topic in medical education. Concrete skills in how to use and interpret AI and ML in a healthcare setting, integrate technology in clinical workflow, develop AI and ML technologies, and have human competencies will be integral skills for future physicians and should be formally introduced in both undergraduate and resident medical curricula and in continuing education for physicians.
Pupic, N.	2023	Artificial Intelligence: The Medium and The Message	Canadian Association of Radiologists' Journal	Canada	WEOG	This is a perspective that argues we need to build a foundation of AI knowledge and to invest in high-quality, clinically-focused AI education for both undergraduate and graduate medical education programs.	To introduction of AI topics, ideally in the first year of medical school, to dispel misconceptions and provide students with enough experiential learning time to become familiar with using AI. There are currently no standardized guidelines, objectives or competencies outlined by the Medical Council of Canada or the Royal College of Physicians and Surgeons of Canada for teaching AI to undergraduate or postgraduate medical learners, despite the movement to more competency-based training.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Ravi, A.	2023	Large Language Models and Medical Education: Preparing for a Rapid Transformation in How Trainees Will Learn to Be Doctors	ATS Scholar	United States	WEOG	A perspective on LLMs. As we enter this era of healthcare delivery, LLMs will present both opportunities and challenges in medical education.	LLMs such as ChatGPT, Med-PaLM, and others will soon be integrated into various aspects of clinical practice and will transform patient and provider experience and medical education for our trainees. Because academic medical centers are at the forefront of clinical innovation and medical education, they must engage with stakeholders to thoughtfully design and implement these tools.
Rusakova, V.	2022	Methodological Aspects of Propaedeutics of Studying Artificial Intelligence by Medical Students	IEEE Xplore	Russia	EEG	The necessity of mastering the basics of artificial intelligence for specialists in various fields today.	Disclosure of the topic of artificial intelligence within the framework of the discipline "Medical Informatics" will increase the interest of first-year students in the application of its capabilities in their future professional activities and motivate them to further study one of the most promising areas of development of modern society.
Safranek, C.	2023	The Role of Large Language Models in Medical Education: Applications and Implications.	JMIR Medical Education	United States, Ireland	WEOG	Written from the perspective of medical students, this editorial offers insights gleaned through immersive interactions with ChatGPT, contextualized by ongoing research into the imminent role of LLMs in health care.	Three distinct positive use cases for ChatGPT were identified: facilitating differential diagnosis brainstorming, providing interactive practice cases, and aiding in multiple-choice question review. These use cases can effectively help students learn foundational medical knowledge during the preclinical curriculum while reinforcing the learning of core Entrustable Professional Activities.
Seetharaman, R.	2023	Revolutionizing Medical Education: Can ChatGPT Boost Subjective Learning and Expression?	Journal of Medical Systems	India	APG	This is a perspective on how medical students can utilize ChatGPT to help them develop essential skills such as communication, problem-solving, and critical thinking, which can be overlooked due to the overload in the medical education curriculum.	Subjective learning and expression skills are crucial for medical students to develop in addition to their objective knowledge. However, the current medical education system may not provide enough opportunities for students to practice these skills. This is where ChatGPT, an AI tool trained on natural language processing, can be useful.
Segers, S.	2023	Why we should (not) worry about generative AI in medical ethics teaching	International Journal of Ethics Education	Belgium	WEOG	To discuss the ethical ramifications for medical ethics training of the availability of large language models (LLMs) for medical students.	The availability of LLMs for use by medical students should be dealt with in ethics training.
Shikino, K.	2024	Educational strategies related to information science and technology for medical students: General medicine physicians' perspective.	Journal of General and Family Medicine	Japan	APG	To summarize recommendations for good practice regarding learning strategies from the perspective of general medicine of incorporating information science and technology (IT) and artificial intelligence (AI) into the core curriculum for medical education.	Three proposed educational strategies related to information science and technology for medical students include: 1: Early exposure to medicine using IT, 2: Implementation of the case study approach, and 3: Developing the Arts.
Soo, H.	2023	Radiology Education: Opportunities to Use Online Tools and Artificial Intelligence to Enhance the Experience	American Journal of Roentgenology	Australia, Germany	WEOG	Commenting on "Opportunities to Use Online Tools and Artificial Intelligence to Enhance the Experience", in response to a publication by Chien and Gunderman.	The author emphasizes AI's benefits in improving in-person and online medical education quality, suggesting that AI-optimized tools could enhance accessibility, reduce costs, and create virtual learning environments.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Taranikanti, V., Davidson, C.	2023	Metacognition through an Iterative Anatomy AI Chatbot: An Innovative Playing Field for Educating the Future Generation of Medical Students	Anatomia	United States	WEOG	To advocate for the incorporation of AI technologies fused with a metacognitive framework as a medium to foster increased critical thinking and skill development that enhances comprehension.	Gen Z's consistent exposure to digital technology has changed their learning abilities and preferences. By understanding the unique characteristics and preferences of Gen Z learners (digital natives, flexibility, instant feedback, shorter attention span, multimedia presentation, etc.), medical educators can design anatomy learning experiences that cater to their needs through enhanced engagement, technology-focused instruction, and iterative feedback.
Tippur, A.	2023	Bridging the Gap: Integrating Artificial Intelligence into Medical Education	DHR Proceedings	United States	WEOG	This paper delves deeper into the role AI plays in the current medical education system.	Call for an integrated approach that harmonizes AI-driven advancements with traditional curricula, ensuring that students gain both technical proficiency and practical expertise. Challenges, including the presence of immature prototypes, varying evaluation methods, and ethical concerns, underscore the complexity of AI integration.
Turner, L.	2024	Demystifying AI: Current State and Future Role in Medical Education Assessment	Academic Medicine	United States	WEOG	To explore how artificial intelligence (AI), including its subsets machine learning (ML) and deep learning (DL), can augment this model to tackle the inherent limitations of traditional assessment methods.	AI has the capacity to revolutionize medical education assessment by transforming longstanding challenges into opportunities for growth and innovation. While the task is complex and high stakes, the benefits are considerable, marking a strategic move toward a more personalized, responsive, and equitable educational landscape.
