THE ROLE OF ARTIFICIAL INTELLIGENCE IN DENTAL EDUCATION: EVALUATING STUDENT PERCEPTION

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ABSTRACT

Aim of study : The aim of the study was to compare the use of artificial intelligence among preclinical and clinical-year medical students Material and methods : A total of 142 students enrolled in Years I–VI at the Faculty of Dental Medicine of Dimitrie Cantemir University participated in this study. Data were collected using a questionnaire consisting of 15 questions, of which 13 were closed-ended questions with predefined answers and 2 were open-ended questions. Statistical analyses were performed using IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA). Differences between sexes were assessed using the Mann–Whitney U test for ordinal variables and Pearson's chi-square test for categorical variables. Results : Most students (87.3%) reported previous use of artificial intelligence (AI) tools for academic activities. The most frequently reported purposes were summarizing scientific articles (71.1%) and explaining medical concepts (57.0%), while research (69.0%) was the most commonly identified area in which AI could be useful. Several differences were observed according to sex. Female students reported a different perceived contribution of AI to understanding dental concepts compared with male students (p=0.032) and were more likely to report previous academic use of AI (100.0% vs. 82.7%, p=0.014). Conclusions : Overall, AI use was common among the surveyed dental students, although patterns of use and selected perceptions varied according to sex and year of study. Differences across study years did not follow a consistent linear pattern.

Key words : artificial intelligence, students, dental medicine, ethical cosideration

INTRODUCTION

Artificial intelligence (AI) represents one of the most important directions in the development of contemporary medicine, with the potential to significantly transform the way diseases are prevented, diagnosed, and treated. Dentistry is a particularly suitable field for the integration of these technologies due to the frequent use of radiographic imaging, the availability of measurable clinical criteria, the development of digital workflows, and the need for treatment individualization.

In a landmark review , (Schwendicke et all.,2020) highlighted the potential of deep learning to transform several aspects of dental care, particularly image analysis, risk assessment, and treatment planning . Subsequently, the scientific literature has shown that AI applications have expanded beyond radiology to include periodontology, orthodontics, implantology, endodontics, prosthodontics, and preventive dentistry (Vashisht et all , 2024).

By integrating images, intraoral scans, clinical data, and digital models, AI can support the evaluation of therapeutic options, the simulation of outcomes, and the planning of complex treatments. The generated recommendations must be tailored to the comprehensive diagnosis and the patient's objectives (Schwendicke et all , 2019).

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Dental radiology is one of the fields in which artificial intelligence has the greatest number of practical applications. The main applications include the detection of carious lesions, the identification of periapical lesions, the assessment of alveolar bone levels, the analysis of dental anatomy, and the analysis of CBCT images (Schwendicke et all. , 2020).

In endodontics, AI can play a role in identifying root canals, analyzing the morphology of the endodontic system, detecting periapical lesions, and predicting treatment outcomes.

A comprehensive review examined the clinical applications of AI, data preparation, ethical considerations, and limitations in endodontics (Mohammad-Rahimi et all, 2024).

In implantology, combining CBCT with intraoral scans and digital models enables the creation of three-dimensional representations of the region of interest. AI can contribute to bone and anatomical structure segmentation, measurements, and virtual planning of implant positioning (Abdulrahman ,2025).

In prosthodontics, AI is integrated into CAD/CAM (computer-aided design/computer-aided manufacturing) workflows, where it can automate or facilitate certain stages of restoration design.

Applications include the design of crowns and other restorations, the suggestion of tooth shapes, scan segmentation, the identification of occlusal contacts, and the optimization of certain digital manufacturing processes (Al Hendi , 2025).

Given its wide applicability across all dental specialties and the continuous advances it has undergone in recent years, we were interested in understanding the extent to which our students use this tool in their daily studies and in preparing assignments and scientific articles, as well as their views on the ethical implications of its use.

MATERIAL AND METHODS

A total of 142 students enrolled in Years I–VI at the Faculty of Dental Medicine of Dimitrie Cantemir University participated in this study. Data were collected using a questionnaire consisting of 15 questions, of which 13 were closed-ended questions with predefined answers and 2 were open-ended questions. Statistical analyses were performed using IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA). Differences between sexes were assessed using the Mann–Whitney U test for ordinal variables and Pearson's chi-square test for categorical variables.

