

**MOBILE DENTAL APPLICATION BASED LEARNING AMONG THE DENTAL  
STUDENTS AND ITS IMPACT ON THEIR CLINICAL PRACTICE – A  
QUESTIONNAIRE STUDY**

**DISSERTATION**

**Submitted to the**

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**In**

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**By**

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**BATCH: 2022-2025**

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I hereby declare that this dissertation entitled "**Mobile Dental Application based learning among the dental students and its impact on their clinical practice- A Questionnaire Study**" is a bonafide, & genuine research work carried out by me under the guidance of **Dr. Anuradha P, Professor and Head, Department of Public Health Dentistry, Babu Banarasi Das College of Dental sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.**

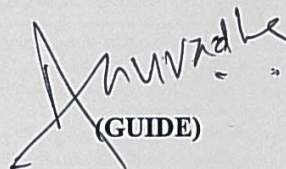
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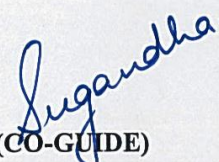
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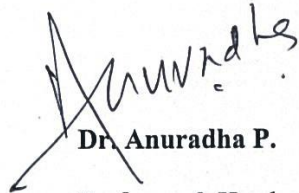
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**Dr. Diwas Rasaily**

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## **LIST OF ABBREVIATIONS**

- MDAs - Mobile Dental Applications
- RP –Rapid Prototyping
- AR/VR – Augmented Reality /Virtual Reality
- AI – Artificial Intelligence
- ML – Machine Learning
- DL - Desktop learning
- MHAs – Mobile Health Applications
- SPSS – Statistical Packages for the Social Sciences.

# **ABSTRACT**

**Introduction :** Technology has significantly enhanced education in healthcare, especially in dentistry. Mobile Dental Applications (MDAs) offer students convenient access to interactive videos, clinical case studies, tutorials, and quizzes. These resources help students improve both their clinical skills and theoretical knowledge. MDAs allow learners to study at their own pace, making learning more flexible and engaging. They complement traditional methods, providing practical, on-demand resources that support hands-on training and theoretical understanding.

**Aim :** To assess Undergraduate and Postgraduate Dental student's perception on Mobile Dental Applications (MDAs) and its usage in learning and clinical practice.

**Material and Methods :** A questionnaire study was conducted among 366 students to explore undergraduate and postgraduate dental student's perceptions on mobile phone based technology and their usage in learning and patient management in dentistry in Lucknow, Uttar Pradesh. The Chi square test was used to compare the gender wise and specialization wise knowledge, attitude and beliefs of the participants.

**Results :** Among the total sample size of 442, the number of students who participated in this study were 366 making the response rate as 82.81% out of which 44.26% (162) were male and 55.7% (204) were female with maximum respondents (95.08%) lying in age group of 18-30 years and rest 4.92% falls in the age group of 30-40 years. Based on education, the number of BDS students was 253 and MDS students was 113 that is 69.13% and 30.87% respectively.

**Conclusion :** This study underscores the need for continued research and innovation in this domain to optimize educational outcomes and improve patient care.

**Keywords :** Mobile dental applications (MDA), digital learning ,clinical practice, technology ,dental students .

# INTRODUCTION

The integration of mobile technology into various fields of education has seen rapid growth in recent years, particularly in healthcare education. In dentistry, where both theoretical knowledge and clinical skills are crucial, mobile-based learning applications have emerged as valuable tools for enhancing students' learning experiences.<sup>1</sup> Mobile Dental Applications (MDAs) provide students with easy access to educational resources, such as clinical case studies, interactive videos, tutorials, and quizzes, which can be used at their convenience. These platforms offer an innovative approach to traditional learning methods by making education more accessible and interactive.<sup>2</sup>

This study focuses on assessing the effectiveness of mobile dental application-based learning among dental students and its impact on their clinical practice. With the increasing availability of mobile devices and internet connectivity, students now have the opportunity to enhance their knowledge through on-demand access to educational content. As the demand for well-trained dental professionals grows, it becomes essential to explore whether the use of MDAs can bridge the gap between theoretical learning and practical skills.

The digital revolution has spread across all medical fields, including dentistry, and, as expected, it has also touched the under-and postgraduate medical education.<sup>3</sup> In dentistry, we are witnessing extraordinary progress generated by digital technology, such as clinical and technical procedures related to intraoral or extraoral scanning, 3D printing, guided dental implantology, complex maxillo-facial guided surgery or orthodontic digital planning, design and production of diverse prosthetic restorations using subtractive or additive methods, computerized validation of diverse fixed or mobile prostheses and computerized patient monitoring.<sup>4-6</sup> The importance of these beneficial elements constantly increases due to the encouraging perspectives in the development of digital dentistry. Today's top trending elements in dentistry digitalization and in influencing the directions of scientific research in this field are considered to be

the following: rapid prototyping (RP); augmented and virtual reality (AR/VR), artificial intelligence (AI) and machine learning (ML); personalized and precision medicine; and tele-medicine.<sup>7,8</sup>

Dental students' training holds a special place in this technological universe and, as a consequence, it must adapt to the characteristic rhythm of development of the actual digital era.<sup>9</sup> Thus, the concept of “virtual teaching and learning” (“e-teaching and e-learning”), which includes the use of digital dental didactic models, has been proposed and successfully applied in university education, facilitating students' understanding of theoretical and practical aspects; these methods ensure students' efficient transition from a preclinical to a clinical context, thus proving their high educational value.<sup>10</sup> Haptic models employing virtual reality techniques represent an alternative to the standard models used in the preclinical training of students. The famous Simodont (Nissin Dental Products Europe BV, Nieuw-Vennep, The Netherlands) was the first simulator that offered the possibility of learning proprioceptive abilities. The results of certain studies demonstrate that a clinically relevant qualitative feedback can be provided via a VR dental simulator.<sup>11</sup> While the cost of virtual simulation equipment is, unfortunately, still high, Nassar pointed out in a relatively recent review that “none can deny the benefits of using these simulations strategies especially in saving faculty time as well as allowing the students to perform repeated attempts to achieve mastery at their own pace and after hours”.<sup>12</sup>

