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Digital literacy and computer self-efficacy among dental students and faculty members

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ABSTRACT

Aims: This study aimed to examine the digital literacy and computer self-efficacy of faculty members and undergraduate students in dental education and to investigate their associations with demographic and technology-related characteristics.

Methods: This cross-sectional survey included 102 undergraduate dental students and all 12 faculty members employed at the institution during the study period. Data were collected using the Personal Information Form, Questionnaire for Determining Prospective Teachers' Digital Literacy Levels, and Computer Self-Efficacy Scale. Descriptive statistics, independent-samples t-tests, Welch's t-test, one-way analysis of variance, non-parametric tests, correlation analyses, and multiple linear regression analyses were performed as appropriate.

Results: Male students had higher digital literacy and computer self-efficacy scores than female students, whereas no significant differences were observed between age groups. Personal computer ownership and previous computer-related training were associated with higher scores on both outcomes. In the multivariable analyses, gender, personal computer ownership, and previous computer-related training remained significantly associated with both digital literacy and computer self-efficacy after adjustment for age, grade level, and frequency of internet use. Grade level was not independently associated with either outcome after adjustment. Faculty members had higher digital literacy and computer self-efficacy scores than students. Digital literacy and computer self-efficacy were strongly positively correlated among students, whereas no statistically significant association was identified among faculty members.

Conclusion: Digital literacy and computer self-efficacy among dental students were associated with gender, access to a personal computer, and previous computer-related training. These findings support the integration of structured technology-supported learning opportunities into dental education while emphasizing that the observed associations should not be interpreted causally.

Keywords: Digital literacy, computer self-efficacy, dental education, higher education, educational technology, digital competence

INTRODUCTION

Rapid developments in digital technologies have transformed individuals' processes of accessing information, communication, learning and professional practice. In particular, the widespread integration of digital tools into educational environments has restructured teaching and learning processes, making online platforms, mobile technologies, simulation applications and interactive digital content central components of contemporary education.[1,2] This transformation has increased the importance of not only using technology effectively, but also accessing, evaluating, analysing and producing information ethically within digital environments.[3] Accordingly, digital literacy and computer self-efficacy have become critical competencies in modern education systems.[4]

Digital literacy is a multidimensional concept referring to individuals' ability to use digital technologies effectively, critically, safely and consciously. Beyond technical skills, digital literacy includes competencies such as information access, information evaluation, digital communication, content creation and problem-solving.[3] Today, digital literacy is considered an essential competency for academic achievement and professional success.[5] Particularly within higher education, the increasing prevalence of digital learning environments has made the digital competence levels of students and faculty members increasingly important.[6]

Computer self-efficacy, on the other hand, refers to individuals' perceptions of their competence in using computers and digital technologies. Based on Bandura's self-efficacy theory, computer self-efficacy is regarded as one of the key variables influencing individuals' motivation regarding technology use, their attitudes toward digital environments and their confidence in performing technology-related tasks.[7] The literature suggests that individuals with stronger self-efficacy beliefs demonstrate more positive attitudes toward technology

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use, adapt more easily to digital learning environments and perform more successfully in technology-supported applications.[8,9]

Previous studies have also demonstrated a significant relationship between digital literacy and computer self-efficacy. Individuals who can use digital tools effectively tend to develop stronger confidence regarding technology use, whereas individuals with high self-efficacy beliefs are more likely to engage actively with digital environments and adapt more successfully to technology-supported learning processes.[4,9,10] Therefore, digital literacy and computer self-efficacy may be considered mutually reinforcing constructs that contribute to individuals' successful participation in contemporary educational environments.

The increasing integration of digital technologies into health education has further emphasized the importance of digital competence among both students and faculty members. Dental education, in particular, represents one of the health disciplines in which digital technologies are used extensively. Digital radiography systems, CAD/CAM applications, virtual simulations, intraoral scanners, three-dimensional modelling technologies and online learning platforms have become integral components of contemporary dental education.[11,12] These technologies not only facilitate the development of students' theoretical and clinical skills but also require faculty members to develop advanced digital pedagogical competencies.[13]

Recent research has further demonstrated the growing importance of digital competence within dental education. Studies involving dental students have examined their experiences with CAD/CAM systems, intraoral scanners, digital workflows, and other technology-supported learning environments, generally indicating positive attitudes toward digital dentistry while also identifying variability in practical experience, confidence, and preparedness for technology-supported clinical practice.[14,16] Recent evidence also suggests that structured exposure to digital technologies during dental education may be relevant to students' confidence and preparedness for digital clinical workflows.[15,16] At a broader level, recent systematic reviews demonstrate that digitalization is becoming increasingly integrated into undergraduate and postgraduate dental education, although implementation and educational outcomes remain heterogeneous across institutions and technologies.[17,18]

More recent research has begun to examine digital competence itself among dental students rather than focusing exclusively on individual dental technologies. Shooriabi et al.[19] assessed dental students using a DigComp 2.2-based instrument and reported relatively high self-perceived digital competence, while overall competence did not differ significantly according to gender, age, academic year, or duration of daily internet use. These findings illustrate the growing interest in broader digital competence within dental education while also suggesting that its demographic correlates may vary across educational contexts.

Technology-supported educational environments, including online learning systems, virtual reality applications and simulation-based instructional tools, contribute to the development of students' clinical competencies and support more interactive and individualized learning experiences.[20] However, the effective integration of digital technologies into educational processes is closely associated with individuals' levels of digital literacy and their confidence regarding computer use.[21] Consequently, determining the digital competence levels of students and faculty members has become increasingly important for improving the quality of dental education and supporting effective technology integration within professional training environments.[22]

Although the literature on digitalization in dental education has expanded considerably in recent years, much of the existing research has focused on students' perceptions, experiences, or performance regarding specific technologies such as CAD/CAM systems, intraoral scanners, virtual simulation, and other digital workflows.[14,18] Recent research has begun to examine broader digital competence and digital literacy among dental students,[19,23] but comparatively limited attention has been given to digital literacy and computer self-efficacy as related but distinct constructs within dental education, particularly through the simultaneous inclusion of students and faculty members.[22] Although previous dental education research has compared students and faculty members in related areas such as e-learning readiness,[30] digital literacy and computer self-efficacy have received substantially less attention as distinct but potentially interrelated constructs examined concurrently across these two groups. Moreover, evidence regarding the demographic and technology-related characteristics independently associated with these constructs among dental students remains limited.[19,23]

Accordingly, the present study aimed to examine digital literacy and computer self-efficacy among dental students and faculty members within the same institutional context and to investigate the relationship between these constructs. In addition, the study examined their associations with demographic and technology-related characteristics among students and used multivariable analyses to determine which factors remained independently associated with digital literacy and computer self-efficacy after adjustment for other measured characteristics. By examining both constructs and both participant groups within a single dental education setting, the study seeks to contribute to a more comprehensive understanding of digital competence and technology-related confidence in contemporary dental education.

METHODS

Ethics

This study was approved by the Niğde Ömer Halisdemir University Ethics Committee (Date: 29.03.2024, Decision No: 2024/07-16). All procedures were conducted in accordance with the Declaration of Helsinki.

Study Design

This study employed a cross-sectional survey design[24] to examine the digital literacy levels and computer self-efficacy beliefs of dental students and faculty members. Within this framework, the relationships between digital literacy, computer self-efficacy and various demographic variables were analysed.

