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Navigating Digital Learning: Exploring Faculty Attitudes Toward Smartphone Integration in Dental Teaching: A Cross-Sectional Study

Soonhan Memon [1], Jotika Maheshwari [1], Monika Mandhan [1], Sandhya Kumari [1], Mowaffaq Abdullmomen Al Absi [2], Sarang Suresh [3 *]

1. Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan. soonhanmemon2k20@gmail.com (S.M); jotika2403@gmail.com (J.M); monikamandhan26@gmail.com (M.M); sandhyarajput1406@gmail.com (S.K).
2. Department of Operative Dentistry, Isra Dental College, Isra University, Hyderabad, Pakistan. drmfqalabsi581@gmail.com (M.A.A.A).
3. Department of Operative Dentistry, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan. sarang.suresh@lumhs.edu.pk (S.S).

***Corresponding Author:** Sarang Suresh. Department of Operative Dentistry, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan. **Email:** sarang.suresh@lumhs.edu.pk

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Abstract

Background and Objective: Smartphones can divert learners and weaken engagement. Few studies have probed how teachers perceive them as a teaching tool. We investigated the frequency of smartphone use in teaching and the perceptions of faculty members to smartphones as an educational tool across dental colleges. **Materials and Methods:** Cross sectional descriptive study at Liaquat University of Medical and Health Sciences, Jamshoro; Isra Dental College; Bhittai Dental College; and Muhammad Dental College, Mirpurkhas from February to April 2026 using a convenience sample among dental faculty who completed self-administered online questionnaire which consists of demographic variables, 15 items measuring smartphone usage frequency, and 14 items assessing perceptions using Likert scales. Data was analyzed using SPSS. Mann–Whitney U and Kruskal–Wallis H tests and Pearson's Chi-square tests were used and multiple linear regression identified predictors of overall perception scores. **Results:** The sample comprised 52.4% males and 47.6% females. The overall mean smartphone usage score was 3.75 and the mean perception score was 4.18. The most frequent usage activity was reading articles online for class preparation (mean = 4.39), while Bluetooth file sharing was least (mean = 2.62). The strongest perception was for anytime, anywhere information access (mean = 4.49), whereas lecture recording attracted the most reserved endorsement (mean = 3.70). No statistically significant differences in usage or perception scores were observed across gender, academic rank, experience, or institutional affiliation; however, prior smartphone usage and male gender as independent predictors of more favorable perceptions. **Conclusion:** Dental faculty held generally favorable perceptions of their educational utility of smartphone. Usage was concentrated in information access, student communication, and digital storage of course materials. **Clinical application:** Dental schools can build on mobile use to support chairside reference, case-based clinical teaching, and faculty development, while prioritizing connectivity infrastructure and clear policy on image capture and lecture recording.

Keywords: Smartphones, Dental education, Digital learning, Educational technology.

1. Introduction

The smartphone has become one of the most widely owned devices of the present era, combining portability, continuous internet connectivity, and range of applications in a single handheld unit. These features have extended learning beyond the physical boundaries of the classroom and have begun to reshape the roles of teachers and learners in higher education.[1]

In medical and dental education, smartphones are increasingly used to access reference material, communicate with students, consult course material, take notes, and capture clinical images, while studies have identified information management and communication as the dominant professional uses of mobile devices.[2,3] Among practicing dentists, mobile applications and social-media platforms are similarly used for information access and are regarded favorably.[4] Integration of such tools into teaching has been associated with gains not only in knowledge but also in collaboration and problem-solving skills.[5]

These benefits are not without counterweights. Smartphones can distract learners during class and, may undermine class engagement.[6] Most published work has examined learners' perceptions of smartphones, whereas comparatively few studies have investigated how teachers themselves use these devices and how they perceive them as a teaching tool.

