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Relationship Between Digital Literacy, Artificial Intelligence Readiness, and Professionalism Among Dental Students

Diş Hekimliği Öğrencilerinde Dijital Okuryazarlık, Yapay Zeka Hazır Bulunuşluğu ve Profesyonellik İlişkisi

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ABSTRACT

Objectives: This study investigated the relationships between clinical dental students' medical AI readiness, digital literacy, and professionalism. Additionally, the potential mediating role of medical AI readiness in the association between digital literacy and professionalism was evaluated.

Materials and Methods: The sample for this cross-sectional analytical study comprised 210 clinical-stage students at the Sivas Cumhuriyet University Faculty of Dentistry. Data were collected using the Digital Literacy Scale (DLS), the Medical Artificial Intelligence Readiness Scale (MAIRS-MS), and the Professionalism Assessment Scale (PAS). Analyses were performed using Spearman's rho correlation and path analysis ($p<0.05$).

Results: Significant positive correlations were observed between digital literacy, professionalism, and medical AI readiness. Path analysis suggested that digital literacy is a significant correlate of both professionalism and MAIRS-MS. However, medical AI readiness did not significantly mediate the relationship between digital literacy and professionalism in this sample. Notably, the 'Ethics' sub-dimension of medical AI readiness showed significant associations with specific professionalism dimensions.

Conclusions: Digital literacy was observed to be significantly associated with dental students' professionalism and medical AI readiness. The lack of a direct correlation between professionalism and medical AI readiness suggests that AI is not yet fully integrated into professional identity. However, the finding that students who understand the ethical dimension of AI exhibit better professional behavior suggests the need to integrate AI ethics courses into professional training.

Keywords: *Artificial intelligence, Computer literacy, Dental students, Professionalism.*

ÖZET

Amaç: Bu çalışma; klinik dönemdeki diş hekimliği öğrencilerinin yapay zeka hazır bulunuşlukları, dijital okuryazarlık seviyeleri ve profesyonellik algıları arasındaki ilişkiyi incelemeyi amaçlamaktadır. Ayrıca, dijital okuryazarlığın profesyonellik ile ilişkisinde tıbbi yapay zekâ hazır bulunuşluğunun potansiyel aracı rolü analiz edilmiştir.

Gereç ve Yöntemler: Bu kesitsel analitik çalışmanın örneklemini Sivas Cumhuriyet Üniversitesi Diş Hekimliği Fakültesi'nde klinik aşamada olan 210 öğrenci oluşturmuştur. Veriler, Dijital Okuryazarlık Ölçeği (DLS), Tıbbi Yapay Zekâya Hazır Olma Ölçeği (MAIRS-MS) ve Profesyonellik Değerlendirme Ölçeği (PAS) kullanılarak toplanmıştır. Analizler Spearman'ın rho korelasyonu ve yol analizi kullanılarak yapılmıştır ($p < 0,05$).

Bulgular: Dijital okuryazarlık, profesyonellik ve tıbbi yapay zeka hazır bulunuşluğu arasında anlamlı pozitif korelasyonlar saptanmıştır. Yol analizi, dijital okuryazarlığın hem profesyonellik hem de tıbbi yapay zeka hazır bulunuşluğu ile anlamlı bir ilişkide olduğuna işaret etmiştir. Bununla birlikte, bu örneklemde tıbbi yapay zeka hazır bulunuşluğunun dijital okuryazarlık ile profesyonellik arasındaki ilişkide anlamlı bir aracı rolü saptanmamıştır. Özellikle, yapay zeka hazır bulunuşluğunun 'Etik' alt boyutu ile belirli profesyonellik boyutları arasında anlamlı ilişkiler bulunmuştur.

Sonuçlar: Dijital okuryazarlık, diş hekimliği öğrencilerinin profesyonelliği ve tıbbi yapay zekaya hazır bulunuşluğu ile anlamlı derecede ilişkili bulunmuştur. Bulgular, tıbbi yapay zeka hazır bulunuşluğunun bu örneklemde dijital okuryazarlık ve profesyonellik arasında anlamlı bir aracılık yapmadığını, ancak yapay zeka etiği ile mesleki davranış arasındaki korelasyonun diş hekimliği müfredatına etik yapay zeka eğitiminin entegre edilmesinin potansiyel faydalarına işaret ettiğini göstermektedir.

Anahtar Kelimeler: *Bilgisayar okuryazarlığı, Diş hekimliği öğrencileri, Profesyonellik, Yapay zeka.*

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Introduction

Artificial intelligence (AI) is a field of computer science that concentrates on creating intelligent systems that demonstrate traits linked to human intellect, including learning, reasoning, and problem-solving.[1] The rapid development and integration of AI applications are transforming healthcare and education models.[2] In dentistry, AI applications are rapidly gaining ground in diagnostic, clinical decision-making, and treatment planning processes, reducing workload, increasing accuracy and improving reliability.[3] Maintaining the high quality offered by AI, particularly in areas such as automated radiological image analysis and prosthesis design, has made it critical for dentists to possess the skills and basic knowledge to evaluate these applications.[4]

AI-powered diagnostic tools are reported to have higher sensitivity than human observers for early caries detection, further highlighting the importance of integrating technology into dental education.[5] To adapt to this technological transformation, individuals must possess certain competencies. Digital literacy, a primary competency, is a multifaceted concept encompassing not only technical skills but also the ability to access information on digital platforms, critically evaluate it, and use it effectively.[6] In dental education, this concept is defined as "future professionals critically interacting with digital health technologies to improve patient care".[7] Another important concept related to digital literacy is AI literacy, which represents the ability to correctly use, identify, and ethically evaluate AI products to adapt to AI-focused digital transformation.[8]

