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Digital Learning In Dentistry: Evaluating Undergraduate Student's Knowledge And Engagement.

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ABSTRACT

Introduction: Digital learning has become an essential component of dental education, providing enhanced flexibility, accessibility, and interactive resources that complement conventional teaching approaches. The unprecedented transition to online platforms during the COVID-19 pandemic further underscored the pivotal role of digital technologies in ensuring continuity of education.In dentistry, students need both strong theoretical knowledge and well-developed clinical skills. Digital learning toolslike virtual simulations, online lectures, and interactive assessmentsare proving to be helpful in supporting this balance. They give learners more opportunities to practice, understand, and apply concepts, ultimately improving learning outcomes.However, how effective digital learning truly is depends a lot on how engaged students are and how much it actually helps them gain knowledge. It is important to understand how undergraduate dental students use these platforms and to assess how well these tools support their academic growth. This understanding can guide improvements in the curriculum and better prepare future dentists for the changing demands of clinical practice.

Method:A cross-sectional survey was carried out using a structured and pre-validated questionnaire among undergraduate dental students. The questionnaire was designed to assess student's knowledge, attitudes, and practices (KAP) related to e-learning. Responses were collected and analysed using both descriptive statistics and inferential statistics. A p-value of less than 0.05 was considered statistically significant.

Result: A total of 400 undergraduate dental students were included, of which205(51.2%) were females, 189(47.3%) were males and6(1.5%) preferred not to mention their gender.Major group of students were aware of digital learning. Not less than 95.3% of the students were aware of digital learning. About 95.8% of students owned their personal electronic devices(laptops, tablets, smartphones).Out of all the students, a majority of 83.5% were confident enough to use the e-learning platforms. Majority of the population agreed to incorporate digital learning in dental curriculum. The 3rd year students gave a more positive response towards e-learning compared to the others.

Conclusion: The findings indicate that to enhance the effectiveness of e-learning in dental education, it is important to strengthen digital infrastructure, offer adequate support and training for faculty, and implement blended learning approaches that integrate both online and in-person teaching.

INTRODUCTION

The incorporation of digital technologies in higher education has significantly transformed teaching and learning practices, including in the field of dentistry. Digital learning, which encompasses e-learning platforms, virtual simulations, recorded lectures, and online assessments, provides students with greater accessibility, flexibility, and interactivity compared to traditional classroom-based instruction[1].This shift has been particularly important in dentistry, where students are required to integrate both theoretical knowledge and practical skills to achieve professional competence[2].

The COVID-19 pandemic accelerated the adoption of digital learning in dental education, forcing institutions worldwide to rely on online platforms to ensure continuity of training[3].While this transition demonstrated the adaptability of both educators and students, it also raised critical questions regarding the effectiveness of digital modalities in delivering core dental knowledge and fostering clinical skill development[4]. Moreover, student's engagement with digital learning tools has emerged as a crucial factor influencing educational outcomes, as motivation and interactivity are strongly associated with knowledge retention and application[5]. Evaluating undergraduate dental student's knowledge acquisition and engagement in digital learning environments is therefore essential. Such evaluation not only highlights the strengths and challenges of digital education but also provides valuable insights for

curriculum innovation. By aligning digital tools with pedagogical objectives, educators can optimize student learning experiences and better prepare future dentists for evolving clinical and technological demands[6].

METHODS

The present study is a cross-sectionaldescriptive questionnaire-basedsurvey study carried out among the undergraduate dental students in Maharashtra. The study was conducted amongundergraduate dental students including 1st year, 2nd year, 3rd year, 4th year and interns which were selected randomly using Simple Random Sampling. A total of 400 undergraduate dental students participated in the following study. Informed consent was taken before the survey was conducted. Questionnaire was shared through WhatsApp to each student while they were made to seat separately in the college. The survey questionnaire was only distributed after giving the students a brief knowledge about thetopic.The questionnaire was conveyed to obtain the details regarding demographic information, knowledge toward e-learning, attitude towards e-learning, e-learning practices using a 5-point Likert scale, from 1- strongly disagree to 5- strongly agree,frequency and duration of e-learning usage, type of content accessed (videos, live lectures, recorded lectures), participation in quizzes, forums, or discussions online. Data entry was done in Microsoft Exceland analysis done using SPSS version 17. Results were displayed in form of frequencies and proportions. Chi-square and ANOVA tests were used. P value of<0.05 was considered statistically significant.

