INTEGRATING ARTIFICIAL INTELLIGENCE AND MEDICAL CHATBOTS INTO MEDICAL EDUCATION: INSIGHTS FROM MEDICAL STUDENTS

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ABSTRACT

Background
The growing technology landscape in the Artificial Intelligence (AI) era requires continuous curriculum advancement. We aimed to explore medical students knowledge, attitudes and perceptions of integrating AI and chatbots into the curriculum.

Method
A cross-sectional questionnaire-based study conducted among pre-clinical students. Of 150 students, 131 responded. The questionnaire assessed their knowledge, attitude and perception toward AI and chatbots use in the medical curriculum. After thematic analysis, data are expressed as percentage.

Results
Students showed a moderate knowledge (73.91%) and a predominantly negative attitude (84.56%) toward integrating AI into curriculum. Concerns included data privacy, trust issues, self-harm (illegal practices), creativity loss, questionable accuracy and reliability, limits skill development, overdependence, errors and liabilities, and lack of ethical judgment. Most (71.76%) had never practiced medical-specific chatbots aligning with their negative attitude. The identified barriers were limited accessibility, inadequate training and guidance. Students showed mixed responses about AI in clinical purposes: diagnosis, telemedicine, and virtual patient simulations. Students commonly used AI tools were non-medical, low-risk applications.

Conclusion
Students knowledge of AI is still developing and attitudes were predominantly negative or cautious toward its integration into the curriculum. Before implementation, concerns regarding ethics, training, and access must be addressed. Students have strong digital familiarity outside of academic and health contexts. These findings suggest the need for carefully regulated, context-specific integration of AI in medical education, with a focus on building capacity, addressing ethical concerns, and ensuring equitable access.

Keywords: *AI, Chatbots, Curriculum, Ethics, Students, Technology*

INTRODUCTION

Artificial intelligence (AI) is considered a branch of engineering or computer science [1] that resolves complex challenges given to it. It is a computer system that has simulation of human intelligence and may beat the human intelligence [2]. It is taking a revolutionary change in the technological landscape. Artificial intelligence has done many revolutions in the field of agriculture [3], vehicle manufacturing companies, Tesla, entertainment, finance and shopping via Netflix, amazon [4].

In healthcare, AI applications have significantly enhanced disease diagnosis [5] prediction of disease [6] drug discovery [1] personalized treatment, remote patient monitoring [7] and virtual health assistants or chatbots [8]. Among its innovations, chatbots: AI-powered conversational agents have emerged as tools for improving patient interaction, offering mental health support [9] and assisting with triage [10] and follow-ups. Even some of them provide coping strategies via platforms like Woebot, Tess, Replika, animal therapy [11].

In clinical practice, AI and chatbots can work synergistically in disease diagnosis and support clinical decision. For example, AI algorithms can analyze MRI scans [12], histo-pathology slides [13] while chatbots can collect patient information such as medical history, symptoms, and lifestyle factors and suggest treatment based on established guidelines. Additionally, the use of AI and chatbots might also decrease the physician burnout [5].

In medical education, AI and chatbots are increasingly being explored for their potential to enhance learning experiences, predictive analytics, and language learning tools [14]. However, the integration of AI in medical education is still limited, especially in settings with fewer resources [15]. There are also concerns related to data privacy, patient autonomy, transparency of algorithm [16], and possible job loss [17] as possible barriers. Hence, there is a need of further research to explore the use of AI in medical education, particularly in terms of authenticity [18]. A study done in Nepal has shown that students have positive attitude to learn about AI but are unaware of its impact in healthcare sector because of ill equipped healthcare system to handle AI challenges [15]. With this outlook, our objective is to explore medical student knowledge, attitude, practice of AI use in medical study and perceptions towards the integration of AI and Chatbots into medical curriculum. The other objective is to find the possible challenges while integrating AI and chatbots into medical curriculum from the perspective of students.

METHODS

It was a cross-sectional questionnaire based study done at Devdaha Medical College and Research Institute (DMCRI). The study was conducted from August 25, 2024 to August 14, 2025, after obtaining ethical clearance from institutional review committee of DMCRI. The participants were pre-clinical medical students. The estimated total participants in the study were 150. Those students enrolled in first and second year (from three batches) of pre-clinical sciences were included in the study.

