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Students' Perspectives and Experiences on Artificial Intelligence in Health Professions Education: A Qualitative Study

Background: As artificial intelligence (AI) becomes more integrated into healthcare and education, the health sciences education literature is said to be sparse regarding how undergraduate health sciences students perceive AI in medical education. The purpose of this research is to explore the perceptions, emotional reactions, and experiences of undergraduate students in a variety of health disciplines on the use of AI in medical education.

Method: A phenomenological study using semi-structured interviews was carried out with 16 students from seven health-related disciplines at Zanjan University of Medical Sciences. Data were analyzed by thematic analysis following the Braun and Clarke Framework.

Results: Five major themes and fifteen subthemes surfaced: 1) Conceptual Understanding and Cognitive Framing: students showed limited technical understanding and awareness of safety and ethical issues; 2) Emotional Landscape: students' emotions ranged from excitement to anxiety and ambiguity; 3) Patterns of Interaction: students frequently utilized AI tools for writing and learning, and there was clear evidence of ethical misuse in their responses; 4) Perceived Educational and Clinical Value: AI was seen by students as valuable when supporting research, supporting clinical decision making, and in telemedicine; 5) Ethical and Institutional Dimensions: these included loss of empathy, unclear boundaries of responsibility, and the need for formal curriculum integration.

Conclusion: Students are eager to adopt AI, but lack formal knowledge of its ethical and clinical implications. Curricular reforms should incorporate AI literacy, critical appraisal, and safe practice guidelines. Tailored, interdisciplinary education is essential to prepare future health professionals to work responsibly with AI.

Key Words: Medical education, Undergraduate, Artificial Intelligence, Health Occupations, Qualitative Research

وجهات نظر الطلاب وتجاربهم حول الذكاء الاصطناعي في تعليم المهن الصحية: دراسة نوعية

الخلفية: مع تزايد دمج الذكاء الاصطناعي (AI) في الرعاية الصحية والتعليم، يُقال إن أدبيات تعليم العلوم الصحية نادرة فيما يتعلق بكيفية إدراك طلاب العلوم الصحية الجامعيين للذكاء الاصطناعي في التعليم الطبي. الغرض من هذا البحث هو استكشاف تصورات وردود الفعل العاطفية وتجارب طلاب البكالوريوس في مجموعة متنوعة من التخصصات الصحية حول استخدام الذكاء الاصطناعي في التعليم الطبي. **الطريقة:** أجريت دراسة ظاهرية باستخدام مقابلات شبه منظمة مع ١٦ طالباً من سبعة تخصصات متعلقة بالصحة في جامعة زنجان للعلوم الطبية. وحلت البيانات من خلال التحليل الموضوعي وفقاً لإطار براون و كلارك.

النتائج: برزت خمسة محاور رئيسية وخمسة عشر محوراً فرعياً: (١) الفهم المفاهيمي والتأطير المعرفي: أظهر الطلاب فهماً تقنياً محدوداً ووعياً بقضايا السلامة والأخلاقيات؛ (٢) المشهد العاطفي: تراوحت مشاعر الطلاب بين الإثارة والقلق والغموض؛ (٣) أنماط التفاعل: استخدم الطلاب أدوات الذكاء الاصطناعي بشكل متكرر للكتابة والتعلم، وكان هناك دليل واضح على سوء الاستخدام الأخلاقي في ردودهم؛ (٤) القيمة التعليمية والسريية المتصورة: رأى الطلاب أن الذكاء الاصطناعي ذو قيمة في دعم البحث، ودعم اتخاذ القرارات السريية، وفي الطب عن بُعد؛ (٥) الأبعاد الأخلاقية والمؤسسية: شملت هذه الأبعاد فقدان التعاطف، وعدم وضوح حدود المسؤولية، والحاجة إلى دمج المناهج الدراسية الرسمية.