RESULT

A total of 400 undergraduate dental students participated in the study. Among those participated, 205(51.2%) were females, 189(47.3%) were males and 6(1.5%) preferred not to mention their gender belonging to the age group of 16 – 27years with the mean age being 21.6 years. The students who participated in the survey were from 1st year, 2nd year, 3rd year, 4th year and Internship. Out of all 400 students, 95.8%(383) students owned a personal electronic device.

According to the survey, 95.3% (381) students were well aware of the concept of e-learning, whereas about 4.7% (19) students not very much aware of the e-learning concept. A round about 94.3% (377) students used different e-learning platforms(e.g., Moodle, Coursera, YouTube, DentalTubules, etc.) while 5.8%(23) students did not use any e-learning platform.A major group of students used the different e-learning platforms.Out of the 400 students, 43.3% (173) reported using e-learning tools weekly, 38.0% (152) used them daily, 10.5% (42) used them monthly, 6.0% (24) used them rarely, and 2.3% (9) reported never using e-learning tools for their dental education.Also, the students were asked to rate their knowledge about e-learning tools. The results being that out of 400 undergraduate dental students, 12.3% rated their knowledge of e-learning tools as neutral, and 29.8% rated it as very good, indicating their familiarity with digital platforms. The majority, 51.2%, rated their knowledge as good, reflecting a moderate level of understanding. A smaller proportion, 4.3%, reported poor knowledge, and only 2.5% rated their knowledge as very poor, indicating a relatively small group of students who are not very confident in their e-learning proficiency.These findings demonstrate that while more than half of the students have at least a moderate awareness of e-learning tools, there is a small amount of population with poor knowledge, highlighting the need for targeted digital literacy training and structured exposure to e-learning platforms in dental curricula.

When the students were enquired about which types of e-learning tools did the students use, it was observed that most of the students used video lectures, mobile apps, online quizzes/test and online textbooks along with virtual simulations. Figure 1 shows the percentage of types of e-learning tools used by the dental students.

Most students reported that e-learning had a positive impact on their overall learning experience. For the statement “E-learning enhances my understanding of dental concepts,” 42.3% agreed and 41.5% strongly agreedshowing that more than 80% of respondents found e-learning helpful in improving their conceptual understanding.Similarly, when asked whether “E-learning allows me to learn at my own pace”, 44% agreed and 44.3% strongly agreed. This highlights that students greatly value the flexibility and self-paced nature of online learning.Students also expressed confidence in using digital tools for learning, with 45.5% agreeing and 38% strongly agreeing that they feel comfortable using online platforms. Only 5.5% disagreed or strongly disagreed, suggesting that most students are digitally competent and well-adapted to online education.Despite these positive findings, technical issues remain a major hurdle. More than half of the students (51.2% agreed and 18.5% strongly agreed) reported that poor internet connectivity or technical problems interfere with their ability to engage effectively with e-learning.Finally, when asked if “E-learning should be incorporated more into the dental curriculum,” 43.3% agreed and 41.5% strongly agreed. This shows a strong student preference for integrating more digital learning opportunities into their formal education.Even though the students used e-learning tools on a large scale, when students were asked if they preferred e-learning over traditional classroom learning, 39.5% strongly disagreed and 44.8% disagreed. This indicates that the majority still favour conventional, face-to-face teaching methods. Only a small number of students were neutral or preferred e-learning, suggesting that while they acknowledge the advantages of digital platforms, traditional classroom learning continues to be their preferred way of studying.

Among the 400 respondents, 11% reported spending more than 10 hours per week on e-learning for dental studies, 33.8% spent 6–10 hours, 41.8% spent 2–5 hours, and 13.5% spent less than 2 hours weekly.In terms of devices used, 85% of students primarily accessed e-learning through smartphones, followed by 68.5% using laptops, 65.5% using tablets, and 22.8% using desktop computers.Regarding frequently used platforms, YouTube was the most common (87.8%), followed by Dental-specific platforms such as DentalTubules (63.2%), WhatsApp/Telegram study groups (76.3%), Zoom/Google Meet (45.8%), Google Classroom (41.8%), Moodle (17.8%), and Coursera (15.3%).When asked whether they attend live virtual lectures, 38.8% responded "Yes," 40.8% attended occasionally, and 20.5% reported not attending live sessions.In terms of purpose, students reported using e-learning primarily for theoretical lectures (34.5%) and clinical demonstrations (23.5%), followed by exam preparation (16.2%), assignments and projects (15.2%), and skill-based learning (10.5%).With respect to note-taking during e-learning, 52.5% used digital devices, 31% took notes manually, 8% relied on screenshots and recordings, and the remaining did not take notes at all.Finally, 88.8% of students reported participating in online dental workshops or webinars, highlighting a goodexposure to formal online training programs.Nearly 90% of students found online quizzes and tests effective or very effective in reinforcing their learning, indicating strongacceptance of online assessments as a useful learning tool.