Today, AI applications are effectively used not only in clinical practice but also in dental education. The literature shows that AI-supported personalized feedback systems significantly improve radiographic diagnostic performance among dental students.[9,10] Keeping up with current technologies ensures that prospective dentists have access to accurate information and supports their clinical skills and self-confidence.[10] Today's dental students, as "digital natives" born into technology, have the potential to integrate AI and digital tools into their clinical practice rapidly; however, this technical familiarity does not always translate into correct use of these tools from academic and ethical standpoints.[6] On the other hand, a significant portion of educators in dental faculties remains relatively unfamiliar with these technologies.[11,12] This "digital divide" leads students to turn to unsupervised sources such as social media rather than structured academic guidance and to experience "hallucinations" (false information generated by AI).[13–15] Furthermore, ethical violations, such as breaches of patient data confidentiality and algorithmic bias, demonstrate that these technologies, despite their "life-saving" potential, pose serious risks when not used correctly.[13-16]

The effective use of artificial intelligence applications requires a strong foundation in digital literacy; therefore, these two concepts are closely related. It is argued that if technological advancements are not adequately integrated into educational processes, a mismatch may occur between clinical practices and professional responsibilities, directly jeopardizing patient safety.[17] In this context, digital literacy forms the basic cognitive foundation necessary to understand the technical and ethical dimensions of AI technologies.

Beyond technological capabilities, integrating these tools into clinical decision-making processes necessitates a reinterpretation of professional values. Professionalism, a fundamental pillar of healthcare, encompasses ethical values, responsibility, patient privacy, and lifelong learning.[18] The acceleration of digitalization and AI integration has posed unprecedented questions for professionalism, requiring a re-examination under "digital professionalism" (e-professionalism) to address data security, algorithmic biases, shared decision-making responsibilities, and maintaining a human-centered approach.[19,20]

The effective, safe, and ethical use of medical AI applications is directly related to healthcare professionals' knowledge, attitudes, and integration skills regarding the technology.[21,22] This is where the concept of "AI readiness" comes into play. This concept refers to individuals'

capacity to understand, evaluate, and integrate AI technologies into their clinical practice. AI literacy encompasses the ability to understand the basic logic of algorithms, question data quality, and assess the compatibility of system outputs with the clinical context.[22] The literature reports that dental students generally have a positive attitude towards AI, but significant deficiencies exist in their knowledge and application.[10,23] Determining the readiness level of dental students in this area is crucial for curriculum development and the formulation of educational strategies.

The literature suggests a positive correlation between AI readiness and perceptions of professionalism and self-efficacy.[24] However, educators' relative unfamiliarity with these technologies in current dental education leads students to learn these skills from external sources rather than through a structured curriculum. There is still a gap in the literature regarding how digital literacy levels and AI readiness among clinical dental students shape their perceptions of professionalism.[11,25] To address this deficiency, this study aims to examine the relationship between medical AI readiness, digital literacy levels, and perceptions of professionalism among clinical dental students. Furthermore, the potential mediating role of medical AI readiness in the association between digital literacy and professionalism was evaluated. The findings of this investigation are anticipated to illuminate the reshaping of dental education curricula to align with the requirements of digital transformation and contribute to the development of future dentists' professional identity. Our hypothesis is that as students' digital literacy and medical AI readiness levels increase, their perceptions of professionalism and ethical responsibility will also increase proportionally.

Materials and Methods

A cross-sectional, descriptive study was approved by the Sivas Cumhuriyet University Health Sciences Research Ethics Committee under decision number 2025-07/70, dated 31.07.2025. All processes were conducted in accordance with the principles of the Helsinki Declaration. The study population consists of clinical-stage (4th- and 5th-year) students at the Sivas Cumhuriyet University Faculty of Dentistry during the 2025-2026 academic year. No sampling was performed; the aim was to reach the entire population. 210 students (105 fourth-year, 105 fifth-year) who voluntarily participated in the study and completed the questionnaire were included in the analyses. Data were collected between 25.08.2025 and 05.01.2026 through digital questionnaire forms. Informed consent was obtained from the participants before the questionnaire.

Equipment for data collection

Individual Data Form: Contains inquiries regarding participants' age and gender, grade level, and technology use habits.

Medical Artificial Intelligence Readiness Scale: Developed and validated by Karaca et al.[22]., this scale evaluates the readiness of medical and dental students to incorporate AI technologies into their professional practice across cognitive, visionary, and ethical dimensions.

Digital Literacy Scale: Measures individuals' competence in accessing information in the digital world, critically evaluating it, and using it in accordance with ethical guidelines.[6] This Likert-type scale, consisting of 17 items and 4 sub-items, was developed by Ng.[27] The validity and reliability study of the Turkish version was conducted by Hamutoğlu et al.[28]

Professionalism Assessment Scale (PAS): A self-assessment instrument of 22 items developed by Klemenc-Ketis Z and Vrecko H.[29] for medical students. Its adaptation and updating for dental students in Turkey were carried out by Kaşali, Özkal Eminoğlu, Demirer, and Çınar Tanrıverdi.[30] The scale has a structure consisting of three factors: "empathy and humanism," "responsibility," and "professional relationship and development." The higher the score on the scale, the more professionalism is interpreted.

Data Collection Process

Data were gathered from August 25, 2025, to January 05, 2026, using the Google Forms online survey platform. Participants were apprised of the study's objective and granted informed consent. Completing the surveys took approximately 10 minutes.

