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Research Article

AN INQUIRY INTO DENTAL STUDENTS' PERCEPTIONS OF ARTIFICIAL INTELLIGENCE IN DENTISTRY: EXAMINING THEIR BELIEFS, ATTITUDES, AND UNDERSTANDING

Sena AYKUT [1], Ayse Ege SELMAN [2]*, Burcu KARADUMAN [3]

[1] Department of Periodontology, Institute of Graduate Education, Biruni University, Istanbul, TURKEY
[2] Department of Periodontology, Faculty of Dentistry, Biruni University, Istanbul, TURKEY
[3] Department of Periodontology, Faculty of Dentistry, Biruni University, Istanbul, TURKEY
*Correspondence: ayseegeselman@gmail.com

ABSTRACT

Objective: Artificial intelligence (AI) is widely anticipated to become an integral component of dentistry soon given its potential to revolutionize both dental education and practice. Therefore, it is essential to understand the perspectives of dental students who will be the future practitioners to adopt and use these technologies effectively and efficiently. The study aimed to evaluate the beliefs, perceptions and attitudes of a sample of Turkish dental students towards AI.

Materials and Methods: Data was collected online from students regarding age, sex and academic year. The students' beliefs regarding AI were assessed using a 21-question survey form of AI Attitude Scale. Also, a 15-question survey form was used to investigate the opinions and knowledge of dental students about AI. A total of 527 dental students between the ages of 18 and 37 participated; 142 of them were first-year, 14 were second-year, 171 were third-year, 90 were fourth-year and 110 were fifth-year students.

Results: There was a significant difference in the mean belief dimension scores based on the sex of the students ($p<0.05$). Overall, the students had some awareness and slight agreement on the positive effects of AI (cost reduction and productivity increase). However, despite these benefits, most students viewed AI as a potential danger to their careers. Especially in the field of dentistry, female students were found to agree more with the negative sub-dimensions of the scale such as unemployment, alienation, environmental pollution and supply-demand imbalances ($p<0.05$).

Conclusion: The study highlights the need for AI education in dental curriculum to prepare future practitioners and addresses their concerns.

Keywords: Artificial intelligence, attitudes, beliefs, dental students, dentistry, perceptions.

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INTRODUCTION

Artificial intelligence (AI) is an interdisciplinary field of science and engineering focused on developing machines and programs that can simulate human intelligence. The ultimate goal of AI technology is to use these machines to solve various challenges by emulating human skills and cognitive processes (1).

Feigenbaum et al. (2) identified several key features that AI robots should possess, including cost reduction, productivity improvement, flexibility, handling in dangerous environments, reliability, and human-like behavior. They also recognized that the widespread adoption of AI robots may lead to negative consequences. For instance, the automation of tasks that were previously performed by humans could lead to job loss and unemployment. This can cause significant economic and social disruptions. In addition, the use of AI robots may also result in social alienation as human interactions are replaced by interactions with machines (3-5). There could also be environmental pollution concerns related to the energy and materials required to produce and maintain AI robots. Finally, significant changes in economic parameters such as supply-demand imbalances could arise as AI adoption disrupts traditional business models and industries.

AI technology has increasingly been utilized in dentistry for various purposes such as diagnosis, treatment planning, and even assisting in surgical procedures (6). Its potential benefits include improved patient outcomes, increased efficiency, and reduced costs (7, 8). In addition to clinical profits, dental education can benefit from AI through the use of virtual reality and personalized learning pathways (9). Thus, it is essential for dental students to have a basic understanding of AI and its potential applications in dentistry. By being aware of the capabilities and limitations of AI, they can make informed decisions about incorporating it into their future practices. Keeping up with the latest developments in technology is also crucial to maintain relevance in the rapidly advancing field of dentistry.

AI is an emerging technology that has the potential to revolutionize the field of dentistry, and understanding how dental students perceive and respond to this technology is essential. Dental students are the future practitioners of the field, and their attitudes towards AI may influence their future use and adoption of this technology. Understanding the attitudes of dental students towards AI can inform the development of AI education programs that are tailored to the needs of dental students, and help to address any concerns or misconceptions they may have about this technology. Overall, investigating the attitudes of dental students towards AI can provide valuable insights into the potential impact of AI on the field of dentistry and help to ensure its successful integration (9). However, there is limited understanding of dental students' attitudes towards AI (10). Therefore, the current study aimed to evaluate the beliefs and attitudes of Turkish dental students towards AI.