Comparisons across years of study were performed using the Kruskal–Wallis test and Pearson's chi-square test, as appropriate. Cramér's V was used to estimate effect size for categorical comparisons. For significant overall differences across study years, post-hoc pairwise comparisons were performed using Dunn's test for ordinal variables and exact tests for categorical variables, with Holm correction for multiple comparisons. A two-sided p-value <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Among the 142 students included in the analysis, 73.2% were male and 26.8% were female, with participants distributed across all six years of study. Most students (87.3%) reported previous use of artificial intelligence (AI) tools for academic activities. The most frequently reported

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purposes were summarizing scientific articles (71.1%) and explaining medical concepts (57.0%), while research (69.0%) was the most commonly identified area in which AI could be useful. Approximately half of the participants considered that AI contributed moderately to their understanding of dental concepts (48.6%), while 41.5% reported that it helped much or very much. More than half (52.8%) considered the use of AI for academic assignments acceptable when disclosed, whereas 40.1% regarded it as ethically questionable or unethical. Regarding broader attitudes toward AI, 34.5% believed that it could facilitate academic plagiarism, 49.3% expected AI to become important in dental diagnosis, and 68.3% supported the inclusion of courses addressing the ethical use of AI in dentistry (Table 1).

Table 1. Characteristics of the study population and patterns of artificial intelligence use among dental students (N = 142**)**

Variable	n (%)
Year of study	
Year I	30 (21.1)
Year II	22 (15.5)
Year III	26 (18.3)
Year IV	23 (16.2)
Year V	16 (11.3)
Year VI	25 (17.6)
Sex	
Female	38 (26.8)
Male	104 (73.2)
Previous use of AI tools for academic activities	
Yes	124 (87.3)
No	18 (12.7)
Frequency of AI use for studying (Likert scale 1–5)	
1	18 (12.7)
2	8 (5.6)
3	43 (30.3)
4	11 (7.7)
5	59 (41.5)
Purposes of AI use*	
Summarizing scientific articles	101 (71.1)
Explaining medical concepts	81 (57.0)
Clinical simulations	38 (26.8)
Exam preparation	38 (26.8)
Writing academic assignments	33 (23.2)
Other purposes	17 (12.0)
Perceived contribution of AI to understanding dental concepts	
Not at all	3 (2.1)
A little	11 (7.7)
Moderately	69 (48.6)
Much	53 (37.3)
Very much	6 (4.2)
Perception of AI use for writing academic assignments	
Completely acceptable	10 (7.0)

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Acceptable if disclosed	75 (52.8)
Ethically questionable	50 (35.2)
Unethical	7 (4.9)
AI may facilitate academic plagiarism	
Yes	49 (34.5)
No	20 (14.1)
Do not know	73 (51.4)
Universities should establish clear rules regarding AI use	
Yes	50 (35.2)
No	27 (19.0)
Do not know	65 (45.8)
AI will become important in dental diagnosis	
Yes	70 (49.3)
No	34 (23.9)
Do not know	38 (26.8)
Potential areas of AI usefulness*	
Research	98 (69.0)
Clinical education	50 (35.2)
Radiographic analysis	43 (30.3)
Treatment planning	39 (27.5)
Diagnosis	27 (19.0)
Concern regarding AI use in medical practice	
Not at all	22 (15.6)
A little	32 (22.7)
Moderately	71 (50.4)
Much	12 (8.5)
Very much	4 (2.8)
University should include courses on the ethical use of AI in dentistry	
Yes	97 (68.3)
No	15 (10.6)
Do not know	30 (21.1)

Data are presented as n (%). *Multiple responses were permitted; percentages therefore do not sum to 100%. †Valid n=141.

Several differences were observed according to sex. Female students reported a different perceived contribution of AI to understanding dental concepts compared with male students (p=0.032) and were more likely to report previous academic use of AI (100.0% vs. 82.7%, p=0.014). Sex differences were also observed in attitudes toward the use of AI for academic assignments (p=0.019) and toward the inclusion of university courses on ethical AI use (p=0.043). Regarding specific applications, female students more frequently reported using AI to explain medical concepts (78.9% vs. 49.0%, p=0.003) and to write academic assignments (36.8% vs. 18.3%, p=0.036), and more frequently identified research as a potential area of AI usefulness (84.2% vs. 63.5%, p=0.031) (Table 2).