The evidence within Pakistan is largely confined to the dental colleges of a single province.[7–9] Because Pakistan's provinces differ substantially in dental-education infrastructure, internet connectivity, and institutional and regulatory environments, evidence from one province cannot be assumed to transfer to another, and province-specific data are needed to guide local planning. This is particularly relevant for dental education, where smartphones support chairside reference, clinical image capture, and communication around case-based teaching. The perceptions and practices of dental faculty in Sindh have not, to our knowledge, been described. The two most directly comparable studies differ from the present work in important ways: Jabali et al. surveyed medical faculty at two Palestinian universities, whereas Junaid et al. examined dental faculty in the neighboring province of Khyber Pakhtunkhwa using only the perception subscale.[8,9] The present study is therefore the first to characterize both the smartphone usage practices and the perceptions of dental faculty in Sindh, and it extends this descriptive work by using multivariable regression to identify independent predictors of faculty perceptions. Two research questions were addressed: how frequently, and in what ways, do dental faculty in Sindh use smartphones to support their teaching; and what perceptions do they hold of smartphones as a teaching tool, and which demographic and behavioral factors independently predict those perceptions? The baseline usage and perception data offers a reference point for institutional and curricular planning wherever the formal integration of smartphones into teaching is under consideration.

2. Materials and Methods

A cross-sectional descriptive study with convenience sampling was conducted across four dental colleges in Hyderabad and Mirpurkhas, including the Institute of Dentistry, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Isra Dental College (IDC), Bhittai Dental College (BDC), and Muhammad Dental College (MDC). Ethical approval was obtained from the

Research Ethics Committee of LUMHS, Jamshoro (LUMHS/REC/1426). The study is reported according to the STROBE guidelines[10] for observational studies. (Supplementary file 1)

All dental teaching faculty affiliated with these four institutions were considered eligible for inclusion. Faculty members who did not own or use a smartphone in their daily professional activities, or who declined to participate, were excluded. No restrictions were placed on gender, academic rank, departmental affiliation, or years of teaching experience.

The sample size was calculated using the formula for determining the minimum sample required to estimate a population mean for a continuous outcome. Z = 1.96. The standard deviation of 0.85 was derived from Jabali et al.[9] A margin of error of E = 0.1 was specified, yielding an initial uncorrected estimate of $n_0 \approx 278$. Since the total registered dental teaching faculty across the four institutions, as per Pakistan Medical and Dental Council (PMDC) minimum staffing requirements, comprised a finite population of N = 160, a finite population correction (FPC) was applied. Accounting for an anticipated response attrition rate of 20%, the final target sample size was adjusted to approximately 122 participants. The survey yielded 91 submissions. After removal of duplicate entries identified by matching institutional email addresses and retaining each respondent's earliest submission, valid responses were retained for analysis, corresponding to 51.3% (82/160) of the estimated eligible faculty population. The achieved sample fell short of the conservative target of 122; however, because the standard deviation assumed in the calculation (0.85) proved larger than the values observed in this sample (0.63 for usage and 0.51 for perception), the realized 95% confidence intervals for the overall mean scores remained narrow, indicating adequate precision for the study's descriptive objectives. The retained sample spanned all four institutions and all academic-rank and experience strata.

Data were collected using a preformed, self-administered, and previously validated online questionnaire originally developed by Jabali et al.[9] The questionnaire was administered via Microsoft Forms (Microsoft Corporation). The questionnaire comprised three sections. Part, one recorded the demographic and professional variables. Part two comprised 15 items assessing the frequency with which respondents employed their smartphones to support teaching activities. Responses were recorded on a five-point Likert scale: Very Often (5), Often (4), Occasionally (3), Rarely (2), and Never (1). Part three comprised 14 items measuring faculty perceptions of smartphones as educational devices, rated on a five-point Likert scale: Strongly Agree (5), Agree (4), Uncertain (3), Disagree (2), and Strongly Disagree (1). The instrument was adopted without modification from the questionnaire developed and validated by Jabali et al., [9] in which the original item pool underwent content and face validity review by six experts in questionnaire development, followed by convergent validity testing, prior to administration. Because the instrument was used without modification, no further item revision was undertaken; however, its internal consistency was re-examined in the present sample. Reliability was high across both domains: Cronbach's α was 0.84 for the 15 usage items, 0.91 for the 14 perception items, and 0.91 for the full 29-item instrument, closely matching the values reported for the source instrument (α = 0.88, 0.92, and 0.95, respectively).