Questionnaire was developed by extensive review of literatures [8, 15, 19-22] and taking opinions from few experts. A pretesting/face validity of questionnaire was done for verification of its construct and content validity. Questionnaire was tested in 10 students from first semester students. The reliability Chronbach's alpha obtained was 0.752. The ambiguous questions were reframed and reconstructed. The futile questions were discarded.

The questionnaire was administered to students to assess their knowledge, attitude and practice of using AI and chatbots. It consisted of four sections (section A to section D); Section A: demographic details, Section B: knowledge about artificial intelligence and Chatbots, Section C: attitude towards AI and Chatbots learning and its integration in medical education curriculum and Section D: practice of AI and chatbots. The questionnaire utilized a Likert scale for scoring, with a few open-ended questions in each section. The Likert scale consists: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). In the knowledge and attitude sections, a scoring cutoff was determined. The total knowledge score was calculated based on eight questions, each with a maximum score of 5, resulting in a total possible score of 40. Knowledge levels were categorized as: High (32–40), Moderate (21–31), and Low (8–20) levels.

Section C (Attitude) consisted of eight statements, with questions 1–7 being positive statements indicative of a positive attitude. The responses were scored on a Likert scale as "Strongly Agree" received a score of 5 and "Strongly Disagree" received a score of 1. However, question 8 was a negative statement, so its scoring was reversed "Strongly Agree" received a score of 1, while "Strongly Disagree" received a score of 5. The total attitude score was obtained by summing the scores from all eight statements and the average score (AS) was calculated by dividing the total score by 8. Attitude was categorized based on the AS, as follow: positive (AS > 4), negative (AS < 4), and neutral (AS = 4) attitude levels.

Section D responses were Never, Rarely, Occasionally, Often, and Daily assessing students practice regarding AI and chatbots applications. The same section employed a Likert scale (Not Useful, Slightly Useful, Moderately Useful, Very Useful, Extremely Useful) to gauge students perspectives on the usefulness of AI and chatbots in medical education across various aspects, including diagnostic support, virtual

patient simulations, personalized learning platforms, research and data analysis, remote learning and telemedicine, professional development, and rating. Individual responses were presented as percentages. The details of questionnaire are available in the Annexures. Open-ended descriptive responses were thematically categorized and expressed in percentages or frequencies.

RESULTS

Questionnaire was delivered to 150 medical undergraduate students. Responses were received from 131 students with a response rate of 87.33%.

A. Results on Knowledge about Artificial Intelligence

We found majority of students (73.91%) have moderate level of knowledge regarding artificial intelligence, Table 1.

Table 1: Knowledge about artificial intelligence, n-131

Knowledge about AI	Score	Percentage of Students
High Knowledge about AI	32-40	2.17%
Moderate Knowledge about AI	21-31	73.91 %
Low level of knowledge about AI	8-20	23.92%

Students were aware of AI use in medical and other fields, Table 2.

Table 2: Compilation of AI uses in different field

Field	Examples
Medical Field	Hair transplant, Butterfly Network (ultrasound), Robotic microsurgery, Babylon Health, Ada Health, K Health, Ginger
Automobile Industry	Tesla (self-driving), Memory chips in car industry
Pharmaceutical Industry	Drug discovery, personalized medicine
Education	ChatGPT (Chat Generative Pretrained Transformer), Gemini, CoPilot, AI-generated educational materials
Virtual Assistants	Google Assistant, Siri, Alexa, Virtual assistants
Social Media and Apps	Snapchat, Photoshop, Chatbots
Shopping and Delivery	AI in shopping apps, Food apps, Delivery apps, Payment apps
News and Media	Speech-to-text, Chatbots for video/news generation, Voice changers
Open AI Technologies	OpenAI tools (e.g., ChatGPT)
Agriculture	AI for climate change management, Precision agriculture
Mechanical/Engineering	Robotics, Mechanical AI
Graphic Design	Photoshop, Tools for designing
Marketing and Food Industry	targeted marketing, customer behavior analysis
Military	surveillance, autonomous systems
Textile and Service Industry	Waiter, Customer service chatbots

B. Attitude towards AI and Chatbots learning and integration in medical education

We found majority (84.56%) of students have negative attitude towards integration of AI and chatbots in

the medical field, Table 3. Some of the major ethical issues (question No. 9) mentioned by students were patient privacy and data security, misdiagnosis and algorithmic errors, employment and human displacement, ethical use and regulation.