Participants

The target population of the study consisted of all undergraduate students and faculty members at the Faculty of Dentistry, Niğde Ömer Halisdemir University, during the data collection period. A total population approach was adopted, and all eligible students and faculty members were invited to participate in the study rather than selecting a subgroup through a sampling procedure.[25]

At the time of data collection, 121 undergraduate students were enrolled in the faculty. Of these students, 102 provided complete and valid responses and were included in the final analysis, corresponding to a valid response rate of 84.3%. The faculty employed 12 academic staff members during the same period, all of whom participated in the study, corresponding to a response rate of 100%. Thus, the final analytical sample consisted of 114 participants (102 students and 12 faculty members).

At the time of the study, the faculty of dentistry was newly established and provided education only to first-, second-, and third-year students. Fourth- and fifth-year cohorts had not yet been established at the institution. Therefore, fourth- and fifth-year students were not excluded on the basis of any eligibility or sampling criterion; rather, these cohorts did not exist during the study period. This institutional characteristic should be considered when interpreting comparisons across year levels.

An a priori sample size or power calculation was not performed because the study was designed to invite the entire eligible population of the faculty during the data collection period rather than to select a predetermined sample. Nevertheless, the small absolute number of faculty members (n=12) should be considered when interpreting analyses involving this group.

Of the students, 64 were female (62.7%) and 38 were male (37.3%); the overall distribution of the study group, including the faculty members, was evaluated within the scope of the research.

Data Collection Tools

The Personal Information Form, Questionnaire for Determining Prospective Teachers' Digital Literacy Levels and the Computer Self-Efficacy Scale were used as data collection tools in the study.

Personal Information Form: The personal information form, developed by the researchers, consists of questions designed to determine demographic variables such as gender, age, year group, ownership of a personal computer, frequency of internet use, and whether the respondent has received computer-related training.

Questionnaire for Determining Prospective Teachers' Digital Literacy Levels: Digital literacy was assessed using the instrument developed by Kıyıcı[26] to determine prospective teachers' digital literacy levels. The instrument was developed following a review of the relevant literature and existing questionnaires. An initial pool of 128 Likert-type items addressing digital literacy and its dimensions was prepared. The draft instrument was reviewed by eight field experts in terms of content appropriateness, clarity of the instructions and items, and response format. Based on expert feedback, 16 items were removed, and the revised instrument was subsequently pilot-tested with 251 prospective teachers. The internal consistency coefficient obtained in the pilot study was Cronbach's α=.9798. Following item analysis, items with unsuitable corrected item-total correlations were removed, resulting in a final 107-item instrument. The instrument addresses digital literacy through four dimensions: computer literacy, information literacy, technology literacy, and media literacy. Items are rated on a five-point frequency-based response format ranging from never to always, with intermediate categories of rarely, sometimes, and often. Scores are calculated using the arithmetic mean of the relevant items, with higher scores indicating higher levels of digital literacy. In the present study, the Cronbach's α coefficient was calculated as 0.984, indicating a high level of internal consistency.

Computer Self-Efficacy Scale: The Computer Self-Efficacy Scale developed by Şensoy[27] was used to assess participants' perceived self-efficacy regarding computer use. During the development of the instrument, an initial pool of 20 items was prepared. Following expert review for content relevance, the instrument was revised to 16 items. The 16-item form was subsequently pilot-tested with 109 teachers. Item analyses supported the retention of all 16 items, and the scale demonstrated high internal consistency, with a Cronbach's α coefficient of .89. The instrument uses a five-point Likert-type response format ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating higher perceived computer self-efficacy. In the present study, the Cronbach's α coefficient was calculated as 0.814, indicating acceptable reliability.

Data Collection

The data collection phase of the study was carried out during the 2024-2025 academic year. The data collection tools were administered to faculty members and students who volunteered to participate in the study using both paper-based and electronic formats. Participants were informed about the purpose of the study, and informed consent was obtained prior to data collection. Completion of the questionnaires took approximately 15 minutes. The data obtained from participants were handled in accordance with the principle of confidentiality. Before the statistical analyses were conducted, the questionnaires were checked for completeness, and only complete responses were included in the analysis.

Statistical Analysis

Prior to inferential analyses, the distributions of the study variables were examined using the Shapiro-Wilk test, skewness and kurtosis values, and inspection for potential outliers. Homogeneity of variance for group comparisons was assessed using Levene's test. For two-group comparisons, student's independent-samples t-test was used when the homogeneity-of-variance assumption was satisfied, whereas Welch's t-test was used when this assumption was violated. For comparisons involving more than two groups, one-way ANOVA was used when the relevant assumptions were satisfied. When the omnibus one-way ANOVA was statistically significant, Tukey's honestly significant difference (HSD) test was used for post-hoc pairwise comparisons, with multiplicity-adjusted p-values reported.

For the student sample, both digital literacy and computer self-efficacy scores showed acceptable distributional characteristics; therefore, Pearson's correlation coefficient was used to examine their association. In contrast, given the small faculty sample (n=12), the significant departure from normality observed for computer self-efficacy scores, and the presence of a potential outlying observation, Spearman's rank-order correlation coefficient was used to examine the association between digital literacy and computer self-efficacy among faculty members. Statistical significance was set at $p<.05$.

In the results of the independent samples t-test, Cohen's d coefficient was calculated to determine the effect size. In the interpretation of Cohen's d-values, 0.20 was considered a small, 0.50 a medium, and 0.80 a large effect size.[28] In one-way analyses of variance, the eta squared (η^2) coefficient was used to determine the effect size. In the interpretation of η^2 values, 0.01 was considered a small effect size, 0.06 a medium effect size, and 0.14 a large effect size.[28]

To account for potential confounding among demographic and technology-related characteristics, two multiple linear regression models were additionally conducted for the student sample, with digital literacy and computer self-efficacy entered separately as dependent variables. Gender, age, grade level, personal computer ownership, frequency of internet use, and previous computer-related training were entered simultaneously as predictors.

Given that multiple hypothesis tests were conducted across several demographic and technology-related variables, the possibility of an increased family-wise type I error rate was considered. These subgroup analyses were treated as exploratory rather than confirmatory; therefore, no formal multiplicity adjustment was applied. Statistical significance was evaluated at the conventional α=.05 level, but findings with p-values close to this threshold were interpreted cautiously and in conjunction with their corresponding effect sizes. Accordingly, these results should be regarded as hypothesis-generating and warrant confirmation in future studies.

RESULTS

Demographic Findings for the Sample Group

A total of 114 participants took part in the study, including 102 students and 12 faculty members. Among the students, 62.7% were female (n=64) and 37.3% were male (n=38). Most participants were between the ages of 17 and 19. In terms of grade level, 43.1% of the students were in year 1, 35.3% were in year 2 and 21.6% were in year 3 (**Table 1**).

Table 1. Demographic characteristics of students in the sample group

Characteristic		f	%
Gender	Female	64	62.7
	Male	38	37.3
Age	17-19	54	52.9
	20 +	48	47.1
Class	Year 1	44	43.1
	Year 2	36	35.3
	Year 3	22	21.6
Ownership of a personal computer	Yes	58	56.9
	No	44	43.1
Frequency of internet use	Medium	14	13.7
	Frequent	50	49.0
	Very frequent	38	37.3
Status of computer-related training	Yes	33	32.4
	No	69	67.6
Students' purpose of internet use	Homework preparation/ information gathering	23	22.6
	Playing games	8	7.8
	Social	65	63.8
	E-mail	3	2.9
	For professional use	3	2.9
Total		102	100

More than half of the students owned a personal computer (56.9%), while 49% reported frequent internet use. However, 67.6% stated that they had not received any computer-related training previously. Regarding the purpose of internet use, most students reported using the internet mainly for social purposes.