الخلاصة: يتطلع الطلاب إلى تبني الذكاء الاصطناعي، لكنهم يفتقرون إلى المعرفة الرسمية بأثاره الأخلاقية والسريية. ينبغي أن تتضمن إصلاحات المناهج الدراسية معرفة بالذكاء الاصطناعي، والتقييم النقدي، وإرشادات الممارسة الآمنة. يعد التعليم المصمم متعدد التخصصات أمراً ضرورياً لإعداد أخصائيي الصحة المستقبليين للعمل بمسؤولية مع الذكاء الاصطناعي.

الكلمات المفتاحية: التعليم الطبي، مرحلة البكالوريوس، الذكاء الاصطناعي، المهن الصحية، البحث النوعي

تبیین دیدگاه و تجارب دانشجویان در حیطه هوش مصنوعی در آموزش علوم پزشکی: یک مطالعه کیفی

زمینه و هدف: با گسترش روزافزون هوش مصنوعی در حوزه‌های سلامت و آموزش، شناخت دیدگاه‌ها و تجارب دانشجویان علوم پزشکی نسبت به این فناوری ضروری است. این مطالعه با هدف بررسی درک مفهومی، واکنش‌های عاطفی و تجربه عملی دانشجویان نسبت به استفاده از هوش مصنوعی در آموزش علوم پزشکی انجام شد.

روش: این مطالعه با رویکرد پدیدارشناسی و با استفاده از مصاحبه‌های نیمه‌ساختاریافته با ١٦ دانشجو از هفت رشته مرتبط با سلامت در دانشگاه علوم پزشکی زنجان انجام شد. داده‌ها با استفاده از روش تحلیل تماتیک و بر اساس چارچوب براون و کلارک تحلیل شدند.

یافته‌ها: تحلیل داده‌ها منجر به استخراج پنج مضمون اصلی و پانزده زیرمضمون شد: (١) درک مفهومی و شناختی: آگاهی محدود نسبت به مفاهیم فنی، اخلاقی و ایمنی؛ (٢) واکنش‌های عاطفی: از هیجان و امیدواری تا اضطراب و تردید؛ (٣) الگوهای تعامل: استفاده کاربردی در یادگیری، نگارش و پژوهش، همراه با مواردی از تخطی اخلاقی؛ (٤) ارزش ادراک‌شده آموزشی و بالینی: نقش مؤثر هوش مصنوعی در یادگیری شخصی‌سازی‌شده، پشتیبانی از تصمیم‌گیری بالینی و پزشکی از راه دور؛ (٥) ابعاد اخلاقی و نهادی: نگرانی از کاهش همدلی، نبود چارچوب‌های شفاف اخلاقی، و نیاز به ادغام ساختاری در کوریکولوم آموزشی.

نتیجه‌گیری: دانشجویان نگرشی مثبت و علاقمندانه به هوش مصنوعی دارند، اما با کمبود دانش رسمی در زمینه‌های اخلاقی، ایمنی و کارکردهای تخصصی مواجه‌اند. طراحی برنامه‌های آموزشی میان‌رشته‌ای، اخلاق محور و منطبق با نیازهای آینده حرفه‌ای برای آماده‌سازی دانش‌آموختگان علوم پزشکی در مواجهه با فناوری‌های نوین امری ضروری است.

واژه‌های کلیدی: آموزش پزشکی، مقطع کارشناسی، هوش مصنوعی، کارکنان سلامت، پژوهش کیفی

صحت کے پیشوں کی تعلیم میں مصنوعی ذہانت پر طلباء کے نقطہ نظر اور تجربات: ایک کوالیٹو اسٹڈی

پس منظر: جیسا کہ مصنوعی ذہانت (AI) صحت کی دیکھ بھال اور تعلیم میں مزید مربوط ہو جاتی ہے، صحت سائنس کی تعلیم کا لٹریچر اس حوالے سے بہت کم کہا جاتا ہے کہ انڈرگریجویٹ ہیلتھ سائنسز کے طلباء میڈیکل ایجوکیشن میں AI کو کس طرح سمجھتے ہیں۔ اس تحقیق کا مقصد طبی تعلیم میں AI کے استعمال سے متعلق صحت کے مختلف شعبوں میں انڈرگریجویٹ طلباء کے تاثرات، جذباتی ردعمل اور تجربات کو تلاش کرنا ہے۔

