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Research Article

Ethical Concerns Surrounding the Use of Artificial Intelligence in Medical Education: Insights from Dental Faculty at Rawal Dental College, Islamabad

Ayesha Arshad[1*], Bilqees Fatima[2], Moneezhay Jaffer[3], Adeela Awan[4], Badar Akram[5], Rida Haque[6]
[1*]BDS, MHPE, Demonstrator, Department of Oral Biology, Rawal Institute of Health Sciences, Islamabad, Pakistan.
[2]MBBS, DCH, MHPE, Women Medical Officer, Department of Paediatrics Medicine, Bahawal Victoria Hospital, Bahawalpur, Pakistan.
[3]BDS, CHPE, MHPE, Assistant Professor, Department of Health Professions Education, Islamabad Medical and Dental College (IMDC), Barakahu, Islamabad, Pakistan.
[4]BDS, MPH, CHPE, MHPE (Scholar), Assistant Professor, Department of Community Dentistry, Rawal Institute of Health Sciences, Islamabad, Pakistan.
[5]MBBS, MHPE, Assistant Professor, Department of Health Professions Education, Islamabad Medical and Dental College (IMDC), Barakahu, Islamabad, Pakistan.
[6]BDS, MPH, Assistant Professor, Department of Community Dentistry, Rawal Institute of Health Sciences, Islamabad, Pakistan.
Corresponding Author: Ayesha Arshad
BDS, MHPE, Demonstrator, Department of Oral Biology, Rawal Institute of Health Sciences, Islamabad, Pakistan.
Email: Ayesha.waqas13@yahoo.com
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ABSTRACT
This study explores the perceptions of dental faculty members at Rawal Dental College, Islamabad, regarding the judicious and ethical use of Artificial Intelligence (AI) in medical education. With the increasing integration of AI into academic and clinical settings, its potential to enhance learning, improve diagnostic accuracy, and streamline administrative processes is widely acknowledged. However, its adoption also raises important ethical concerns that warrant careful consideration.
A qualitative phenomenological design was employed to explore the lived experiences and views of faculty members with exposure to AI in educational contexts. Ten participants were selected through purposive sampling and engaged in semi-structured interviews until data saturation was achieved. Data were analyzed using Braun and Clarke's thematic analysis approach to identify key patterns within the narratives.
The findings revealed a balanced perception of AI among faculty, recognizing its educational benefits while simultaneously expressing significant ethical concerns. Key issues included data privacy and confidentiality, algorithmic bias, unequal access to AI tools, lack of institutional policies, and limited awareness of ethical guidelines. Participants also emphasized the need for transparency in AI systems and clear accountability mechanisms to ensure trust in academic and clinical decision-making.
The study highlights the necessity for institutional frameworks, structured ethical training, and faculty development programs to support the responsible integration of AI in dental education. Such measures are essential to ensure that AI serves as an educational aid while upholding professional integrity and ethical standards.

Keywords: Artificial Intelligence, Medical Education, Ethics, Faculty Perceptions, Dental Education, Qualitative Research.

INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming healthcare and medical education by improving efficiency, decision-making, and learning outcomes. In dental education, AI has emerged as a powerful tool for personalized learning, clinical simulation, and administrative support systems.1,2 However, alongside these advancements, concerns regarding ethical use, transparency, and accountability have become increasingly prominent.3,4

Ethical challenges associated with AI include algorithmic bias, lack of explainability, and risks to data privacy.5,6 These concerns are particularly important in healthcare education, where clinical decisions and professional training directly influence patient safety and future practice standards.4,7 The European

Commission and AI ethics frameworks emphasize that trustworthy AI must ensure fairness, accountability, and human oversight.5.8

In addition to technical advancement, AI significantly impacts the human dimension of education. While it can assist faculty in reducing workload and improving teaching efficiency, it cannot replace empathy, contextual judgment, and human reasoning.9 Maintaining balance between automation and human oversight is therefore essential in medical and dental education.10

Despite the increasing global adoption of AI in education and healthcare, there is still limited understanding of faculty perceptions regarding its ethical implications, particularly in developing countries. Faculty attitudes are crucial as they directly influence curriculum delivery and professional development of future healthcare practitioners.11,12

Therefore, this study aims to explore dental faculty perceptions regarding the ethical and judicious use of AI in dental education at Rawal Dental College, Islamabad, focusing on ethical concerns, awareness of guidelines, and responsible integration of AI in academic practice.