Table 2 shows that faculty members primarily used the internet for information gathering and e-mail communication. Both groups reported regular engagement with digital technologies. Nevertheless, the proportion of students who had received computer-related training remained relatively low.

Table 2. Purposes of internet use among faculty members in the sample group

Characteristic		f	%
Purpose of internet use by faculty members	Information gathering	6	50
	Playing games	0	0
	For social purposes	2	16.6
	E-mail	4	33.3
	For professional use	0	0
Total		12	100

Findings on Normality

As shown in **Table 3**, neither digital literacy (p=.061) nor computer self-efficacy (p=.373) scores showed a statistically significant departure from normality among students. Skewness and kurtosis values were also within acceptable limits.

Table 3. Results of the normality assessment for digital literacy and computer self-efficacy scores among students

						Shapiro-Wilk	
Variable	$\bar{X}$	SD	Median	Skewness	Kurtosis	Statistics	p
Digital literacy	3.46	.72	3.31	.238	-.594	.976	.061
Computer self-efficacy	3.51	.58	3.53	-.259	-.352	.986	.373

p>.05 indicates no statistically significant departure from normality. SD: Standard deviation

As shown in **Table 4**, digital literacy scores did not significantly deviate from normality (p=.894), whereas computer self-efficacy scores showed a statistically significant departure from normality (p=.042). Given the small faculty sample (n=12), this distributional characteristic was taken into account when selecting the subsequent statistical procedures.

Table 4. Results of the normality assessment for digital literacy and computer self-efficacy scores among faculty members

						Shapiro-Wilk	
Variable	$\bar{X}$	SD	Median	Skewness	Kurtosis	Statistics	p
Digital literacy	3.93	.56	3.91	-.097	-.641	.968	.894
Computer self-efficacy	3.91	.48	4.03	-1.114	.898	.855	.042*

p<.05 indicates a statistically significant departure from normality. *Significant at the p<.05 level. SD: Standard deviation

Findings Regarding Digital Literacy and Computer Self-Efficacy Levels

Table 5 shows that the mean digital literacy score among students was 3.46 (SD=0.72), while the mean computer self-efficacy score was 3.51 (SD=0.58). Because validated cutoff values for categorizing these scale scores as low, moderate, or high are not available, the scores are presented and interpreted as continuous measures rather than categorical levels.

Table 5. Distribution of students' scores on digital literacy levels and attitudes towards computer self-efficacy beliefs

Variable	n	$\bar{X}$	Mode	Median	SD	Observed range	Possible range
Digital literacy	102	3.46	2.76	3.310	.72	1.82-5.00	1.00-5.00
Computer self-efficacy	102	3.51	3.50	3.531	.58	1.94-4.62	1.00-5.00

SD: Standard deviation

Table 6 indicates that faculty members had higher mean scores for both digital literacy and computer self-efficacy than students. In addition, faculty members' scores showed a narrower observed range.

Table 6. Distribution of scores for faculty members' digital literacy levels and attitudes towards computer self-efficacy beliefs

Variable	n	$\bar{X}$	Mode	Median	SD	Observed range	Possible range
Digital literacy	12	3.93	3.06	3.915	.56	3.06-4.86	1.00-5.00
Computer self-efficacy	12	3.91	4.25	4.031	.48	2.81-4.37	1.00-5.00

SD: Standard deviation

Findings Regarding the Gender Variable

Table 7 shows a statistically significant gender difference in students' digital literacy scores, Welch's t (59.92)=-2.220, p=.030, with male students reporting higher scores than female students. A statistically significant gender difference was also observed for computer self-efficacy, t (100)=-2.432, p=.017, again in favour of male students.

Table 7. Comparison of students' digital literacy and computer self-efficacy scores according to gender

Variable	Gender	n	$\bar{X}$	SD	df	Test statistic	p	Cohen's d
Digital literacy	Female	64	3.33	.61	59.92	-2.220[a]	.030*	.47
	Male	38	3.68	.84				
Computer self-efficacy	Female	64	3.41	.52	100	-2.432[b]	.017*	.50
	Male	38	3.69	.64				

[a]Welch's t-test was used because the homogeneity-of-variance assumption was violated. [b]Student's independent-samples t-test was used because the homogeneity-of-variance assumption was satisfied. *Significant at the p<.05 level. SD: Standard deviation

Findings Regarding the Age Variable

As shown in Table 8, students aged 17-19 years did not differ significantly in digital literacy from those aged 20 years and over, t (100)=0.772, p=.442, Cohen's d=0.15. Similarly, no statistically significant difference was observed in computer self-efficacy between the two age groups, t (100)=-0.567, p=.572, Cohen's d=-0.11. The small effect sizes further indicate that age-related differences in both outcomes were limited.

Table 8. Comparison of students' digital literacy and computer self-efficacy scores according to age

Variable	Age	n	$\bar{X}$	SD	df	t	p	Cohen's d
Digital literacy	17-19	54	3.51	.78	100	0.772	.442	.15
	20+	48	3.40	.65				
Computer self-efficacy	17-19	54	3.48	.62	100	-0.567	.572	-.11
	20+	48	3.55	.54				

SD: Standard deviation

Findings Regarding Class Level

Table 9 shows that students' digital literacy scores did not differ significantly across grade levels, F (2, 99)=2.097, p=.128, η^2=.041. In contrast, computer self-efficacy scores differed significantly according to grade level, F (2, 99)=3.263, p=.042, η^2=.062. Third-year students had the highest mean computer self-efficacy score ($\bar{X}$=3.73, SD=0.51), followed by first-year ($\bar{X}$=3.54, SD=0.58) and second-year students ($\bar{X}$=3.35, SD=0.59). Tukey HSD post-hoc comparisons indicated that the difference between second- and third-year students was statistically significant (mean difference=0.387, adjusted p=.035), whereas the differences between first- and second-year students (adjusted p=.281) and between first- and third-year students (adjusted p=.403) were not statistically significant. Therefore, although third-year students had the highest mean computer self-efficacy score, the findings do not indicate a gradual increase in computer self-efficacy with academic progression.

Table 9. Comparison of students' digital literacy and computer self-efficacy scores according to grade level

Variable	Class level	n	$\bar{X}$	SD	f	p	η^2
Digital literacy	Year 1	44	3.56	.73	2.097	.128	.041
	Year 2	36	3.27	.70			
	Year 3	22	3.59	.70			
Computer self-efficacy	Year 1	44	3.54	.58	3.263	.042*	.062
	Year 2	36	3.35	.59			
	Year 3	22	3.73	.51			

Tukey HSD post-hoc comparisons were conducted following the significant omnibus ANOVA for computer self-efficacy. Only the year 2-year 3 comparison was statistically significant (adjusted p=.035); year 1-year 2 (adjusted p=.281) and year 1-year 3 (adjusted p=.403) were not significant. *η^2=eta squared. Significant at the p<.05 level. SD: Standard deviation, HSD: Honestly significant difference, ANOVA: Analysis of variance

Findings Regarding Ownership of a Personal Computer

Table 10 shows that students who owned a personal computer had significantly higher digital literacy scores ($\bar{X}$=3.64, SD=0.69) than those who did not own a personal computer ($\bar{X}$=3.23, SD=0.70), t (100)=2.922, p=.004, Cohen's d=0.58. Similarly, students who owned a personal computer reported significantly higher computer self-efficacy scores ($\bar{X}$=3.67, SD=0.50) than those without a personal computer ($\bar{X}$=3.31, SD=0.62), t (100)=3.201, p=.002, Cohen's d=0.64. These findings indicate that personal computer ownership was associated with higher scores on both digital literacy and computer self-efficacy.