MATERIALS AND METHODS

The study conformed to the ethical guidelines of the Helsinki Declaration (11) and was approved by the Non-Interventional Clinical Research Ethics Committee of Biruni University, Istanbul, Turkey (02.12.2021-2021/63-07). An online survey form was prepared using Google Form and distributed electronically via email and WhatsApp from December 2021 to January 2022. To minimize missing data, a forced choice format was

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employed in the survey. Before participation, all individuals were given detailed information about the study, and only those who provided online informed consent were allowed to proceed with the survey. To maintain anonymity, no personal information was collected from any participant.

Table 1. Belief dimension of Artificial Intelligence Attitude Scale.

Items	Sub-dimension
1. AI-powered robots operate at a faster pace compared to human labor.	Productivity increase
2. The production of AI robots will result in wastage of unpurchased surplus goods.	Disruption of supply demand balances
3. AI robots operate with lower expenses compared to human labor.	Cost reduction
4. AI-powered robots can produce higher quality employees than human labor.	Productivity increase
5. Continuous use of AI robots will result in environmental pollution.	Environmental pollution
6. AI robots produce fewer errors in their work than human labor.	Productivity increase
7. Continuous use of AI robots will harm natural resources.	Environmental pollution
8. AI-powered robots exhibit greater resistance to unclean, monotonous, and hazardous environments than humans.	Handling in dangerous environments
9. AI-powered robots will result in communication disorder among individuals.	Estrangement
10. AI-powered robots can work for longer durations than humans.	Flexibility
11. AI-powered robots are more reliable than humans in accomplishing tasks.	Reliability
12. AI-powered robots will cause social explosions caused by unemployment.	Unemployment
13. AI-powered robots are more successful in solving complex problem than humans.	Reliability
14. In the future, AI-powered robots will possess the ability to think like a human.	Acting like a human
15. The use of AI-powered robots will result in estrangement among individuals.	Estrangement
16. In the future, AI-powered robots will possess the ability to learn from experience like a human.	Acting like a human
17. In the future, AI-powered robots will be able to communicate like humans.	Acting like a human
18. The continuous use of AI-powered robots will disrupt the economic supply-demand balance.	Disruption of supply demand balances
19. In the future, AI-powered robots will possess psychological elements (reflexes and common sense) that humans have.	Acting like a human
20. In the future, AI-powered will replace humans.	Acting like a human
21. In the future, the replacement of humans with AI-powered robots will increase the unemployment rate.	Unemployment

AI: Artificial intelligence

The survey was divided into three sections. The first section included socio-demographic data on participants' age, sex and academic year. The next section of survey consisted of 21 questions assessing the students' beliefs regarding AI, taken from the "Artificial Intelligence Attitude Scale (AIAS)" developed by Ferik (12). The belief dimension of AIAS comprised 10 sub-dimensions, six of which were positive (cost reduction, productivity increase, flexibility, handling in dangerous environments, reliability and acting like a human),

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while the remaining four were negative (environmental pollution, estrangement, disruption of supply demand balances, unemployment). Table 1 presents the questions related to the belief dimension of the AIAS. Questions 2, 5, 7, 9, 12, 15, 18, and 21 had the reverse content. Participants were asked to rate their level of agreement on a six-point Likert scale, with options ranging from one (strongly disagree) to six (strongly agree). The Cronbach's alpha reliability coefficient was 0.99 for the complete scale, which indicates that the tool is reliable and valid. In the last section, 15 statements and questions focused on the students' opinions and knowledge regarding AI and its utilization in dentistry. The response options available for the questions were "yes", "no" or "partially".

Statistical analysis

The statistical analysis for this study was conducted using a statistical software package (NCSS 2007, Kaysville, Utah, USA). Descriptive statistics, including frequency, percentages, minimum-maximum, median, mean and standard deviation values were calculated. The normality of the data was assessed using the Shapiro-Wilk test. Intergroup comparisons were carried out by either the Mann-Whitney U or the Kruskall-Wallis test, depending on the number of the groups. Correlations were determined using the Spearman rank correlation test. A p value <0.05 was considered statistically significant.