Statistical Analysis

Statistical analyses were performed using R (version 4.4.1) and IBM SPSS Amos (version 24.0; IBM Corp., Armonk, NY, ABD**)** software. Cronbach's Alpha coefficient was used to evaluate the internal consistency of the scales. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess normality. The Mann-Whitney U Test was used to compare scale scores that did not conform to normality assumptions between pairs of groups. The Kruskal-Wallis test was used to compare scale scores that did not conform to normality assumptions across groups of three or more. Spearman's Test was used to examine the relationship between scale scores that did not conform to normal distribution. The rho correlation coefficient was used. The suitability of the mediating effect model for normality was examined under the assumption of multiple normality. Since the data did not conform to a normal distribution, path analysis was tested using the Bootstrap Maximum Likelihood method. Analysis results were presented as mean ± standard deviation and median (minimum–maximum)/rank mean for quantitative variables. The significance level was set at $p < 0.05$.

Results

This cross-sectional, analytical investigation aimed to ascertain the correlations among digital literacy levels, medical AI readiness, and professional attitudes among dental students. The sample consisted of 210 clinical students (105 (50%) in their 4th year and 105 (50%) in their 5th year) at Sivas Cumhuriyet University Faculty of Dentistry who voluntarily participated in the study. Data were gathered via an online survey tool utilizing a sociodemographic information form, the "DLS," the "MAIRS-MS," and the "PAS".

As presented in Table 1, descriptive statistics on the sociodemographic characteristics and technology use habits of the dental faculty students participating in the study indicate that 69% (n=145) were female and 31% (n=65) were male. The average age of the students was calculated as 22.79 ± 1.53 (Median=23, Min =21, Max =35). Regarding daily internet usage, 42.4% used the internet for 3-5 hours, 33.8% for 1-3 hours, and 21% for 5 hours or more. Instagram was the most used social media platform among dental students, with 61%, while Google Scholar was the most preferred platform for academic research, with 61.3%, followed by PubMed with 23.5%. In terms of digital device use, almost all students (97.6%) used smartphones, and one-third (33.3%) used tablets.

Table 1. Sociodemographic data of participants.

	Frequency	Percentage
Gender		
Male	65	31
Female	145	69
Class		
4th Grade	105	50
5th Grade	105	50
Daily internet usage time		
0-1 hour	6	2.9
1-3 hours	71	33.8
3-5 hours	89	42.4
5 hours and above	44	21
The social media platform you use most often		
Instagram	128	61
X/Twitter	18	8.6
Facebook	1	0.5
TikTok	8	3.8
Other	55	26.2

Your most frequently used academic research site		
PubMed	48	23.5
Scopus	4	2
Google Scholar	125	61.3
ScienceDirect	4	2
Other	23	11.3
Your most frequently used digital devices~		
Smartphone	205	97.6
Tablet	70	33.3
Other	210	100
	Mean ± Standard Deviation	Median (min- max)
Age	22.79 ± 1.53	23 (21-35)

~Multiple Responses

Given the non-normal distribution of the data, the median (minimum–maximum) scores for the scales were as follows: DLS: [64 (17-85)], PAS: [90 (22-110)], and MAIRS-MS: [73 (22-110)]. The internal consistency coefficients (Cronbach's Alpha) for the scales were 0.968, 0.984, and 0.978, respectively. Furthermore, Cronbach's Alpha values for all sub-dimensions of the scales were also found. Alpha coefficients were found to be above 0.817, indicating that the data collection tools have a high level of reliability (Table 2).

Table 2. Descriptive statistics and Cronbach's Alpha values for scale scores.

	Mean ± Standard Deviation	Mean (min -max)	Cronbach's Alpha
Attitude	25.64 ± 6.08	27 (7-35)	0.929
Technical	21.27 ± 5.58	22.5 (6-30)	0.937
Cognitive	7.4 ± 1.85	8 (2-10)	0.855
Social	6.85 ± 1.95	7 (2-10)	0.817
Digital Literacy Scale	61.16 ± 14.45	64 (17- 85)	0.968
Empathy and humanism	41.18 ± 9.1	42 (10-50)	0.975
Professionalism, relationships and development.	32.36 ± 7.08	33 (8-40)	0.948
Responsibility	15.96 ± 3.52	16 (4-20)	0.900
Professionalism Assessment Scale	89.5 ± 19.36	90 (22-110)	0.984
Cognitive	24.9 ± 6.76	24 (8-40)	0.950
Skill	27 ± 7.1	28 (8-40)	0.961
Foresight	9.94 ± 2.77	10 (3-15)	0.939
Ethics	10.4 ± 2.72	11 (3-15)	0.934
Medical Artificial Intelligence Readiness Scale	72.25 ± 17.92	73 (22-110)	0.978

The relationships among the scale scores were analyzed using Spearman's rho, and the results are presented in Table 3. According to the analysis results, a statistically significant, positive, and moderate correlation was found between dental students' digital literacy levels and their professionalism assessments (r = 0.407; p < 0.001). Similarly, a statistically significant, positive, and moderate correlation was found between digital literacy and medical AI readiness levels (r = 0.435; p < 0.001). However, no statistically significant correlation was found between professionalism assessment and medical AI readiness levels (p > 0.05). At the sub-dimension level, significant positive correlations were observed, particularly between the "Tech-

