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Original Article

Exploring Dental Students' and Educators' Perspectives on AI in Education: A Questionnaire Study-Based Review.

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Running Title : Artificial Intelligence in Dental Training

Abstract

Background: Artificial Intelligence (AI) for generative purposes, specifically ChatGPT, has been gradually shaping dental education by supplementing learning, smoothing research, and improving diagnostic insights. Meanwhile, the extent of AI assimilation and knowledge, the benefits perceived, and the ethical concerns among educational stakeholders in dentistry still require thorough review. This study aims to evaluate the perceptions and attitudes of dental practitioners and students toward AI tools in dental education.

Methods: This study employed a structured, pre-validated questionnaire comprising 37 closed- and open-ended questions, administered to 384 respondents across several dental institutions. The survey assessed demographic data, AI awareness, perception of its utility, experience in implementation, ethics, and practical issues. Descriptive data are summarised to identify critical trends and inform inferential interpretations.

Results: Most respondents (66.5%) had used AI tools in dental education, with 65.2% moderately familiar. Over 73% of respondents supported formal AI training programs, with ChatGPT primarily used for literature reviews (59%), exam preparation (34%), and case simulations (22%). While 88.6% found AI useful, only 28.6% fully trusted it for clinical decisions. Concerns included reduced hands-on training (11.7%), over-reliance (10.2%), and ethical issues (7%). Despite this, 76.9% were likely to recommend AI tools.

Conclusion: AI tools like ChatGPT are rapidly entering dental education, offering potential to enhance learning and research. However, ethical, pedagogical, and clinical boundaries remain unclear. The survey highlights the urgent need for institutional AI policies, formal training, and evidence-based guidelines. Further studies should assess the long-term impact of AI on clinical competence and cognitive development in dentistry.

Keywords: Artificial Intelligence (AI), Dental Education, ChatGPT, Critical Thinking, Clinical Training, Educational Technology, Digital Dentistry, AI Literacy, Self-directed Learning, Dental Curriculum.

INTRODUCTION

Artificial Intelligence is rapidly transforming dental education by simulating human cognition in the processes of teaching and meeting academic needs in health-related disciplines[1]. Diagnostic assistance, patient simulation, data mining, and generative tools such as ChatGPT for academic writing, literature reviews, and topic summarisation are just some of the tools that foster interactive and inquiry-based learning [2,3,4]. The studies demonstrated that AI efficiently made biomedical content more accessible, especially in oral pathology, radiology, and treatment planning, thereby reducing cognitive load [5,6,7]. Personalised learning paths supported by AI promote engagement and retention through adaptive platforms corresponding to competency-based education [8,9]. However, its critics raise concerns about overdependence on AI, contradictory thinking skills, diminishing faculty-student mentorship, plagiarism, bias, and ethical dilemmas in assessment [10, 11, 12, 13]. Such a lack of institutional policies becomes a hindrance when it comes to implementing them, as many institutions do not have a formal policy in place[14]. Moreover, uncertainty about the theoretical basis and ethical limitations of AI among existing dental professionals often leads to an uncritical acceptance of AI outputs [15]. As a result of the rapid emergence of AI in education, a systematic appraisal of perceptions, attitudes, and practices is necessary to identify the opportunities, concerns, and ethical ambiguities that will inform AI literacy initiatives, institutional policies, and the development of curricula in dental education.

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METHODS

Study Design and Setting

This study employed a quantitative, cross-sectional, multicenter design based on a survey. It aimed to determine the perceptions, attitudes, and practices regarding the use of Artificial Intelligence tools in dental education. Cross-sectional surveys are often used in healthcare education research to capture a snapshot in time, detailing the current perspectives and behaviours of a defined population. This approach is particularly relevant for exploratory studies in emerging technologies, such as AI [16].

Data were gathered from various institutes accredited across India to incorporate the diversity of demography and academics in the participant sample. Such a multicenter methodology increases generalizability and external validity by including variations related to levels of pedagogical and technological exposure [17].