Following ethical approval, the questionnaire was distributed electronically during a one-month data collection window. Faculty members were approached through student research collaborators stationed at each college, who shared the Microsoft Forms link directly with eligible

teaching staff. Participation was entirely voluntary; informed consent was implied in the completion and submission of the online form, as communicated in the study prior to the first questionnaire item. Respondents were assured of anonymity, with no personal identifiable information beyond an institutional email address used solely for deduplication retained in the dataset. Each submitted response was automatically time-stamped by Microsoft Forms.

All data were entered into and analyzed using IBM SPSS Statistics, Version 26.0 (IBM). A two-tailed significance threshold of $\alpha = 0.05$ was applied to all inferential tests. Because the online form required a response to every item before submission, the analytic dataset contained no missing values. Categorical variables, including gender, academic rank, departmental affiliation, years of teaching experience, and institutional affiliation, were described as frequencies and percentages. Smartphone usage and perception items were described using means and standard deviations. Each respondent's overall usage and perception scores were computed as the means of the item ratings, respectively. Normality of the smartphone usage and perception score distributions was assessed within each demographic subgroup separately using the Shapiro-Wilk test. Overall perception scores significantly violated normality. For evaluating differences in overall smartphone usage and perception scores between male and female faculty, the Mann–Whitney U test was applied. For comparisons of overall scores across academic rank, years of teaching experience, and institutional affiliation the Kruskal–Wallis H test was applied. To determine associations between categorical demographic variables and individual Likert-scale item responses, responses to each of the 29 items were dichotomized prior to analysis: for usage items, responses of 'Often' or 'Very Often' (score ≥ 4) were classified as high frequency, and responses of 'Occasionally', 'Rarely', or 'Never' (score ≤ 3) were classified as low frequency; for perception items, responses of 'Agree' or 'Strongly Agree' (score ≥ 4) were classified as positive, and responses of 'Uncertain', 'Disagree', or 'Strongly Disagree' (score ≤ 3) were classified as neutral or negative. Two-way contingency tables were constructed for each item-by-demographic combination, and Pearson's Chi-square test was applied. To identify independent demographic and behavioral predictors of positive faculty perceptions of smartphones as an educational tool, multiple linear regression analysis was performed.

3. Results

In this study out of the 91 questionnaire submissions, 82 unique responses were retained after removal of duplicate entries. The final sample comprised 43 males (52.4%) and 39 females (47.6%). Most respondents were Lecturers [27 (32.9%)], and the largest proportion had more than 10 years of teaching experience [33 (40.2%)]. Most were affiliated with the LUMHS [41 (50.0%)] (Table 1).

Table 1. Demographic characteristics of study participants (n = 82).

Variable	Category	n	(%)
Gender	Male	43	52.4
	Female	39	47.6
Academic Rank	Lecturer / Registrar	27	32.9
	Assistant Professor	21	25.6
	Senior Lecturer / Senior Registrar	13	15.9
	Professor	11	13.4
	Associate Professor	10	12.2

Years of Teaching Experience	More than 10 years	33	40.2
	Less than 5 years	24	29.3
	5 – 10 years	25	30.5
Institutional Affiliation	LUMHS	41	50.0
	BDC	23	28.0
	MDC	12	14.6
	IDC	6	7.3

The overall mean smartphone usage score was 3.75 (SD = 0.63; 95% CI: 3.61–3.89). The highest-ranked activity was reading news, books, and articles online for class-related information (mean = 4.39, SD = 0.90), with 89.0% (73/82) of respondents reporting use at least 'Often'. Mean scores for all items are presented in Table 2.

Table 2. Mean scores for smartphone usage items ranked in descending order (n = 82).