Table 3. Examining the relationship between scale scores.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Attitude	*r*	1													
	p	.													
2. Technical	*r*	0.712	1												
	p	**<0.001**	.												
3. Cognitive	*r*	0.621	0.618	1											
	p	**<0.001**	**<0.001**	.											
4. Social	*r*	0.582	0.755	0.660	1										
	p	**<0.001**	**<0.001**	**<0.001**	.										
5. Digital Literacy Scale	*r*	0.866	0.934	0.737	0.810	1									
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.									
6. Empathy and humanism	*r*	0.392	0.313	0.416	0.283	0.380	1								
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.								
7. Professionalism, relationships and development	*r*	0.409	0.360	0.411	0.308	0.414	0.849	1							
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.							
8. Responsibility	*r*	0.392	0.264	0.359	0.300	0.356	0.819	0.791	1						
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.						
9. Professionalism Assessment Scale	*r*	0.407	0.337	0.428	0.311	0.407	0.952	0.947	0.884	1					
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.					
10. Cognitive	*r*	0.325	0.426	0.198	0.459	0.404	0.018	0.035	0.074	0.025	1				
	p	**<0.001**	**<0.001**	**0.004**	**<0.001**	**<0.001**	0.793	0.609	0.287	0.719	.				
11th Skill	*r*	0.350	0.438	0.283	0.440	0.416	0.176	0.149	0.136	0.151	0.785	1			
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.011**	**0.031**	**0.049**	**0.029**	**<0.001**	.			
12. Foresight	*r*	0.347	0.405	0.317	0.419	0.417	0.236	0.216	0.209	0.227	0.661	0.799	1		
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.001**	**0.002**	**0.002**	**0.001**	**<0.001**	**<0.001**	.		
13. Ethics	*r*	0.272	0.332	0.311	0.335	0.324	0.249	0.196	0.205	0.224	0.552	0.771	0.850	1	
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.004**	**0.003**	**0.001**	**<0.001**	**<0.001**	**<0.001**	.	
14. Medical Artificial Intelligence Readiness Scale	*r*	0.356	0.454	0.277	0.465	0.435	0.132	0.128	0.117	0.119	0.892	0.956	0.851	0.793	1
	p	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	0.057	0.064	0.092	0.085	**<0.001**	**<0.001**	**<0.001**	**<0.001**	.

r: Spearman's rho Correlation Coefficient

nical" sub-dimension of the Digital Literacy Assessment and the "Skills" sub-dimension of the Medical AI Readiness Assessment. On the other hand, a statistically significant but very weak correlation was determined between the 'Empathy and Humanism' dimension of professionalism and the 'Skills' dimension of MAIRS-MS ($r = 0.176$, $p = 0.011$).

The Mann-Whitney U test was used to compare scale scores by gender, and the results are presented in Table 4. As a result of the analysis, the DLS total score showed a statistically significant difference by gender ($p = 0.020$). The median DLS score of male dental students [66 (IQR: 60-72)] was significantly higher than that of female students [63 (IQR: 58-68)]. When the sub-dimensions were examined, significant differences were found in favor of men in the "Technical" (Male=24, Female=22; p=0.002) and "Social" (Male=8, Female=7; p = 0.001) sub-dimensions of the Digital Literacy Scale. In addition, male students (Median = 27) scored significantly higher than female students (Median = 24) on the "Cognitive" sub-dimension of the MAIRS-MS ($p = 0.024$). No significant differences were found between genders in the total score or sub-dimensions of the PAS ($p > 0.05$).

Table 4. Comparison of scale scores by gender.

	Male	Female	Test Statistics	p
Attitude	27 (7:35) / 107.08	27 (7-35) / 104.79	-0.253	0.800 [x]
Technical	24 (6:30) / 124.67	22 (6-30) / 96.91	-3,061	**0.002** [x]
Cognitive	8 (2:10) / 115.95	8 (2-10) / 100.82	-1,668	0.095 [x]
Social	8 (2: 10) / 126.02	7 (2-10) / 96.3	-3,276	**0.001** [x]
Digital Literacy Scale	66 (19: 85) / 120.07	63 (17-85) / 98.97	-2,326	**0.020** [x]
Empathy and humanism	41 (10:50) / 102.21	42 (10-50) / 106.98	-0.526	0.599 [x]
Professionalism, relationships and development.	32 (8:40) / 102.95	33 (8-40) / 106.64	-0.408	0.683 [x]
Responsibility	16 (4: 20) / 98.02	16 (4-20) / 108.85	-1,194	0.233 [x]
Professionalism Assessment Scale	91 (22: 110) / 102.12	90 (22-110) / 107.01	-0.539	0.590 [x]
Cognitive	27 (9:40) / 119.65	24 (8-40) / 99.16	-2,260	**0.024** [x]
Skill	29 (8:40) / 114.88	27 (8-40) / 101.3	-1,497	0.134 [x]
Foresight	10 (3:15) / 109.68	10 (3-15) / 103.62	-0.668	0.504 [x]
Ethics	11 (3:15) / 108.8	11 (3-15) / 104.02	-0.527	0.598 [x]
Medical Artificial Intelligence Readiness Scale	78 (25: 110) / 116.32	72 (22-110) / 100.65	-1,727	0.084 [x]

Mann-Whitney U Test; Median (minimum-maximum)/rank mean

The students' scale scores were compared across class levels using the Mann-Whitney U test, and the results are presented in Table 5. According to the analysis findings, a statistically significant difference in the total PAS score was observed across class levels ($p = 0.017$). The median PAS score of 4th-year students who have completed the pre-clinical period and moved on to clinical training (93) is significantly higher than that of 5th-year students (88). A statistically significant decrease was observed in the 'Empathy and Humanism' subscale scores between 4th and 5th-year students ($p = 0.004$). The median score of 4th-year students [43 (min: 10, max: 50)] was significantly higher than that of 5th-year students [40 (min: 10, max: 50)]. However, no statistically significant differences were found in the total scores and sub-dimensions of the DLS and the MAIRS-MS across class levels ($p > 0.05$).

Table 5. Comparison of scale scores by class.