Ethical Considerations

Followed the guidelines of the Declaration of Helsinki when the study was undertaken. It was entirely voluntary, anonymous, and based on informed consent. Data privacy and confidentiality of participants were maintained to the fullest, in compliance with the guidelines of the General Data Protection Regulation (GDPR) for research involving digital data [18]. The Institutional Ethical Committee King George's Medical University approved the study before its initiation [XXXVI PGTSC IIA/P7]

Survey Instrument Development

An online questionnaire that allowed for self-administration was designed through Google Forms. The instrument was developed following a comprehensive literature review on the applications of AI in health and dental education [19,20]. The 37 questions in the survey were divided into five thematic areas:

1. Demographics (age, gender, academic role, number of years in teaching).
2. Perception about AI Tools (such as ChatGPT or similar platforms).
3. Attitudes (usefulness considered, trust of AI content).
4. Practices (e.g., literature review, clinical simulation).
5. Ethical and Practical Concerns (over-reliance on AI, ethical grading, policies on AI).

The questionnaire included a mixture of Likert scales (1-5), multiple-choice options, and check-all-that-apply categories, along with two open-ended responses to gather qualitative insights.

The questionnaire's content validity was assured by subjecting it to scrutiny by five experts in dental education, educational technology, and bioethics. After receiving feedback from the experts, the questionnaire was revised to enhance clarity, relevance, and comprehensiveness.

A total of twenty subjects, whose data were not included in the final analysis, were in the pilot to test the internal consistency of the questionnaire. The result was a Cronbach's alpha of 0.84, suggesting that the questionnaire is very reliable [21].

Participant Recruitment and Sampling

The population here constituted Dental Educators, postgraduates, and undergraduates from five dental colleges:

- Actively engaged in dental education (teaching/studying);
- Aged ≥18 years;
- Possessing elementary digital literacy skills (mostly the ability to interact with online forms).

The sampling technique chosen was convenience sampling, which tends to induce selection bias. Still, due to the risk associated with conducting early exploratory research, this method is often employed in educational studies [22].

A total of 384 valid questionnaires were ultimately retrieved. However, the sample size is slightly less than the minimum requirement for a population proportion study at 95% confidence and a 5% margin of error (n = 385 for an infinite population) [32].

Data Collection Procedure

Participants were invited through institutional mail, student WhatsApp groups, and professional dental forums. The form stayed available for response for about 21 days. A mandatory consent checkbox preceded the survey questions to ensure ethical participation.

This was to prevent a single IP from submitting multiple times, thereby avoiding possible duplication. No personal identifiers were accepted for this purpose beyond the email ID (on an optional basis), which was used only for validation.

Data Management and Analysis

All responses were exported to Microsoft Excel and SPSS 2.0 Software (IBM Corporation, Armonk, New York, USA).

Descriptive statistics were calculated for all variables, including frequency, percentage, and mean. Central tendencies and dispersion were used to analyse the Likert scale responses, while cross-tabulations enabled the differentiation of subgroups such as faculty and students. Open-ended responses were analysed through thematic analysis, employing inductive coding to identify recurring themes and insights [24]. Data completeness was also verified, and listwise deletion was applied to cases with incomplete data.

Instrument Strengths and Limitations

The study benefits include its multicentric performance, a well-structured and pre-validated survey tool, and a reasonable response rate. Some of the limitations of the study include the use of non-random sampling, which restricts the generalizability of the findings. In addition, the reliance on self-

reported data introduces the possibility of social desirability bias. Furthermore, the absence of longitudinal data limits the ability to analyse evolving perceptions or assess the long-term educational impacts of AI. Nonetheless, despite these limitations, the study's findings provide valid insights into the current state of AI usage and acceptance in dental academia.

RESULTS

Demographics and General Profile of Respondents

A total of 384 participants completed the survey (100% response) Most were young professionals, with 51.6% aged 25–34 and 37.2% aged 18–24. Females formed the majority (66.1%). Undergraduates (41.4%) and postgraduates (31.5%) dominated, while 14.8% were faculty and 12.2% others; 65.9% had 0–2 years of teaching experience. Regarding AI familiarity, 65.6% were "somewhat familiar" and 25.5% "very familiar," while only 8.1% were unfamiliar and 0.8% had never used AI tools. About 65.9% had used ChatGPT or similar platforms, with most rating their understanding of AI in education as moderate (Table 1).