Table 10. Comparison of students' digital literacy and computer self-efficacy scores according to personal computer ownership

Variable	Computer ownership	n	$\bar{X}$	SD	df	t	p	Cohen's d
Digital literacy	Yes	58	3.64	.69	100	2.922	.004*	.58
	No	44	3.23	.70				
Computer self-efficacy	Yes	58	3.67	.50	100	3.201	.002*	.64
	No	44	3.31	.62				

Cohen's d was calculated using the pooled standard deviation. *Significant at the p<.05 level. SD: Standard deviation

Findings Regarding Frequency of Internet Use

The Kruskal-Wallis test examined whether students' digital literacy and computer self-efficacy scores differed according to the frequency of internet use. Table 11 shows that the rank averages for digital literacy scores were similar across students who used the internet moderately, frequently and very frequently. The analysis therefore revealed no significant difference between the groups (X^2=0.167, p=.920).

Table 11. Comparison of students' digital literacy and computer self-efficacy scores according to internet usage frequency

Variable	Frequency	n	Rank mean	df	X^2	p
Digital literacy	Medium	14	49.14	2	.167	.920
	Frequent	50	51.18			
	Very frequent	38	52.79			
Computer self-efficacy	Medium	14	46.79	2	.591	.744
	Frequent	50	53.41			
	Very frequent	38	50.72			

Similarly, computer self-efficacy scores did not differ significantly based on internet usage frequency (X^2=0.591, p=.744). Although students who used the internet frequently reported slightly higher rank averages, the differences between the groups remained statistically insignificant. Overall, internet usage frequency did not produce a significant difference in students' digital literacy or computer self-efficacy levels.

Findings Regarding the Status of Computer-Related Training

Table 12 shows that students who had received previous computer-related training reported significantly higher digital literacy scores ($\bar{X}$=3.71, SD=0.61) than those who had not received such training ($\bar{X}$=3.34, SD=0.74), t (100)=2.455, p=.016, Cohen's d=0.52. Similarly, students with previous computer-related training demonstrated significantly higher computer self-efficacy scores ($\bar{X}$=3.80, SD=0.49) than students without such training ($\bar{X}$=3.38, SD=0.58), t (100)=3.637, p<.001, Cohen's d=0.77. These findings indicate that previous computer-related training was associated with higher levels of both digital literacy and computer self-efficacy. The effect size was moderate for digital literacy (Cohen's d=0.52) and moderate-to-large for computer self-efficacy (Cohen's d=0.77).

Table 12. Comparison of students' digital literacy and computer self-efficacy scores according to previous computer-related training

Variable	Receipt of training	n	$\bar{X}$	SD	df	t	p	Cohen's d
Digital literacy	Yes	33	3.71	.61	100	2.455	.016*	.52
	No	69	3.34	.74				
Computer self-efficacy	Yes	33	3.80	.49	100	3.637	<.001*	.77
	No	69	3.38	.58				

Cohen's d was calculated using the pooled standard deviation, *Significant at the p<.05 level. SD: Standard deviation

Findings Regarding the Comparison of Digital Literacy and Computer Self-Efficacy Levels Among Faculty Members and Students

Table 13 presents the results of the Mann-Whitney U test comparing the digital literacy levels of students and faculty members. Faculty members obtained higher rank averages than students, and the difference between the groups was statistically significant (U=372.500, p=.027, r=.207). These findings suggest that faculty members demonstrated higher digital literacy levels than students.

Table 13. Comparison of digital literacy scores of students and faculty members

Variable	Status	n	Rank mean	Total	U	p	Effect size r
Digital literacy	Student	102	55.15	5625.50	372.500	.027*	.207
	Faculty members	12	77.46	929.50			

Effect size r was calculated as |Z|/√N. *Significant at the p<.05 level

Table 14 shows a similar pattern for computer self-efficacy scores. Faculty members again reported higher rank averages than students, and the difference between the groups reached statistical significance (U=362.000, p=.021, r=.216). Accordingly, faculty members demonstrated significantly higher computer self-efficacy levels compared to students.

Table 14. Comparison of scores for students' and faculty members' computer self-efficacy beliefs

Variable	Status	n	Rank mean	Total	U	p	Effect size r
Computer self-efficacy	Student	102	55.05	5615.00	362.000	.021*	.216
	Faculty members	12	78.33	940.00			

Effect size r was calculated as |Z|/√N. *Significant at the p<.05 level

Findings Regarding the Relationship Between Digital Literacy and Computer Self-Efficacy Beliefs

Given the small faculty sample and the departure from normality observed in computer self-efficacy scores, Spearman's rank-order correlation was used to examine the relationship between digital literacy and computer self-efficacy. As shown in **Table 15**, a weak positive but statistically non-significant association was observed between the two variables (ρ=.177, p=.583).

Table 15. Spearman's rank-order correlation between digital literacy and computer self-efficacy among faculty members

Variables	n	Spearman's ρ	p
Digital literacy-computer self-efficacy	12	.177	.583

Spearman's rank-order correlation was used because of the small faculty sample and the departure from normality observed in computer self-efficacy scores

Table 16 presents the relationship between students' digital literacy levels and computer self-efficacy beliefs. The analysis revealed a strong positive and statistically significant correlation between the two variables (r=.660, p<.001). In other words, students with higher digital literacy levels also reported stronger computer self-efficacy beliefs.

Table 16. The relationship between students' digital literacy levels and computer self-efficacy beliefs

Correlations		Digital literacy	Computer self-efficacy
Digital literacy	r	1	.660**
	p		<.001
	n	102	102
Computer self-efficacy	r	.660**	1
	p	<.001	
	n	102	102

*Significant at the p<.05 level

Multivariable Analyses

To examine whether the observed associations remained after accounting for potentially interrelated participant characteristics, two multiple linear regression analyses were conducted in the student sample. Gender, age, grade level, personal computer ownership, frequency of internet use, and previous computer-related training were entered simultaneously as predictors.

As shown in **Table 17**, the overall model predicting digital literacy was statistically significant, F (8, 93)=3.229, p=.003, explaining 21.7% of the variance in digital literacy scores (R^2=.217; adjusted R^2=.150). After simultaneous adjustment for the other variables in the model, gender (β=-.247, p=.013), personal computer ownership (β=-.246, p=.012), and previous computer-related training (β=-.221, p=.026) remained significantly associated with digital literacy. Female students had lower adjusted digital literacy scores than male students, while students without a personal computer and those without previous computer-related training also had lower adjusted scores. Age, grade level, and frequency of internet use were not independently associated with digital literacy.