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Table 2. Comparison of AI use, perceptions, and attitudes according to sex

Variable	Female (n=38)	Male (n=104)	p-value	Effect size†
Frequency of AI use for studying, median [IQR]	3.0 [3.0–5.0]	4.0 [3.0–5.0]	0.816	—
Perceived contribution of AI to understanding dental concepts, median [IQR]	3.0 [2.0–3.0]	2.0 [2.0–3.0]	**0.032**	—
Concern regarding AI use in medical practice, median [IQR]	2.0 [1.0–2.0]	2.0 [1.0–2.0]	0.083	—
Previous use of AI for academic activities			**0.014**	0.206
Yes	38 (100.0)	86 (82.7)		
No	0 (0.0)	18 (17.3)		
Perception of AI use for writing academic assignments			**0.019**	0.264
Completely acceptable	5 (13.2)	5 (4.8)		
Acceptable if disclosed	25 (65.8)	50 (48.1)		
Ethically questionable	8 (21.1)	42 (40.4)		
Unethical	0 (0.0)	7 (6.7)		
AI may facilitate academic plagiarism			0.697	0.071
Yes	11 (28.9)	38 (36.5)		
No	6 (15.8)	14 (13.5)		
Do not know	21 (55.3)	52 (50.0)		
Universities should establish clear rules regarding AI use			0.660	0.077
Yes	15 (39.5)	35 (33.7)		
No	8 (21.1)	19 (18.3)		
Do not know	15 (39.5)	50 (48.1)		
AI will become important in dental diagnosis			0.331	0.125
Yes	15 (39.5)	55 (52.9)		
No	10 (26.3)	24 (23.1)		
Do not know	13 (34.2)	25 (24.0)		
University should include courses on ethical AI use			**0.043**	0.211
Yes	24 (63.2)	73 (70.2)		
No	8 (21.1)	7 (6.7)		
Do not know	6 (15.8)	24 (23.1)		
Purposes of AI use*				
Explaining medical concepts	30 (78.9)	51 (49.0)	**0.003**	0.251
Summarizing scientific articles	31 (81.6)	70 (67.3)	0.146	0.122
Writing academic assignments	14 (36.8)	19 (18.3)	**0.036**	0.176
Exam preparation	11 (28.9)	27 (26.0)	0.887	0.012
Clinical simulations	8 (21.1)	30 (28.8)	0.475	0.060
Other purposes	4 (10.5)	13 (12.5)	0.977	0.002
Potential areas of AI usefulness*				
Research	32 (84.2)	66 (63.5)	**0.031**	0.181
Clinical education	16 (42.1)	34 (32.7)	0.400	0.071
Radiographic analysis	13 (34.2)	30 (28.8)	0.682	0.034
Treatment planning	11 (28.9)	28 (26.9)	0.979	0.002
Diagnosis	8 (21.1)	19 (18.3)	0.894	0.011

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Data are presented as n (%) or median [IQR], as appropriate. *Multiple responses were permitted. †Cramér's V. Bold values indicate p<0.05.

AI-related behaviors and perceptions also differed across years of study. Significant overall differences were observed for the frequency of AI use (p=0.011), its perceived contribution to understanding dental concepts (p=0.013), previous academic use of AI (p<0.001), perceptions regarding the potential of AI to facilitate plagiarism (p<0.001), use of AI for explaining medical concepts (p<0.001), and use of AI for summarizing scientific articles (p=0.006) (Table 3).