Item	Mean	SD
Read news, books, and articles online to gather class-related information	4.39	0.90
Contact students for important information	4.27	1.02
Have course materials (slides, notes, quizzes) available on smartphone	4.28	0.96
Send text notifications (cancellations, venue or time changes)	4.20	0.96
Use online dictionaries for class-related topics	4.10	1.15
Access internet or eBook textbooks	4.06	1.02
Download and store up-to-date materials for class	4.04	0.87
Conduct library and literature searches	3.79	1.11
Access and download text, audio, and video materials	3.74	1.24
Allow students to photograph the board at end of class	3.67	1.14
Send emails with course outlines and content to students	3.55	1.17
Encourage students to submit assignments online	3.45	1.32
Use smartphone as a timer or alarm during class or exams	3.39	1.29
Check classroom attendance via smartphone	2.74	1.36
Share materials with students via Bluetooth	2.62	1.25

The overall mean perception score was 4.18 (SD = 0.51; 95% CI: 4.07–4.29). The highest-rated item was that smartphones provided easier access to information anywhere and anytime (mean = 4.49, SD = 0.55). The lowest-rated item was that video recording of lectures benefits absent or struggling students (mean = 3.70, SD = 0.98). All 14 perceptions are presented in Table 3.

Table 3. Mean scores for faculty perception items ranked in descending order (n = 82).

Item	Mean	SD
Smartphones provide easier access to information anywhere and anytime	4.49	0.55
Smartphone features help users learn grammar, spelling, and pronunciation	4.39	0.58
Smartphones encourage students to store study materials on digital devices	4.38	0.56
Smartphones improve access to courses and learning materials	4.32	0.72
Smartphones are useful as a supplementary teaching tool	4.30	0.70
Smartphones allow access to up-to-date information via web and social media	4.28	0.67
Smartphones help faculty organize their work better	4.22	0.72
Smartphones increase communication between lecturers and student	4.20	0.76
Smartphones help students be more prepared for class	4.16	0.79
Smartphones allow students to work at their own pace	4.07	0.75
Text messaging via smartphones is useful as an instructional tool	4.02	0.99

Smartphones can reduce paper use by converting materials to digital format	4.05	0.68
Smartphones can increase in-class participation and collaboration	3.91	0.86
Video recording of lectures allows absent or struggling students to review content	3.70	0.98

No statistically significant differences in overall smartphone usage scores were observed across any of the demographic variables (gender, academic rank, years of teaching experience, or institutional affiliation; all $p > 0.05$). For perception scores, no significant differences were found across academic rank ($H = 5.667$, $df = 4$, $p = 0.225$), years of teaching experience ($H = 3.119$, $df = 2$, $p = 0.210$), or institutional affiliation ($H = 1.552$, $df = 3$, $p = 0.670$). The difference by gender approached but did not reach significance, with male faculty scoring marginally higher than female faculty (4.29 vs. 4.06; Mann–Whitney $U = 1048.0$, $p = 0.052$), (Table 4).

Table 4. Comparison of overall smartphone usage and perception scores by demographic variable (n = 82).