طریقہ: زنجان یونیورسٹی آف میڈیکل سائنسز میں صحت سے متعلق سات مضامین کے ١٦ طلباء کے ساتھ نیم ساختہ انٹرویوز کا استعمال کرتے ہوئے ایک غیر معمولی مطالعہ کیا گیا۔ براؤن اور کلارک فریم ورک کے بعد موضوعاتی تجزیہ کے ذریعے ڈیٹا کا تجزیہ کیا گیا۔

نتائج: پانچ بڑے تھیمز اور پندرہ ذیلی تھیمز منظر عام پر آئے: (١) تصوراتی تفہیم اور علمی فریمنگ: طلباء نے حفاظت اور اخلاقی مسائل کے بارے میں محدود تکنیکی سمجھ اور آگاہی ظاہر کی۔ (٢) جذباتی منظر: طلباء کے جذبات جوش و خروش سے لے کر اضطراب اور ابہام تک؛ (٣) تعامل کے نمونے: طلباء نے لکھنے اور سیکھنے کے لیے کثرت سے AI ٹولز کا استعمال کیا، اور ان کے جوابات میں اخلاقی غلط استعمال کا واضح ثبوت تھا۔ (٤) سمجھی گئی تعلیمی اور طبی قدر: AI کو طلباء نے تحقیق کی حمایت کرتے ہوئے، طبی فیصلہ سازی کی حمایت کرتے ہوئے، اور ٹیلی میڈیسن میں قیمتی سمجھا۔ (٥) اخلاقی اور ادارہ جاتی جہت: ان میں ہمدردی کا نقصان، ذمہ داری کی غیر واضح حدود، اور نصاب کے رسمی انضمام کی ضرورت شامل ہے۔

نتیجہ: طلباء AI کو اپنانے کے خواہشمند ہیں، لیکن اس کے اخلاقی اور طبی مضمرات کے بارے میں باضابطہ معلومات کی کمی ہے۔ نصابی اصلاحات میں AI خواندگی، تنقیدی تشخیص، اور محفوظ مشق کے رہنما خطوط کو شامل کرنا چاہیے۔ مستقبل میں صحت کے پیشہ ور افراد کو AI کے ساتھ ذمہ داری سے کام کرنے کے لیے تیار کرنے کے لیے موزوں، بین الضابطہ تعلیم ضروری ہے۔

کلیدی الفاظ: طبی تعلیم، انڈرگریجویٹ، مصنوعی ذہانت، صحت کے پیشے، کوالیٹو ریسرچ

INTRODUCTION

Over the past decade, artificial intelligence (AI) has undergone rapid advancement, driven by unprecedented increases in computing power, and the vast availability of digital data (1). At its core, AI refers to the capability of machines to perform cognitive functions such as speech and image recognition, pattern detection, language generation, and decision-making (2). These capabilities have positioned AI as a central force not only in clinical medicine, but across the entire continuum of health sciences in the redesigning of tools, practices, and education (3, 4). AI technologies are already changing the way healthcare is delivered in clinical settings (4, 5). Machine learning algorithms are matching or exceeding human specialists' abilities in complex medical diagnosis (6). For example, AI has matched radiologists in detecting breast cancer, and dermatological diagnostic systems accuracy matched that of a board certified dermatologist (7, 8). Furthermore, AI tools have been applied to risk stratification, personalized treatment planning, and error analysis in electronic health records, each made contribution to improving patient safety (1). AI technology has also introduced a 4P model of medicine - predictive, preventive, personalized, participatory, which has also expanded patient choice and involvement in their care directions (4). AI is causing a revolution, and this influence is not solely confined to the clinical world; it is also changing how the next generation of health professionals are educated and trained (9). AI technologies are offering significantly enhanced learning opportunities for all areas of health professions education through personalized and interactive learning opportunities. AI technologies can assess how students are performing, provide a more tailored assessment and feedback experience, and change the pacing and course of instruction based on the learner's learning trajectory (10). Intelligent tutoring systems, virtual patients, chatbots, and augmented reality applications are not "coming next year" - they are being used right now to transform how we educate future health professionals (11, 12). These tools do much more than provide information - they can provide a simulation of clinical reasoning and communication skills to promote adaptive problem-solving. For example, based on how students interact with fellow virtual patients, the AI can assess diagnostic reasoning, procedural accuracy, or even bedside manner (13). Natural language processing tools can support history-taking simulations, while image-recognition systems help students interpret radiological or histological slides. Moreover, these systems help bridge the persistent gap between theoretical knowledge and clinical practice, a longstanding challenge in health sciences education (11).