Usmani, A.	2022	Usage of artificial intelligence and virtual reality in medical studies	Pakistan Journal of Medicine Sciences	Pakistan	APG	To discuss the use of AI and VR being assimilated in medical studies so the field can progress at the same pace as the rapidly developing world.	There is a dire need to focus on the novel subject of artificial intelligence other than the routine subjects of clinical and biomedical sciences. This will enable the students of this era to face the challenges and advancements of the transformed health care environment. The medical universities should prepare the students from year one of their studies
Waisberg, E.	2023	ChatGPT and medical education: a new frontier for emerging physicians	Canadian Medical Education Journal	United Kingdom, United States, Ireland	WEOG	To ask ChatGPT to advise on how to build an AI to classify optical coherence tomography (OCT) images.	All things considered, ChatGPT can potentially be a useful tool in medical education to improve students' understanding of AI, but employing it beyond educational purposed should be approached with caution.
Weidenr, L., Fischer, M.	2024	Proposing a Principle-Based Approach for Teaching AI Ethics in Medical Education	JMIR Medical Education	Austria	WEOG	To introduce a comprehensive set of ethical principles for teaching AI ethics in medical education.	There is an imperative need for medical AI ethics education and the integration of a comprehensive set of ethical principles into medical education to prepare physicians for the ethical challenges posed by AI in medicine.
Wu, Y.	2024	Embracing ChatGPT for Medical Education: Exploring Its Impact on Doctors and Medical Students.	JMIR Medical Education	China	APG	Overview of using ChatGPT in medical education.	ChatGPT enhances medical education by improving clinical reasoning, personalizing learning, promoting precision medical education, and supporting medical research. However, a balanced and responsible integration requires a focus on ethics and human-centered approaches.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Xu, Y.	2024	Medical education and physician training in the era of artificial intelligence	Singapore Medical Journal	China, Singapore, United States	APG, WEOG	This perspective delves into the prospective influence of AI on medical education, residency training and the continuing education of attending physicians or consultants.	AI holds promise in enhancing current medical education and training frameworks, potentially leading to a revolutionary shift from traditional pedagogy to AI-assisted or AI-integrated pedagogy models.
Yan, M.	2023	ChatGPT and medicine: how AI language models are shaping the future and health related careers	nature biotechnology	Canada, Brazil	LAC, WEOG	A summary of potential applications and our recommendations on the current readiness level of each application supported by AI language models is reviewed.	ChatGPT holds transformative potential for medicine across clinical, research and educational domains. As AI technology evolves, we must responsibly address its limitations to maximize its potential. The question is not whether AI will shape medicine, but how and when. Do not be left behind.
Zhong, J.	2023	Commentary: The desire of medical students to integrate artificial intelligence into medical education: An opinion article.	Frontiers in Digital Health	Singapore, United States	APG, WEOG	To respond to this call for AI-oriented medical education by providing some internationally applicable ideas that would turn this proposal of from Meyer's et al. (5) into reality.	This article is meant to be a short commentary on some important considerations for the inclusion of AI content in medical schools' curriculum.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Afzal, S.	2020	AI Medical School Tutor: Modelling and Implementation	AIME 2020, Conference Paper	India, Singapore, United Kingdom	APG, WEOG	Describing an example of the design, modelling, implementation and evaluation of a conversational medical school tutor (MST) in the LKC School of Medicine of Nanyang Technological University (Singapore).	The Medical School Tutor (MST) as a holistic learning tool driven by AI techniques to prepare medical students in their transition from academic study to clinical application. The interaction design modeled on CBL pedagogy engaged students with realistic clinical cases. The content and context understanding enabled using NLP techniques allows seamless introduction of curriculum resources and generation of appropriate feedback. The survey results show high scores on usability, learning gains and engagement; and validate the purpose and efficacy of conversational tutoring in complex medical domain. The combination of clinical cases with medication foundation curriculum through conversational interface seems to be a novel and an enriching experience for students. In future, MST aims to provide a truly personalized tutoring experience featuring responses adapted to student's learner model.
Dolianiti, F.	2020	Chatbots in Healthcare Curricula: The Case of a Conversational Virtual Patient	Brain Function Assessment in Learning. BFAL 2020	Greece, United Kingdom	WEOG	Introduces the case of a Conversational Virtual Patient (CVP) prototype, which enables natural language-based interaction between the medical student and the Virtual Patient (VP). Details the implementation of the CVP prototype.	In view of employing participatory design and co-creating open access chatbots for healthcare curricula, this CVP prototype will form the basis for the co-creation sessions, by familiarizing stakeholders with the chatbot technology and enabling the requirement elicitation process.
Finzel, B.	2021	Multimodal Explanations for User-centric Medical Decision Support Systems	CEUR Workshop Proceedings	Germany	WEOG	To present a system that uses multimodal explanations (verbal and visual) for decisions made by machine learning models to support medical diagnoses, and explore its use in medical education.	Motivated by empirical evidence that indicates that multimodal explanations are beneficial for understanding, we presented an approach and its implementation that combines verbal, dialogue-based explanations with visual, prototype-based explanations in order to give insights into the reasons of a decision of a model trained to classify the stage of cancerous colon tissue samples.