METHODOLOGY

Research Design: This study adopted a qualitative phenomenological research design to explore dental faculty perceptions regarding the ethical use of Artificial Intelligence (AI) in dental education. Phenomenology is used to understand lived experiences and subjective interpretations of participants regarding a specific phenomenon. This approach allows in-depth exploration of ethical concerns, attitudes, and institutional challenges associated with AI integration in academic settings.

Study Setting and Population: The study was conducted at Rawal Dental College, Islamabad. The target population included dental faculty members involved in undergraduate and postgraduate teaching. Faculty members were selected due to their direct engagement in teaching, assessment, and clinical supervision, where AI-based tools are increasingly being introduced.

Sampling Technique and Sample Size: A purposive sampling technique was used to recruit participants with relevant exposure or awareness of AI in dental education. Ten faculty members were selected for semi-structured interviews. Data collection continued until thematic saturation was achieved, where no new themes emerged from additional interviews.

Data Collection: Data were collected through semi-structured, face-to-face interviews conducted within the college setting. Each interview lasted approximately 30–45 minutes. An interview guide was used to ensure consistency while allowing flexibility for participants to express their perspectives in depth. Informed consent was obtained from all participants prior to data collection. Interviews were audio-recorded and transcribed verbatim to ensure accuracy.

Data Analysis: Data were analyzed using Braun and Clarke's thematic analysis approach, which involves systematic identification, coding, and development of themes from qualitative data. This method allows for interpretation of patterns within participants' narratives regarding ethical concerns, institutional barriers, and perceptions of AI use in education.

Ethical Considerations: Ethical principles such as confidentiality, anonymity, and voluntary participation were strictly followed. Participants were informed about the study purpose and their right to withdraw at any stage without consequences. Ethical AI concerns such as privacy and responsible data use were also considered during interpretation of findings, aligning with global AI ethics frameworks.

RESULTS

Thematic analysis of interviews with dental faculty identified five interrelated themes concerning the use of artificial intelligence (AI) in dental education and clinical practice: (1) Integration of AI in Clinical and Academic Settings, (2) Perceived Benefits of AI, (3) Challenges and Barriers to AI Implementation, (4) Ethical Concerns, and (5) Awareness and Need for Training. The findings reflected a dual perspective: faculty recognized the expanding utility of AI across clinical, educational, and scholarly activities, while also identifying challenges related to implementation, ethical governance, institutional preparedness, and training.

Theme 1: Integration of AI in Clinical and Academic Settings

Faculty described AI as increasingly incorporated into both clinical practice and academic activities. Clinical applications included radiographic interpretation, diagnostic support, digital impressions, smile design, and treatment planning, whereas academic applications included quiz generation, student performance analysis, content creation, and virtual simulations. Dr. 3 (Oral Pathology) described using AI for *"quiz creation and student performance data analysis"* as well as *"radiographic image interpretation."* Similarly, Dr. 9 (Prosthodontics) reported using AI for *"digital impressions, smile design, and precision diagnostics."* AI was also used to support teaching through virtual simulations and treatment planning.

The range of applications identified by participants is summarized in Table 1.

Table 1. Integration of AI in Clinical and Academic Settings

Subtheme	Faculty/Department	Illustrative quote
AI in diagnostics	Dr. 3, Oral Pathology	"Currently I am using AI tools … for diagnostics like radiographic interpretation."
AI in prosthetic design	Dr. 9, Prosthodontics	"In my clinical work, AI aids in digital impressions, smile design, and diagnostic planning for precision."
AI in teaching simulations	Dr. 10, Orthodontics	"I integrate AI through virtual simulations in teaching and use it for precise digital impressions and treatment planning."
Academic content creation	Dr. 6, Dental Materials	"Whenever I have limited time to prepare, I quickly get an overview of topics through AI and deliver that to my class."

These findings indicate that AI was being used as an adjunct to existing clinical and educational practices, rather than being confined to a single application.

Theme 2: Perceived Benefits of AI

Faculty perceived AI as beneficial in terms of diagnostic support, time efficiency, research advancement, and personalized learning. Participants described AI as facilitating access to information, simplifying academic tasks, and supporting more efficient clinical activities. Dr. 6 (Dental Materials) emphasized that AI *"saves time and makes concepts easier to grasp,"* while also highlighting its potential to facilitate the detection of caries and other abnormalities. Dr. 4 (Operative Dentistry) emphasized its contribution to keeping faculty informed about developments in scientific research, stating that AI *"keeps us up to date with recent developments and scientific advancements."*

Table 2. Perceived Benefits of AI

Subtheme	Faculty/Department	Illustrative quote
Diagnostic support	Dr. 6, Dental Materials	"AI … will make detecting caries and different abnormalities much faster and easier."
Time efficiency	Dr. 6, Dental Materials	"AI saves time and makes concepts easier to grasp."
Research advancement	Dr. 4, Operative Dentistry	"AI keeps us up to date with recent developments and scientific advancements."
Personalized learning	Dr. 1, Periodontology	"Faculty might use AI-powered software to develop personalized study recommendations for students."