On the other hand, digital applications are not intended to completely replace the traditional, conventional methods of teaching and learning, which have proved their efficiency and have already been validated.<sup>13</sup> In this respect, the training on mechanical patient simulators (“phantom heads”) using standard dental models undisputedly remains an important stage in the preclinical training of dental students. Practical exercises performed on standard dental

didactic models aim to form and, subsequently, to enhance the practical abilities of under- and postgraduate dental students, so that, in contact with real patients, they can demonstrate appropriate precision, correctness and expeditiousness in performing practical daily dentistry.<sup>14</sup>

Mobile dental applications (MDAs) are increasingly being adopted in dental education to enhance students' learning experiences and clinical practice skills. Research indicates that these applications can significantly improve academic performance, knowledge retention, and skill acquisition among dental students.<sup>15</sup> MDAs offer numerous advantages, including easy access to educational resources, clinical case studies, and multimedia content such as videos and interactive tutorials. Studies show that using these applications boosts students' understanding of clinical procedures and improves their decision-making and confidence in clinical tasks. The ability to access learning materials anytime and anywhere makes mobile learning flexible and conducive to self-paced learning, which is particularly helpful in dental education.<sup>16</sup>

However, some challenges remain, such as concerns about potential distractions from non-educational content on smartphones, the need for consistent internet access, and the limited availability of high-quality peer-reviewed educational material in some apps.<sup>17</sup> Despite these issues, MDAs are regarded as valuable tools for bridging the gap between theoretical learning and practical application in dental clinics. The impact of MDAs extends beyond theoretical knowledge, with significant improvements in clinical skill levels observed in students who utilize mobile learning resources. Moreover, mobile learning fosters greater engagement and interactivity, which enhances learning outcomes.<sup>18</sup> While MDAs cannot replace traditional hands-on clinical training, they serve as powerful supplements to dental education, offering flexibility, increased accessibility, and opportunities for continuous learning. This makes them a

promising component of modern dental education and clinical practice development.

The present study is structured as a questionnaire-based investigation to evaluate dental students' perceptions of mobile dental applications in their education. This research is particularly relevant as dental education continually evolves with technological advancements. By examining the impact of MDAs, the study will contribute valuable insights into how technology-enhanced learning can improve clinical outcomes, enhance skill acquisition, and support the development of future-ready dental professionals.

Hence the study aims to determine how mobile learning influences students' understanding of clinical procedures, decision-making skills, and overall confidence in performing dental tasks. The feedback collected through the questionnaire will help in understanding the strengths and limitations of MDAs as educational tools and their potential role in transforming dental education and clinical practice.

# **AIM AND OBJECTIVES**

**AIM:**

To assess Undergraduate and Postgraduate Dental student's perception on Mobile Dental Applications (MDAs) and its usage in learning and clinical practice .

**OBJECTIVES:**

1. To assess Undergraduate and Postgraduate Dental student's Attitude towards any Mobile Dental Applications (MDAs) as an educational tool in dental education and clinical practice .
2. To assess Undergraduate and Postgraduate Dental student's Practice towards any Mobile Dental Applications (MDAs) as an educational tool in dental education and clinical practice .

# **REVIEW OF LITERATURE**

**Kumar S et al (2010)**<sup>19</sup> conducted a study on Internet usage among undergraduate dental students in India. Internet usage was assessed among the first- to senior-year undergraduate dental students at the Darshan Dental College and Hospital, Udaipur, India. The study was conducted during the beginning of the academic year 2007-2008. Data were collected by using a questionnaire, which consisted of nine multiple choice questions. The chi-square test was used to compare the responses between male and female students and to analyze the difference among year classes. The total sample size was 247, and the overall response rate was 66%. Only 5.7% and 4.1% of the students used the internet daily for general and dental purposes, respectively. More than half the subjects (55.5%) never used the internet for academic purposes in comparison to 9.3% for general use. Nearly half of the subjects preferred home for internet access; only 7.9% accessed the internet at school. About 60% of the subjects used search engines to access dental subjects, and the students from clinical years used the search engines for dental education more often than the preclinical students (78% versus 41.2%,  $P=0.001$ ). Dental students at this private dental institution in India reported lower levels of internet use than students in other countries, which may be due to limited access and availability at the present institution.

**Singh RP, Gopalakrishnapillai AC, Bhat N, Pawar A (2019)**<sup>20</sup> conducted a study on Perception of dental and medical teaching faculty regarding mobile dental applications. All the teaching faculty of ITS Dental College were included in the survey and were provided with the questionnaire containing three components pertaining to demographic details, prevalence, and perception regarding ideal mobile dental apps. Data were collected through Google forms and were assessed on a 5-point Likert scale. An intraclass correlation between the study subjects and significant association was found, which was interpretative of strong correlation among the participants ( $ICC = 0.273$ ,  $P =$

0.042). The chi-squared test also revealed a significant association for most of the responses ( $P = 0.00$ ), except for the fact that “dental apps are essential tools.” Nearly 89% of the participants were using smartphones and 75% of the faculty cited as portability of mobile dental apps as the biggest advantage.