RESULTS

Of the 527 participants, there were 229 male (43.5%) and 298 were female (56.5%). The distribution of students across different grade levels was as follows: 142 students (27%) were in the 1st grade, 14 (2.7%) were in the 2nd grade, 171 (32.4%) were in the 3rd grade, 90 (17.1%) were in the 4th grade, and 110 (20.8%) were in the 5th grade. The dental students' median age was 22 (18-37) years, and there was a similarity in the median age distribution between the male and female students ($p>0.05$). However, there was a difference in the median age among the grades ($p<0.001$).

Table 2 presents the belief dimension and its sub-dimension scores based on the sex of the participants. The mean belief dimension scores were found significantly different between male and female students ($p<0.05$). The mean scores for productivity increase, flexibility, handling in a dangerous environment, and acting like a human were similar between male and female students ($p>0.05$). Although the mean scores for cost reduction and reliability were significantly lower for females than for males ($p<0.05$), females had statistically higher mean scores than males for environmental pollution, estrangement, supply-demand balance disruption, and unemployment ($p<0.05$).

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Table 2. Comparisons of belief dimension and sub-dimension scores among sex

Sub-dimension	**Total (n=527) Mean± SD Min-Max (Median)**	**Male (n=229) Mean± SD Min-Max (Median)**	**Female (n=298) Mean± SD Min-Max (Median)**	**p***
Cost Reduction	3.61±1.33 1-6 (4)	3.84±1.35 1-6 (4)	3.43±1.29 1-6 (3)	0.001
Productivity Increase	3.78±0.98 1-6 (3.67)	3.87±1.06 1-6 (4)	3.71±0.92 1.33-6 (3.67)	0.067
Flexibility	4.43±1.07 1-6 (5)	4.41±1.12 1-6 (5)	4.44±1.04 1-6 (5)	0.965
Handling in-Dangerous Environment	4.15±1.17 1-6 (4)	4.13±1.19 1-6 (4)	4.16±1.15 1-6 (4)	0.928
Reliability	3.72±1.05 1-6 (3.5)	3.83±1.13 1-6 (4)	3.63±0.98 1-6 (3.5)	0.018
Act Like a Human	3.43±1.01 1-6 (3.4)	3.49±1.05 1-6 (3.4)	3.38±0.98 1-6 (3.2)	0.072
Environmental Pollution	3.63±1.14 1-6 (3.5)	3.41±1.13 1-6 (3.5)	3.79±1.12 1-6 (4)	0.001
Estrangement	3.95±1.17 1-6 (4)	3.74±1.21 1-6 (4)	4.1±1.11 1-6 (4)	0.001
Disruption of Supply-Demand Balances	3.66±1 1-6 (3.5)	3.5±1.01 1-6 (3.5)	3.78±0.97 1-6 (3.5)	0.003
Unemployment	4.17±1.09 1-6 (4.5)	4.01±1.14 1-6 (4)	4.29±1.05 1-6 (4.5)	0.003
Belief dimension score	**Total (n=527) Mean± SD Min-Max (Median)**	**Male (n=229) Mean± SD Min-Max (Median)**	**Female (n=298) Mean± SD Min-Max (Median)**	**p***
	3.49±0.49 1.76-5.54 (3.5)	3.56±0.50 2.14-5.24 (3.52)	3.43±0.50 1.76-5.19 (3.43)	0.001

SD: Standart Deviation. *Mann Whitney-U test; $p<0.05$

Table 3 presents the belief dimension and sub-dimension scores of the different grades of the participants. Although statistically significant differences were found between grades considering the mean values of belief dimension scores ($p<0.05$), the mean scores for cost reduction, environmental pollution, estrangement, and supply-demand balance disruption values were similar ($p>0.05$). However, the mean scores for productivity increase, flexibility, handling in a dangerous environment, reliability, acting like a human being, and unemployment were found to be significantly different across the different grade levels ($p<0.05$).

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Table 3. Comparisons of belief dimension and sub-dimension scores according to grades.