Nevertheless, the implementation of AI in education is not without resistance. Several barriers hinder its widespread adoption: the lack of digital literacy, concerns over privacy, and ethical data use, unequal access to technological infrastructure, and fears of diminishing physician roles (1, 14, 15). Many educators feel anxious about being replaced or competed against by AI tools that are able to produce immediate answers for students potentially undermining the academic authority (10). There is also rising worry that students aren't always employing their creativity, critical thinking, and interpersonal communication skills if they rely too much on AI work (16, 17). Beyond institutional and pedagogical concerns, unresolved legal and ethical questions also persist, particularly regarding liability when AI recommendations are adopted—or disregarded—in both clinical and educational decisions (15, 18, 19).

Despite these complexities, there is a strong consensus that AI will not replace human professionals, but rather augment their capabilities (20). To ensure the ethical and effective integration of AI in the health sciences education, it is imperative to understand the perspectives of students, who are both primary users of these tools and future health professionals. However, current evidence, particularly in developing contexts, is limited. Few qualitative studies have captured students' real experiences, expectations, and concerns about AI in their education. This study will address that gap by investigating the experiences and perceptions of students from a variety of health disciplines regarding the use of AI in their education. The results are anticipated to influence program design, faculty training, and institutional policies that respond to students' changing needs in an AI-focused educational environment.

METHODS

This study used a qualitative research design with a phenomenological orientation to better understand the perceptions, experiences, and expectations of health sciences students in regard to the use of AI. A qualitative approach was suitable for the study because it allows for deeper explorations of the lived experiences and subjective understandings of participants, which is fundamental to accurately interpreting the multifaceted meanings of AI in educational contexts.

Participants were recruited from multiple disciplines of health sciences at Zanjan University of Medical Sciences. We used purposive sampling to achieve purposeful maximum variation in terms of gender, level of study, and field of study. The inclusion criteria were being an enrolled undergraduate who has been studying in a health field for at least a year. Students who were unwilling to participate, and students with less than

one-year enrollment in the university were excluded. Sixteen students participated in the study and this number is consistent with qualitative recommendations that sample adequacy is achieved when data saturation takes place (21).

Data were collected through semi-structured interviews, conducted via face-to-face meetings, or through a video conferencing platform. The interview guide was developed based on a review of the literature on AI in education, focusing on perceived usefulness, barriers to integration, ethics, and expectations.

The interview guide was developed after a comprehensive review of the literature on artificial intelligence in medical education and was designed to explore students' perceptions, experiences, and attitudes toward AI. The guide contained open-ended questions organized around six key domains: (1) general background and initial awareness of AI, (2) sources of knowledge and prior exposure, (3) personal and educational experiences with AI tools, (4) perceived opportunities and challenges of AI integration, (5) future expectations and readiness for curricular adoption, and (6) ethical and professional implications of AI use in education. Examples of guiding questions included: "Have you ever encountered AI-based tools in your medical education? How was your experience?", "What opportunities or challenges do you think AI creates in medical education?", and "Do you believe formal training in AI should be integrated into the curriculum? Why or why not?" Probing questions were also used to clarify responses and encourage deeper reflection. The open format allowed participants to share their personal experiences and perspectives, while the structured domains ensured consistency across interviews.