**Nayak PP, Nayak SS, Vikneshan M, Sathiyabalan D (2019)<sup>2</sup>** conducted a study on Smartphone Apps - The Powerful E-learning Tools for Dental Professionals and Students. A total of 210 apps were included in the study. Various features of app including, the type, cost, ratings, number of downloads, involvement of dental professional in its development, target group, applicability and, user feedback was recorded. Among the apps reviewed, 165 and 45 apps were general and specialty related respectively. Most of the apps reviewed were free, developed by dentist and targeted towards students. Around 81.9% android apps had less than 1000 downloads. Around 60% of the applications were updated within last fifteen months. Most of the apps contained only text matter with few pictures. Very few apps used high definition animation to show various intercellular interactions; and augmented and virtual reality techniques to demonstrate and allow students to practice dental procedures in the virtual model. Such apps could go a long way in improving the understanding, especially of abstract concepts. Dental educational apps are relatively less, particularly the specialty related apps.

**Joda, T.; Bornstein, M.M.; Jung, R.E.; Ferrari, M.; Walimo, T.; Zitzmann, N.U. (2020)<sup>6</sup>** conducted a study on Recent trends and future direction of dental research in the digital era. The digital transformation in dental medicine, based on electronic health data information, is recognized as one of the major game-changers of the 21st century to tackle present and upcoming challenges in dental and oral healthcare. This opinion letter focuses on the estimated top five trends and innovations of this new digital era, with potential to decisively influence the direction of dental research: (1) rapid

prototyping (RP), (2) augmented and virtual reality (AR/VR), (3) artificial intelligence (AI) and machine learning (ML), (4) personalized (dental) medicine, and (5) tele-healthcare. Digital dentistry requires managing expectations pragmatically and ensuring transparency for all stakeholders: patients, healthcare providers, university and research institutions, the medtech industry, insurance, public media, and state policy. It should not be claimed or implied that digital smart data technologies will replace humans providing dental expertise and the capacity for patient empathy. The dental team that controls digital applications remains the key and will continue to play the central role in treating patients. In this context, the latest trend word is created: augmented intelligence, e.g., the meaningful combination of digital applications paired with human qualities and abilities in order to achieve improved dental and oral healthcare, ensuring quality of life.

**Zhang et al. (2020)**<sup>21</sup> conducted a study on Smartphone and medical application use among dentists in China. The questionnaires for this cross-sectional study were randomly sent to dentists by email, and 379 dentists responded. Dentists' demographics and perceptions of WeChat, QQ (the most popular social media apps in China) and other medical apps were assessed; the questionnaire including questions on the purpose, frequency, daily use, and opinion of the apps they used. A total of 379 valid responses were received; the respondents had a median age of 33.6 years old (63.3% female). All subjects (100%) owned a smartphone, and all of them installed and used WeChat or QQ in their clinical practice. Only 76% of subjects installed medical apps (other than WeChat and QQ) on their smartphones. Male dentists were more likely to install medical apps than female dentists ( $p < 0.05$ ). With increasing age, the percentage of dentists who installed medical apps decreased ( $p < 0.001$ ). The frequency and daily use were higher for WeChat and QQ than for medical apps.

Medical apps were positively perceived, with dentists reporting that they recommend these medical apps to their peers (Likert score:  $1.67 \pm 0.68$ ).

**Mergany, N.N., Dafalla, AE. & Awooda, E (2021)<sup>15</sup>** conducted a study on Effect of mobile learning on academic achievement and attitude of Sudanese dental students: a preliminary study. A quasi-experimental study was conducted among undergraduate dental students from two Sudanese universities. A total of 67 students who voluntarily agreed to participate were randomly allocated into a control group of 33 and an intervention group of 34 students. Initially, the two groups undertook a pre-test to ensure the standardization of a scale regarding their existing academic knowledge of dental surgery forceps used for tooth extraction. Then the intervention group was provided with a mobile application (Dental Surgical Forceps application version 2.1.0.0), and 3 weeks later a post-test was given for both groups. The attitude of the students toward the effectiveness of mobile learning was as assessed by five-point Likert scale questionnaire. For comparison of the numerical parametric data, a T. test was used, while for non-parametric categorical data a Chi-Squire test was used, with level of statistical significant difference set at  $P$ -value of  $\leq 0.05$ . The response rate was 91% for the intervention group (31 out of 34 students completed the study), and 78% for the control group (26 out of 33 students completed the study). Statistical significant difference was observed between the pretest and post-test mean scores of the intervention group ( $P < 0.005$ ), while the differences were not significant among the control group ( $P > 0.05$ ). Regarding the attitude of the dental students, the mean scores of the sample indicate that the vast majority of the participants (93.5%) showed positive attitude regarding the effectiveness of mobile learning.

**Subramani P, Rajaram S, Kumari GS, Sureshkumar K (2021)<sup>18</sup>** conducted a study on Usage of mobile technologies by undergraduate dental students. A questionnaire was made and distributed to undergraduate dental students from

1st year to interns, and the responses were collected at Asan Memorial Dental College and Hospital, Chengalpattu, Tamil Nadu. 92.8% of the total undergraduate dental students opted smartphones as their first choice to access the internet. 57.6% of the students used the internet most often for both dental course and personal reasons. 90.4% of the preclinical students used smartphones to connect the internet, and 80.4% of the clinical students used smartphones to access the internet more frequently. It was concluded that Dental students use smart phones with various learning apps to enhance their learning online.