	4th Grade	5th Grade	Test Statistics	p
Attitude	27 (7-35) / 107.33	27 (7-35) / 103.67	-0.437	0.662 [x]
Technical	23 (6-30) / 112.44	22 (6-30) / 98.56	-1.655	0.098 [x]
Cognitive	8 (2-10) / 108.74	8 (2-10) / 102.26	-0.773	0.439 [x]
Social	7 (2-10) / 111.57	7 (2-10) / 99.43	-1.448	0.148 [x]
Digital Literacy Scale	64 (17- 85) / 110.21	63 (17-85) / 100.79	-1.123	0.261 [x]
Empathy and humanism	43 (10-50) / 117.45	40 (10-50) / 93.55	-2.850	**0.004** [x]
Professionalism relationship and development	34 (8-40) / 113.57	32 (8-40) / 97.43	-1.924	0.054 [x]
Responsibility	16 (4-20) / 111.91	16 (4-20) / 99.09	-1.529	0.126 [x]
Professionalism Assessment Scale	93 (22-110) / 115.5	88 (22-110) / 95.5	-2.386	**0.017** [x]
Cognitive	24 (8-40) / 103.82	24 (8-40) / 107.18	-0.400	0.689 [x]
Skill	29 (8-40) / 107.17	27 (8-40) / 103.83	-0.398	0.691 [x]
Foresight	10 (3-15) / 108.78	9 (3-15) / 102.22	-0.781	0.435 [x]
Ethics	11 (3-15) / 107.27	11 (3-15) / 103.73	-0.421	0.674 [x]
Medical Artificial Intelligence Readiness Scale	73 (22-110) / 106.8	73 (22-110) / 104.2	-0.309	0.757 [x]

Mann-Whitney U Test; Median (minimum-maximum)/ rank mean

Potential variations in scale results were examined across different durations of daily internet involvement using the Kruskal-Wallis test. This analysis confirmed that the cumulative outcomes of the DLS, Professionalism Assessment Scale, and MAIRS-MS did not differ significantly, with both total and sub-dimension ratings remaining consistent regardless of daily internet usage levels.

One of the main hypotheses of the study, the mediating role of the Medical AI Readiness Scale in the relationship between the DLS and the Professionalism Assessment Scale, was tested using the Bootstrap Maximum Likelihood method (Table 6). An evaluation of the model fit parameters for the proposed structural framework revealed a discrepancy; while GFI=1, CFI=1, and SRMR=0.000 initially suggested a high level of fit, the RMSEA value of 0.522 was significantly above the acceptable threshold, indicating a poor model fit. Consequently, the model's overall fit to the data is considered questionable, and the results are interpreted as statistical associations rather than definitive causal links. According to the path analysis results, the unstandardized path coefficient (β) for the direct relationship of the DLS on the Medical AI Readiness Scale was statistically significant and positive (β = 0.631; 95% CI [0.375, 0.861]; $p < 0.001$). Similarly, the unstandardized path coefficient (β) for the direct association between the DLS and the PAS was also statistically significant and positive (β = 0.841; 95% CI [0.507, 1.148]; $p < 0.001$). However, the unstandardized path coefficient (β) for the link between the Medical AI Readiness Scale and the PAS was not found to be statistically significant (β = 0.029; 95% CI [-0.144, 0.240]; p = 0.769). The mediation analysis revealed that the indirect relationship via the Medical AI Readiness Scale was not statistically significant ($\beta = 0.018$; $p = 0.765$).

Table 6. Structural Model Results

Dependent variable		Independent variable	β [1] (95% CI)	β [2] (95% CI)	S. Error	p	R^2 [2]
Medical Artificial Intelligence Readiness Scale	<---	Digital Literacy Scale	0.631 (0.375: 0.861)	0.509 (0.306: 0.671)	0.127	**<0.001**	0.259
Professionalism Assessment Scale	<---	Medical Artificial Intelligence Readiness Scale	0.029 (-0.144: 0.24)	0.027 (-0.138: 0.225)	0.100	0.769	0.412
Professionalism Assessment Scale	<---	Digital Literacy Scale	0.841 (0.507: 1.148)	0.628 (0.415: 0.795)	0.167	**<0.001**	
Digital Literacy Scale --> Medical Artificial Intelligence Readiness Scale --> Professionalism Assessment Scale			0.018 (-0.079: 0.175)	0.014	---	0.765	---

[1]Unstandardized path coefficients, [2]Standardized path coefficients

The structural model used to examine the direct associations among the variables is presented in Figure 1. When the goodness-of-fit indices of the model were examined, GFI=1.00, CFI=1.00, and SRMR=0.000 were observed. However, the RMSEA value of 0.522 indicated a poor fit, suggesting that the model's overall fit to the data is questionable despite other indices. According to the path analysis results, digital literacy was found to have a direct, positive, and statistically significant association with professionalism (unstandardized β = 0.841, standardized β = 0.628, p < 0.001) and medical AI readiness (unstandardized β = 0.631, standardized β = 0.509, p < 0.001).

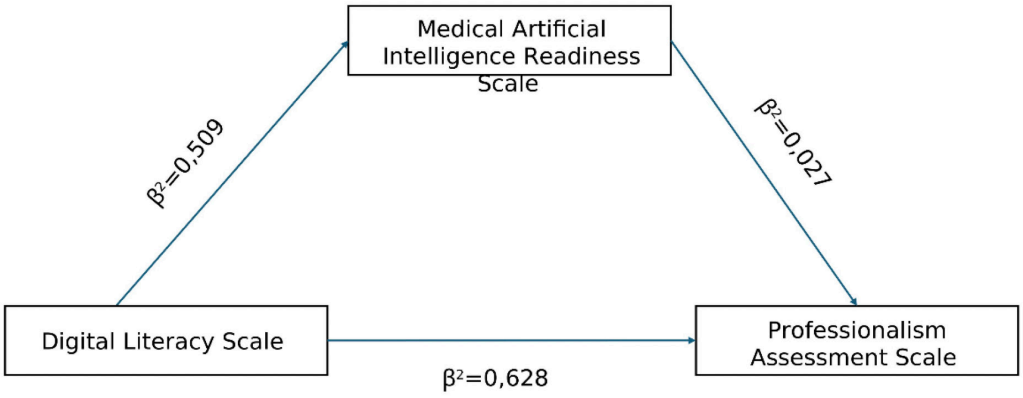

Figure 1. Path analysis model showing the relationships between variables (Standard coefficients)

Discussion

This study investigated the relationships between digital literacy, medical AI readiness, and professionalism levels among dental faculty students. It also examined how these variables were distributed according to various sociodemographic factors. Our findings revealed statistically significant, positive, and moderate correlations between students' digital literacy levels and their professionalism assessments and medical AI readiness. A notable finding from the structural analysis pertains to the evaluation of the mediation model. The analysis suggests that professionalism is significantly associated with digital literacy, while no evidence of a significant mediating

role for medical AI readiness was detected in this relationship within this sample.