The interviews were audio-recorded with the participant's consent, and the interviews lasted between 30 to 60 minutes. All recorded interviews were transcribed verbatim, which also included anonymizing all interviews. Thematic analysis was used as the primary method of data interpretation, following the six-phase framework which Braun and Clarke (2006) developed (22). This flexible yet rigorous method enables the identification, organization, and interpretation of patterns of meaning (themes) within qualitative data. The steps included:

1. Familiarization: All transcripts were read multiple times to achieve immersion.
2. Generating initial codes: A line-by-line coding process was conducted using an inductive approach. Codes were manually created and applied across the dataset.
3. Searching for themes: Codes were clustered into potential themes based on conceptual similarity.
4. Reviewing themes: Emerging themes were reviewed for coherence and consistency, and non-representative or overlapping themes were

redefined or merged.

5. Defining and naming themes: Each theme was clearly defined and supported by illustrative quotations.

6. Producing the report: A thematic map was developed, and findings were integrated into the results section with interpretative commentary.

To strengthen the trustworthiness of the study, several strategies were employed. First, the semi-structured interview guide was reviewed by two specialists in medical education and qualitative research, and then piloted with two students outside the main sample to ensure questions were clear and relevant. Consistency was maintained by using the same guide across all interviews, while still allowing flexibility for follow-up questions when needed. Credibility was supported through member checking, where participants reviewed key findings to confirm accuracy. The analysis process also included peer debriefing with two qualitative experts, who provided critical feedback to refine interpretations and reduce potential bias. A detailed audit trail documented every step of data collection and analysis, and triangulation was achieved by including students from different disciplines and academic years. To promote transferability, the study setting, participants, and procedures were described in depth. Reflexivity was addressed through memo-writing, allowing the researchers to reflect on their own perspectives and how these might shape interpretation.

All study procedures were conducted in accordance with ethical guidelines for qualitative research. Informed consent was obtained from all participants, and the study received approval from the university ethics committee.

Ethical standards were maintained through data anonymization, declaration of conflicts of interest,

RESULTS

The study engaged 16 undergraduate students from diverse health science disciplines at Zanjan University of Medical Sciences. Participants included six medical students, four pharmacy students, two midwifery students, one dentistry student, one public health student, one occupational health and safety engineering student, and one nutrition student. Participants who took part in this study ranged in age from 20 to 26 years, with academic semesters varying between 3rd and 10th. This diversity allowed the study to explore a wide range of perceptions regarding AI across clinical, theoretical, and applied aspects of health education. Thematic analysis showed five major themes and several subthemes related to students' understanding, emotional responses, practical experiences, perceived opportunities, and concerns surrounding the application of AI in medical education. Table 1 presents the extracted themes and subthemes.

Table 1. Thematic Analysis: Students' Experiences and Perspectives on AI in Medical Education	
Main Theme	Subthemes
1. Conceptual Understanding and Cognitive Framing	1.1 Surface-Level Familiarity
	1.2 Information Sources and Disciplinary Variance
	1.3 Knowledge Deficit in Safety, ethics, and Regulation
2. Emotional Landscape and Attitudinal Orientation	2.1 Enthusiasm and Anticipated Benefit
	2.2 Anxiety, Threat Perception, and Professional Identity
	2.3 Emotional Ambivalence and Cognitive Dissonance
3. Patterns of Interaction and Application	3.1 Pragmatic Academic Use
	3.2 Academic Misconduct and Ethical Blurring
	3.3 Passive vs. Active Engagement
4. Perceived Educational and Clinical Value	4.1 Personalized Learning and Knowledge Consolidation
	4.2 Research and Writing Support
	4.3 Clinical Decision Support and Diagnostic Assistance
	4.4 Telemedicine and Remote Patient Monitoring
5. Ethical, Cultural, and Institutional Dimensions	5.1 Ethical Uncertainty and Moral Responsibility
	5.2 Cultural and Humanistic Tensions
	5.3 Privacy and Bias
	5.4 Institutional Support and Curriculum Reform

Theme 1: Conceptual Understanding and Cognitive Framing of AI

This theme captured how students mentally conceptualized AI, their sources of information, and the extent to which their understanding is grounded in accurate, domain-relevant knowledge.

1.1: Surface-Level Familiarity

Most students described AI in generic terms, such as "machines that think like humans" or "smart assistants," often based on the interactions with consumer technologies like virtual assistants, chatbots, or social media algorithms. Their understanding was largely intuitive and lacked depth regarding technical components such as machine learning, data training, or algorithmic modeling. This reflects a superficial, popularized framing of AI rather than a scientific one.