Foadi, N.	2021	Defining learning outcomes as a prerequisite of implementing a longitudinal and transdisciplinary curriculum with regard to digital competencies at Hannover Medical	Journal of Medical Education and Curricular Development	Germany	WEOG	To describe the implementation of learning outcomes related to digital competencies in the compulsory curriculum at Hannover Medical School.	MHH project group concluded that medical students should be taught digital competencies that enable an understanding of underlying functional principles of digital systems rather than their correct utilization. The presented project indicates that a close interdisciplinary collaboration of physicians and medical informaticians can be a promising approach to incorporate digital competencies in the undergraduate medical curriculum.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Hershberger, P.	2021	Advancing Motivational Interviewing Training with Artificial Intelligence: ReadMI	Advances in Medical Education and Practice	United States	WEOG	To improve the effectiveness and efficiency of MI training by developing and testing a tool called ReadMI. This tool uses NLP to provide immediate, objective feedback on MI techniques, allowing for more precise training compared to traditional methods, which are often time-consuming and subjective.	The study demonstrates that the ReadMI tool, which uses NLP, effectively enhances Motivational Interviewing training by providing immediate, quantifiable feedback on clinicians performance. The article addresses the challenges of traditional training methods, offering a more efficient way to develop essential communication skills in healthcare settings.
Hu, R.	2022	Insights from teaching artificial intelligence to medical students in Canada.	Communications Medicine	Canada	WEOG	To describe an AI training curriculum developed and delivered to Canadian medical undergraduates and provide recommendations for future AI medical education.	AI is highly technical, with foundational concepts involving mathematics and computer science. Training medical personnel to understand AI poses unique challenges relating to content selection, clinical relevance, and method used to teach the material. The workshop series successfully introduced AI concepts to medical students and addressed challenges like varying levels of prior knowledge and ensuring long-term retention.
Kong, J.	2021	Virtual Integrated Patient: An AI supplementary tool for second-year medical students	The Asia Pacific Scholar	Singapore	APG	To describe the supplementary use of Virtual Integrated Patient (VIP) equipped with conversational technology that provides students online practice in various clinical skills such as history-taking, physical examination, and investigations for second-year medical students.	Out of the 106 participants, 87% strongly agreed or agreed that using VIP helped in remembering the content while 69% of them felt that VIP increased their confidence and competence in history-taking. VIP was well-received by students and showed promise as a tool to supplement history-taking tutorials, prior to students' encounter with SPs and real patients. Hence, this trend showed its potential as an alternative when clinical rotations were delayed or cancelled.
Krive, J.	2023	Grounded in reality: artificial intelligence in medical education.	JAMIA Open	United States	WEOG	To propose a solution that integrates competency-driven AI instruction in the medical school curriculum.	This educational innovation was tested in 2 cohorts of fourth-year medical students who demonstrated an improvement in knowledge with an average quiz score of 97% and skills with an average application assignment score of 89%. Weekly reflections revealed how students learned to transition from theory to practice of AI and how these concepts might apply to their upcoming residency training programs and future medical practice.
Kumar, A.	2022	AI/VRT: 5.0 Transformation in Medical Education with Next Generation AI-3D Animation and VR Integrated Computer Graphics Imagery	International information and engineering technology association	India, Saudi Arabia, Taiwan	APG	To assist universities in maintaining and improving their education and learning systems through the use of a VR-based e-learning platform.	The VR-based virtual classroom provides quality instructions and a well-thought-out learning strategy. It has been employed to support digital teaching. The work refines and repairs the flaws of the virtual classroom model with the help of VR and AI, which promote the learning by novice trainees. It is reasonable to conclude that the approach enhances the technical capabilities and learning abilities of students.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Lajoie, S.P.	2020	Student Modeling for Individuals and Groups: the BioWorld and HOWARD Platforms	International Journal of Artificial Intelligence in Education	Canada	WEOG	Describes a student model for BioWorld and the HOWARD project (designed to scale up the problem-based learning (PBL) tutoring expertise using technology to assist medical tutors in monitoring and responding to multiple small groups simultaneously).	A short synopsis was provided of mapping learning trajectories through student modeling and the use of overlay models to provide adaptive feedback to medical students. Process mining and text mining approaches were also discussed as ways to supplement the overlay model with different types of data sources. Finally, the link between cognitive, self-regulatory, and affect data was described as a way to build a more robust model of individual differences in solo learning situations.
Lang, J., Repp, H.	2020	Artificial intelligence in medical education and the meaning of interaction with natural intelligence - an interdisciplinary approach	GMS Journal for Medical Education	Germany	WEOG	The interdisciplinary research-related teaching and learning project (Natural) Science and Technology in Medicine –NWTmed brings together students at the Justus-Liebig-University Giessen (JLU) from the fields of medicine and other (natural) scientific disciplines in structured courses with the aim of thinking, learning, and working in an interdisciplinary and research-oriented manner already during their medical education.	The course resulted in a gain in knowledge and an increase in interest in the topic of AI was noted in the evaluations, and a willingness on the part of the students to pursue further independent study was also expressed. The topic of AI and its relevance to the field of medicine is not yet sufficiently represented in medical education. It will require integration in the curriculum and performance evaluations as well as interdisciplinary and research-related teaching formats.
Li, Y.	2021	Using a Machine Learning Architecture to Create an AI-Powered Chatbot for Anatomy Education.	Medical Science Educator	Hong Kong	APG	Artificial Intelligence chatbots allow interactive dialogue-driven teaching of medical sciences. Open-source tools allow educators to adapt existing technology to create intelligent learning systems. We utilised an open-source machine learning architecture and fine-tuned it with a customised database to train an AI dialogue system to teach medical students anatomy.	The system is a significant innovation in the field of autonomous AI agents for medical education. It is a system which can generate intelligent, educational conversations and has a vast range of responses to students engaging it with their own natural language. This innovation report can encourage educators to consider building intelligent AI systems based on open-source resources for medical education.