Variable	n	Usage Mean	SD	95% CI	Perception Mean	SD	95% CI	Test Stat	p
Gender [Mann-Whitney U test]									
Male	43	3.79	0.61	3.61–3.98	4.29	0.45	4.16–4.43	U=890.5 (usage)	0.632
Female	39	3.71	0.65	3.50–3.92	4.06	0.54	3.89–4.23	U=1048.0 (perc.)	0.052 [1]
Academic Rank [Kruskal-Wallis H test]									
Lecturer / Registrar	27	3.87	0.59	3.64–4.10	4.34	0.58	4.11–4.57		
Sr. Lecturer / Sr. Registrar	13	3.79	0.82	3.30–4.29	4.23	0.46	3.95–4.51		
Assistant Professor	21	3.53	0.62	3.25–3.82	4.00	0.42	3.81–4.19	H=3.490 (usage); H=5.667 (perc.)	0.479; 0.225
Associate Professor	10	3.72	0.42	3.42–4.02	4.20	0.45	3.88–4.52		
Professor	11	3.87	0.64	3.44–4.29	4.13	0.41	3.85–4.40		
Years of Teaching Experience [Kruskal-Wallis H test]									
More than 10 years	33	3.69	0.59	3.48–3.90	4.10	0.42	3.95–4.25		
Less than 5 years	24	3.87	0.73	3.56–4.18	4.29	0.56	4.05–4.53	H=1.707 (usage); H=3.119 (perc.)	0.426; 0.210
5 – 10 years	25	3.72	0.58	3.48–3.96	4.23	0.50	4.02–4.43		
Institutional Affiliation [Kruskal-Wallis H test]									
Isra Dental College	6	3.87	0.68	3.15–4.58	4.31	0.46	3.82–4.79		
Muhammad Dental College	12	4.04	0.45	3.76–4.33	4.24	0.49	3.93–4.55	H=3.443 (usage); H=1.552 (perc.)	0.328; 0.670
Institute of Dentistry, LUMHS	41	3.70	0.65	3.49–3.90	4.23	0.50	4.07–4.38		
Bhittai Dental College	23	3.67	0.65	3.39–3.95	4.07	0.50	3.86–4.29		

* $p < 0.05$. U = Mann-Whitney U statistic; H = Kruskal-Wallis H statistic. Usage and perception scores each range from 1.00 to 5.00. 95% CI = 95% confidence interval.

Eight statistically significant associations were identified between demographic variables and individual item-level responses (Table 5). By institutional affiliation, four significant associations were found: Muhammad Dental College faculty reported the highest rate of high-frequency encouragement of online assignment submission [11/12 (91.7%)] compared with LUMHS [16/41 (39.0%); $\chi^2(3) = 10.310$, $p = 0.016$]; online dictionary use was highest at Isra Dental College and LUMHS [37/41 (90.2%)] compared with Bhittai Dental College [15/23 (65.2%); $\chi^2(3) = 7.882$, $p = 0.049$]; smartphone attendance checking was highest at Muhammad Dental College [7/12 (58.3%)] compared with Bhittai [4/23 (17.4%); $\chi^2(3) = 8.181$, $p = 0.042$]; and positive perception of web and social media access was universal at LUMHS and Isra Dental College but lower at Muhammad Dental College [9/12 (75.0%); $\chi^2(3) = 10.356$, $p = 0.016$].

By gender, male faculty were more likely to hold positive perceptions of both video recording of lectures [36/43 (83.7%) vs. 20/39 (51.3%); $\chi^2(1) = 8.497$, $p = 0.004$] and in-class collaboration [39/43 (90.7%) vs. 26/39 (66.7%); $\chi^2(1) = 5.799$, $p = 0.016$]; both associations were confirmed by Fisher's exact test ($p = 0.002$ and $p = 0.013$, respectively). By academic rank, Senior Lecturers/Registrars reported the highest rate of high-frequency downloading of audio and video materials [11/13 (84.6%)] compared with Associate Professors [3/10 (30.0%); χ^2 (4) = 10.372, $p = 0.035$]. By years of experience, faculty with less than 5 years reported the highest frequency of encouraging online submission [18/24 (75.0%)] compared with those with 5–10 years [9/25 (36.0%); χ^2 (2) = 8.189, $p = 0.017$].

Table 5. Statistically significant associations between demographic variables and item-level responses (n = 82).

Domain **Item**	Demographic Variable	Key Comparison	χ^2	df	p^2
Usage Items					
Encourage online assignment submission	Institution	MDC: 11/12 (91.7%) high vs. LUMHS: 16/41 (39.0%) high	10.310	3	0.016*
Use online dictionaries for class topics	Institution	LUMHS: 37/41 (90.2%) high vs. BDC: 15/23 (65.2%) high	7.882	3	0.049*
Download audio and video materials	Academic Rank	Sr. Lecturer/Registrar: 11/13 (84.6%) high vs. Associate. Professor: 3/10 (30.0%) high	10.372	4	0.035*
Encourage online assignment submission	Experience	< 5 years: 18/24 (75.0%) high vs. 5–10 years: 9/25 (36.0%) high	8.189	2	0.017*
Check attendance via smartphone	Institution	MDC: 7/12 (58.3%) high vs. BDC: 4/23 (17.4%) high	8.181	3	0.042*
Perception Items					
Video recording of lectures	Gender	Male: 36/43 (83.7%) positive vs. Female: 20/39 (51.3%) positive	8.497	1	0.004*