The study revealed that most undergraduate dental students possessed a moderate level of knowledge about e-learning tools. Overall, students expressed a positive attitude toward e-learning, agreeing that it improves their understanding of dental concepts and should be integrated more into the curriculum. Despite this, many students still preferred traditional classroom teaching as their primary mode of learning. E-learning was most commonly used for skill development, completing assignments, and preparing for exams, with smartphones and video-based platforms being the tools of choice. While participation in online workshops was relatively low, online quizzes and tests were widely appreciated for helping reinforce key concepts and support revision.

DISCUSSION

The present study explored the knowledge, attitudes, and practices of undergraduate dental students toward e-learning. The results showed that most students had only a moderate level of knowledge about digital platforms and tools. This finding aligns with earlier research in both dental and medical education, which suggests that although students are generally familiar with commonly used platforms, their overall digital literacyespecially when it comes to advancede-learning applicationsremains limited[7,8].

When it came to attitude, most students showed a positive outlook toward e-learning. They felt that online learning not only improved their understanding but also gave them the flexibility to study at their own pace. Similar results were reported by Mukhtar et al., who found that medical students valued the accessibility and convenience of e-learning during the COVID-19 pandemic[9.]Other studies have highlighted that students appreciate being able to revisit recorded lectures and use multimedia resources, as these features help reinforce their understanding and strengthen conceptual learning[10].

Despite this positive attitude, many students still preferred traditional classroom-based learning. Similar findings were reported by Abbasi et al. and Al-Balas et al., where students expressed that online learning could not fully replace face-to-face teachingparticularly in fields like dentistry, where hands-on practice and clinical exposure are essential[11,12.]

Challenges such as limited hands-on training, reduced peer interaction, and fewer opportunities for direct patient care continue to affect the effectiveness of e-learning in dental education. These insights suggest that a blended learning approachcombining traditional classroom teaching with digital toolsmight offer the most effective way to support student learning[13.]

The study also found that students frequently used platforms like YouTube, Google Classroom, and Zoom for their studies, highlighting the growing reliance on accessible and user-friendly digital tools. However, participation in structured online workshops and dental webinars was relatively low, possibly due to limited awareness or insufficient institutional support. Previous research has similarly shown that while students often turn to informal digital resources, formal online professional training tends to be underutilized[14].Another key finding was the widespread acceptance of online assessments. Most students felt that quizzes and tests conducted online were helpful in reinforcing their learning. This is in line with the findings of Deng et al., who reported that online formative assessments can significantly boost both student engagement and academic performance[15].One of the key advantages of online assessments is their ability to provide immediate feedback and encourage active recall, which are widely recognized as important benefits of e-learning[16].

Nevertheless, many students reported facing technical challenges, such as unstable internet connections and limited access to advanced digital infrastructure. Similar barriers have been highlighted in several national and international studies as major obstacles to successfully 0implementing e-learning in medical and dental education[17].

Addressing these infrastructure challenges is essential for the long-term success of digital learning. Overall, the findings of this study highlight the increasing importance of e-learning in dental education, while emphasizing that it should complementnot replacetraditional teaching. Institutions should focus on improving digital infrastructure, encouraging students to participate in structured online training, and adopting blended learning approaches to enhance overall learning outcomes.

LIMITATION

This study has a few limitations that should be considered when interpreting the results. Since it was a cross-sectional survey, the findings reflect student's opinions at a single point in time and may not account for changes in perceptions as e-learning continues to evolve. The reliance on self-reported questionnaires may have introduced response bias, as some students might have given socially desirable answers rather than their true opinions. Future research should include multicentric studies with larger and more diverse samples to provide a broader and more comprehensive understanding of e-learning practices in dental education.

CONCLUSION

This study shows that undergraduate dental students have a moderate understanding of e-learning but generally feel positive about using it. They value the flexibility and convenience it offers and see it as helpful for grasping concepts and preparing for exams. Despite this, many still prefer traditional face-to-face teaching, likely because dental education relies heavily on hands-on clinical experience.

Students frequently use digital platforms for lectures, assignments, and quizzes, but technical issues, such as slow or unreliable internet, continue to be a challenge. These results suggest that e-learning works best as a supplement to, rather than a replacement for, in-person teaching.

By adopting a well-structured blended learning approach, improving digital infrastructure, and offering more interactive online experiences, the effectiveness of e-learning can be enhanced, better supporting students in both their academic and clinical training.