Meade, S.	2023	A Pilot Remote Curriculum to Enhance Resident and Medical Student Understanding of Machine Learning in Healthcare.	World Neurosurgery	United States	WEOG	To implement a novel, remotely delivered curriculum designed to develop literacy in ML for neurosurgical trainees or medical students.	This pilot elective demonstrated the interest, value, and feasibility of a remote elective to establish ML literacy; however, feedback to increase accessibility and flexibility of the course encouraged our team to implement changes. Future elective iterations will have a semiannual, 2-week format, splitting lectures more clearly between theory (the method and its value) and application (coding instructions) and will make lectures open-source prerequisites to allow tailoring of student learning to their planned application of these methods in their practice and research.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Mergen, M.	2023	Immersive training of clinical decision making with AI driven virtual patients - a new VR platform called medical tr.AI.ning.	GMS Journal for Medical Education	Germany	WEOG	To develop a modular digital training platform for medical education with virtual, interactable agents and to integrate this platform into the medical curriculum. The medical tr.AI.ning platform will provide veridical simulation of clinical scenarios with virtual patients, augmented with highly realistic medical pathologies within a customizable, realistic situational context.	Medical tr.AI.ning will be integrated into the current curricula of the involved universities at Homburg and Münster, and further universities will be invited. Extensive documentation and the development of guidelines and recommendations ensure the utilization and adaptability of our platform even outside of our project. The authoring tool will be able to empower further experts in medical didactics to develop new scenarios and thus guarantee sustainability of medical tr.AI.ning.
Ossa, L.	2022	A smarter perspective: Learning with and from AI-cases	Artificial Intelligence in Medicine	Switzerland, The Netherlands	WEOG	To propose a dynamic approach to case-based learning that utilizes the scenarios where AI is currently used in clinical practice as examples.	To encourage readers to consider a different perspective and see AI as an educational resource instead of merely an educational need. The emphasis on interlinking clinical and technical knowledge using CBL-AI could prove a valuable resource for teaching students essential clinical and technical skills. Doctors can explore topics relevant to clinical practice through AI; for example, turning concerns over the intelligibility of AI into reflection about the importance of explaining the clinical decision to patients and supporting shared-decision making. Moreover, CBL-AI can positively impact three fundamental skills: critical reflection, ethical thinking, and interdisciplinary collaboration. These skills take on particular value in AI because doctors will be better equipped to handle AI in its context and potentially contribute to developing accurate, ethical and valuable AI systems.
Pendergrast, T.	2023	Anki Tagger: A Generative AI Tool for Aligning Third-Party Resources to Preclinical Curriculum	JMIR Medical Education	United States	WEOG	Using large language models, it was developed a method to efficiently query existing flashcard libraries and select those most relevant to an individual's medical school curricula.	Using large language models, a method was developed to efficiently query flashcards in existing widely used libraries and select those most relevant to an individual's medical school curricula. The feasibility of implementing a ChatGPT flashcard generation into pre-clerkship medical school curricula has not been evaluated and is an area of future study, with algorithmic fine-tuning and prompt optimization likely to further increase the specificity of selections.
Pereira, D.	2023	Designing and building OSCEBot ® for virtual OSCE - Performance evaluation.	Medical Education Online	Portugal	WEOG	To present the development process of OSCEBot®, a chatbot to train medical students in the clinical interview approach.	Although some chatbots for training OSCES already exist, the present work focused on developing it together with key players. In addition, the system is integrated into a closed-used platform already consolidated in medical education, maintaining data security and confidentiality. To the best of the author's knowledge, no preliminary study of this kind has ever been conducted for a chatbot to acquire OSCE skills, making it an extremely important first step to put measures in place for a chatbot used in OSCE training.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Prachnakorn, N.	2024	Incorporating artificial intelligence into a workshop on scientific and scholarly report writing for preclinical medical students.	Medical Teacher	Thailand	APG	This article presents the use of an artificial intelligence (AI) tool (ChatGPT) to transform a didactic lecture to an interactive workshop.	This article illustrates an example of the use of AI to support teaching and learning activities to optimise the limited resources and reinforce active learning. AI tools can be used in creative and productive ways in medical education. The next step is to explore the functions and opportunities to use AI in different types of educational activities such as designing activities, creating materials, supporting activities, evaluating learning outcomes.
Qian, X.	2022	The effectiveness of artificial intelligence-based automated grading and training system in education of manual detection of diabetic retinopathy	Frontiers in Public Health	China	APG	To develop an artificial intelligence (AI)-based automated diabetic retinopathy (DR) grading and training system from a real-world diabetic dataset of China, and in particular, to investigate its effectiveness as a learning tool of DR manual grading for medical students.	The proposed AI-based automated DR grading achieved high diagnostic accuracy for the detection of referral DR and each level of DR according to the modified protocol of ICDDR grading system. It can aid the human graders to improve their diagnostic accuracy and sensitivity especially to those lacking didactic training on DR management. Furthermore, it can be used as assistant training system for medical students to experience the real scenarios which makes the traditional lectures properly illustrated.
Rujano-Balza, M.	2021	Histology Classifier App: Remote Laboratory Sessions Using Artificial Neural Networks.	Medical Science Educator	Venezuela	LAC	The Histology Classifier app was developed as a strategy to recreate laboratory sessions using digital platforms. This mobile app uses convolutional neural networks (CNN) to help students verify their identification of histological basic tissues.	This learning method offers students a practical approach to using AI-assisted tools in research and medical diagnostics, thus creating valuable data through user insights and inputs. Approaching histopathological image-related diagnostics by using smartphones has demonstrated promising results; therefore, implementations such as this one could be considered a future clinical choice for fast and reliable analysis of large amounts of samples.
Szeliga, M.	2023	Virtual Clinic – AI Used in the Teaching of Medical Interviews, Diagnosis, and Treatment Planning	Social Computing and Social Media	Poland	EEG	The use of AI chatbots to conduct a doctor-patient dialogue as part of a Virtual Clinic.	The Virtual Clinic is an artificial intelligence-based software that provides a safe environment for medical students and young doctors to simulate medical interviews and treatment. What sets the Virtual Clinic apart is its high degree of case realism.