1.2: Information Sources and Disciplinary Variance

The majority of students reported gaining knowledge of AI via informal, non-academic channels, particularly social media, and peer discussions. Very few referenced structured courses. Furthermore, pharmacy and public health students were slightly more likely to cite scholarly resources, while medical and midwifery students leaned more on anecdotal exposure, possibly in terms of heavier curricular loads.

1.3: Knowledge Deficit in Safety, Ethics, and Regulation

While students generally felt comfortable discussing what AI can do, virtually none demonstrated an understanding of how AI systems can fail, what safeguards exist, or what professional responsibilities accompany AI use. When asked for

opinions on the risks of AI in clinical contexts, many were neither certain nor able to take responsibility, pointing out the "engineers" or "the system." This indicates a fundamental gap in safety and risk literacy that is concerning for future healthcare providers' preparedness for introducing AI.

Theme 2: Emotional Landscape and Attitudinal Orientation

This theme explored the affective responses and attitudinal orientations of students toward AI, encompassing curiosity, hope, skepticism, and fear.

2.1: Enthusiasm and Anticipated Benefit

A significant number of students displayed enthusiasm and wonderment about AI, considering it a transformative technology that could customize personalized learning, simplify complicated content, and democratize access to high quality education. AI was described as an "on-demand tutor" to improve educational equity in poorly funded contexts.

"It is going to be like science fiction movies in the future!"

2.2: Anxiety, Threat Perception, and Professional Identity

At the same time, many study participants expressed concern, stemming primarily from fears about AI rendering people obsolete in health care. The concern was expressed that overuse of AI could diminish the care aspects of empathy, clinical intuition, and human interaction. For some individuals, the fear was existential: AI represented a threat to the viability of their profession.

2.3: Emotional Ambivalence and Cognitive Dissonance

Multiple participants expressed contradictory feelings at the same time—they reported feelings of optimism about the ability of AI to accomplish tasks efficiently, but fear of the ethical implications (agency, accountability, etc.) of it. This ambivalence was more pronounced for senior students who felt overwhelmed with the current workload they were being asked to manage and were apprehensive about exploring new technologies (even though they acknowledged them as useful), demonstrating a general tension between new technology and the increased educational burden.

Theme 3: Patterns of Interaction and Application of AI Tools

This theme focused how students actually engaged with AI in their academic and personal lives, including types of tools used, motivations, and ethical boundaries.

3.1: Pragmatic Academic Use

Many students had discovered AI through informal means, such as social media, conversations with peers, or their own trial and error exercises using some level of AI tool, notably ChatGPT. Their engagement with AI was primarily characterized by some level of exploration, which illustrated how students were engaging with the technology at their own initiative in often unstructured ways. Specifically, students used the tools to streamline writing assignments, distill difficult material, and create summaries in short periods of time. The students typically viewed these tools as productivity tools rather than replacements for original thought. Students liked the productivity but they were mindful of the accuracy.

3.2: Academic Misconduct and Ethical Blurring

One of the most important and enlightening things discussed in the meeting was a student who admitted that they had used AI to complete several academic assignments and had also cheated on a test - an act against academic integrity. Others admitted to using AI for idea generation or text editing without clearly understanding where legitimate assistance ends and plagiarism begins. This indicates a fuzzy ethical landscape with a clear need for defined academic protocols and training around assumptions and ethics around AI.

“AI helped me rewrite research articles, understand difficult books, and even cheat in one exam!”

Interestingly, one student reported being penalized for presumed AI use despite completing the assignment independently; the student explained that their submission received a low grade because the instructor assumed it had been AI-generated, as it appeared more polished than peers’ work. This incident reflects the complexity of enforcing academic integrity in the AI era, where assumptions about tool usage may unintentionally lead to unfair assessment practices.