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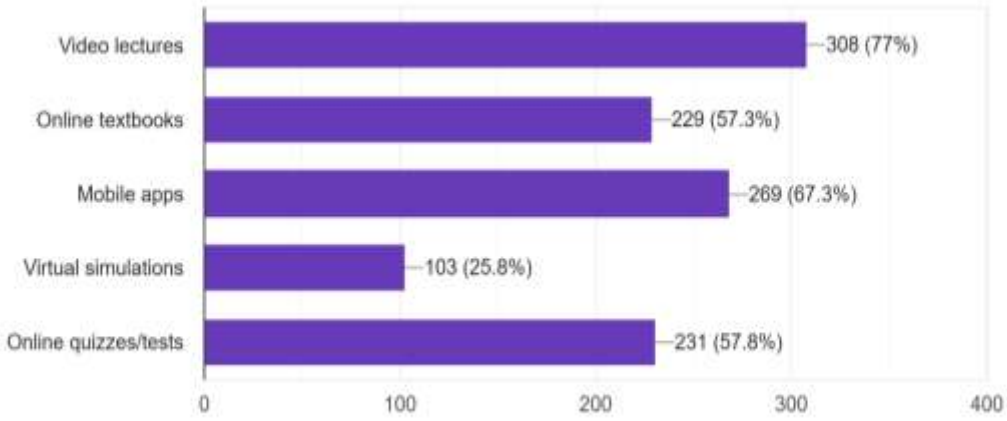
Table 1: Shows the Demographic Information of the participants.

DEMOGRAPHIC INFORMATION	
1. Age • 16 – 18 years • 19 – 21 years • 22 – 24 years • 25 – 27 years	 34% (136) 12.5% (50) 40% (160) 13.5% (54)
2. Gender • Males • Females • Prefer not to mention	 47.3% (189) 51.2% (205) 1.5% (6)
3. Year of Study • 1st year • 2nd year • 3rd year • 4th year • Intern	 11.8% (47) 20.0% (80) 24.3% (97) 21.5% (86) 22.5% (90)
4. Own a personal electronic device. • Yes • No	 95.8% (383) 4.2% (17)

Table 2: Show the Knowledge of undergraduates towards e-learning

KNOWLEDGE TOWARDS E-LEARNING	
1. Awareness of the concept e-learning • Yes • No	 95.3% (381) 4.7% (19)
2. Have you used any e-learning platforms • Yes • No	 94.3% (377) 5.8% (23)
3. How often do you use e-learning tools for your dental education? • Daily • Weekly • Monthly • Rarely • Never	 38% (153) 43.3% (173) 10.5% (42) 6% (24) 2.2% (9)
4. Rate your knowledge of e-learning tools • Very poor • Poor • Neutral • Good • Very good	 2.5% (10) 4.3% (17) 12.3% (49) 51.2% (205) 29.8% (119)

Figure - 1 Types of E-learning tools used by the dental students.



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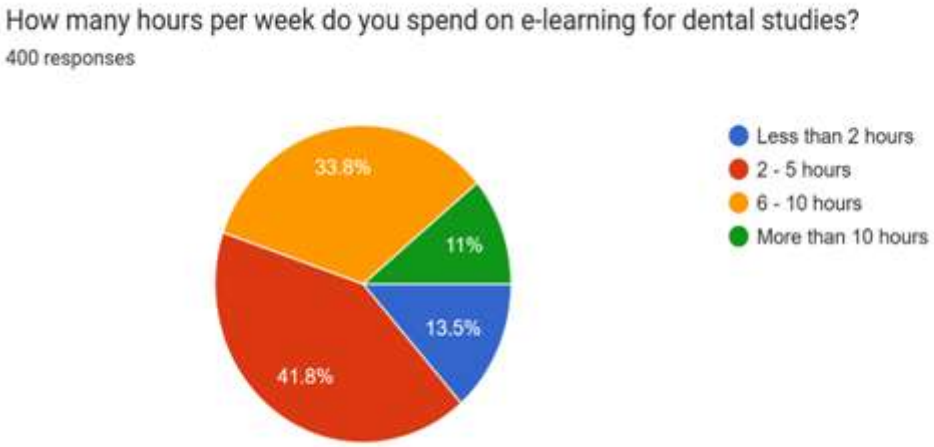