- 38% rated themselves as "3" (moderate)
- 26.8% rated "2" (low to moderate)
- 16.4% rated "4" (high)
- 13% rated "1" (low)
- Only 5.7% considered their knowledge to be very high (5)

This data suggests a knowledge gap between use and understanding, highlighting a potential area for curricular improvement (Table 1).

Perceived Usefulness of AI Tools

When the usefulness of AI tools in dental education was scored:

- 34.4 percent with a "4" (legally high usefulness)
- 24.7 percent were marked as "3" (moderate)
- 21.4 percent gave a "5" (greater usefulness)
- Lower ratings were distributed in small amounts, with 10.2 percent in score "1" and 10.2 percent in score "2"

This implies a strongly positive attitude toward the utility of AI, with almost 80% of respondents considering it to be medium to high in usefulness (Table 1).

The Integration of Attitudes in AI in Dental Education

The majority (67.9%) of respondents preferred AI as a complement to, rather than a substitute for, conventional teaching, and thus were in favour of hybrid learning. In contrast, AI was not widely trusted for clinical decision-making, with only 7.3% stating their confidence was very high; the majority of respondents rated their trust as moderate (52.6%) or low (19.3%), indicating that AI was somewhat cautiously relied upon in treatment planning (Table 1).

Table 1. Knowledge, Attitudes, and Practices Towards AI in Dental Education.

S.No	Category	Variable / Indicator	Findings
1.	Perception & Familiarity	Familiarity with AI tools	Somewhat familiar: 65.6%; Very familiar: 25.5%; Unfamiliar: 8.1%; Never used: 0.8%
		Used AI tools (e.g., ChatGPT)	65.9% reported usage
		Self-rated AI understanding (1–5 scale)	1: 13%; 2: 26.8%; 3: 38%; 4: 16.4%; 5: 5.7%
2.	Usefulness	Usefulness rating (1–5 scale)	1: 10.2%; 2: 10.2%; 3: 24.7%; 4: 34.4%; 5: 21.4%
3.	Attitudes	AI should complement not replace teaching	67.9% agree/strongly agree; 2.3% disagree
		Trust in AI for treatment decisions	Very high (5): 7.3%; Moderate (3): 52.6%; Low (2): 19.3%
4.	Ethical Awareness & Policy	Awareness of institutional AI policies	Yes: 26.3%; No: 50.8%; Uncertain: 22.9%
		Ethical perception of AI in grading	Highly ethical: 10.7%; Moderately ethical: 56.5%; Unethical: 22.9%
5.	Use Cases of AI	Common applications	Literature review: 59%; Exam prep: 34%; Case simulations: 22%; Clinical decision-making; Anatomy/Physiology explanations
		Simplifying complex topics	72.9% said ChatGPT often/always helped
		Fostering autonomous learning	Agree: 55.7%; Strongly agree: 14.1%
6.	Concerns	Major concerns	Loss of hands-on training: 11.7%; Over-dependence: 10.2%; Ethical risks: 6.8%
		AI reduces critical thinking	Agree: 53.9%; Strongly agree: 24.7%
		AI reduces mentorship	50.5% agreed

7.	Support & Future Adoption	Likelihood of recommending AI tools	Very likely: 22.1%; Somewhat likely: 64.8%; Unlikely/ very unlikely: 13.3%
		Support for AI training in curriculum	74.7% agreed formal training needed
		Support for compulsory AI literacy	Agree: 56%; Strongly agree: 15.1%
		Transparency preference (AI-labeling)	Insist on clear labeling: 37%; Maybe: 60.2%
8.	Responsibility for AI errors	Accountability views	Shared responsibility (developers, educators, students, regulators): 31.5%; Developers only: 9.9%; Educators: 10.1%; Regulators: 10.2%
9.	Overall Impact & Satisfaction	Perceived impact of AI in dentistry	Moderate: 35.2%; Significantly positive: 22.9%; Negative: 1.6%
		Satisfaction with AI tools	Moderately satisfied: 53.9%; Highly satisfied: 22.7%; Dissatisfied: 3.1%

Ethical Awareness and Institutional Preparedness

The findings reveal a significant policy gap in AI regulation among institutions, with only 26.3 per cent of respondents indicating awareness of the policy and more than half stating that there was none. Another engagement with ethical issues was that only 10.7% rated the AI grading as highly moral, a majority of 56.5% said it was moderately ethical, and 22.9% placed it at the opposite end of the scale, saying it was unethical, which raises questions about fairness and transparency. The participants, nevertheless, mentioned several legitimate purposes of ChatGPT, the foremost among them being literature review, exam preparation, and patient case simulation (Table 1).