Sub-dimension	**Total (n=527) Mean± SD Min-Max (Median)**	**1st grade (n=142) Mean± SD Min-Max (Median)**	**2nd grade (n=14) Mean± SD Min-Max (Median)**	**3rd grade (n=171) Mean± SD Min-Max (Median)**	**4th grade (n=90) Mean± SD Min-Max (Median)**	**5th grade (n=110) Mean± SD Min-Max (Median)**	**p****
Cost Reduction	3.61±1.33 1-6 (4)	3.49±1.1 1-5 (3)	3.86±1.17 2-5 (4)	3.76±1.38 1-6 (4)	3.27±1.42 1-5 (3)	3.75±1.44 1-6 (4)	0.075
Productivity Increase	3.78±0.98 1-6 (3.67)	3.6±0.79§ 1.33-5(3.67)§	3.69±0.77 2-5 (3.67)	3.82±1.08§ 1-6 (3.67)§	3.55±0.87§ 1-5 (3.67)§	4.15±1.07 1.33-6 (4.17)	0.001
Flexibility	4.43±1.07 1-6 (5)	4.13±1.06 1-5 (5)	4.64±0.5 4-5 (5)	4.51±1.15† 1-6 (5)†	4.47±0.84† 1-5 (5)†	4.63±1.13† 1-6 (5)†	0.001
Handling in Dangerous Environment	4.15±1.17 1-6 (4)	3.84±1.06 1-5 (4)	4.43±0.85† 3-5 (5)†	4.37±1.22†,¶ 1-6 (5)†,¶	3.94±1.19 1-5 (4)	4.33±1.12† 1-6 (4)†	0.001
Reliability	3.72±1.05 1-6 (3.5)	3.35±0.91 1-5 (3)	3.68±0.99 2,5-5 (3,5)	3.87±1.13† 1-6 (4)†	3.56±0.96§ 1-5 (3,75)§	4.09±1.03¶,† 1-6 (4)¶,†	0.001
Act Like a Human	3.43±1.01 1-6 (3.4)	3.24±0.94§ 1-5 (3.2)§	3.06±1.05§ 1.2-5 (3.2)§	3.48±0.98§,† 1-6 (3.4)§,†	3.2±0.95§ 1-5 (3.2)§	3.83±1.07 1-6 (3.8)	0.001
Environmental Pollution	3.63±1.14 1-6 (3.5)	3.7±1 1-5 (3.5)	3.93±0.9 2.5-5 (4)	3.66±1.15 1-6 (3.5)	3.5±1.04 1-5 (3.5)	3.55±1.37 1-6 (3.5)	0.505
Estrangement	3.95±1.17 1-6 (4)	3.92±1.04 1-5 (4)	3.79±0.85 2-5 (3.75)	4.01±1.17 1-6 (4)	3.68±1.07 1-5 (4)	4.11±1.39 1-6 (4)	0.057
Disruptionof Supply-Demand Balances	3.66±11-6 (3.5)	3.61±0.83 1.5-5 (3.5)	3.57±0.73 2-5 (3.5)	3.8±1.06 1-6 (4)	3.43±0.84 1-5 (3.5)	3.7±1.2 1-6 (3.5)	0.093
Unemployment	4.17±1.09 1-6 (4.5)	4.02±0.98 1.5-5 (4)	4.11±1.15 1.5-5 (4.5)	4.32±1.05†,¶ 1-6 (4.5)†,¶	3.93±0.99 1-5 (4)	4.31±1.32†,¶ 1-6 (4.5)†,¶	0.018
Belief dimension score	**Total (n=527) Mean± SD Min-Max (Median)**	**1st grade (n=142) Mean± SD Min-Max (Median)**	**2nd grade (n=14) Mean± SD Min-Max (Median)**	**3rd grade (n=171) Mean± SD Min-Max (Median)**	**4th grade (n=90) Mean± SD Min-Max (Median)**	**5th grade (n=110) Mean± SD Min-Max (Median)**	**p****
	3.49±0.49 1.76-5.54 (3.5)	3.54±0.49‡ 2.14-5.19 (3.52)‡	3.33±0.20 2.76-3.62 (3.33)	3.54±0.50‡ 2.10-5.19 (3.52)‡	3.37±0.54 1.76-5.24 (3.38)	3.46±0.40 2.33-4.95 (3.48)	0.006

SD: Standard Deviation. **Kruskal Wallis Test. §Compared to 5th grade, †Compared to 1st grade, ¶Compared to 4th grade, ‡Compared to 2nd grade; *p<0.05*

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Table 4. The distribution of responses to the statements and questions regarding AI in dentistry.