Table 17. Multiple linear regression analysis predicting digital literacy among students

Predictor	B	β	p
Gender (female vs. male)	-0.365	-.247	.013*
Age (≥20 vs. 17-19 years)	-0.066	-.046	.700
Grade level (year 2 vs. year 1)	-0.314	-.210	.072
Grade level (year 3 vs. year 1)	-0.165	-.095	.483
Personal computer ownership (no vs. yes)	-0.355	-.246	.012*
Internet use (frequent vs. medium)	0.117	.081	.585
Internet use (very frequent vs. medium)	0.147	.099	.508
Previous computer-related training (no vs. yes)	-0.338	-.221	.026*

Reference categories were male, 17-19 years of age, year 1, personal computer ownership, medium internet use, and previous computer-related training. R^2=.217; adjusted R^2=.150. Overall model: F (8, 93)=3.229, p=.003. *Significant at the p<.05 level

As presented in **Table 18**, the model predicting computer self-efficacy was also statistically significant, F (8, 93)=4.757, p<.001, accounting for 29.0% of the variance (R^2=.290; adjusted R^2=.229). Gender (β=-.229, p=.015), personal computer ownership (β=-.288, p=.002), and previous computer-related training (β=-.290, p=.003) remained significantly associated with computer self-efficacy after simultaneous adjustment. Female students, students without a personal computer, and students without previous computer-related training had lower adjusted computer self-efficacy scores. Age, grade level, and frequency of internet use were not independently associated with computer self-efficacy.

Table 18. Multiple linear regression analysis predicting computer self-efficacy among students

Predictor	B	β	p
Gender (female vs. male)	-0.274	-.229	.015*
Age (≥20 vs. 17-19 years)	0.075	.065	.568
Grade level (year 2 vs. year 1)	-0.260	-.215	.053
Grade level (year 3 vs. year 1)	-0.087	-.062	.629
Personal computer ownership (no vs. yes)	-0.337	-.288	.002*
Internet use (frequent vs. medium)	0.221	.191	.180
Internet use (very frequent vs. medium)	0.155	.129	.365
Previous computer-related training (no vs. yes)	-0.358	-.290	.003*

Reference categories were male, 17-19 years of age, year 1, personal computer ownership, medium internet use, and previous computer-related training. R^2=.290; adjusted R^2=.229. Overall model: F (8, 93)=4.757, p<.001. *Significant at the p<.05 level

DISCUSSION

Digital technologies have become increasingly central to both theoretical instruction and clinical training within dental education. In this context, the present study examined the digital literacy and computer self-efficacy levels of dental students and faculty members. The results showed measurable variation in digital literacy and computer self-efficacy scores across students and faculty members, with faculty members obtaining higher scores than students on both measures. These findings should be interpreted on the basis of the observed continuous scores rather than categorical levels, as validated cutoff values for classifying these measures as low, moderate, or high are not available. Similar observations have been reported in previous studies emphasizing the expanding role of online learning systems, digital simulations and technology-enhanced educational applications in health education settings.[4,20] In dentistry specifically, technologies such as digital radiography systems, CAD/CAM applications and intraoral scanners are no longer peripheral tools but increasingly routine components of professional training and clinical practice.[11]

The digital literacy and computer self-efficacy scores observed among students may be associated with the extent to which digital technologies are embedded within contemporary university life. Students today routinely engage with online learning platforms, mobile applications and digital educational resources throughout their academic experiences. Continuous interaction with such technologies may be associated with greater technological competence and confidence regarding digital tool use. Previous studies have similarly reported positive associations between sustained exposure to digital learning environments and digital competence and self-efficacy perceptions.[4,10] The present findings appear particularly relevant in dental education, where students increasingly encounter technology-intensive systems during both pre-clinical and clinical training processes.[20,29]

Recent dental education research provides additional context for these findings. Ceylan et al.[23] reported a significant positive relationship between digital literacy and perceived professional competence among dental students, highlighting the relevance of digital literacy to students' perceptions of their professional capabilities. More recently, Shooriabi et al.,[19] using a DigComp 2.2-based assessment, found that dental students demonstrated a heterogeneous profile of self-perceived digital competence, with relatively stronger perceptions in some technical and functional domains and lower competence in higher-order domains such as critical thinking, digital citizenship, and lifelong learning. Taken together, these findings suggest that digital competence among dental students should be considered a multidimensional construct rather than being inferred solely from students' routine exposure to digital technologies.

The study further revealed that faculty members demonstrated higher levels of digital literacy and computer self-efficacy than students. A similar pattern has been reported in recent dental education research. Zahid and Agou[30] compared dental students and faculty members and found that faculty members demonstrated higher scores than students across almost all domains of e-learning readiness, including computer skills, online skills, and overall readiness. Although e-learning readiness is conceptually distinct from digital literacy and computer self-efficacy, these findings provide dental education-specific evidence that students and faculty members may differ in their preparedness for technology-supported educational environments. One possible interpretation of the higher digital literacy and computer self-efficacy scores observed among faculty members may be considered within the Technological Pedagogical Content Knowledge (TPACK) framework.[31] This framework emphasizes the integration of technological, pedagogical, and content knowledge in educational practice. Faculty members may have greater opportunities than students to engage with technology in teaching, research, and professional activities. However, TPACK was not directly measured in the present study; therefore, this framework is used only as a possible theoretical perspective for interpreting the observed group differences rather than as an explanation directly supported by the study data. Faculty members may have opportunities to engage with digital tools through teaching, research, academic communication, and other professional activities; however, the frequency and nature of such technology use were not directly assessed in the present study.[32,33] From a theoretical perspective, their higher scores may be consistent with greater opportunities to engage with technological and pedagogical practices; however, the present study did not directly assess faculty members' ability to integrate pedagogical strategies with technological applications. From the perspective of Bandura's self-efficacy theory,[34] repeated successful experiences in orchestrating technology-enhanced learning environments serve as mastery experiences, thereby reinforcing their beliefs regarding their capability to perform technology-related tasks effectively. Accordingly, potential explanations involving professional experience, age, technology exposure, or pedagogical technology use should be regarded as hypotheses for future research rather than explanatory mechanisms established by the present study.

In addition, the concept of digital pedagogical competence may help explain the higher digital competence levels observed among faculty members. Digital pedagogical competence involves not only technical technology use but also the ability to integrate digital tools into teaching and learning processes effectively. Particularly after the rapid expansion of online and hybrid education models, faculty members have been required to adapt to technology-supported instructional approaches more intensively. Similar findings have been reported in the literature indicating that greater professional experience with digital technologies is positively associated with digital literacy and self-efficacy beliefs.[6,7] Nevertheless, the relatively high digital competence levels observed among students also suggest that contemporary students are increasingly familiar with digital technologies prior to entering higher education.

One of the most notable findings of the present study is the significant positive relationship identified between digital literacy and computer self-efficacy among students. This finding supports theoretical perspectives suggesting that digital competence and self-efficacy are mutually reinforcing constructs.[35] According to self-efficacy theory, individuals who successfully perform technology-related tasks develop stronger beliefs regarding their ability to use technology effectively.[34] Similarly, individuals with high levels of self-efficacy tend to engage more actively with digital technologies, persist when encountering technological difficulties and adapt more successfully to digital learning environments.[7,36] Accordingly, higher digital literacy may coexist with stronger perceptions of computer self-efficacy, while greater confidence regarding technology use may likewise be associated with more extensive engagement with digital tools. However, the cross-sectional nature of the present study does not allow the direction of this relationship to be determined.

This finding is also consistent with previous studies reporting positive relationships between digital literacy and computer self-efficacy.[9,10] However, the current study contributes to the literature by examining this relationship specifically within dental education. In dentistry, students are increasingly expected to use digital diagnostic systems, simulation technologies and technology-supported clinical applications throughout their education and professional practice. Therefore, digital literacy and computer self-efficacy may be important competencies associated with students' readiness to engage with contemporary clinical technologies and technology-supported professional environments.