The findings further suggest that faculty perceived AI as having potential to support individualized learning and scholarly activities, in addition to improving efficiency in routine tasks.

Theme 3: Challenges and Barriers to AI Implementation

Despite recognizing AI's potential, participants identified several barriers to implementation, including technical challenges, resistance to change, over-reliance on technology, and inadequate infrastructure. Dr. 5 (Dental

Materials) described both technical and organizational difficulties, noting that "*There are technical issues at times, and adopting new technology can be time-consuming,"* and that *"Some staff and students are resistant to change."* Concerns about excessive dependence on technology and data privacy were also expressed.

Table 3. Challenges and Barriers to AI Implementation

Subtheme	Faculty/Department	Illustrative quote
Technical challenges	Dr. 5, Dental Materials	"There are technical issues at times, and adopting new technology can be time-consuming."
Resistance to change	Dr. 5, Dental Materials	"Some staff and students are resistant to change."
Over-reliance on technology	Dr. 7, Community Dentistry	"We are concerned about data privacy as the whole thing is overly aligned on technology."
Lack of infrastructure	Dr. 1, Periodontology	"The integration of AI tools requires proper infrastructure, which is not always available."

Collectively, these accounts indicate that AI implementation was perceived as requiring not only technological access but also institutional readiness, infrastructure, and willingness to adapt.

Theme 4: Ethical Concerns

Ethical concerns constituted a distinct theme and included data privacy, algorithmic bias, academic integrity, originality of work, and potential misuse of AI in learning. Faculty expressed concern regarding the confidentiality of patient and student data and the possibility that poorly validated AI systems could produce biased or inaccurate outcomes.

Dr. 8 (Oral Medicine) identified *"data privacy, algorithmic bias, and the potential for AI to exacerbate healthcare disparities"* as key concerns. Academic integrity was also highlighted by Dr. 2 (Prosthodontics), who identified *"student data privacy, bias, and authenticity of work"* as ethical concerns. Participants further expressed concern that excessive dependence on AI could affect students' independent critical thinking and decision-making.

Table 4. Ethical Concerns Regarding AI

Subtheme	Faculty/Department	Illustrative quote
Data privacy	Dr. 8, Oral Medicine	"Data privacy, algorithmic bias, and the potential for AI to exacerbate healthcare disparities are some concerns."
Academic integrity	Dr. 2, Prosthodontics	"My AI ethics concerns include student data privacy, bias, and authenticity of work."
Algorithmic bias	Dr. 7, Community Dentistry	"The over-reliance on technology could lead to biased or inaccurate outcomes if AI systems are not properly validated."
Misuse of AI in learning	Dr. 1, Periodontology	"Students might depend too much on AI tools, which could impact their independent critical thinking and decision-making skills."

Thus, faculty perspectives reflected the need to balance the potential benefits of AI with privacy protection, fairness, academic integrity, and appropriate human oversight.

Theme 5: Awareness and Need for Training

The final theme concerned institutional support, structured training, hands-on exposure, and curriculum integration. Faculty emphasized that effective AI adoption depended not simply on access to AI tools but also on the capacity of faculty and students to use them appropriately. Dr. 9 (Prosthodontics) emphasized the importance of *"policies, training, and working with AI professionals"* to facilitate effective and ethically acceptable implementation. Similarly, Dr. 1 (Periodontology) stressed that *"Proper training is necessary to ensure that AI tools are not misused and underutilized."*

Table 5. Awareness and Need for Training

Subtheme	Faculty/Department	Illustrative quote
Institutional support	Dr. 1, Periodontology	"Faculty should follow institutional guidelines and encourage discussions on ethical AI applications."
Structured training	Dr. 9, Prosthodontics	"By implementing policies and providing training, AI's ethical use can be ensured."
Hands-on exposure	Dr. 6, Dental Materials	"AI is helpful but only if people know how to use it practically. Training is essential for meaningful adoption."
Curriculum integration	Dr. 10, Orthodontics	"Future dental programs should include AI modules so students are prepared for evolving technologies."

Participants therefore advocated formal training, practical exposure, institutional guidance, and curriculum-level integration to enhance awareness and support responsible AI adoption.