Our analysis of the data revealed a significant positive correlation between students' digital literacy levels and their professionalism assessments. This situation may suggest that healthcare professionals with higher digital literacy tend to exhibit professional values and ethical behaviors more consistently. The literature emphasizes the importance of digital literacy in areas such as effective communication, accurate information access, and patient safety.[26] The concept of "digital professionalism" proposed by Mather and Cummings[20] also supports this finding. The integration of digital technologies into healthcare settings necessitates the continuation of professional behaviors in digital environments. As students' digital literacy skills improve, they will be able to assume the professional responsibilities required by the digital age more easily. Our path analysis results reveal that digital literacy is significantly associated with both professionalism ($\beta = 0.841$, $p < 0.001$) and medical AI readiness ($\beta = 0.435$, $p < 0.001$) in this sample. The results indicate that digital capabilities affect professional growth processes and are important for future technological integrations. In the literature, digital literacy is defined as the ability to find, critically analyze, and reproduce information in digital environments within an ethical framework. Individuals lacking this fundamental competence are unlikely to safely integrate complex AI algorithms into their professional practice.[6,7] The associations identified in our research suggest that digital literacy is a foundational competency for dental students to integrate these tools with professional standards and ethical responsibilities.[16] This finding emphasizes that inherent technical familiarity, often attributed to 'digital natives,' does not automatically equate to the academic and ethical proficiency required in a clinical setting. Indeed, the positive correlation between perceived professionalism and medical AI readiness is based on the fact that individuals with high levels of digital literacy approach technology with a conscious attitude that prioritizes patient benefit and protects professional values.[15] Consequently, it is theoretically argued that without a solid foundation of digital literacy, students' cognitive and visionary preparation for AI technologies will be incomplete, making it difficult to exhibit professional attitudes in the digitalized healthcare ecosystem. [22,31]

Another noteworthy point of the study is the positive relationship between digital literacy and medical AI readiness. In particular, there is a strong correlation between the "Technical" sub-dimension of the DLS and the "Skills" sub-dimension of the MAIRS-MS. This indicates that students familiar with computers and digital systems are much more receptive to the idea of using artificial intelligence applications in the clinic and feel more competent in this area. Similar results were reported in the study conducted by Sim et al.[32] on dental hygienist students. Given that digital systems underpin artificial intelligence, it is perfectly natural that a student who understands the logic of these systems is better prepared for it.

Our study did not find a statistically significant relationship between professionalism assessment and medical AI readiness. However, studies in the literature report positive relationships between these two concepts. For example, Ta'an et al.[33] found a relationship between professional identity and medical AI readiness among healthcare workers and emphasized the importance of the ethical dimension in particular. Similarly, El-Bassal et al.[34] stated that professionalism moderates the relationship between medical AI readiness and nurses' self-efficacy. Although a weak, statistically insignificant correlation trend ($r = 0.119$, $p = 0.085$) was observed between students' interest in and readiness for AI and their professional attitudes, further analyses (Path Analysis) show that the main factor shaping professional attitudes is Digital Literacy rather than medical AI readiness. This finding leads to the hypothesis that AI may not yet be fully integrated into dental students' ethical and professional value systems, potentially being perceived more as a technical tool rather than an integral component of professional identity. Furthermore, when the relationships

between the sub-dimensions of the scales are examined; a statistically significant, positive but weak correlation was found between the 'Ethics' sub-dimension of the Medical AI Readiness Scale and the ' Responsibility ' (r = 0.205, p = 0.003) and 'Professional Relationship and Development' (r = 0.196, p = 0.004) sub-dimensions of the PAS. This suggests a potential association between students' understanding of the ethical dimension of AI and more positive professional behavior attitudes. These findings point toward the possible benefits of integrating AI ethics courses with professionalism training in dental education in this context.

When examining sociodemographic data, it was found that the gender factor created some differences. Male students scored higher on the total score of the DLS and in the "Technical" and "Social" sub-dimensions. Furthermore, it was determined that male students scored higher than female students in the "Cognitive" sub-dimension of the MAIRS-MS. These findings are consistent with some studies in the literature. Aydınlar et al.[16], in their study on health students in Turkey, reported that male students had higher rates of exposure to coding and digital technologies than female students. In another study conducted by Gencer[35] among medical faculty students, it was found that cognitive readiness for AI was significantly higher in male students. Since our study did not directly measure sociocultural or background factors, further qualitative or longitudinal research is required to identify the underlying drivers of these observed gender-based variances in digital competencies.

In our class-level comparisons, we found an unexpected result: 4th-year students scored significantly higher than 5th-year students on the PAS, particularly in the "Empathy and Humanism" sub-dimension. This finding is quite remarkable, as while an increase in professionalism perception is expected in later years of education, the opposite was observed in our study. Studies in the literature report a decrease in empathy levels among students during the clinical years of medical education.[36] On the other hand, a recent study by Çakan and İpek[10] on dental students reported that artificial intelligence readiness peaked in the 2nd year and showed a significant decrease in the 5th year. The cross-sectional nature of our study is a significant limitation in interpreting these findings; tracking changes in students' perceptions of empathy and professionalism longitudinally would provide a deeper understanding of these dynamics.