Table 3. Comparison of AI use and perceptions according to year of study

Variable	Year I (n=30)	Year II (n=22)	Year III (n=26)	Year IV (n=23)	Year V (n=16)	Year VI (n=25)	p-value
Frequency of AI use, median [IQR]	4.0 [3.0–5.0]	4.5 [3.0–5.0]	3.0 [2.2–4.8]	5.0 [3.0–5.0]	5.0 [3.8–5.0]	3.0 [1.0–4.0]	**0.011**
AI helps understanding of dental concepts, median [IQR]	3.0 [2.0–3.0]	3.0 [2.0–3.0]	2.0 [2.0–3.0]	2.0 [2.0–3.0]	2.0 [2.0–3.0]	2.0 [2.0–2.0]	**0.013**
Concern regarding AI use, median [IQR]	2.0 [0.2–2.0]	2.0 [1.0–2.0]	2.0 [1.0–2.0]	2.0 [1.0–2.0]	2.0 [1.0–2.0]	2.0 [1.0–2.0]	0.855
Previous AI use – Yes	28 (93.3)	22 (100.0)	23 (88.5)	22 (95.7)	14 (87.5)	15 (60.0)	**<0.001**
AI may facilitate plagiarism – Yes	5 (16.7)	4 (18.2)	15 (57.7)	6 (26.1)	3 (18.8)	16 (64.0)	**<0.001**
Universities should establish clear AI rules – Yes	12 (40.0)	12 (54.5)	8 (30.8)	3 (13.0)	2 (12.5)	13 (52.0)	0.060
AI will become important in dental diagnosis – Yes	13 (43.3)	13 (59.1)	12 (46.2)	10 (43.5)	7 (43.8)	15 (60.0)	0.806
University should include courses on ethical AI use – Yes	23 (76.7)	17 (77.3)	17 (65.4)	12 (52.2)	9 (56.2)	19 (76.0)	0.104
Purposes of AI use*							
Explaining medical concepts	23 (76.7)	14 (63.6)	17 (65.4)	7 (30.4)	13 (81.2)	7 (28.0)	**<0.001**
Summarizing scientific articles	27 (90.0)	14 (63.6)	18 (69.2)	18 (78.3)	13 (81.2)	11 (44.0)	**0.006**
Writing academic assignments	8 (26.7)	5 (22.7)	11 (42.3)	3 (13.0)	4 (25.0)	2 (8.0)	0.072
Exam preparation	12 (40.0)	4 (18.2)	5 (19.2)	6 (26.1)	6 (37.5)	5 (20.0)	0.327
Clinical simulations	4 (13.3)	5 (22.7)	8 (30.8)	5 (21.7)	7 (43.8)	9 (36.0)	0.228

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Potential areas of AI usefulness*							
Research	27 (90.0)	14 (63.6)	20 (76.9)	15 (65.2)	9 (56.2)	13 (52.0)	**0.035**
Clinical education	11 (36.7)	8 (36.4)	10 (38.5)	7 (30.4)	8 (50.0)	6 (24.0)	0.653
Radiographic analysis	9 (30.0)	8 (36.4)	9 (34.6)	6 (26.1)	5 (31.2)	6 (24.0)	0.937
Treatment planning	7 (23.3)	5 (22.7)	8 (30.8)	8 (34.8)	5 (31.2)	6 (24.0)	0.909
Diagnosis	6 (20.0)	3 (13.6)	7 (26.9)	2 (8.7)	3 (18.8)	6 (24.0)	0.626

Data are presented as n (%) or median [IQR], as appropriate. *Multiple responses were permitted. Bold values indicate $p<0.05$.

A balanced analysis should give limitations the same importance as benefits. Recent reviews have highlighted concerns regarding data quality, the risk of algorithmic bias, transparency, and insufficient clinical validation (Shah et all., 2025).

The U.S. Food and Drug Administration (FDA) emphasizes the need to manage AI-based medical devices throughout their entire life cycle, from development and evaluation to use and monitoring (FDA). This principle is also relevant to the responsible selection of technologies used in dentistry, although the applicable legal framework in Romania and the European Union must be analyzed separately.

The World Health Organization has highlighted the need for artificial intelligence systems used in healthcare to respect human rights, be transparent, and be subject to appropriate governance (WHO Guidance).

In the European Union, the relevant regulatory framework includes the General Data Protection Regulation (GDPR) and the Artificial Intelligence Act (AI Act), Regulation (EU) 2024/1689. The specific applicability of the requirements depends on the intended purpose of the system, its classification, and the role of the organization using it. Certain AI systems integrated into medical devices may fall into the category of high-risk systems, under the conditions set out in the regulation (Regulation UE 2016 and 2024).

CONCLUSIONS

Overall, AI use was common among the surveyed dental students, although patterns of use and selected perceptions varied according to sex and year of study. Differences across study years did not follow a consistent linear pattern, suggesting variation between student cohorts and specific types of AI use rather than a uniform increase or decrease throughout dental education.

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