Figure – 2 Hours per week undergraduates spend on e-learning

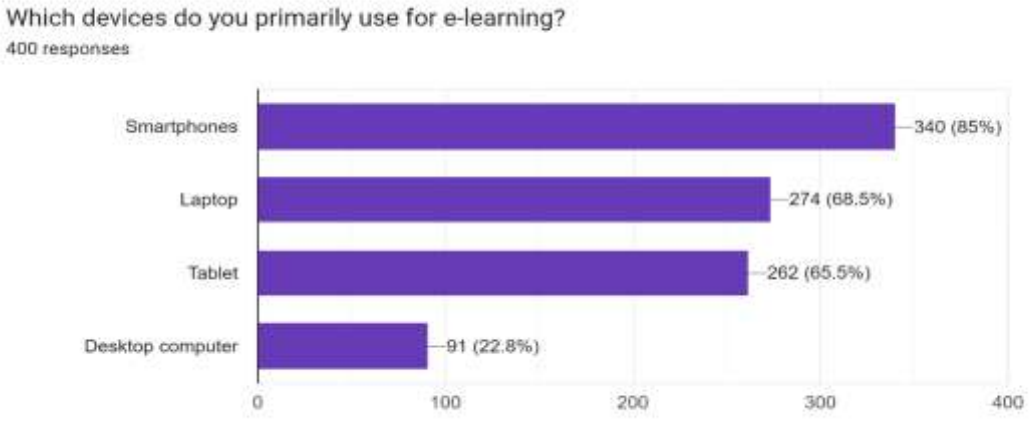

Figure – 3 Devices primarily used for e-learning

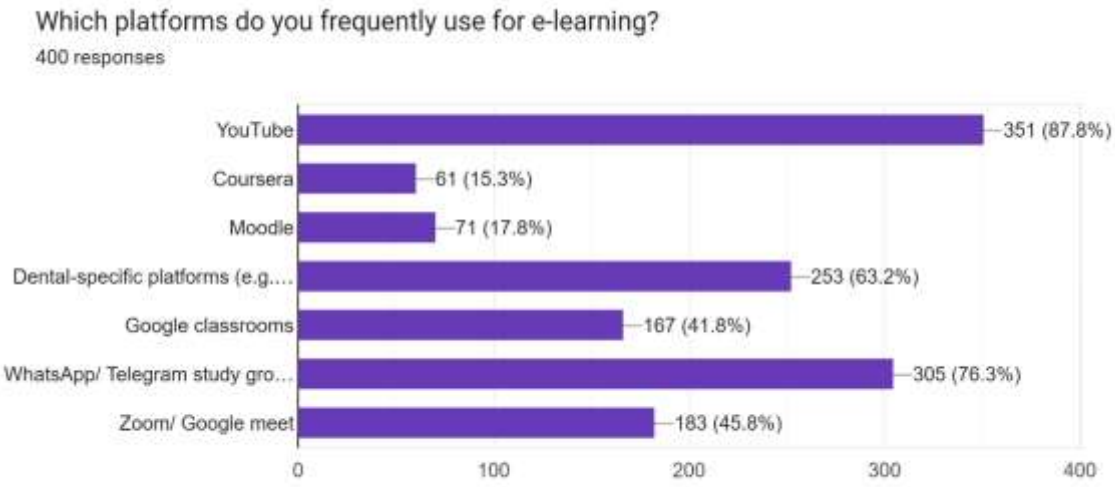

Figure – 4 Platforms used for e-learning

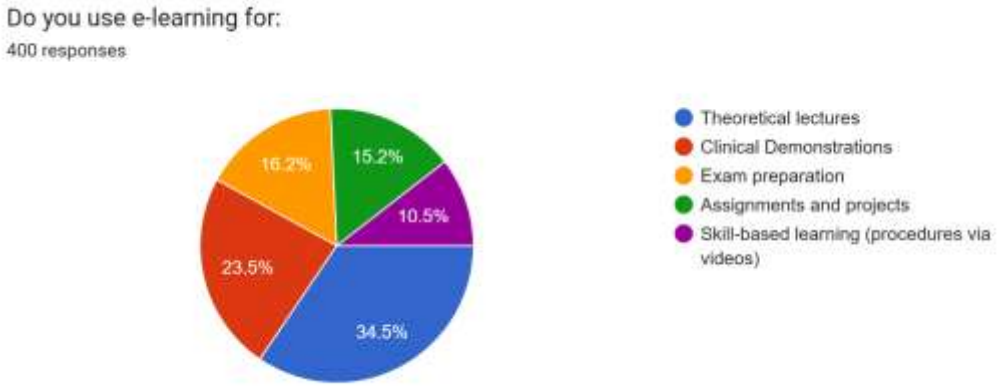

Figure – 5 E-learning used for