Male students reported higher levels of digital literacy and computer self-efficacy than female students in the unadjusted comparisons. Importantly, the multivariable analyses showed that gender remained significantly associated with both digital literacy ($\beta=-.247$, $p=.013$) and computer self-efficacy ($\beta=-.229$, $p=.015$) after adjustment for age, grade level, personal computer ownership, frequency of internet use, and previous computer-related training. However, technology-related interests, patterns of technology use, and other potentially relevant psychosocial or contextual factors were not directly measured in the present study. Therefore, these explanations should be regarded as possible interpretations rather than mechanisms demonstrated by the present data. Thus, the observed gender differences could not be explained solely by differences in these measured characteristics. Previous studies have suggested that repeated exposure to technology-related experiences can strengthen perceptions of technological competence and self-efficacy.[8,9] At the same time, these findings should be interpreted cautiously. Recent research increasingly indicates that gender-based differences in digital competence may be narrowing as access to digital technologies and participation in online learning environments become more widespread.[4]

However, recent evidence from dental education does not consistently demonstrate gender-related differences in digital competence. Shooriabi et al.[19] found no statistically significant difference in overall self-perceived digital competence between male and female dental students ($p=.73$), with a negligible effect size (Cohen's $d=.05$). Similarly, a large study of undergraduate dental students examining ICT-related skills and technology use reported no significant gender differences in overall ICT skills or educational use of digital technologies.[37] These findings contrast with the present study, in which male students had higher digital literacy and computer self-efficacy scores and gender remained independently associated with both outcomes after adjustment for the other measured characteristics. This discrepancy suggests that gender-related patterns in digital competence may vary across institutional, educational, and sociocultural contexts and should not be assumed to represent a consistent characteristic of dental students.

Although gender remained independently associated with both outcomes in the adjusted analyses, this association should not be interpreted as evidence of a causal effect of gender. Other unmeasured factors, including the nature and quality of previous digital experiences, technology usage patterns, socio-cultural influences, individual interest in technology, and opportunities for engagement with digital learning environments, may contribute to the observed differences. The cross-sectional design of the present study also precludes causal inference.

Within the context of dental education, this issue becomes particularly important because contemporary dental training increasingly requires all students, regardless of gender, to engage actively with technology-intensive systems such as digital imaging applications, virtual simulations, CAD/CAM systems and computer-assisted treatment planning tools.[29,38] Consequently, educational initiatives aimed at reducing possible inequalities in digital competence development may contribute to more equitable participation in technology-supported clinical education processes.[33] From this perspective, minimizing gender-based disparities in access to and use of digital technologies may support more inclusive and sustainable professional training environments.[39]

No significant differences were identified between the 17-19-year-old and ≥20-year-old student groups in terms of digital literacy or computer self-efficacy. This result may be related to the relatively similar digital experiences shared by contemporary university students. Regardless of age, students are now routinely exposed to online learning systems, mobile technologies and digital communication platforms throughout their education. As a result, age may no longer function as a strong differentiating factor in technology-related competence within higher education environments. Similar findings have been reported in previous studies suggesting that digital technologies have become integrated into the everyday educational experiences of younger generations.[10,40] Accordingly, age-related differences in digital competence may have become less pronounced compared with previous periods.[41] In contemporary higher education settings, access to digital technologies and routine engagement with online platforms may contribute to more homogeneous levels of digital experience among students.[42]

This finding is consistent with several previous studies reporting that age does not necessarily create significant differences in digital literacy or computer self-efficacy among university students.[10] Nevertheless, some studies have argued that older individuals may experience greater difficulties in adapting to emerging technologies.[3] The absence of significant age differences in the current study may therefore be explained by the relatively homogeneous age distribution of the participants and their similar exposure to digital learning environments within higher education.

Recent dental education research provides further support for the absence of a clear age-related pattern. Shooriabi et al.[19] found no statistically significant difference in overall self-perceived digital competence among dental students according to age. This dental education-specific finding is consistent with the present results, in which neither the unadjusted comparisons nor the multivariable analyses identified a significant association between age and digital literacy or computer self-efficacy. Nevertheless, given the relatively restricted age range of the present sample, these findings should not be interpreted as evidence that age is unrelated to digital competence across broader or more age-diverse dental populations.

From the perspective of health education, this finding may indicate that digital competence is increasingly becoming a universal educational requirement rather than an age-dependent skill.[33,43] Particularly in dental education, students are expected to utilise digital systems actively regardless of age due to the increasing prevalence of technology-supported diagnostic and clinical applications.[29] Consequently, initiatives aimed at improving digital competence should be designed inclusively to address all student groups.

The multivariable findings further supported this pattern, as age was not independently associated with either digital literacy (β=-.046, p=.700) or computer self-efficacy (β=.065, p=.568) after adjustment for the other measured demographic and technology-related characteristics.

In the unadjusted analysis, students' computer self-efficacy differed significantly according to grade level, with third-year students reporting higher levels than the other grade groups. One possible theoretical perspective for interpreting this pattern is Situated Learning Theory proposed by Lave and Wenger.[44] Although situated learning was not directly measured in the present study, this framework may help contextualize the observed grade-level pattern. As students progress through dental education, they increasingly encounter dental-specific digital systems, such as CAD/CAM technologies, intraoral scanners, and digital imaging, within authentic or simulated professional contexts.[29,38] Such experiences may transform abstract technological knowledge into applied professional competence. Repeated interaction with these technologies may also provide mastery experiences that contribute to stronger computer self-efficacy beliefs, consistent with Bandura's theoretical framework.[34] Previous research has similarly suggested that greater practical experience with technology may contribute positively to computer self-efficacy.[8,9]

However, the multivariable analysis provided a more nuanced interpretation of this finding. After adjustment for gender, age, personal computer ownership, frequency of internet use, and previous computer-related training, grade level was no longer independently associated with computer self-efficacy. Thus, although greater exposure to professional technologies among upper-year students may plausibly contribute to the pattern observed in the unadjusted analysis, the findings do not support interpreting grade level itself as an independent factor. Rather, the initial grade-level difference may partly reflect differences in students' broader technology-related experiences and access.

Recent evidence from dental education also suggests that academic progression may not necessarily correspond to higher overall digital competence. Shooriabi et al.[19] reported no statistically significant differences in overall self-perceived digital competence across academic years among dental students. Although the construct assessed in that study is not identical to computer self-efficacy, its findings reinforce the need for caution when interpreting year-of-study differences as evidence of progressive development in technology-related competence. In the present study, this caution is particularly important because the unadjusted difference in computer self-efficacy was not retained after adjustment for other demographic and technology-related characteristics.

No significant grade-level difference was observed for digital literacy in the unadjusted analysis, and grade level likewise showed no independent association with digital literacy in the multivariable model. This may suggest that students enter university with a relatively established baseline of digital competence, given the extensive integration of digital technologies into their everyday and educational lives.[40,42] Taken together, these findings indicate that progression through dental education should be considered alongside students' access to technology and previous technology-related learning experiences rather than as an isolated determinant of digital competence.