Access to up-to-date web/social media info	Institution	LUMHS & IDC: 100% positive vs. MDC: 9/12 (75.0%)	10.356	3	0.016*
In-class participation and collaboration	Gender	Male: 39/43 (90.7%) positive vs. Female: 26/39 (66.7%) positive	5.799	1	0.016*

* $p < 0.05$. High use defined as response ≥ 4 (often or very often); Positive perception defined as response ≥ 4 (agree or strongly agree). Fisher's exact test substituted where expected cell frequency < 5. Results ordered by ascending p-value within each domain.

The multiple linear regression model was statistically significant [$F(11, 70) = 5.950$, $p < 0.001$] and accounted for 48.3% of the variance in overall perception scores ($R^2 = 0.483$; adjusted $R^2 = 0.402$). All VIF values ranged from 1.10 to 2.25, confirming the absence of multicollinearity. Two predictors independently and significantly predicted higher perception scores. The overall smartphone usage score was the strongest predictor ($\beta = 0.453$, SE = 0.073, $t = 6.210$, $p < 0.001$; 95% CI: 0.307–0.598). Male gender was also a significant predictor ($\beta = 0.251$, SE = 0.096, $t = 2.625$, $p = 0.011$; 95% CI: 0.060–0.441). Academic rank, years of teaching experience, and institutional affiliation were not statistically significant predictors (all $p > 0.05$).

4. Discussion

This study examined how dental faculty across four colleges in Sindh use smartphones to support their teaching, and how they perceive these devices as educational tools. Three findings stand out. First, faculty reported relatively high overall usage and favorable perceptions of smartphones as a teaching tool. Second, no statistically significant overall differences in usage or perception were detected across gender, academic rank, experience, or institution. Third, in adjusted analysis, prior smartphone usage and male gender independently predicted more favorable perceptions, even though the unadjusted difference by gender did not reach significance.

Jabali et al., reported an overall usage mean of 3.18 and a perception mean of 3.60.[9] Junaid et al., reported a perception mean equivalent to approximately 3.92.[7] Their follow-up reported an overall usage mean equivalent to approximately 3.35.[8] The present study's mean scores sit numerically above both the Khyber Pakhtunkhwa (KPK) and Palestinian figures, suggesting comparatively high receptivity among Sindh dental faculty; however, because the source studies differed in scale coding and sampling, no formal statistical comparison between cohorts was possible, and this difference should be read as descriptive rather than definitive. The pattern may reflect two factors: the global maturation of smartphone use in teaching and the disruption introduced by the COVID-19 pandemic, which forced near-universal incorporation of mobile devices into teaching.[11] Fouda et al., reported that approximately 74% of teaching staff adapted readily to technology-based learning and 73% preferred a blended model going forward rather than full reversion to in-person delivery.[12]

The highest-frequency activities in our study were reading articles online for class preparation, contacting students for important information, and storing course materials on the device. This finding aligns with Junaid et al., in which online dictionary access for course content was the most frequent item.[8] Wallace et al., similarly identified information management and student communication as the dominant professional uses of mobile computing devices among teachers.[3] Zhang et al., found that medical apps and social-media platforms were widely used for professional

information access, with most respondents endorsing their value despite limited formal institutional integration.[4] The two least-frequent activities in our study were file sharing via Bluetooth and smartphone-based attendance verification show the same pattern reported by Junaid et al., who identified classroom attendance as the lowest-used item among KPK dental faculty.[8] Bluetooth has been displaced by cloud-based and messaging-app transfer in professional workflows; smartphone-based attendance is rare because of an absence of institutional infrastructure in Pakistani dental colleges, not because faculty oppose it.