A notable finding of this study involves the mediation analysis performed via the structural model. The results showed no evidence of a significant mediating role for medical AI readiness in the relationship between digital literacy and professionalism in this sample. Instead, digital literacy was found to be directly and significantly associated with the level of professionalism. This suggests that fundamental digital competencies (information security, digital ethics, critical information literacy) show a stronger association with professional attitudes and behaviors among today's dental students compared to AI-specific skills. AI is rapidly becoming widespread in fields such as radiographic analysis or treatment planning.[37] However, students' current awareness and usage levels regarding these technologies might not yet have reached a depth that is significantly linked to their professional identity development within this sample. In light of these findings, it has been concluded that professionalism among dental faculty students is primarily associated with digital literacy in this sample, and no evidence of a significant mediating role for medical AI readiness was found in this relationship.

While today's dental students belong to the digitally native generation, the relative lack of familiarity between some educators and these technologies may create certain challenges in education. In this process, it is argued that educators should assume the role of "digital mentors," rather than simply being technical experts, guiding students in blending technology with clinical reasoning and professional ethical values [25]. For more effective guidance, literature suggests it is important for educators to update their own digital literacy, incorporate

the limitations of AI (such as algorithmic bias) into the curriculum, and position technology as a tool that supports, rather than replaces, clinical decisions.[32] In this way, the technological proficiency of students combined with the professional experience of educators could potentially create a safe and competent foundation for future dental practice.[7]

Our study has several methodological limitations. First, the cross-sectional and self- reported nature of the data collection may lead to common method bias, as all variables were measured at a single time point. Furthermore, given the cross-sectional design, the observed relationships should be interpreted as statistical associations rather than causal proof. Additionally, the exceptionally high Cronbach' s alpha values observed in our scales might suggest item redundancy rather than superior reliability, which should be addressed in future research with more concise tools. A major methodological limitation involves the discrepancy in the structural model fit indices; while the GFI and CFI reached 1.00, the RMSEA value of 0.522 indicates a poor model fit, requiring the path analysis results to be interpreted as preliminary statistical links rather than definitive mechanisms. Despite these limitations, the findings suggest that digital literacy is a significant correlate of both medical AI readiness and professionalism among clinical dental students.

Conclusions

Our results point toward the possibility that students' professional identity in the digital age is more closely associated with core digital competencies than AI-specific technical skills alone. While students demonstrate a general openness to AI, the lack of a significant mediating role for medical AI readiness could suggest that these tools are not yet fully integrated into their professional value systems. Future research encompassing longitudinal designs and larger sample groups would be beneficial for the generalizability and potential causal interpretation of the findings.

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Conflict of Interest

The author declares that there are no financial conflicts of interest with any institution, organization, or individual

Authorship Contributions

Idea/Concept: Z.M, A.S Design: Z.M, A.S Control/Supervision: Z.M, A.S Materials: Z.M, A.S Data Collection and/or Processing: Z.M, A.S Analysis and/or Interpretation: Z.M, A.S Literature Review: Z.M, A.S Writing the Article: Z.M, A.S Critical Review: Z.M, A.S