**Fatma Salem Alzahrani, and Ammar Saleh Alshamrani (2023)<sup>22</sup>** conducted a study on Evaluation of the Use of Mobile Devices for M-Learning among Dental Students at Taif University. The study comprised 51 dental students from the 1st, 2nd, 5th, and 6th years. Data were collected through an online google survey form and analyzed using Excel 2016 and SPSS 17.0. The questions were both quantitative and qualitative. The chi-square test was also applied to non-parametric questions for two independent variables, study year and gender, to evaluate mobile usage for m-learning. A significant association was seen between the time duration of mobile usage and study year ( $P=.00$ ) and gender ( $P=.00$ ). There was also a significant association between the purposes of mobile usage with study year ( $P=.00$ ) and gender ( $P=.02$ ). Moreover, significant association found between preferences for mobile usage and study year ( $P=.00$ ) and gender ( $P=.00$ ). A total of 29% of the students use mobile devices for m-learning for more than 7 hours. A total of 78% of the students trust the reliability of mobile devices for m-learning. Most students use mobile devices (37%) more often than computers (6%). A total of 96% of dental students consider mobile devices as a medium for m-learning. It was concluded that students have adapted to m-learning quickly as it is fast, convenient, and reliable. Mobile devices can also be used for numerous tasks and different purposes.

**Vayrtnen E et al (2023)**<sup>23</sup> conducted a scoping review on The Use of Patient-Oriented Mobile Phone Apps in Oral Health. A scoping review of published scientific literature on the use of patient-oriented mobile phone apps in oral health was conducted in accordance with the Joanna Briggs Institute. A search was performed in PubMed and Scopus for studies published between January 2000 and June 2021 that were written in English. All study types except for those reporting developmental protocols were included in this review. In total, 2 reviewers independently screened the studies using the eligibility criteria. The study protocol was registered in the Open Science Framework registries in June 2021. The initial search yielded a total of 977 studies, 45 (4.6%) of which met the inclusion criteria. All the studies (45/45, 100%) were published after 2009. Most studies (31/45, 69%) concerned oral health promotion using mobile phone apps, followed by behavior management (5/45, 11%). More than half (23/45, 51%) of the included studies were conducted in Asian countries. Overall, 31% (14/45) of the studies focused on adolescents. A total of 51% (23/45) of the studies were randomized controlled trials (RCTs). Approximately 39% (9/23) of the included RCT studies reported a substantial reduction in dental plaque, and 26% (6/23) of the studies reported significant improvement in gingival health. Regarding dental anxiety management, 13% (3/23) of the RCT studies reported a significant decrease in mean heart rate and lower Facial Image Scale scores. It was concluded that the use of mobile apps in oral health is increasing among patients, mainly children and adolescents. Many studies that have used mobile apps have focused on promoting oral health. However, other areas such as diagnostic and remote consultations (teledentistry) have until recently been neglected despite their great potential.

**Pascadopoli M et al (2023)**<sup>24</sup> conducted a scoping review on Smartphone Applications in Dentistry. This scoping review considered randomized clinical trials, cross-sectional studies, before–after (pre–post) studies with no control

group, and observational studies. Once the inclusion and exclusion criteria had been defined, a preliminary confined search was performed on PubMed and Scopus; key terms from the collected articles were selected to design a search strategy, and then a search of all the included articles' reference lists was run for further research. Studies were excluded if they did not fulfill the inclusion criteria. The preferred reporting items for scoping reviews (PRISMA-ScR) consensus was followed. The risk of bias was evaluated by providing a qualitative analysis of the clinical studies via the National Heart, Lung, and Blood Institute (NHLBI) Quality Assessment of Controlled Intervention Studies, Observational Cohort Studies, and Cross-Sectional Studies (NHLBI, NIH). A total of 21 studies were included in this review. The literature indicates that MHAs are effective in improving oral hygiene in adolescents and children and reducing the dental plaque index, including in patients undergoing orthodontic treatment. MHAs are also able to reduce the symptoms of patients affected by obstructive sleep apnea–hypopnea syndrome (OSAHS) and improve the swallowing-related quality of life of elderly patients. MHAs are furthermore recommended to decrease dental anxiety among patients, both during dental procedures and the post-operative period. MHAs are useful to spread knowledge about traumatic dental injuries among non-oral health professionals and to monitor dental erosion and awake bruxism. MHAs' clinical outcomes might have been influenced by the demographic features of the subjects involved. Further studies considering a longer follow-up period and larger samples are needed. In conclusion, MHAs can be considered a useful tool to monitor oral disease and increase patients' quality of life related to oral health.

**Aljohani K, Agou S, Alnahdi F, Bakhuraybah A, Abed H (2023)<sup>25</sup>** conducted a study on The impact of a smartphone application and Internet resource usage on dental education. A cross-sectional web-based survey was used. Data on demographics and smartphone usage were collected. Besides, participants were

able to add their suggestions at the end of the study using a free open box. The statistical significance was at  $P > 0.05$ . A total of 151 valid responses were collected. Of these, the majority were female (57.6%). All the participants had a smartphone, and 36.4% spent 6 to <8 h surfing. Google Scholar (81.5%) was the most used source for finding information, followed by PubMed (69.5%) and Wikipedia (49%). Almost 95.4% of participants used their smartphones to read scientific papers. Nearly 71.5% of respondents said that they used their smartphones for social networking. Most dental care providers regularly use smartphone applications/health Internet sites for education and research. In this study, we found many Internet sites and applications commonly used by the interns, which can be reviewed, updated, and utilized by the curriculum committee and included in the teaching process as this will save time and effort in training.

**Prakash A, Anand K, Kumar A, Raj R, Anand S, Kriti, et al (2023)<sup>1</sup>** conducted : A cross-sectional study on Knowledge, attitude, and perception of dental undergraduates towards mobile and digital learning methods in India. About 200 undergraduate students of dentistry in a single institution were selected as a convenient sample. Information obtained from responses was entered into an Excel sheet (Microsoft Corporation) and was further analyzed. Data collection was done for a period of one month. Obtained data were recorded and subjected to statistical analysis by use of statistical SPSS software (version 20.0, IBM). Descriptive statistical data were recorded as frequencies or percentages. Chi-square statistical test was used for the assessment of responses obtained from dental undergraduate students. The level of significance was fixed at a probability of  $<0.05$ . On statistically analyzing, 99% of students were found to possess knowledge regarding the use of mobile phones for digital education. A good statistical correlation was obtained between attitude and perception regarding accessing digital learning using mobile phones. In the

present study, good knowledge, attitude, and perception regarding the use of digital learning using phones were found among Indian dental undergraduates.