Tao, X.	2021	Mobile-based learning of drug prescription for medical education using artificial intelligence techniques	International Journal Mobile Learning Organisation	Australia, Singapore	APG, WEOG	This paper discusses the relevance of mobile learning in medical education and introduces an innovative mobile application design to practice drug prescription in medical education.	Mobile learning for medical education is one such area with great demand for advanced AI techniques. This paper introduces an innovative framework adopting AI techniques, with the aim of providing a mobile application design to facilitate medical education. Medical students can use such applications on their smartphone anytime and anywhere to practice drug prescriptions for different patient profiles.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Tsopra, R.	2023	Putting undergraduate medical students in AI-CDSS designers' shoes: An innovative teaching method to develop digital health critical thinking.	International Journal of Medical Informatics	France	WEOG	The University Paris Cité medical school designed an innovative program to develop the digital health critical thinking of undergraduate medical students that consisted of putting medical students in Artificial Intelligence and Clinical Decision Support Systems (AI-CDSS) designers' shoes.	Putting students in AI-CDSS designers' shoes seemed to be a fruitful and innovative strategy to develop digital health skills and critical thinking toward AI technologies. We expect that such programs could help future doctors work in rapidly evolving digitalized environments and position themselves as key leaders in digital health.
Waghray, N.	2023	Chatbot in anatomy learning and recapitulation: Prototype and review	ScienceDirect	India	APG	To present the novel invention AnaBot, an interactive digital system for recapitulating and assessing anatomy topics by medical and anatomy students during exam preparations. The AnaBot, an interactive digital assistant of the present invention, comprises of computing device inbuilt with conversational AI, an anatomy repository library, a psychometric analytical unit, a musical therapy unit, and a server device inbuilt with library and virtual assistant AI.	To incorporate a chatbot into the medical curriculum either as a patient simulator, a tool for revision, or a method to standardize exams. This study also showed that a chatbot would be more helpful sooner in the medical training process than later.
Waibel, A.M., Bischoff, M.	2024	Digital competencies in medical studies: results of an interdisciplinary course.	HNO	Germany	WEOG	The introduction of an elective course in digital competencies in medicine fills a curricular gap at the Medical Faculty of the University of Freiburg.	Six students participated in the elective course in the summer semester of 2022. The evaluation shows that the goals of the course were achieved. The participants were able to acquire theoretical knowledge and deepen it through practical exercises.
Wiedeman, C.	2020	Innovating the medical imaging course	Technology and Innovation	United States, China	APG, WEOG	To report the teaching philosophy, practice, and considerations with respect to the integration of deep learning, tomographic imaging, and hands-on programming to modernize the medical imaging course. The second section of this paper describes the first experience innovating the medical imaging course with an AI framework for biomedical engineering graduate students.	This course features seamless integration of fundamental ideas and key methods of medical imaging modalities, thorough understanding of neural networks and their representative architectures, and the adaption and optimization of AI for deep tomographic image reconstruction. To attain this goal, classroom teaching and hands-on projects are combined to offer students valuable learning opportunities.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Zhang, G.	2022	TraineR: A crowd training platform for deep learning image labeling tasks	Software Impacts	China	APG	Deep learning provides a new opportunity to automatically screen pediatric retinopathy, but it requires large-scale expert labeling. The authors developed TraineR (R stands for ROP or Retina). TraineR is an online training platform for inexperienced medical students, interns, and technicians, to help them quickly master image reading and labeling abilities.	Developed TraineR to educate inexperienced workers to quickly master the required domain expertise. The system provides a front-end web app for inexperienced workers to learn and test their image diagnostic abilities. It also provides a back-end module for pediatric ophthalmologists to edit the quiz bank and curate image labels. TraineR has been published under the EPL (Eclipse Public License) license. It can also be used as a general-purposed crowdsourced training platform by providing domain-specific quiz bank content.
Zhang, Y.	2024	Exploring the Application of the Artificial-Intelligence-Integrated Platform 3D Slicer in Medical Imaging Education	Diagnostics	China	APG	3D Slicer, an open-source medical image analysis platform, has become a valuable tool in medical imaging education due to its integration of various AI applications. Through its open-source architecture, students can gain practical experience with diverse medical images and the latest AI technology, reinforcing their understanding of anatomy and imaging technology while fostering independent learning and clinical reasoning skills.	3D Slicer has demonstrated potential in medical image analysis, its application in medical image education remains limited and poses challenges. The transformation of teaching platforms constitutes a complex process requiring substantial and transformative changes. The 3D Slicer platform, encompassing a multitude of AI technologies, not only furnishes students with convenient tools for in-school learning but also lays a robust groundwork for their research and clinical endeavors.
Zhou, N.	2023	Experimental Teaching System of Human Physiology and Artificial Intelligence Application in Basic Medical Education	IEEE 4th Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability	China	APG	To discuss the principles and applications of human physiology in medical education combined with the experience in basic medical teaching. The discussion provided a reference value for medical basic education, especially the new teaching model of basic medical science using artificial intelligence computer simulation.	In the experimental teaching system of human physiology, students are the experimenter and the subject. They participate in experiments and experience intuitive learning, which stimulates their interest in learning. Students link the knowledge from experiments to clinical practice to significantly improve the teaching effect.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Abd-Alrazaq, A.	2023	Large Language Models in Medical Education: Opportunities, Challenges, and Future Directions	JMIR Medical Education	APG, WEOG	Qatar, United Arab Emirates, Kuwait, Canada	A perspective on the opportunities and challenges of using LLMs in medical curriculum development, teaching methodologies, personalized study plans and learning materials, student assessments, and more. We believe that the insights gleaned from this analysis will serve as a foundation for future recommendations and best practices in the field, fostering the responsible and effective use of AI technologies in medical education.	LLMs have the potential to revolutionize medical education, enhance the learning experience, and improve the overall quality of medical education by offering a wide of applications, such as acting as a virtual patient and medical tutor, generating medical case studies, and developing personalized study plans. However, LLMs do not come without challenges. Academic dishonesty, misinformation, privacy concerns, copyright issues, overreliance on AI, algorithmic bias, lack of consistency and human interaction, and inequity in access are some of the major hurdles that need to be addressed.