Another important finding of the study was that students who owned personal computers demonstrated significantly higher levels of digital literacy and computer self-efficacy in the unadjusted comparisons. Importantly, personal computer ownership remained significantly associated with both digital literacy (β=-.246, p=.012) and computer self-efficacy (β=-.288, p=.002) after adjustment for gender, age, grade level, frequency of internet use, and previous computer-related training. This finding highlights the potential relevance of access to technology in relation to digital competence.[35] Students who own personal computers may have greater opportunities for autonomous learning, repeated practice, and continuous interaction with digital environments.[7] According to self-efficacy theory, repeated successful experiences with technology may contribute to stronger beliefs regarding one's technological capabilities.[34] Therefore, regular engagement with digital tools may support both digital literacy and perceptions of computer self-efficacy.

The literature similarly suggests that access to digital technologies contributes positively to digital competence development.[4,21] The persistence of the association with personal computer ownership after multivariable adjustment suggests that access to a personal computer may represent an important correlate of digital competence within this sample, beyond the other measured demographic and technology-related characteristics. However, because of the cross-sectional design, this association should not be interpreted causally. This issue may be particularly relevant within dental education because of the increasing reliance on digital technologies in both theoretical and clinical training. Applications such as digital radiography systems, virtual simulations, digital patient management platforms, and three-dimensional modelling software often require continued engagement with digital devices outside classroom settings. Therefore, limited access to personal digital technologies may restrict opportunities to develop digital competence and technology-related confidence.

Dental education-specific evidence also suggests that prior experience with digital technologies may be relevant to students' engagement with digital workflows. In an undergraduate digital dentistry training module involving intraoral scanning and computer-aided design, students with previous CAD experience demonstrated better performance in CAD task completion and intraoral scanning than students without such experience.[45] Although prior CAD experience is not equivalent to personal computer ownership, this finding provides additional context for the possibility that differences in access to and experience with digital technologies may be associated with students' readiness to engage with technology-intensive dental education.

Students who had received previous computer-related training also demonstrated significantly higher levels of digital literacy and computer self-efficacy in the unadjusted comparisons. These associations remained statistically significant after adjustment for the other measured characteristics, both for digital literacy (β=-.221, p=.026) and computer self-efficacy (β=-.290, p=.003). Thus, previous computer-related training emerged as an important correlate of both outcomes even when gender, age, grade level, personal computer ownership, and frequency of internet use were considered simultaneously.

Nevertheless, this association should not be interpreted as evidence that previous computer-related training caused higher digital literacy or computer self-efficacy. Because participation in such training was not experimentally assigned, students with greater pre-existing interest in technology, greater confidence in using digital tools, or more previous technology experience may have been more likely to participate in computer-related training. Therefore, the direction of the observed association cannot be established from the present cross-sectional data.

This finding highlights a potentially important association between previous technology-based educational experiences and digital competence.[41] Previous research has suggested that computer-related training may be associated with stronger problem-solving abilities in digital environments, lower technology-related anxiety, and greater confidence regarding technology use.[7,36] From the perspective of self-efficacy theory, structured learning experiences and repeated successful interactions with technology may function as mastery experiences that reinforce individuals' beliefs regarding their technological capabilities.[34]

Recent dental education research provides more specific support for the educational relevance of structured exposure to digital technologies. Nassani et al.[14] reported significant improvements in dental students perceived knowledge and skills following a CAD/CAM educational exercise, while Liu et al.[16] found improvements in theoretical knowledge and practical performance following the integration of intraoral scanning and digital analysis tools into a dental training model. Research on full digital workflows has also indicated that students with previous CAD experience may demonstrate better performance in digital tasks such as CAD procedures and intraoral scanning.[45] Although these studies examined specific digital dentistry interventions and prior digital experience rather than the broader computer-related training variable assessed in the present study, collectively they support the educational relevance of structured and repeated exposure to digital technologies within dental curricula.

Within dental education specifically, this finding has considerable importance because contemporary dental practice increasingly depends on technology-supported diagnostic and clinical systems. The growing use of CAD/CAM systems, digital radiography, virtual simulation technologies and digital patient records requires dental students to develop advanced digital competencies during their education.[29,38] Therefore, expanding practical digital competence training within dental curricula may contribute significantly to students' professional readiness and technological adaptability.[33,43]

In contrast, frequency of internet use was not significantly associated with either digital literacy or computer self-efficacy in the unadjusted analyses. This pattern was also supported by the multivariable analyses, in which frequency of internet use was not independently associated with either outcome after adjustment for gender, age, grade level, personal computer ownership, and previous computer-related training. These findings suggest that the frequency of internet use alone may be less relevant to digital competence than the nature and purpose of technology engagement. In other words, greater frequency of internet use may not necessarily translate into more advanced digital skills or stronger confidence in computer use.

Recent dental education research provides further support for this interpretation. Shooriabi et al.[19] found no statistically significant differences in overall self-perceived digital competence among dental students according to the duration of daily internet use. This finding is consistent with the present results and suggests that the amount of time spent online may not, by itself, reflect the quality or educational relevance of students' digital engagement. Indeed, frequent use of digital technologies does not necessarily imply competence across more complex domains such as information evaluation, critical thinking, digital content creation, or responsible participation in digital environments.[19]

Among faculty members, Spearman's rank-order correlation indicated a weak positive but statistically non-significant association between digital literacy and computer self-efficacy (ρ=.177, p=.583). This finding differs from the strong positive association observed among students. However, the faculty result should be interpreted with considerable caution because the faculty group was small (n=12), which substantially limits statistical power and the precision of the estimated association. In addition, the relatively homogeneous digital competence levels observed among faculty members may have restricted variability and, consequently, the ability to detect an association between the two constructs. It is also possible that faculty members' professional technology use is associated with institutional responsibilities and occupational requirements rather than with individual self-efficacy perceptions alone.[32] Therefore, the absence of a statistically significant association in this small faculty group should not be interpreted as evidence that digital literacy and computer self-efficacy are unrelated among faculty members. Future studies with larger faculty samples are needed to examine this relationship more reliably.

Overall, the findings of the present study suggest that digital literacy and computer self-efficacy are closely interconnected among dental students, consistent with previous research on the relationship between digital competence and self-efficacy.[35] The increasing integration of technology into dental training and clinical practice makes digital competence an essential component of professional preparation.[43] Therefore, educational environments that support students' active engagement with digital technologies may contribute not only to the development of digital literacy but also to stronger self-confidence regarding technology use.[7] In this regard, expanding technology-supported learning environments, simulation-based instructional practices and practical digital competence training within dental education programmes may support both academic achievement and professional readiness in increasingly digitalised healthcare environments.[33,38]

This study examined the digital literacy levels and computer self-efficacy beliefs of dentistry students and faculty members within the context of higher education. Furthermore, the study contributes to the growing body of literature examining digital competence within health and dental education.[29,33]

While age, grade level, and frequency of internet use were not independently associated with either outcome in the multivariable analyses, gender, personal computer ownership, and previous computer-related training remained significantly associated with both digital literacy and computer self-efficacy. These findings highlight the potential relevance of technology access and prior structured technology-related learning experiences to students' digital competence, while also indicating that the observed associations should not be interpreted causally. Furthermore, faculty members exhibited significantly higher levels across both variables compared with students; however, given the observational design and the small faculty sample, this group differences should be interpreted as associations rather than consequences of professional or pedagogical technology engagement.[32]

Implications for Dental Education

The findings of the present study have several important implications for dental education. First, the results suggest that digital competencies should be integrated more systematically into undergraduate dental curricula rather than being addressed through isolated technology-related courses. The increasing use of digital radiography systems, CAD/CAM applications, virtual simulations and digital patient management systems within contemporary dentistry requires students to develop not only technical knowledge but also confidence regarding technology use. Therefore, embedding technology-supported learning experiences into both theoretical and clinical training processes may contribute to stronger digital literacy and computer self-efficacy among dental students. From a theoretical perspective, Situated Learning Theory proposed by Lave and Wenger[44] may provide a useful framework for considering how authentic engagement with professional digital technologies could support digital competence development. However, situated learning processes were not directly assessed in the present study, and this interpretation should therefore be regarded as a theoretically informed implication rather than an empirical finding of the study.