**Nagarajappa S et al (2023)**<sup>26</sup> conducted a randomized control trial on Impact of smartphone application ‘Dent-O-Xpert’ on oral health related knowledge, attitude and behavior of young adults. It involved 168 young adults aged 18–25 from professional institutions in Indore, India. The intervention group received oral health education through “Dent-O-Xpert” smartphone application with educational content, interactive modules, reminders and personalized recommendations, while the control group received traditional oral health sessions. Primary outcome measure including knowledge, attitude, behavior, and oral hygiene were evaluated through validated questionnaires and clinical examinations at baseline, 1 month, and 2 months. The data were analyzed using SPSS-23. The Dent-O-Xpert group showed significantly improved oral health knowledge scores at both follow-ups. By second follow-up visit, both plaque and oral hygiene scores were significantly reduced in Dent-O-Xpert group ( $0.25 \pm 0.4$ ) compared to control group ( $0.71 \pm 0.48$ ). Tooth-brushing frequency (96.4 %), brushing techniques (59.5 %), timely toothbrush changes (97.6 %), and use of supplementary oral hygiene aids (31–35.7 %) improved in the Dent-O-Xpert group. Attitudes toward oral health care were also more positive in this group. No significant changes in oral health behavior and attitude were observed in the control group. The study findings indicate that Dent-O-Xpert smartphone application is effective in improving the oral health related knowledge, attitude and behavior.

**Ramani P et al (2023)**<sup>27</sup> wrote AN OVERVIEW ON MOBILE APPLICATION IN DENTISTRY. Applications for smart phones that are relevant to dentistry are gaining popularity and are an easier way for students, professionals, and patients to acquire information. The purpose of this article is to examine how mobile technologies and current dental "apps" are used. The

transition from desktop learning (D-learning) to mobile learning (M-learning) has been a significant one throughout time, and it has only been made feasible with the use of electronic media and the expansion of the Internet. Despite the rise of mobile applications, there is still a need for all content to have a solid supporting body of evidence. Today, there are many excellent examples of dental applications that make the most of this electronic medium.

**Rajeev, et al. (2024)**<sup>17</sup> conducted a cross-sectional study on Evaluation of mobile phone and social usage among dental students as an educational and clinical adjunct in Davanagere City, South India. The participants' responses were then computed into a Microsoft Excel worksheet, evaluated with the Statistical Package for the Social Sciences, IBM version 21.0, and interpreted. Descriptive statistics were performed. Results: A total of 268 participants participated. About 77.2% were female (n = 206) and 22.8% were male (n = 61). There was found to be a lack of awareness regarding dental health education apps which is indicative of the need to include more application-based academic curricula strengthened by recent advances in technology. Conclusion: The study found a great increase in smart phones as well as social media among dental students but there is a great need to raise awareness among students regarding subject related databases.

# **METHODOLOGY**

## **STUDY DESIGN:**

A questionnaire study was conducted to explore undergraduate and postgraduate dental student's perceptions on mobile phone based technology and their usage in learning and patient management in dentistry in Lucknow, Uttar Pradesh.

## **STUDY AREA:.**

- Lucknow is the capital of UP.
- The city is located at an altitude of approximately 123 meters (404 feet) above sea level, and the Lucknow area covers a total of 2,528 square kilometers (976 square miles)
- It is bound by Barabanki on the east, by Unnao on the west, by Raebareli in the south and by Sitapur and Hardoi in the north.
- Lucknow lies on the northwestern bank of the Gomti River.
- The provisional report of the 2011 Census of India states that there were 2,815,601 residents in Lucknow, consisting of 1,470,133 men and 1,345,468 women.
- In 2011, Lucknow's overall literacy rate was 84.72%, with 2,147,564 literate individuals—1,161,250 of whom were men and 986,314 of whom were women.
- Relevant demographic details like age, gender and education of the study participants was included in the study.

## **STUDY POPULATION:**

- The study population consisted of undergraduate and postgraduate students of a dental college in Lucknow.

**ETHICAL CLEARANCE:**

Approval for ethical clearance was granted by the Institutional Ethical Committee of Babu Banarasi Das College of Dental Sciences, BBDU, Lucknow.

**CONSENT:**

All participants in the study provided verbal consent and permission was taken from the college authorities

**INCLUSION CRITERIA:**

- Dental students pursuing both Bachelor of Dental Surgery (BDS) and Master of Dental Surgery (MDS).
- Participants of both genders.
- Ability to understand and answer questions.
- Participants who were willing to participate voluntarily and those who submitted the completed forms.

**EXCLUSION CRITERIA:**

- Those who were not able to understand the questions or unwilling to participate in the study.
- Students who did not complete the questionnaire were not allowed to participate in the study.
- Participants who were not using smart phones devices.

### **PILOT STUDY:**

- A pilot study was conducted among 10% students to check the feasibility of the study and to access the relevance and content validity of the questionnaire.
- The reliability was calculated using test retest and Cronbach's alpha.
- The pilot study suggested that a majority of the subjects were looking forward for a new and enhanced version of the Modern Education system and feel that these mobile based education not only helps in understanding but also makes a lot of work easy and faster.