Statements and Questions	Yes		No		Partially	
	n	%	n	%	n	%
1. I have general knowledge of AI and its functioning.	126	23.9	114	21.6	287	54.5
2. I keep up-to-date with the latest technological advancements	183	34.7	71	13.5	273	51.8
3. Are you familiar with the use of AI in dentistry?	88	16.7	181	34.3	258	49.0
4. Can AI be considered essential in the field of dentistry?	251	47.6	62	11.8	214	40.6
5. Can the use of AI in dentistry be considered as a threat?	84	15.9	238	45.2	205	38.9
6. Would you be interested in utilizing AI in your professional career in the future?	281	53.3	71	13.5	175	33.2
7. Can the use of AI in diagnosis provide more benefits for practices/clinics/hospitals?	280	53.1	48	9.1	199	37.8
8. Can the implementation of AI in dental clinics offer treatment benefits?	258	49.0	65	12.3	204	38.7
9. AI in dentistry can reduce errors that may arise from mental or physical exhaustion.	300	56.9	49	9.3	178	33.8
10. The implementation of AI in dentistry enables quick and precise accessibility and storage of patient information and data.	329	62.4	49	9.3	149	28.3
11. Is it necessary for faculties of dentistry to offer training on AI?	322	61.1	66	12.5	139	26.4
12. Do you think it would be beneficial to have AI applications in faculties of dentistry?	324	61.5	48	9.1	155	29.4
13. Would it be beneficial to utilize AI applications more frequently in dentistry?	245	46.5	70	13.3	212	40.2
14. Can AI applications in dentistry be considered reliable?	880	34.2	54	10.2	293	55.6
15. Dentistry could be replaced by AI in the future.	107	20.3	229	43.5	191	36.2

AI: Artificial intelligence

Pairwise comparisons between groups revealed that the mean productivity increase scores for 1st, 3rd and 4th grade groups were significantly lower than the 5th grade group ($p<0.05$). The mean flexibility scores of 1st grade students were significantly lower than those of the other grades, ($p<0.05$). Furthermore, 1st grade students exhibited significantly lower mean scores for handling dangerous environments than other grades ($p<0.05$). In contrast 3rd grade students had significantly higher scores than the 4th grade students in this regard ($p<0.05$). The mean reliability scores for 1st grade students were significantly lower than those for 3rd and 5th grade groups ($p<0.05$), and 4th grade students had lower scores than the 5th grade group ($p<0.05$). The mean scores for the "acting like a human being" sub-dimension were significantly lower among 1st grade students compared to the 2nd, 3rd and 5th grade students ($p<0.05$). Similarly, the mean scores for this sub-dimension were lower in the 4th grade than in the 5th grade ($p<0.05$). In terms of the mean unemployment sub-dimension scores, 1st grade students had significantly lower values than the 3rd and 5th

grade groups ($p<0.05$). Moreover, the mean scores for this sub-dimension were significantly higher in the 3rd and 5th grade groups than in the 4th grade group ($p<0.05$).

Table 4 displays the distribution of responses to the statements and questions regarding the use of AI in dentistry.

DISCUSSION

The utilization of AI technology in dentistry has progressively increased to improve treatment outcomes, patient experience, and practice management (4, 6). The integration of AI in dentistry may impact the roles of dental professionals, including their responsibilities, skills, and competencies. Therefore, understanding dental students' attitudes toward AI can inform the development of AI-related curricula and training programs to prepare them for the future of dentistry. Additionally, it can help identify potential challenges or concerns related to the adoption and use of these technologies, and inform the development of strategies to overcome them. Hence, our research aimed to evaluate dental students' beliefs, perceptions, and attitudes towards AI.

While numerous studies have investigated the attitudes and perceptions of medical students toward AI, research on dental students is limited. Additionally, none of the previous studies employed an objective scale similar to implemented in our research. Consequently, there is no data available for direct comparison of our findings with those of previous studies. For this reason, our results are compared the studies with students from different fields and countries.