Recent dental education research reinforces the need for more systematic curricular integration of digital technologies. Mwogosi et al.[46] identified substantial gaps in digital competency, infrastructure, and structured digital training within dental education and emphasized the combined importance of institutional readiness, faculty development, technological infrastructure, and student competency development. Similarly, recent evidence from clinical-year dental students indicates strong interest in digital dentistry alongside perceived insufficiency in existing curricular coverage, further supporting the need for structured and progressive integration of digital technologies throughout dental education.[47] These findings provide contemporary dental education-specific support for moving beyond isolated exposure toward more systematic and competency-oriented digital training.

The findings also highlight the importance of supporting continuous digital pedagogical development among faculty members. This implication is supported by recent dental education evidence demonstrating persistent limitations in faculty training for digital technologies. Mwogosi et al.[46] reported limited formal digital training among dental educators and identified faculty development as a central component of effective and sustainable digital integration in dental education. In this regard, Wenger's concept of Communities of Practice[48] may provide a valuable framework for fostering collaborative professional learning, knowledge sharing and sustainable technology integration within dental education environments. Because Communities of Practice was not directly examined in the present study, this framework is proposed as a potential approach for future faculty development rather than as an explanation empirically tested by the current data. Creating collaborative learning communities among faculty members may encourage the exchange of technological experiences, strengthen digital pedagogical competencies and support the effective adaptation of emerging educational technologies into teaching practices.

Another important implication concerns equitable access to digital technologies. The findings demonstrated that personal computer ownership and prior computer-related training were positively associated with both digital literacy and computer self-efficacy, and these associations remained statistically significant after adjustment for the other measured characteristics. The second-level digital divide framework[49] may provide one possible theoretical perspective for interpreting the observed associations between technology access, previous computer-related training, and digital competence. This framework emphasizes inequalities not only in access to digital technologies but also in the skills, experiences, and opportunities required to use these technologies effectively. However, the dimensions of the digital divide were not directly measured in the present study; therefore, this framework is used only to contextualize the findings rather than as an empirically tested explanation. Therefore, universities should implement supportive policies aimed at reducing inequalities in digital competence development and expanding students' opportunities to engage with technology-supported learning environments both inside and outside the classroom.

This implication is also supported by dental education-specific evidence. Bayazıt and Öztürk Bayazıt[50] reported that oral and dental health students with limited access to the internet and personal digital devices experienced particular difficulties with distance education and emphasized the importance of identifying and addressing digital inequalities among learners. More recent evidence from dental training institutions has likewise demonstrated disparities in access to digital infrastructure and digital tools across institutional settings.[46] Together, these findings reinforce the importance of considering equitable access alongside skills and training when planning the digital transformation of dental education.

Finally, future research should examine digital literacy and computer self-efficacy within larger and more diverse samples across different dental schools and educational contexts. Mixed-methods studies incorporating qualitative data may also provide a deeper understanding of how students and faculty members experience technology integration within dental education and how these experiences are associated with professional readiness in increasingly digitalized healthcare environments.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study was conducted at a single institution, which may limit the generalizability of the findings to dental students and educational settings with different institutional, curricular, or technological characteristics. Although the study aimed to reach the entire eligible student and faculty populations at the institution, the findings remain specific to this institutional context. In addition, although all faculty members employed at the institution participated in the study, the absolute size of the faculty group was small (n=12) because the faculty of dentistry was newly established at the time of data collection. This small group size limits the statistical power of analyses involving faculty members, particularly correlation analyses; therefore, findings pertaining to this group should be regarded as exploratory and interpreted cautiously.

Second, because the institution had not yet established fourth- and fifth-year cohorts, the student population consisted exclusively of first-, second-, and third-year students. Consequently, the findings, particularly those concerning grade level, cannot be generalized to senior dental students, who may have greater exposure to clinical practice and digital dental technologies.

Third, both digital literacy and computer self-efficacy were assessed using self-report instruments. Accordingly, the responses may be subject to self-report bias, including differences in participants' perceptions of their own competencies, and may not necessarily reflect objectively demonstrated digital skills or technology-related performance. In addition, the instruments used in the present study were originally developed and validated in educational populations other than dental students and faculty members. Although internal consistency was assessed in the present sample, the applicability and measurement properties of these instruments specifically within dental education populations require further investigation. More specifically, although the Digital Literacy Questionnaire demonstrated high internal consistency in the present sample, this finding provides evidence of reliability rather than construct validity. Because this instrument was originally developed for prospective teachers and its construct validity has not been specifically established among dental students or dental faculty members, findings derived from this instrument should be interpreted with this measurement limitation in mind.

Fourth, the cross-sectional design of the study limits causal interpretation of the observed associations. Although multivariable analyses were conducted to account for potential confounding among gender, age, grade level, personal computer ownership, frequency of internet use, and previous computer-related training, residual confounding due to unmeasured factors cannot be excluded. Therefore, the adjusted associations identified in the present study should not be interpreted as evidence of causal relationships.

Finally, a relatively large number of statistical comparisons were conducted across demographic and technology-related characteristics. Because these analyses were exploratory, no formal adjustment for multiple testing was applied. Consequently, an increased risk of type I error cannot be excluded, particularly for findings with p-values close to the conventional significance threshold. These findings should therefore be interpreted cautiously and confirmed in future studies using larger samples, prospectively defined hypotheses, and confirmatory analytical approaches.

CONCLUSION

This study examined digital literacy and computer self-efficacy among dental students and faculty members and explored their relationships with demographic and technology-related characteristics. Digital literacy and computer self-efficacy were strongly and positively associated among students, whereas no statistically significant association was identified among faculty members; however, the latter finding should be interpreted cautiously because of the small faculty sample. The multivariable findings showed that gender, personal computer ownership, and previous computer-related training remained significantly associated with both digital literacy and computer self-efficacy after adjustment for the other measured characteristics. In contrast, age, grade level, and frequency of internet use were not independently associated with either outcome. These findings suggest that access to digital technologies and previous structured technology-related learning experiences may be particularly relevant when considering students' digital competence and confidence in technology use. Nevertheless, because of the cross-sectional design, these associations should not be interpreted as causal relationships. From an educational perspective, the findings support providing dental students with equitable opportunities to access digital technologies and participate in structured technology-supported learning experiences throughout their education. Future multicentre and longitudinal studies with larger student and faculty samples are needed to clarify the factors associated with digital competence and to examine how these competencies develop over the course of dental education.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Niğde Ömer Halisdemir University Ethics Committee (Date: 29.03.2024, Decision No: 2024/07-16).

Informed Consent

Written informed consent was obtained from all individual participants prior to their inclusion in the study. Participants were fully informed about the study's aims, procedures, potential risks and benefits, and their rights-including the right to withdraw at any time without consequence. All participants voluntarily signed a written informed consent form.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

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Author Contributions

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