3.3: Passive vs. Active Engagement

Some students engaged with AI tools in a passive way (e.g., following the advice given by a chatbot), while very few went on to explore features like prompting, editing, and synthesis. Generally, the depth of engagement with the tool was connected to either academic seniority or being involved in a research project, but even amongst the advanced users, understanding of AI’s mechanisms was limited.

Theme 4: Perceived Educational and Clinical Value of AI

This theme encompassed students’ perceptions of how AI could enhance both educational practices and clinical care, particularly in areas of decision-making and accessibility.

4.1: Personalized Learning and Knowledge Consolidation

AI was easily seen as a possibility for personalizing learning. Students liked the fact that AI could tailor their explanations to their level, rephrase difficult subjects, and give students immediate feedback, things they missed in the traditional didactic education.

“To me, AI is a virtual assistant that simplifies our work. It’s like having someone ready 24/7 to help.”

4.2: Research and Writing Support

Participants often reported they were using AI for grammar checking, citation managing, abstract writing, and literature searching. They believed these features could help to alleviate cognitive and time burdens when writing academically. Concerns were raised by some students about the pedagogical implications of using AI in the long term, with concerns that prolonged use could limit the development of their independent writing skills.

“I always used to spend hours fixing grammar in my essays. Now I paste it into the AI and get suggestions in seconds — it’s a lifesaver.”

4.3: Clinical Decision Support and Diagnostic Assistance

Most students viewed AI as a valuable second-opinion tool for diagnostics purposes, especially since junior clinicians are still developing their diagnostic reasoning. They cited specific examples such as in radiology with AI-assisted reports, drug-interaction alerts with interactions, symptom-checking algorithms that produced reasonable suggestions during busy hours or when they were unsure how to evaluate a case. AI was thus framed as a cognitive extender - standby - but not a substitute for, their clinical judgement. Although students indicated they would value these types of tools when providing care to patients, they also acknowledged that it will require training to avoid exclusively relying on the tools seeing them as valid stand-alone. Interestingly, while students were excited by these tools, many also recognized the need for training to be able to interpret and use AI implications in practice - again realizing that blindly trusting a system or automated process

could be dangerous.

“If we always rely on AI to make decisions, maybe we’ll forget how to think critically ourselves.”

4.4: Telemedicine and Remote Patient Monitoring

There was specific recognition of the value of AI in telehealth from students particularly concerned with public health and medicine. This was especially clear in terms of the management of chronic disease, care for elderly clients, and palliative care. Learning of AI-capable remote monitoring seemed like a good affordable and available option to support within marginalized or rural populations.

Theme 5: Ethical, Cultural, and Institutional Dimensions of AI Integration

This theme explored students' concerns and reflections regarding the broader implications of AI for education, ethics, and institutional readiness.

5.1: Ethical Uncertainty and Moral Responsibility

Students raised tricky questions about accountability, consent, and algorithm transparency. They questioned who would be liable for any harm or misinformation from AI systems, thinking through the situation involved if the AI “erodes” moral responsibility in medical decision-making.

“AI responded confidently, but when I double-checked, it was completely wrong. That’s dangerous if you rely on it blindly.”

5.2: Cultural and Humanistic Tensions

The perceived mechanization of education also raised cultural concerns. Some students expressed concern that reliance on AI would reduce the humanistic and relational attributes central to medical education, such as empathy, intuition, and patient-centered communication.

“AI can teach you facts, but it doesn’t help you build relationships with patients.”

“Learning medicine isn’t just about data — it’s about patient emotions too. AI lacks that.”

5.3: Privacy and Bias

Concerns related to ethical issues such as data privacy, algorithmic bias, and transparency were also cited. For example, some students expressed uneasiness about AI system models using sensitive patient data without consent for training. Others mentioned biases that could occur if AI systems were trained on insignificant datasets and unrepresentative data.

“If AI is trained on limited data, it could make biased decisions that affect patient care.”

5.4: Institutional Support and Curriculum Reform

While students valued the AI workshops run by Zanjan University of Medical Sciences, some expressed the need for thoughtful instructional planning for curricular integration. They desired fully required and for-credit courses rather than

voluntary workshops. As is the case with learning any tool, students want to learn not only how to use AI, but also when it is appropriate to use it, why it is appropriate to use it, and how to do so in an ethical and critical manner. However, they also acknowledged the constraints of overloaded curricula and emphasized the importance of gradual, thoughtful implementation.