Overall synthesis of findings: Across the five themes, faculty described AI as an emerging and increasingly integrated component of dental education and clinical practice. Its perceived value was linked to efficiency, diagnostic support, access to information, personalized learning, and academic productivity. However, these benefits were accompanied by concerns regarding technical readiness, infrastructure, resistance to change, privacy, algorithmic bias, academic integrity, and inappropriate reliance on AI. The findings consistently highlighted training, institutional policies, practical exposure, and curriculum integration as important considerations for responsible implementation of AI in dental education and practice.

DISCUSSION

The findings of this study demonstrate that dental faculty perceive Artificial Intelligence (AI) as a valuable tool for improving diagnostic accuracy, clinical efficiency, and educational innovation. These findings are consistent with literature highlighting AI's growing role in healthcare transformation and dental education.13,14

However, participants emphasized that AI should function as an assistive tool rather than replacing human judgment. This aligns with human-centric AI frameworks that promote augmentation rather than substitution of human intelligence.15 Faculty concerns regarding maintaining clinical reasoning and professional oversight are consistent with studies emphasizing safe integration of AI in healthcare education.4,15

A major finding of this study is strong ethical concern surrounding AI adoption. Participants highlighted issues such as data privacy, algorithmic bias, and lack of transparency. These concerns are strongly supported by previous research identifying ethical risks including discrimination, opacity, and misuse of data in AI systems.5,6,4 Ethical principles such as fairness, accountability, and transparency remain central to trustworthy AI deployment.7,5

Academic integrity was another important concern. Faculty members expressed that over-reliance on AI tools may weaken students' independent learning and critical thinking abilities. Similar concerns have been reported in studies on generative AI in education, which highlight risks related to originality, dependency, and academic misconduct.11,12

The study also identified infrastructural and institutional barriers to AI adoption, including lack of training, limited resources, and resistance to change. These findings align with evidence suggesting that successful AI integration depends on institutional readiness, technical infrastructure, and faculty development programs.16,17 In resource-limited settings, these barriers become more significant.

Despite these challenges, participants acknowledged the educational benefits of AI, particularly in personalized learning, simulation-based teaching, and improved student engagement. Similar findings have been reported in literature demonstrating that AI enhances adaptive learning and educational efficiency.10,9 However, concerns were raised that excessive reliance on AI may reduce hands-on clinical training and weaken traditional teacher–student interaction.

A key contribution of this study is the emphasis on ethical governance. Faculty members stressed the importance of transparency, accountability, and fairness in AI systems. These concerns align with established ethical frameworks for trustworthy AI, which emphasize human oversight and responsible

implementation.16

Finally, the study highlights a significant gap in AI literacy among faculty members. Participants emphasized the need for structured training programs and curriculum integration to ensure responsible AI use. This aligns with global evidence indicating that AI literacy remains limited among healthcare professionals and requires targeted capacity-building strategies.11,18

Overall, the findings suggest that while AI is widely perceived as beneficial in dental education, its adoption is strongly shaped by ethical concerns, institutional readiness, and faculty preparedness. Responsible and regulated implementation is essential to ensure safe integration into academic and clinical practice

STRENGTHS AND LIMITATIONS

Strengths: The phenomenological design enabled an in-depth exploration of faculty perspectives, while purposive sampling and semi-structured interviews provided rich, context-specific insights. Data saturation and systematic thematic analysis further strengthened the credibility of the findings.

Limitations: The study was conducted at a single dental institution with only ten faculty participants, which may limit the transferability of the findings. The study also relied on self-reported perceptions and included faculty perspectives only; therefore, students and other relevant stakeholders were not represented.

CONCLUSION

This study demonstrates that dental faculty perceive artificial intelligence (AI) as a valuable adjunct to dental education and clinical practice, particularly for diagnostic support, teaching efficiency, personalized learning, research, and academic productivity; however, these benefits are accompanied by important ethical concerns related to data privacy and confidentiality, algorithmic bias, academic integrity, over-reliance on technology, transparency, and preservation of human judgment. The findings indicate that responsible AI integration requires more than access to technology and should be supported by institutional preparedness, adequate infrastructure, clear ethical policies, structured AI literacy and ethics training, and appropriate human oversight. A human-centred approach is therefore essential, whereby AI augments rather than replaces professional judgment, critical thinking, and teacher–student interaction. Dental institutions should consider integrating AI-related competencies and ethical principles into faculty development and dental curricula to promote responsible adoption. Further multi-institutional research involving faculty, students, and other stakeholders is warranted to develop contextually appropriate frameworks for ethical AI integration in dental education.

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