D'Souza, R.	2024	Twelve tips for addressing ethical concerns in the implementation of artificial intelligence in medical education	Medical Education Online	APG, WEOG	Australia, India	To provide guidance to medical educators on addressing ethical concerns in the integration of artificial intelligence (AI) in medical education through a set of practical tips.	The paper outlines 12 essential tips to help educators address ethical concerns when integrating AI into medical education, focusing on transparency, bias, validation, privacy, informed consent, collaboration, faculty development, and regulatory awareness. These guidelines aim to ensure that AI in medical education is implemented responsibly and ethically, benefiting both students and educators by fostering trust, fairness, and accountability.
Heng, J.	2023	The impact of Chat Generative Pre-trained Transformer (ChatGPT) on medical education	Postgraduate Medical Journal	APG	Singapore	To discuss the potential benefits and limitations of ChatGPT and how medical educators have to develop skills and curricula to best harness this innovative power.	It is imperative for educators and students to critically review their responses to such new technologies. Adapting to technologies such as ChatGPT requires significant review, appraisal, policy curation, and investments to handle its use adroitly to reap maximal benefit with minimal harms.
Indran, I.	2023	Twelve tips to leverage AI for efficient and effective medical question generation: A guide for educators using Chat GPT	Medical Teacher	APG	Singapore	This explore the utility of ChatGPT to generate diverse, high-quality medical questions, focusing on multiple-choice questions (MCQs) as an illustrative example, to increase educator's productivity and enable self-directed learning for students.	Integrating LLM tools like ChatGPT into generating medical assessment questions like MCQs augments but does not replace human expertise. With continual instruction refinement, AI can produce high-standard questions. Yet, the onus of ensuring ultimate quality and accuracy remains with subject matter experts, affirming the irreplaceable value of human involvement in the artificial intelligence-driven education paradigm.
Jacobs, S.	2023	Reimagining Core Entrustable Professional Activities for Undergraduate Medical Education in the Era of Artificial Intelligence	JMIR Medical Education	WEOG	United States	To provide a practical evaluation of the Entrustable Professional Activities (EPAs) EPAs, alongside actionable recommendations on how medical education, viewed through the lens of the AAMC EPAs, can adapt and remain relevant amid rapid technological advancements.	By leveraging the transformative potential of AI, we can reshape medical education to align with an AI-integrated future of medicine. This approach will help equip future healthcare professionals with technological competence and adaptive skills to meet the dynamic and evolving demands in healthcare and propose modifications to align with the advancements in AI technologies and their implications in healthcare and undergraduate medical education.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Jowsey, T.	2023	Medical education empowered by generative artificial intelligence large language models	Trends in Molecular Medicine	WEOG	Australia, New Zealand	To provide support to early adopters of generative AI and LLMs by offering valuable strategies that can be integrated into their curriculum and assessment development. Generative AI and LLMs can be integrated into the learning and teaching practices, enhancing students' digital capability and fostering digital citizenship – ensuring future readiness.	This article highlights that generative AI and LLMs should be utilized in pedagogical design (i.e., curriculum and assessment development) and incorporated into the pedagogical experience. That is, educators should provide learners with direct interaction and engagement with this technology throughout the learning process. It is vital to equip today's learners with essential digital capabilities. As educators, we must foster an understanding of the effective, safe, and ethical use of these technologies to ensure the students of today are the digital citizens of tomorrow.
Katznelson, G., Gerke, S.	2021	The need for health AI ethics in medical school education.	Advances in Health Sciences Education	WEOG	Canada, United States	To discuss key ethical issues requiring medical school education and suggest that case studies based on recent real-life examples are useful tools to teach the ethical issues raised by health AIs.	The ethical issues that should constitute this curriculum are informed consent, bias, safety, transparency, patient privacy, and allocation. There is no shortage of current health AI events that raise challenging questions about these issues, and that can be presented in the context of case studies. With exposure to case studies based on real-life examples that raise these issues, medical students can gain the skills to appreciate and solve the ethical challenges of health AI that are already affecting the practice of medicine.
Lazarus, M.	2022	Artificial intelligence and clinical anatomical education: Promises and perils	Anatomical Sciences Education (ASE)	WEOG	Australia	To examine five tensions between the promises and the perils of integrating AI into anatomy education. These tensions highlight the ways in which AI is currently ill-suited for incorporating the uncertainties intrinsic to anatomy education in the areas of (1) human variations, (2) healthcare practice, (3) diversity and social justice, (4) student support, and (5) student learning.	This presents a paradigm shift away from wholesale, enthusiastic adoption of novel technologies into anatomy teaching, toward a collective effort by anatomy educators to closely inspect the hidden and unintended impacts of artificial intelligence-infused anatomical education (AIEd) on learning, and a call to action for anatomy educators to be part of the development of AIEd fit-for-purpose.
Lenihan, D.	2023	Three Effective, Efficient, and Easily Implementable Ways to Integrate A.I. Into Medical Education	Cureus	WEOG	United States	With the tech readiness of today's students in mind, here are three recommendations for how to best infuse A.I. into medical education. This strategic guidance can deliver significant benefits to today's techfluent medical school students and enhance their training in their journeys to become doctors.	The sensible steps detailed above offer an achievable gateway to its more widespread acceptance and adaptation.
Masters, K.	2023	Ethical use of artificial intelligence in health professions education: AMEE Guide No. 158	Medical Teacher	APG	Oman	This guide focuses on the ethical issues likely to face health professional education teachers and administrators as they encounter and use AI systems in their teaching environment.	This Guide has reviewed the most important topics and issues related to the Ethical use of AI in Health Professions Education, leading to an understanding that these debates are not merely philosophical, but have a direct impact on our existence, and the way in which we perceive ethics and behaviour in health professional educator (HPE).