For the perception domain, the strongest endorsement was for the factor that smartphones permit information access at any time and place. This finding is aligned with Jabali et al.[9] and Junaid et al.[7,8] It is also consistent with George et al., in which faculty endorsed social media and mobile-mediated content delivery for boosting student engagement and problem-solving skills.[5] The lowest-rated perception item in our study was that recording lectures benefits absent or struggling students. Junaid et al. similarly reported that KPK faculty held the most reserved views about lecture recording among all perception items.[7] Two underlying concerns possibly drive this hesitancy that recorded content may erode in-person attendance, and that asynchronous viewing may not reproduce the live interaction between teachers and students. Both concerns remain unresolved in the dental education literature in that even faculty who otherwise endorse smartphone integration retain reservations specifically about recording as a pedagogical tool.

A distinctive finding of this study is the identification of male gender as an independent predictor of positive perception. Male faculty held significantly more favorable views of lecture recording and smartphone-supported in-class collaboration. This is notable because Junaid et al. reported no statistically significant gender effect on overall scores.[7,8] Jabali et al. also found no gender effect.[9] Notably, this gender effect emerged in the adjusted regression model and at the level of individual perception items, even though the overall difference in perception scores by gender was only a non-significant trend ($p = 0.052$); it nonetheless stands as a novel observation, since neither Jabali et al. nor Junaid et al. detected a gender effect. Whether it reflects genuine attitudinal differences, differential prior exposure, or culturally mediated comfort with monitoring technologies cannot be resolved within a cross-sectional design and warrants further study.

Prior smartphone usage as the strongest predictor of favorable perceptions was found in regression analysis. This is consistent with the Technology Acceptance Model framework in which skill readiness and self-efficacy influenced perceived ease of use and perceived usefulness, and these together with prior experience positively influenced behavioral intention to adopt mobile learning.[13]

The inter-institutional differences in usage and perception suggest that institutional culture and infrastructure matter as much as faculty attitudes for translating digital technology into practice. Junaid et al identified significant inter-college and inter-departmental variation.[8] In LUMHS faculty led in online dictionary use and held universally positive perceptions of social-media-based information access, while others lagged across both perception and usage. The convergence between our findings and those of Junaid et al.[7,8] suggests that this inter-institutional variation in how faculty use smartphones for teaching is not unique to our setting.

Several limitations should be acknowledged. The cross-sectional design prevents causal

inference; whether higher usage drives more positive perceptions or the reverse cannot be determined. The low response rate comparable to similar online faculty surveys, may introduce non-response bias, with smartphone-enthusiastic faculty potentially over-represented. Self-report may inflate frequency estimates for socially desirable behaviors. The sample is skewed toward LUMHS and may not generalize to dental education across Sindh or Pakistan more broadly. Finally, the reference questionnaire does not distinguish between perceived benefit to faculty workflow and perceived benefit to student learning, and we did not capture data on specific applications, time spent using smartphones for teaching, or student-side outcomes. Future work should address this attitude measurement, focusing on institutional and cultural determinants of adoption.

5. Conclusion

In conclusion, dental faculty across the four colleges studied made active use of smartphones in their teaching, principally for accessing information, communicating with students, and storing course material, and holding broadly favorable perceptions of smartphones as a teaching tool; Bluetooth file sharing and smartphone-based attendance were the least common uses. Overall use and perception did not differ significantly across demographic groups, but prior smartphone use and male gender independently predicted more favorable perceptions. For dental education in Sindh, these findings provide a first local baseline and indicate that initiatives to integrate smartphones into teaching can build on faculty's existing personal use and experience rather than assume reluctance.

Abbreviation	**Full Form**
LUMHS	Liaquat University of Medical and Health Sciences
BDC	Bhittai Dental College
IDC	Isra Dental College
MDC	Muhammad Dental College
REC	Research Ethics Committee
KPK	Khyber Pakhtunkhwa

Declarations:

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