### **SAMPLE SIZE ESTIMATION**

Total Enumerates : 442

| SAMPLE              | PARTICIPANTS |
|---------------------|--------------|
| BDS BATCH 2018-2022 | 73           |
| BDS BATCH 2019-2023 | 76           |
| BDS BATCH 2020-2024 | 71           |
| BDS BATCH 2021-2025 | 57           |
| BDS BATCH 2022-2026 | 52           |
| MDS BATCH 2020-23   | 37           |
| MDS BATCH 2021-24   | 37           |
| MDS BATCH 2022-25   | 39           |
| TOTAL               | 442          |

## **SCHEDULE OF THE SURVEY:**

- The period of data collecting was July 2023–December 2023.
- Information was collected from the students during their clinical posting which enables 100 percent response rate from the undergraduate students and for the post graduate students of different specialists, questionnaire was distributed to them and were collected next day .
- Completed questionnaire was obtained back by the investigator.

## **INSTRUMENTS AND SUPPLIES**

- The following tools and materials were utilized
  1. Questionnaire
  2. Pencil/pen
  3. Eraser
- There was a ready supply of hardboard bases and clips, sharpened pencils, pens, erasers, and assessment forms.

## **QUESTIONNAIRE:**

- The questionnaire was formed using content validity by a subject expert who is also the research head of the study.
- Face validity was conducted on 20-25 people by distributing the questionnaire in multiple format.
- The correlation test was used to determine content validity.
- The questionnaire had four components –
- Part- I included questions intended to gather data on the study group's demographics, including gender, location, smart device types and internet

access methods (Wi-Fi, 3G/4G, or both), the installation of dental apps (free or paid), frequency of use, and purpose.

- Part – II of the questionnaire contained 08 questions pertaining to student's perception related to dental apps and their comparison with the traditional source of knowledge sharing, usage of dental devices and any threats related to it.
- The seven questions in Part III of the survey asked about dental students' perceptions of using mobile dentistry apps in their clinical and pre-clinical practice.
- Part – IV contained 07 questions related to student's perception on the characteristic of ideal dental app and recommendations.

#### **DATA COLLECTION:**

- The questionnaire was distributed personally by the investigator himself and collected back the same day.

#### **STATISTICAL ANALYSIS:**

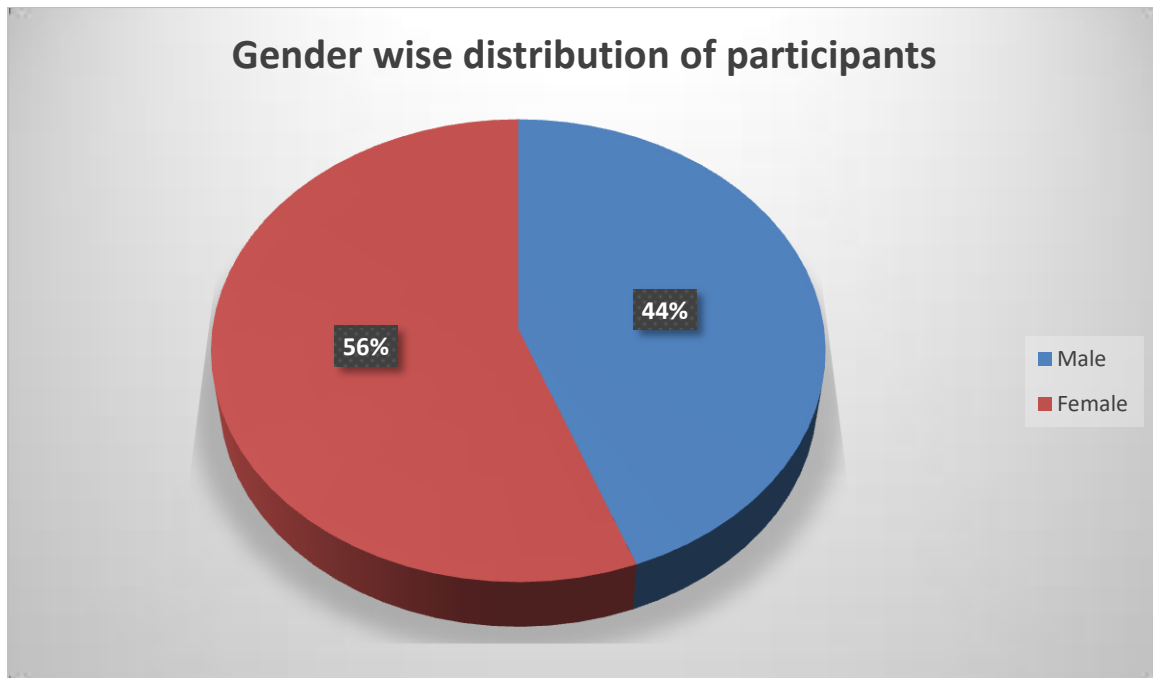
- The data collected were entered in IBM SPSS 20.0 version (Chicago, Inc, USA).
- The results are presented in frequency and percentage through graphs and tables.
- The Chi square test was used to compare the gender wise and specialization wise knowledge, attitude and beliefs of the participants.
- P value < 0.05 was regarded statistically significant. All the data were reported with exact p-values and 95% confidence intervals (CI) and 5% margin of error (z).