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Masters, K.	2023	Medical Teacher's first ChatGPT's referencing hallucinations: Lessons for editors, reviewers, and teachers	Medical Teacher	APG	Oman	After explaining ChatGPT's "hallucinations" regarding citing and referencing, this commentary illustrates the problem by describing the detection of the first known Medical Teacher submission using ChatGPT inappropriately, the lessons that can be drawn from it for journal editors, reviewers, and teachers, and then the wider implications if this problem is left unchecked.	As AI systems evolve in their sophistication and power, academics have a greater opportunity to produce high-quality manuscripts. One must, however, ensure that responsibility and authorship reside with the human author; for this, academics must perform at the same ethical standard they require from their students. When they fail to do so, journal staff and reviewers must be able to detect inappropriate use of AI tools.
Mondal, H.	2023	ChatGPT for teachers: Practical examples for utilizing artificial intelligence for educational purposes	Indian Journal of Vascular and Endovascular Surgery	APG	India	To provide practical examples of the utilization of ChatGPT for educational purposes in the context of teaching.	The article demonstrates how ChatGPT can serve as a valuable tool for teachers in preparation of presentation slide, formulating essay-type, multiple choice, and viva questions, answering students' queries, making customized content for students according to comprehension capability, evaluation of answers, creating case vignette, plan a lesson, or create contents for blended learning.
Ng, F.	2023	Artificial intelligence education: An evidence-based medicine approach for consumers, translators, and developers	Cell Reports Medicine	APG, WEOG	China, United States, Singapore, United Kingdom	To outline a core curriculum for AI education of future consumers, translators, and developers, emphasizing the links between AI and evidence-based medicine (EBM), with suggestions for how teaching may be integrated into existing curricula.	As AI applications continue to proliferate in healthcare, the need to educate clinicians to effectively appraise and use these tools is becoming more pressing. Supplementation of existing curricula with AI may prove to be the most realistic way to prepare consumers for the changing landscape of digital health, and this may be facilitated by linking AI teaching to related concepts in EBM.
Ngo, B.	2021	Artificial Intelligence: Has Its Time Come for Inclusion in Medical School Education? Maybe...Maybe Not.	MedEdPublish	WEOG	United States	To address the lack of formal AI instruction by presenting an informative primer with curricular suggestions for each medical school year, from a U.S. perspective, tailored to medical students and their educators.	To encourage medical students to dive in and explore the rapidly evolving field of AI by reading research articles, watching educational videos, having thought-provoking conversations with peers and faculty, creating AI interest groups, and/or using any method that is convenient and comfortable for them. Medical educators will be playing a prominent role in structuring medical education about AI.
Saleem, N.	2024	ChatGPT as an innovative heutagogical tool in medical education	Cogent Education	APG, WEOG	India, Norway	To investigate the potential advantages of integrating the new generative artificial intelligence (AI) technology, ChatGPT, into higher education, specifically within the field of medical education.	To showcase ChatGPT as a heutagogical(self-determined learning) tool in medical education. Through thoughtful integration and ethical usage of AI tools like ChatGPT, the future of education can be shaped to offer more personalized, accessible, and effective learning experiences.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Seth, P.	2023	Data Science as a Core Competency in Undergraduate Medical Education in the Age of Artificial Intelligence in Health Care.	JMIR Medical Education	WEOG	Canada, United States	To outline major content domains and associated learning outcomes in data science applicable to medical student curricula, suggest ways to incorporate these themes into existing curricula, and note potential implementation barriers and solutions to optimize the integration of this content.	An understanding of the basic principles of data science and AI in modern health care must be considered a core competency for clinicians of today and the future. Medical training, along with education of other health care providers, must respond urgently to integrate these concepts into undergraduate medical curricula. development to support meaningful implementation to ensure that the next generation of physicians will be optimally prepared Data science–literate physicians will be able to wisely leverage the relative strengths of humans and machines, leading to the best outcomes for patients.
Tsang, R.	2023	Practical Applications of ChatGPT in Undergraduate Medical Education	Journal of Medical Education and Curricular Developmen	WEOG	Canada	To outline how ChatGPT may be applied to support undergraduate medical education during the preclinical and clinical years and highlight possible concerns regarding its use, which necessitates the creation of formal policies and training by medical schools.	ChatGPT is a robust, evolving AI chatbot that has considerable potential to augment UGME in both the preclinical and clinical years. While its future potential and applications remain unenumerated, the current version can aid exam preparation and knowledge development, although concerns over AI hallucinations and unreliable sources limits its present utility as an evidence-based clinical support resource and research tool.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Dave, T.	2023	ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations	Frontiers in Artificial Intelligence	Ukraine, India	APG, EEG	The paper analyzes the advantages, limitations, future prospects, and ethical considerations of ChatGPT and AI in healthcare and medical domains, and provides a summary of its applications.	ChatGPT is a state-of-the-art language model that has numerous advantages and applications in the healthcare and medical domains. It can assist medical professionals in various tasks, such as research, diagnosis, patient monitoring, and medical education. However, the use of ChatGPT also presents several ethical considerations and limitations such as credibility, plagiarism, copyright infringement, and biases. Therefore, before implementing ChatGPT, the potential limitations and ethical considerations need to be thoroughly assessed and addressed.
de Souza, L.	2023	ChatGPT and medicine: a potential threat to science or a step towards the future?	Journal of Medical Artificial Intelligence	Brazil, United Kingdom, Egypt	AG, LAC, WEOG	To provide an overview of the potential uses of ChatGPT in medicine, exploring its advantages, limitations, and how it can impact various medical specialties.	ChatGPT represents a powerful tool in the field of medicine, offering great potential to improve patient care and outcomes. As a language model trained on vast amounts of text data, ChatGPT can assist in clinical decision-making, medical research, and education, among other applications. Its ability to generate human-like responses and understand natural language input makes it an appealing tool for healthcare providers and researchers.