Table: 3: Students attitude towards integration of AI in medical education

Attitude	Percentage
Positive (>4)	0.195%
Neutral (=4)	15.21%
Negative (<4)	84.56%

There were many perceived negative expectations on AI use in medical field. Raised concerns are, data privacy and security, overdependence, accessibility and training gaps, misuse by general public due to easy public access, risk of illegal practices, employment displacement, emotional intelligence limits, students creative thinking compromised, technical and system reliability, miscommunication- due to lack of patient doctor interactions, cultural and regional variance in dose/mismatch, lack of human oversight etc.

Despite negative attitude of students towards integration of AI in medical education, they have some recommendations for its use in the medical field, Table 4.

Table 4: Recommendations for using AI in the medical field, n-131

Theme	Recommendations	Percentage
1. Medical Education and Learning	Better visualization, concept clarity in subjects	40%
2. Research and Knowledge Access	Easy and quick access to information- exploring medical issues- Aids research and training	18%
3. Clinical Assistance and Diagnostics	Use in ICU/critical care, labs- help diagnosis - Support simple/general surgeries	15%
4. Limited and Cautious Use	minimize dependence - no replacement of books and human judgment-Implement with monitoring	12%
5.Enhancing Practical Understanding	Encouraging familiarity with AI-tools- Bridging gap between theory and practice- concept development	7%
6. Doctor-Patient Alignment	Align with doctor–patient understanding- Must support mutual decision-making	3%
7. Time Efficiency and Error Reduction	Saves time- Reduces human error in diagnosis or critical care	3%
8. AI for Chronic/Complex Diseases	Helpful in chronic disease, dementia, infertility, advanced cancer	2%

C. Practice of AI and Chatbots by Medical Students

Majority of students (71.76%) have never used medical-specific chatbots, Table 5. There is a mixed response for the overall use of AI-tools. For medical studies about half of students never use ChatGPT and

many students (41.22%) never use AI-tools for exam preparation.

Table 5: Frequency distribution of students in using Chatbots and AI-tools, n-131

Practice Statements	Never (%)	Rarely (%)	Occasio-nally (%)	Often (%)	Daily (%)
1. Interacted with medical Chatbots	94 (71.76%)	23 (17.56%)	9 (6.87%)	2 (1.53%)	3 (2.29%)
2. Use Chatbot for enhancing my medical studies.	20 (15.27%)	46 (35.11%)	26 (19.85%)	23 (17.56%)	16 (12.21%)
3. Frequency of using AI-tools or applications for learning purposes	11 (8.4%)	40 (30.53%)	37 (28.24%)	28 (21.37%)	15 (11.45%)
4. Using AI-tools during exam preparation	54 (41.22%)	43 (32.82%)	9 (6.87%)	20 (15.27%)	5 (3.82%)
5. Used AI-tools in other places: entertainment, weather updates, exercise, language processing, finance	6 (4.58%)	17 (12.98%)	9 (6.87%)	42 (32.06%)	57 (43.51%)

Students demonstrated the highest appreciation for AI applications in research and data analysis (90.83%), professional development (96.94%) and personalized learning (88.54%), as evidenced by the predominance of "moderately useful", "very useful" and "extremely useful" ratings in these categories, Table 6. In contrast, AI applications in diagnostic support and remote learning/telemedicine received more varied responses, indicating a comparatively cautious acceptance, Table 6.

Table 6: Rating of Students for Six Different AI Applications, n-131

Applications	Not useful	Slightly useful	Moderately useful	Very useful	Extremely Useful	Total Useful (sum of moderate to extreme) %
Diagnostic support	8	43	43	30	7	61.6
Virtual patient simulations	9	19	58	26	19	78.62
Personalized learning	0	15	21	48	47	88.54
Research and Data analysis	3	9	9	62	48	90.83
Remote Learning/Tele medicine	11	16	37	48	19	79.38
Professional Development	4	28	32	42	25	96.94