DISCUSSION

This qualitative study explored the perceptions, experiences, and attitudes of undergraduate health sciences students regarding the integration of AI in the medical education. The findings showed a dynamic interplay between curiosity, limited conceptual understanding, ethical ambiguity, and a strong demand for curricular integration. Participants expressed mixed emotions, ranging from excitement and optimism to anxiety and uncertainty, particularly concerning the potential misuse of AI and its impact on professional responsibilities. Overall, these themes highlight both the promise and the challenges of AI adoption in medical education. These themes resonate with and expand upon those identified in recent international literature (23, 24).

One of the most striking findings was the superficial level of AI understanding among participants. While students were familiar with AI in popular terms, such as chatbots, language models, or smart diagnostic tools—they largely lacked a robust grasp of technical concepts like algorithmic bias, data validation, transparency, or regulatory frameworks. This pattern aligns with studies where students reported high interest and a low base of knowledge in AI. A systematic review by Mousavi et al. reinforced this trend, as most students had low knowledge and limited skills in working with AI, revealing a worldwide educational gap (24).

In addition to limited awareness, ethical ambiguity in AI usage emerged as a salient theme. While many students used AI tools to improve their writing, summarize lectures, or assist in research, some admitted to using it in ways that could be classified as academic misconduct. One student explicitly stated they had used AI to cheat in an exam, a finding mirrored in recent reports from universities around the world, where institutions have begun to revise academic integrity policies in response to the rise of generative AI (25). The boundary between assistance and academic dishonesty remains blurred in students’ minds, suggesting the need for clearer institutional guidelines and ethics training (26).

Despite these concerns, students overwhelmingly viewed AI as a transformative tool in education and clinical practice. The applications, such as intelligent tutoring systems, virtual simulations, diagnostic support, and telemedicine were all cited as valuable. These findings were consistent with

literature showing that AI has the potential to enhance personalized learning, promote engagement, and reduce the cognitive burden on students (27-29). However, most participants still regarded these tools as supplemental rather than substitutive.

An intriguing paradox we found, was the presence of enthusiasm, and overburden. We found that almost all participants were in favor of formal education about AI, though some medical students were feeling so overwhelmed by their core curriculum, they couldn't engage with new and emerging technologies. This finding is consistent with the results of Ma et al. (2023), who suggest that AI content must be embedded into existing modules (e.g., ethics, medical informatics), rather than forcing AI content as separate additional work (30). More flexible and interdisciplinary approaches may help to mitigate the resistance, and provide a way to embed digital literacy within the healthcare domains (31).

LIMITATIONS

This study was limited by its single-institution scope and relatively small sample size, which may affect generalizability. Additionally, self-reported data may be subject to social desirability bias. Despite efforts to ensure diversity, participants' views may not fully represent all health disciplines or educational contexts.

CONCLUSION

These findings collectively present evidence for the emerging consensus that AI is not a fad, but a paradigm shift in healthcare and medical education. AI concepts have to become part of core curricula

in medical education and health sciences curricula with attention to foundational literacy, ethics, bias awareness and safe use of AI. Students should be exposed to real-world scenarios of AI error, bias, and accountability, to encourage critical engagement. Institutions should develop clear policies about acceptable use of AI, as well as training in distinguishing between legitimate enablement by AI versus academic dishonesty. Educators also need to be prepared to support students in learning in an AI-enhanced environment, through training and collaborative curriculum development approaches.

Ethical Considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. Interviews were conducted after the participants were informed about the purpose of the study and signed informed consent. Participants were also assured that data would remain confidential and anonymous. This study was approved by the Ethics Committee of Zanjan University of Medical Sciences.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to all the students at Zanjan University of Medical Sciences who generously shared their time, insights, and experiences during the interviews.

Financial Support: This research was supported by Zanjan University of Medical Sciences, Zanjan, Iran (Research Project Code: 1391).

Conflict of Interest: None declared.

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