Komasawa, N., Yokohira, M.	2023	Simulation-Based Education in the Artificial Intelligence Era	Cureus	Japan	APG	To discuss the challenges and future directions of Simulation-Based Education (SBME) in the artificial intelligence (AI) era.	In the AI era, we should implement a new medical education curriculum not only on the application or how to use it but also on a deep understanding of its principles and risks. While new AI technology has developed, learning theory has remained the same. Therefore, we should focus on the complementary role of SBME in clinical education and perform continuous improvements.
Lin, Y., Yu, Z.	2023	A bibliometric analysis of artificial intelligence chatbots in educational contexts	Interactive Technology and Smart Education	China	APG	To bridge the research gap by taking an educational perspective to review the existing literature on artificial intelligence chatbots.	Educational applications of chatbots are a popular research issues on this topic include technological advancements, students' perception of chatbots and effectiveness of chatbots in different educational contexts. Originating from similar technological and theoretical foundations, chatbots are primarily applied to language education, educational services (such as information counseling and automated grading), health-care education and medical training. Diversifying application contexts demonstrate specific purposes for using chatbots in education but are confronted with some common challenges.
Narayanan, S.	2023	Artificial Intelligence Revolutionizing the Field of Medical Education	Cureus Journal of Medical Science	India	APG	To summarize the AI tools and their application in medical teaching or learning, assessment, and administrative support. This article can aid medical institutes in planning and implementing AI according to the needs of the educators.	Although AI has long been adopted in education, its application is still limited in medical institutions. As a futuristic approach to development, medical organizations should strategically orient educators and administrators about potential areas of AI in teaching, assessing, and management. As for any emerging technology, the success of AI in medical education will ultimately rely on organizational support and commitment by teachers and students to use the technology effectively within ethical boundaries.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Núñez, A.	2024	Machine Learning: A training need today for tomorrow's physicians	Revista Chilena de Anestesia	Chile	LAC	Review the current landscape of machine learning (ML) in medical education.	The future of ML use in medical education is promising but requires careful attention to ethical concerns and data quality. It is essential that medical education professionals and technology developers collaborate to ensure that the use of ML in medical education is ethical, equitable, and beneficial for all involved. Therefore, the design of the medical curriculum must evolve to meet the needs and expectations of current students, who are increasingly familiar with technological tools.
Peter, T., Terhemen, Y.	2023	Data Science Evolution and Application in Medical Education	International Journal of Human Kinetics and Health Education	Nigeria	AG	To define data science and its application in various domains of mathematics, statistics, artificial intelligence, computer engineering, deep learning, big data and machine learning were explained. Medical education and its peculiarities as well as the various challenges encountered in Nigeria.	The value of integration of medical education and technology along with the attendant benefits was highlighted. Appropriate recommendations were made on the need to leverage on data science to improve learning experience and outcomes in medical education. The studies reviewed so far show that there is little consensus on what and how to teach artificial intelligence in undergraduate medical education.
Quispe, J.	2024	The Transformative Role of Technology in Medical Education	Salud ciencia y tecnologia	Peru	LAC	To evaluate the impact of various emerging technologies in medical education and their influence on clinical practice, highlighting improvements in skills and diagnostic accuracy, as well as the personalization of learning.	The continued integration of emerging technologies into medical education shows promising potential to personalize learning and improve patient care. However, challenges such as data security and appropriate training must be addressed to ensure successful implementation and lasting impact on clinical practice and medical education.
Sahu, P.	2024	ChatGPT in research and health professions education: challenges, opportunities, and future directions	Postgraduate Medical Journal	Trinidad and Tobago	LAC	To review the impact of ChatGPT on research and health professions education by identifying the challenges and opportunities in these fields. Additionally, it aims to provide future directions to mitigate the challenges and maximize the benefits of this technology in health professions education.	With the advancement of AI technology, ChatGPT will become a game-changer in the field of research and healthcare professions education. It should be used as a complementary tool to the conventional methods of teaching and learning in healthcare education rather than a replacement. However, there is a need to address ethical concerns and limitations such as lack of real-time data, data inaccuracies, biases, plagiarism, and copyright infringement before its implementation.
Tokuç, B., Varol, G.	2023	Medical Education in the Era of Advancing Technology	Medical Education and Technology	Turkey	WEOG	To discuss the various digital learning tools introduced into medical education, as well as their advantages and disadvantages. We also try to understand how the shift to artificial intelligence may affect medical education and practice and how we can make technology efficient without losing the human dimension in doctor-patient relationships.	In the new educational environments, technological advancements, and the digital domain have become the main drivers of access to information and interpersonal communication. Accordingly, modern medical education should adopt these new technologies in medical education in addition to the traditional models and evaluate their advantages and disadvantages very well. A hybrid model built on the components of both traditional and digital paradigms, with strengths, and prudence, will presumably be the best for a modern student.

Lead Author	Year	Title	Journal	Country	Region	Aim	Conclusions
Williams, L., Grainger, R.	2020	Social accountability for students in a machine learning era	Focus on Health Professional Education: A Multi-Professional Journal	New Zealand	WEOG	An overview of machine learning (ML) as it relates to the medical curriculum and the importance of integrating ML, or the wider field of health informatics, into the medical curricula.	It is essential that ML is used in a conscientious manner to create a cost-effective healthcare system that delivers equitable outcomes, and future health professionals should have the knowledge and skills to achieve and maintain this. By incorporating teaching on ML and other technologies into their curricula, schools for health professionals can drive the digital healthcare revolution.
Zarei, M.	2024	Application of artificial intelligence in medical education: A review of benefits, challenges, and solutions	Medicina Clínica Práctica	Iran	APG	To review a thorough evaluation of the advantages, challenges, and leading strategies for utilizing AI in the field of medical education.	The expanding integration of AI into medical practice, especially in recent decades, has also led to an increase in the use of different AI methods in medical education. Further research is needed to specifically identify the potential benefits and challenges, and analyze the proposed solutions for these challenges. The academic curriculum should be evaluated periodically in order to improve the effectiveness of incorporating AI in medical education.