DISCUSSION

In this study, medical students have a moderate level of knowledge (73.91%) regarding artificial intelligence and its real life exposure. The level of knowledge in our students is less as compared to other country studies such as Saudi Arabia (98.4% had knowledge) [23]. We found students are able to recall or identify real-world applications of AI in both medical and non-medical fields suggesting a developing understanding but not comprehensive. They mentioned number of AI tools and applications that are in use nowadays such as use in automobile industry, social media, virtual assistants, open AI, mechanical engineering, shopping and delivery apps. We found majority (84.56%) of medical students have

negative attitude towards integration of AI and chatbots in the medical curriculum. Our study is contrary to the other study where 93.95% of medical students have strong belief that AI is crucial in the medical field [24]. The Pakistani students showed positive attitude towards integration of AI in medical field [25]. Further, a study done in Saudi Arabia also mentions that students have positive attitude (81.8%) towards AI integration in diagnostic precision and patient care despite lack of formal education on AI [23]. In India, 46.8% were in favor for AI integration in medical field [26]. Meanwhile, our students mentioned many negative prospects in terms of patients data privacy and security, high chance of data misuse by general public via easy public access, and high risk of illegal practices. To address data privacy and security, there are different data privacy preserving AI techniques such as block chain and federated learning (or keeping or sharing data). However, these tools have certain limitations such as high communication/computing costs, slow execution time, with accuracy compromise [27]. Hence, accuracy compromise is detrimental and is not acceptable in medical field. It seems there is a need for the development of proper data privacy techniques before integrating it into the curriculum. The other negative prospects of students are accessibility and training gaps among medical personnel, limiting their skills development and chances of job displacement. AI should not be viewed as a foe or a replacement for human, rather it should be a vital ally [28] to equip and support medical professionals [29]. Hence, this highlights the importance and need of providing proper training and continuous skill enhancement for health care professionals.

Our students, pointed out that lack of emotional intelligence in AI-systems could negatively impact patient compliance and its excessive use contributes to an overdependence on AI and chatbots in clinical practice. Besides, they emphasized that excessive dependence on AI will also limit once learning and teaching, diminishing persons thinking and creativity, ultimately leading to shallow knowledge. This is in accordance with a finding in which students were concerned that AI could undermine their clinical thinking in medicine [30]. Additionally, they also raised concern about technical and system reliability (machine malfunction, surgical errors) of AI. Moreover, students mentioned that dependence on AI can lead to miscommunication and decline patients-doctors interactions, ultimately development of trust issues in patients. To address these concerns, AI training should incorporate transdisciplinary research collaborations between medical experts and computer scientists and there should be ongoing auditing and monitoring of data to ensure proper validation and reliability [31]. As medical science continually

evolves, lack of such validation may lead to persistent trust issues. To add on this, students highlighted lack of human oversight in AI use can also result in poor or absent ethical judgment.

Hence, the overall negative attitude observed among Nepalese students may stem from limited access to emerging technologies, insufficient faculty expertise, lack of exposure, and underlying ethical beliefs. However, it is important to recognize that their cautious attitudes toward AI are not solely the result of moderate knowledge, training gaps or inaccessibility. In many cases, this disbelief reflects valid concerns about potential harm, ethical dilemmas, and the unintended consequences of overreliance on technology. Adopting new tools should not be seen as inherently necessary or beneficial; each innovation must be critically evaluated based on its context-specific risks and benefits. Notably, despite their negative attitude about integrating AI into medical curriculum, students offered constructive recommendations for its use. A significant proportion, 40% strongly supported the application of AI as a learning aid, particularly in visualization and teaching enhancement. Further, moderate proportion (18%) of students mentions using AI in the research purpose as assistant or trainer. On the other hand, 12% of students emphasized the need for cautious and limited use of AI, highlighting concerns about overdependence, potential risks, and the importance of human oversight. Some students recommend clinical use of AI as diagnostic tool and ICU care, but suggest keeping it for support, not replacement. Few students mentioned for the development of laws and policy for the ethical issues that can arise in near future.

We found majority of students (71.76%) have never practiced medical-specific chatbots which aligns with their negative attitude towards its integration into medical field. However, about half of the students use chatbots such as ChatGPT to enhance their medical studies as similar to a study done in United State [32]. Whereas, in Japan, many students found ChatGPT lacked precision in medical studies [33]. Additionally, we found many (61.06%) students use AI-based tools for learning at least occasionally. However, a notable 38.94% of students report using them rarely or not at all. This indicates that, despite increasing interest, a significant proportion of students may still favor traditional learning approaches, harbor doubts about the reliability of AI tools, or face barriers such as limited access or familiarity. Most students (74.04%) use AI rarely or never for exam preparation and health issues suggesting it is not yet a common tool during high-stakes academic periods or stressful health conditions. It is similar to the Jordanian students, where only 29.3% of students use AI for exam preparation [34]. In our study, the most widely adopted area of AI usage among students is in every-

day life activities such as entertainment, weather updates, exercise, and finance, which are considered to be minimal risk activities, with 75.57% reporting they use AI tools often or daily. This indicates a strong digital familiarity outside of academic and health contexts, which are considered high risk.