# RESULTS

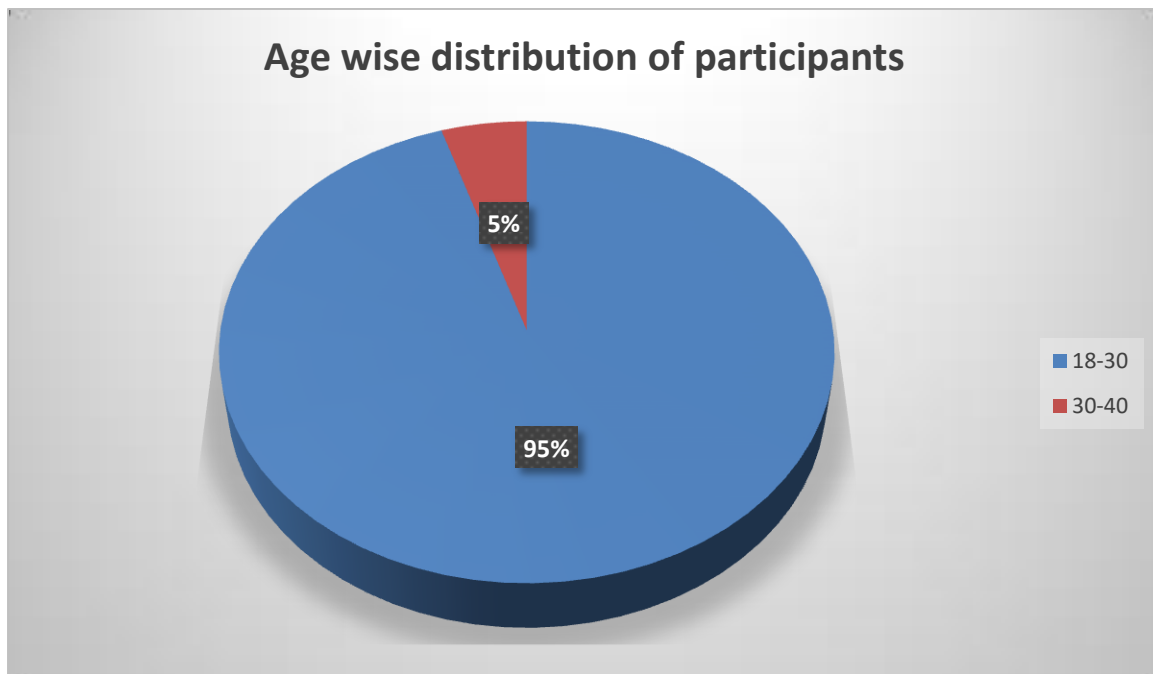
From the data retrieved by the survey, a randomly distributed population was obtained as respondents (Table 1). Among the total sample size of 442, the number of students who participated in this study were 366 making the response rate as 82.81% out of which 44.26% (162) were male and 55.7% (204) were female with maximum respondents (95.08%) lying in age group of 18-30 years and rest 4.92% falls in the age group of 30-40 years. Based on education ,the number of BDS students was 253 and MDS was 113 that is 69.13% and 30.87% respectively .

**Table 1: Demographic detail of participants**

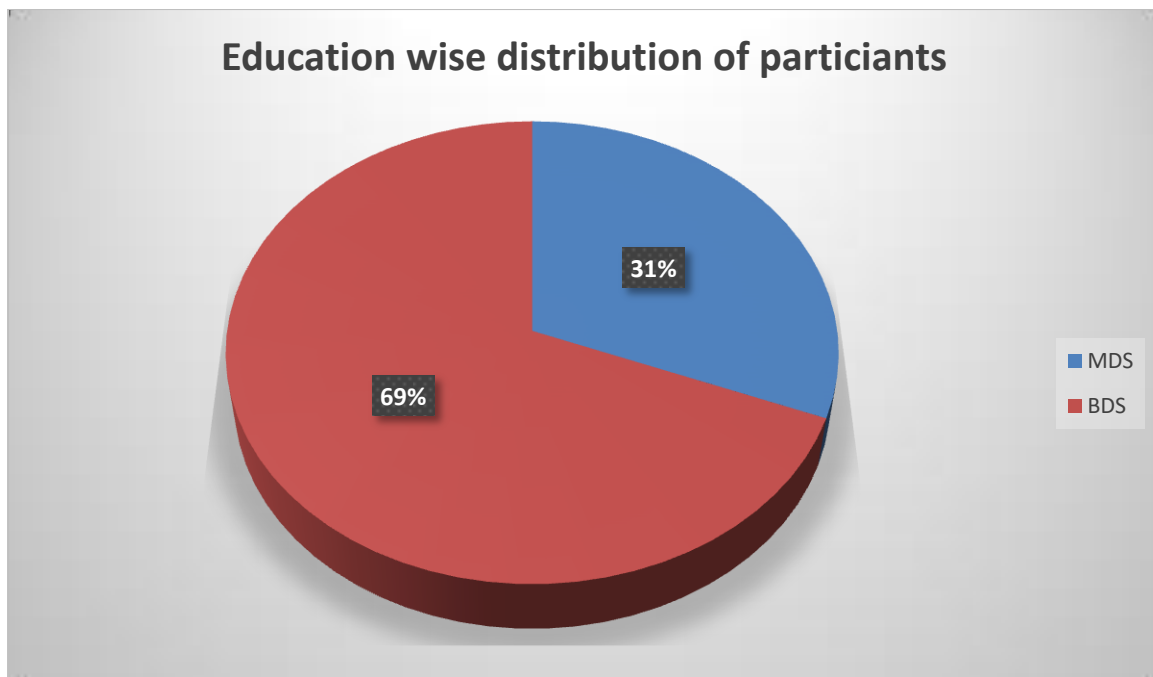
| Demographic variables | Total (n) | Percentage |
|-----------------------|-----------|------------|
| <b>Gender</b>         |           |            |
| Male                  | 162       | 44.26 %    |
| Female                | 204       | 55.7 %     |
| <b>Age range</b>      |           |            |
| 18-30                 | 348       | 95.08 %    |
| 30-40                 | 18        | 4.92 %     |
| <b>Education</b>      |           |            |
| BDS                   | 253       | 69.13%     |
| MDS                   | 113       | 30.87%     |



**Graph 1: Gender wise distribution of participants**



**Graph 2: Age wise distribution of participants**



**Graph 3: Distribution of participants based on education**

**Table 2** shows response of study participants knowledge, attitude and perception regarding use of mobile dental apps and its impact on their clinical/pre-clinical training.