Use Cases and Utility Perception

Participants identified numerous areas where ChatGPT and similar tools proved beneficial:

- Literature reviews (most reported use case; 59%)
- Exam preparation
- Patient case simulations
- Clinical decision-making
- Anatomy/Physiology explanations

Alongside that, respondents cited concerns about the inadequacy of Internet-extracted information and distrust in this kind of knowledge (38.6%). The study also shows that 34.3% of respondents cite time constraints in accessing dental materials, while 64.3% experienced difficulty finding knowledge from the Internet. Also, 55.7% and 14.1% of the respondents strongly agree and agree that ChatGPT supports autonomous learning, indicating that a shift is occurring toward self-directed learning through AI assistance (Table 1).

Concerns and Negative Perceptions

The majority of AI in dental education concerns are cited to be:

- Lack of hands-on training (11.7%)
- Over-dependence on technology (10.2%)
- Ethical risks (6.8%)
- Bias in AI outputs (often co-listed)

The majority of respondents (53.9% agreed and 24.7% strongly agreed) felt that AI could reduce students' critical thinking by fostering over-dependence. Additionally, 17.7% highlighted concerns such as reduced engagement, technical issues, and weakened faculty-student relationships. Half of the participants (50.5%) also believed that AI might erode the mentorship role of faculty, positioning it as a potential rival to traditional academic guidance (Table 1).

Support and Future Adoption

Respondents generally held a constructive attitude toward the AI tools in dental education. Regarding ChatGPT, 86.9% would endorse its use (64.8% somewhat likely, 22.1% very likely). There was also endorsement for formal training in AI by 74.7% of participants, and 71% advocated that AI literacy be made compulsory (56% agreed, 15.1% strongly agreed). The respondents further emphasised transparency-the fact that 37% wanted AI-generated content to be explicitly marked, whereas 60.2% were in moderate support of the marking, shows the accountability therein concerning the utilisation of AI (**Table 1**).

Responsibility for AI-Related Errors and Oversight

More than 31% of respondents said that responsibility for AI-generated errors should be shared among developers, educators, students, and regulators. The smaller groups felt that one entity alone should bear it-the developer (9.9%), the educator (10.1%), or the regulator (10.2%). This implies a strong preference for a shared governance and ethical model by multiple stakeholders in the AI integration into education (**Table 1**).

Overall Impact and Satisfaction

When asked to rate the overall impact of AI in dentistry:

- 35.2% rated it "moderate"
- 22.9% considered it "significantly positive"
- Only 1.6% believed AI had worsened learning outcomes

On satisfaction with AI tools

- 53.9% were moderately satisfied
- 22.7% rated their satisfaction as high
- Only 3.1% expressed dissatisfaction.

These results affirm that the majority of the respondents view AI as an asset, albeit with caveats and critical implementation demands (**Table 1**).

Table 2. Summary of Key Metrics

S.No	Metric	Value
1.	Sample Size	384
2.	AI Users	66.5%
3.	Familiar with AI	90.7%
4.	Believe AI Should Support (Not Replace) Traditional Teaching	67.9%
5.	Believe AI Promotes Self-learning	69.8%
6.	Believe AI Could Reduce Critical Thinking	78.6%
7.	Believe AI Reduces Mentorship	50.5%
8.	Support AI Literacy Training	71.1%
9.	Satisfied or Very Satisfied with AI Tools	84.1%
10.	Recommend AI Tools to Peers	85.6%

DISCUSSION

The study, numbering 384 participants across the strata of dental academia, sets a strong baseline of perception, attitudes, and practices about AI tools such as ChatGPT. It underscores the global momentum of AI adoption in education, along with its potential for transformation and challenges in clinical teaching .