Previous research has shown that beliefs can significantly shape attitudes (13). Therefore, we incorporated the belief dimension of the AIAS developed by Ferik (12), into our study to assess the perceptions and attitudes of Turkish dental students towards AI technology. To the best of our knowledge, this study is the first to use the AIAS for this purpose and to indicate that dental students have a moderate level of belief in AI.

According to our results, a slight agreement was observed among dental students regarding the benefits of AI robots, such as cost reduction, increased productivity, and the ability to perform tasks quickly and accurately with fewer errors and at lower costs than human labor. This aligns with the findings of Kwak et al. (14), whose research showed that nursing students also see the potential for AI to improve performance. Moreover, our study found that AI was perceived as advantageous due to its ability to work flexible hours and operate more safely in hazardous environments.

The dental students in this study displayed a slight tendency to agree that AI technology is reliable. Consistent with our findings, a large majority of participants (80%) in a Saudi Arabian study involving senior-year dental students and dental practitioners observed the advantages, including accelerated diagnostic procedures, the acquisition of clinically significant, high-quality data, and the reduction of AI errors (15). Nonetheless, the mean scores for reliability were considerably lower among female students in comparison to their male peers. Pinto Dos Santos et al. (16) also observed similar results, as 83.7% of medical students acknowledged the potential of AI to conduct reliable imaging tests automatically, with male students expressing a greater inclination towards perceiving AI as reliable in terms of diagnosis. However,

Yuzbasioglu (10) discovered that there was some discrepancy among dental students regarding the use of AI as a "definitive diagnostic tool" in disease diagnosis. Specifically, 46.30% of students disagreed while only 30.00% agreed. In contrast to our findings, a different study examining the attitudes and perceptions of dental students towards AI applications found that female students had a more favorable view compared to their male counterparts (17). This suggests that sex may play a role in shaping attitudes towards AI among dental students. Studies have shown that men and women may have different levels of interest and confidence in using technology, with men generally being more confident and enthusiastic about it (18). This could translate into differences in attitudes towards AI, with men potentially being more open to it and women potentially being more skeptical or cautious. Female students' lack of interest in AI could be attributed to their perception of its reliability.

When the negative consequences of the use of AI were evaluated, in the present study students also exhibited some degree of agreement that the implementation of AI could result in unemployment, social isolation, environmental degradation, and disruptions in supply-demand balance. This result may have been obtained because the usage of AI in dentistry is perceived only as a robot. Notably, female students showed stronger agreement regarding these potential negative impacts. In a related study involving medical students, female students were found to be more inconfident about the benefits of AI implementation than male students (16). Based on our findings, a majority of students did not completely reject the idea that the utilization of AI could pose a threat and eventually substitute for dentistry (54.8% and 56.5%, respectively). On the other hand, Yuzbasioglu (10) found that Turkish dental students did not share the belief that AI could take their place in the field. Additionally, in a systematic review comprising 13 studies, a low rate of dental students (28.45 %), expressed the belief that AI would replace dentists in the future (19). AI acceptance may be related to the relationship between people and technology. As mentioned earlier, studies have shown that men consider themselves more tech-savvy than women (18) and Pinto Dos Santos et al. (16) showed tech-savvy medical students were less frightened of the potential negative impacts of AI. This may explain why the negative impacts of AI were more prominent in female students than in male students.

Based on the results of our research, it appears that students in their final year of study are more prone to expressing apprehension about unemployment, suggesting that their anxiety regarding this issue may intensify as they approach graduation. Moreover, our findings showed that there was a significant age difference between the grades. This finding regarding the perception between classes may be due to the difference in age distribution. Anxiety could hinder the advancement of AI technology by creating negative attitudes towards it. As per the social cognitive theory, anxiety is one of the elements that impact people's attitudes towards technology (20). People who have high levels of anxiety toward technology tend to experience confusion, a lack of motivation, and avoidance of technological tools (21). Nonetheless, Wang et al. (21) observed that individuals experiencing anxiety may feel motivated to gain a better understanding of AI. Moreover, according to Bulut et al. (22), dentists are not too anxious about learning about AI and may be generally competent and adaptable when it comes to learning and utilizing new developments and technologies, like AI. Overall, the potential benefits of AI robots are significant, but the negative impacts should also be carefully considered and addressed to ensure that the benefits are maximized, and the negative consequences are minimized.