References

1. Büyükkaya B, Altındiş S, Cevahir F. Diş Hekimliği Öğrencileri Yapay Zeka Uygulamalarına Ne Kadar Hazır? *J Biotechnol Strateg Health Res.* 2023;7:265-74.
2. Fahim YA, Hasani IW, Kabba S, Ragab WM. Artificial Intelligence in Healthcare and Medicine: Clinical Applications, Therapeutic Advances, and Future Perspectives. *Eur J Biomed Res.* 2025;30:1-21.
3. Sunar A, Taş Ç, Sır E, Polater H, Bağlıoğlu N. Diş Hekimliğinde Yapay Zeka Uygulamaları. *KOU Sag Bil Derg.* 2024;2:41-57.
4. Jeong H, Han S-S, Jung H-I, Lee W, Jin Jeon K. Perceptions and Attitudes of Dental Students and Dentists in South Korea Toward Artificial Intelligence: A Subgroup Analysis Based on Professional Seniority. *BMC Med Educ.* 2024;24:1-12.
5. Hung M, Yevseyevich D, Khazana M, Schwartz C, Lipsky MS. Charting New Territory: AI Applications in Dental Caries Detection from Panoramic Imaging. *Dent J (Basel).* 2025;13:1-12.
6. Akman Y. Dijital Okuryazarlık, Çevrim İçi Öğrenme ve Akademik İsteklilik Arasındaki İlişkinin İncelenmesi. *JTES.* 2021;19:1012-36.
7. Mun SB, Yoo SR, Kim YJ, Kim K, Kim BC, Kim KG. AI-driven Prediction of Dental Implant Numbers to be Placed for Patient-Specific Treatment Planning. *Int Dent J.* 2025;75:1-9.
8. Dağaşan A. Dijital Okuryazarlık ile Yapay Zekâ Okuryazarlığı Arasındaki İlişkide Bilgi ve İletişim Teknolojilerine Yönelik Tutumun Aracı Rolü. *TEKE.* 2025;14:238-51.
9. Gokkurt Yilmaz BN, Ozbey F, Yilmaz BE. Effect of artificial intelligence-assisted personalized feedback on radiographic diagnostic performance of dental students: a controlled study. *BMC Med Educ.* 2025;25:1-9.
10. Çakan KN, İpek İ. From lecture hall to clinic: dental students' AI readiness and anxiety across educational stages. *BMC Med Educ.* 2025;25:1-11.
11. Qamar W, Khaleeq N, Nisar A, Tariq SF, Lajber M. Exploring dental professionals' outlook on the future of dental care amidst the integration of artificial intelligence in dentistry: a pilot study in Pakistan. *BMC Oral Health.* 2024; 24:1-8.
12. Aboalshamat KT. Perception and utilization of artificial intelligence (AI) among dental professionals in Saudi Arabia. *Open Dent J.* 2022;16:1-7.
13. Alshammari AF, Madfa AA, Anazi BA, Alenezi YE, Alkurdi KA. Comparison of accuracy and consistency of AI Language models when answering standardised dental MCQs. *BMC Med Educ.* 2025;25:1-9.
14. Kavadella A, Dias da Silva MA, Kaklamanos EG, Stamatopoulos V, Giannakopoulos K. Evaluation of ChatGPT's Real-Life Implementation in Undergraduate Dental Education: Mixed Methods Study. *JMIR Med Educ.* 2024;101-14.
15. Roganović J, Radenković M, Ethical Use of Artificial Intelligence in Dentistry. In: Radenković M (ed). *Ethics- Scientific Research, Ethical Issues, Artificial Intelligence and Education*. IntechOpen, 2023, pp83-94.
16. Aydınlar A, Mavi A, Kütükçü E, Kırımlı EE, Alış D, Akın A, *et al.* Awareness and level of digital literacy among students receiving health-based education. *BMC Med Educ.* 2024;24:1-13.
17. Wartman SA, Combs CD. Reimagining medical education in the age of AI. *AMA J Ethics.* 2019;21:146-52.
18. Cruess S, RL Cruess. The development of professional identity. In: Swanwick T, Forrest K, O'Brien BC (eds). *Understanding Medical Education: Evidence, Theory, and Practice*. John Wiley & Sons Ltd., 2019, pp239–54.
19. Mesko B, Győrffy Z. The rise of the empowered physician in the digital health era: Viewpoint. *J Med Internet Res.* 2019;21:e12490.
20. Mather CA, Cummings E. Developing and sustaining digital professionalism: a model for assessing readiness of healthcare environments and capability of nurses. *BMJ Health Care Inform.* 2019;26:1-5.
21. EJ Topol. High-performance medicine: the convergence of human and artificial intelligence. *Nat Med.* 2019;25:44-56.
22. Karaca O, Çalışkan SA, Demir K. Medical artificial intelligence readiness scale for medical students (MAIRS-MS)–development, validity and reliability study. *BMC Med Educ.* 2021;21(1):112.
23. Dashti M, Londono J, Ghasemi S, Khurshid Z, Khosraviani F, Moghaddasi N, *et al.* Attitudes, knowledge, and perceptions of dentists and dental students toward artificial intelligence: a systematic review. *J Taibah Univ Med Sci.* 2024;19:327-37.

24. El-Bassal NAM, El-Sayed AAI, Elgamal HG. Empowering nurses in the AI era: investigating the interplay between professionalism, AI readiness, and self-efficacy. *BMC Nurs*. 2025;24(1):1287

25. Thurzo A, Strunga M, Urban R, Surovková J, Afrashtehfar KI. Impact of Artificial Intelligence on Dental Education: A Review and Guide for Curriculum Update. *Educ. Sci. (Basel)*. 2023;13(2):150

26. Boshnjaku A, Krasniqi E, Kamberi F. The emerging need to integrate digital health literacy as a course into health-related and care-related profession curricula. *Front Public Health*. 2025;13:1-4.

27. W Ng. Can we teach digital natives digital literacy? *Comput Educ*. 2012;59:1065-78.

28. Hamutoğlu NB, Canan Güngören Ö, Kaya Uyanik G, Gür Erdoğan D. Dijital Okuryazarlık Ölçeği: Türkçe 'ye Uyarlama Çalışması *EGEEFD*. 2017;1:408-29.

29. Klemenc-Ketis Z, Vrecko H. Development and validation of a professionalism assessment scale for medical students. *Int J Med Educ*. 2014;5:20511.

30. Kaşali K, Eminoğlu DÖ, Üstündağ ŞD, Tanrıverdi EÇ. Türk Diş Hekimliği Öğrencilerinde Profesyonellik Değerlendirme Ölçeğinin Geçerliliği ve Güvenilirliği. *Curr Res Health Sci*. 2024;1:115-22.

31. Schwendicke F, Chaurasia A, Wiegand T, Uribe SE, Fontana M, Akota I, *et al.* Artificial intelligence for oral and dental healthcare: Core education curriculum. *J Dent*. 2023;128:104363.

32. Sim S-J, Kim J-H, Hong M-H, Hong S-M, Lee M-J. Study on the Attitudes toward Artificial Intelligence and Digital Literacy of Dental Hygiene Students. *J Dent Hyg Sci*. 2024;24:171-80.

33. Ta'an W, Damrah S, Al-Hammouri MM, Williams B. Professional identity and its relationships with AI readiness and interprofessional collaboration. *PLoS One*. 2025;20:e0322794.

34. El-Bassal NAM, El-Sayed AAI, Elgamal HG. Empowering nurses in the AI era: investigating the interplay between professionalism, AI readiness, and self-efficacy. *BMC Nurs*. 2025;24:1-13.

35. Gencer K, Gencer G. Tıp Fakültesi Öğrencilerinin Tıbbi Yapay Zeka Hazır Bulunuşluluğunun İncelenmesi. *Kocatepe Med J*. 2024;25:143-9.

36. O'Tuathaigh CMP, Idris AN, Duggan E, Costa P, Costa MJ. Medical students' empathy and attitudes towards professionalism: Relationship with personality, specialty preference and medical programme. *PLoS One*. 2019;14:e0215675.

37. Harte M, Carey B, Feng QJ, Alqarni A, Albuquerque R. Transforming undergraduate dental education: the impact of artificial intelligence. *Br Dent J*. 2025;238:57-60.