1. Rising Awareness and Adoption of Artificial Intelligence in Dental Education. AI tools like ChatGPT are widely used for academic purposes. A majority is somewhat familiar with them, accounting for 65.2%, and 25.5% being extremely familiar. These trends reflect that AI is becoming increasingly acknowledged in higher education as a tool for enhancing competencies, quick knowledge acquisition, and self-learning. In dental education, this means AI is approached at a research level, not resisted.
2. Perceived Usefulness and Functional Utility of AI Most of the respondents viewed AI as being extremely useful in dental education, especially for literature searches, with about 59%, exam preparation (34%), and case simulation (22%), as well as for simplifying complex topics, such as radiology and pathology. Yet another 76% of respondents considered AI to be good for learning. In comparison, only 28.6% were very confident about the clinical decision-making ability of AI, indicating scepticism toward AI replacing human judgment. Altogether, AI is generally considered a good supplementary tool for theoretical learning, but not a substitute for clinical expertise.
3. Ethical, Pedagogical, and Institutional Concerns The paragraph describes AI and other issues. Such issues include the loss of skills and hands-on training (11.7%), over-reliance on technology (10.2%), and ethical risks (7%). More than half worry that AI could diminish critical thinking skills along with faculty mentoring, thereby damaging reflective learning and enhanced clinical maturity. Another concern is the existing policy gap: almost 50% believe there are no policies regarding AI in their institutions, and roughly one-third see that ethical guidelines are being formulated, leading to uncertainty and risks for misuse and fairness issues like grading and plagiarism.
4. Dependency vs. Empowerment: The Paradox of AI in learning. The paragraph portrays a paradox concerning AI in dental education: AI promotes self-learning, yet at the same time fosters cognitive dependence. About 78.1% of the respondents feared the danger of over-reliance on AI, which could be detrimental to critical thinking, problem-solving, and inquiry-based learning. Moreover, hands-on training, interacting with patients,

and clinical improvisation can never be replaced by AI. According to more than one-third of the respondents, there was a feeling that AI may partially replace practical training, hence further emphasising the need to clearly establish AI as an adjunct and not as a replacement.

5. Training, Regulation, and Future Readiness. This could be taken as an indicator that 36.7% of the participants strongly supported making AI literacy programs a formal policy, thereby establishing the institution's stance on recognising AI educational programs. They also suggested that there should be well-structured and science-based training programs and regulations, and that the responsibility of errors arising from AI-generated content should lie among developers, trainers, learners, and regulators. Further, 60% of the respondents wanted AI-generated content to be classified under clear guidelines to maintain transparency, academic integrity, and credibility, especially with the possibility of generators giving out erroneous information or putting it out of context.
6. The Path Forward: Balancing Innovation with Caution. Both paragraphs address the issue that while AI has enormous potential in democratizing learning, encouraging curiosity, and making education more accessible, it might be used maliciously through uncritical acceptance. Such unmindful use of AI in dental education would lead to dehumanisation, over-dependence on it, and the reinforcement of bias. Therefore, a cautious balance needs to be struck between innovation and control. In short, this model involves a reasonable compromise: some routine tasks are performed by AI, with human faculty available for mentorship, critical appraisal, and ethical oversight. Three key pillars need to be worked upon by institutions: (1) introducing AI literacy into the curriculum; (2) developing strong ethical and legal policies; and (3) investing in AI platforms that meet the standards for dental education.

CONCLUSION

The study highlights a shifting paradigm in dental education, with 66.5% of individuals already utilising AI tools, primarily ChatGPT, which supports adoption but also raises concerns about the ethical and pedagogical implications for pharmacological competence, particularly in the faculty's ability to teach critical thinking and mentor students. Almost half of the respondents are unsure of any institutional policies, whereas 73.4% reported a need for formal AI literacy training and the development of an ethical framework. The paper emphasises that AI should be complementary, not a substitute for, traditional pedagogy, and calls for educators, developers, and regulators to work together to enable integration in the safest, most transparent, and most effective way. Ultimately, it is a matter of preparedness and governance to incorporate AI into dental education, ensuring that future professionals remain technologically competent, critically aware, and ethically grounded.

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