Our study found that most students demonstrated limited or moderate knowledge with AI and its operational principles. This corresponds with earlier studies that have identified a significant knowledge gap and a pressing need for education among students in health professions (23). Furthermore, a study providing support discovered that despite being acquainted with AI, the majority of dental students in Turkey had inadequate knowledge regarding its operational principles (10). One of the main reasons for the lack of knowledge on AI among dental students could be the absence of a formal curriculum on AI in dental schools. Moreover, dental students may not have access to resources and tools to explore and learn about AI. Without adequate exposure to AI, they may not be able to appreciate its potential and its relevance in dentistry. Some students may view AI as a complex and technical field that is difficult to comprehend. This perception could deter them from pursuing further knowledge on AI. A study involving a considerable sample size of over 27,000 individuals, found a relationship between higher levels of education and a favorable perception of AI (24). This suggests that providing education and training to dental students on AI technology could potentially improve their perception of it and prepare them better for the integration of AI into dentistry. A majority of the students (61.1%) in our study believe that there should be training on AI in their dental faculties which can be considered a promising finding, as it shows that a significant proportion of the student population recognizes the importance of AI training in dental education. Furthermore, participants in an additional investigation involving dental students stated that graduate and undergraduate programs should both include AI (25). At the same time, this finding also underscores the need for such training, as it implies that the current level of AI education in dental faculties may not be meeting the needs and expectations of the students. In other words, the fact that such a large percentage of students think that AI training is necessary highlights a potential gap in the existing curriculum that needs to be addressed.

The use of a scale to provide a quantitative and objective analysis of AI perception is a strength of the present study. On the other hand, the primary limitation was the use of a general scale that was not created specifically for dental students since no other scale about questioning beliefs in AI exists in the literature. Moreover, since AI has a wide range of uses, non-specific general questions were asked to students to measure general perception. It should also be noted that our results do not represent the entire Turkish dental students, and there is no homogeneous distribution between grades in terms of the number of students. Further research is required, with a focus on dentistry-related queries in particular and an increased sample size. Our study addresses the disparities in perceptions about AI between sex and grade among Turkish dental students. In addition, economic status and parental education level may affect the approach to this technology. Therefore, a comparison based on these parameters may be useful for a clearer understanding of the perception of AI.

Cultural and social factors can influence the acceptance and adoption of new technologies, including AI. Therefore, evaluating the perceptions and attitudes of Turkish dental students towards AI can provide insights into the cultural and societal factors that may facilitate or hinder the integration of AI in dentistry in Turkey. Yet, these findings cannot be extrapolated to all dental students. The experiences, education, and exposure to technology may differ among dental students from different institutions, regions, or countries. While dental students may share some similarities in their training and education, they are not a homogenous group, and individual differences may exist that could influence their attitudes and behaviors

toward AI adoption. The results therefore need to be interpreted with caution. Overall, the acceptance and adoption of AI are complex and multifaceted issues that are influenced by a wide range of cultural and social factors. Additional research can help to identify the key drivers of AI acceptance and adoption, as well as the barriers that prevent certain groups or communities from embracing these technologies.

CONCLUSION

In conclusion, the dental students' positive attitude towards AI technology and its potential benefits in dentistry is a promising sign of the future of the dental profession. However, the concerns about the potential impact of AI on the demand for dental professionals cannot be overlooked. It is essential to adapt to this developing technology by providing dental students with a comprehensive education covering both conventional and AI-based techniques. The need for further research with larger sample sizes and multiple centers to gain a better understanding of student attitudes on this issue is crucial.

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Authorship contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Sena Aykut, Ayşe Ege Selman, Burcu Karaduman. The manuscript was written by talking the opinions of all the authors and reaching a consensus. All authors read and approved the final manuscript.

Data availibity statement

Data available within the article

Declaration of competing interest

All authors declare no potential conflicts of interest in this study.

Ethics

Non-Interventional Clinical Research Ethics Committee of Biruni University, Istanbul,Turkey (02.12.2021- 2021/63-07)

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