In our study, students gave the highest ratings as "useful" to AI in research, data analysis, and personalized learning, while responses were more mixed for diagnostic support and telemedicine. A recent study reports that ChatGPT is among the most commonly used and preferred AI-tools by medical students, playing a significant role in enhancing personalized learning experiences [35]. Moreover, several studies have acknowledged the role of AI in advancing health research [36, 37]. Therefore, our students indicate strong support for academic uses of AI, but highlight the need for further development and trust in clinical, virtual education and telemedicine applications. It also indicates a clear recognition of AI potential to tailor education to individual needs, increase engagement, and close learning gaps. In diagnostic support there is a mixed perception some found it moderately useful, and others rated it only slightly useful. This suggests uncertainty or lack of confidence in AI diagnostic role, possibly due to concerns about reliability, accuracy, or clinical integration. The majority of students rated virtual patient simulations as moderately useful. This suggests that students generally recognize the value of virtual patient simulations, particularly as a supportive learning tool for clinical training. However, the presence of lower ratings (19 students) indicates that these tools might limit the realism or effectiveness, pointing to a need for preparation of better simulation quality or better integration into the curriculum.

The potential barriers to curriculum development from the student perspectives could be gaps in accessibility, technical knowledge, and proper guidance. This must be addressed before AI-tools can be meaningfully integrated into teaching. Similar barriers such as knowledge, curriculum gaps, accessibility and time constraints were identified in Jordan study [34]. Besides, students expressed strong apprehension about data privacy, patient confidentiality, and the risk of AI misuse, indicating the need for ethical frameworks in any AI-integrated curriculum. The review article [38] has also clearly emphasized the importance of incorporating both technical and ethical competencies in developing curriculum for undergraduate medical education. Nevertheless, there are many drawbacks on entire dependence with AI and chatbots. The data provided to AI for its training [19] should be accurate; otherwise, it will affect the patient's diagnosis and treatment plan, potentially leading to unsafe decisions, as many users seems to use ChatGPT for self-diagnosis and health care [39].

Further, it may breach the patient confidentiality/autonomy leading to no trust because every input is stored by AI. Furthermore, AI-driven automation may create threat to job holders and chance of job displacement [17]. Ultimately, the rise of ethical concerns about AI give rise to regulatory and legal challenges, particularly regarding liability in the case of AI-related accidents or errors [40], and transparency. Hence, the some sort of AI-vigilance, alike to pharmacovigilance, holds principal importance in the medical field and may address some of the ethical issues raised due to use of AI.

The limitation of our study is that it was a cross-sectional survey conducted at a single institution and included only pre-clinical students. As a result, the perspectives of clinical students were not represented. Therefore, the views of clinical students who may have different experiences, expectations, or concerns regarding AI integration in medical education were not incorporated in this study. However, preclinical student views are still valuable. Capturing their early attitudes is important, as they may influence how students approach training, innovation, and eventual integration of AI in clinical practice. Their views therefore reflect the mindset of a new generation of learners who may anticipate faster and more innovative applications of AI, often drawing parallels with its use in other fields.

Future studies can be conducted across many institutions, including a broader range of student groups and consultants, with a particular focus on the role of AI in diagnostics for chronic and rare diseases, to provide a more comprehensive understanding.

CONCLUSION

Students have a moderate knowledge regarding AI, with greater familiarity in general applications than in medical contexts. While knowledge is still developing, their overall attitude toward integrating AI into medical education was predominantly cautious or negative. Concerns raised were data privacy, overdependence, reduced creativity, and lack of human oversight, indicating ethical awareness and practical concerns rather than mere resistance to change. Despite this, many students recognized the potential of AI to enhance learning and research, particularly in visualization, data analysis, and personalized education. However, they remained hesitant about its role in clinical purposes such as diagnosis, telemedicine, and virtual patient simulations. In daily practice, AI tools were more commonly used for entertainment, language learning, and general information, while usage for exam preparation or health consultation was limited. Students also identified key barriers to AI acceptance, including limited accessibility, lack of technical training, and inadequate guidance. These findings suggest the need for carefully regulated, context-specific integration of AI in medical education, with a focus on building capacity, addressing ethical concerns, and ensuring equitable access.

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