The response of the participant to question “does dental apps serve as an essential tool for dental undergraduate/ postgraduate studies”, among 253 BDS students 26.09% agreed and 36.76% strongly agreed whereas 9.89% disagreed and among MDS students 23.0% disagreed and 33.63% agreed. No statistically significant difference was seen after applying chi-square test ( $p = 0.845$ ).

When asked whether they believe that dental apps are superior to dental books, 19.37% BDS and 15.93% MDS students disagreed whereas 17.39% BDS and 25.66% MDS students agreed. When asked if dental apps can serve as supplement to dental books, 18.97% BDS and 27.43% MDS students

agreed and 14.23% BDS and 17.70% MDS students disagreed. A statistically significant difference was seen ( $p = 0.030$ ).

The response of the participants to question “dental apps provide useful literature for academic/competitive examinations”, among the BDS students 26.88% agreed, 26.09% strongly agreed, 18.58% disagreed and 13.04% were unsure whereas among MDS students, 36.28% agreed, 30.09% strongly agreed, 14.16% disagreed and 7.96% were unsure. No statistically significant difference was seen ( $p = 0.341$ ).

Belief of the participants regarding potential threat/data breach for using dental apps shows that 28.46% agreed and 31.23% strongly agreed among BDS students whereas among MDS students, 28.32% agreed and 32.74% strongly agreed. Also 44.66% BDS students were of the opinion that dental apps improve and enhances the clinical decision making and 10.67% believed that they are less time consuming whereas among MDS students 29.20% were of the opinion that dental apps improve and enhances the clinical decision making and 30.97% believed that they are less time consuming .

The response of the participant to question “ideal dental apps should be produced by a medical publisher” shows that among BDS students 13.44% disagreed, 27.27% agreed and 18.18% were unsure whereas among MDS students 6.19% were unsure, 31.86% agreed and 13.27% disagreed. No statistically significant difference was seen ( $p = 0.236$ ).

The response of the participant to question “ideal dental apps should only specifically mean for health professionals” showed that 28.46% BDS students agreed and 34.39% strongly agreed whereas among MDS students 32.74% agreed and 16.81% disagreed. A statistically significant difference was seen ( $p = 0.04$ ).

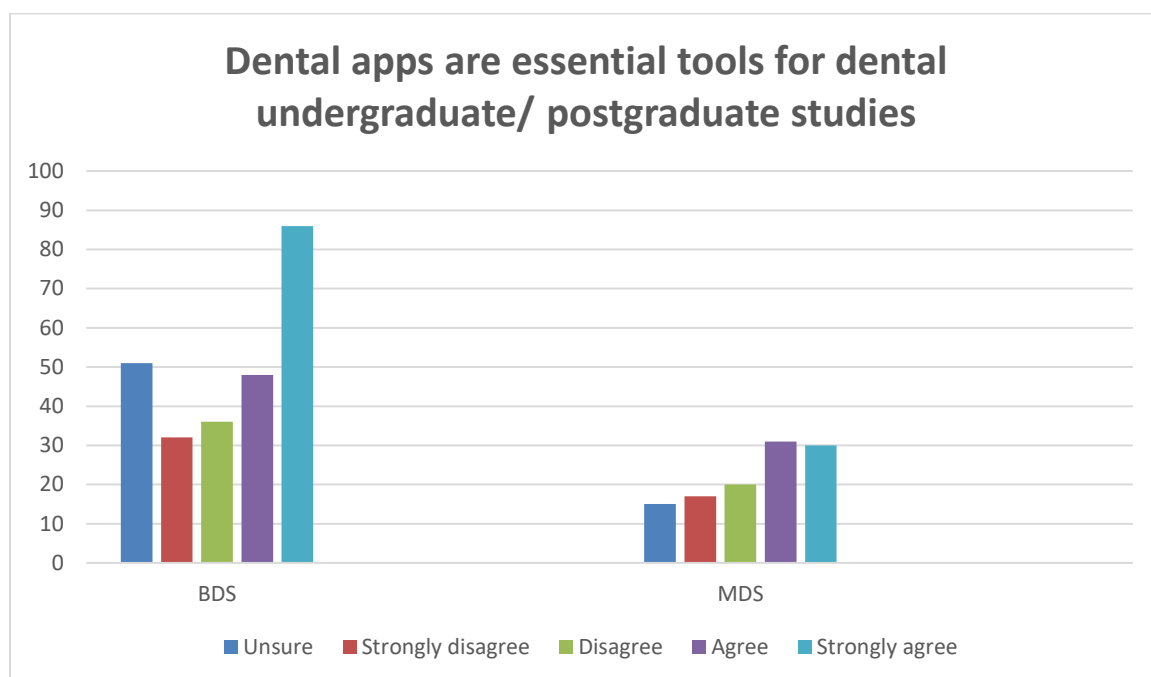
**Table 2: Response of study participants knowledge, attitude and perception regarding use of mobile dental apps and its impact on their clinical/pre-clinical training.**

| Questions                                                                        | Students   | RESPONSE       |                   |                |                |                | Chi-square value | p value      |
|----------------------------------------------------------------------------------|------------|----------------|-------------------|----------------|----------------|----------------|------------------|--------------|
|                                                                                  |            | Unsure         | Strongly disagree | Disagree       | Agree          | Strongly agree |                  |              |
| 1. Dental apps are essential tools for dental undergraduate/postgraduate studies | <b>BDS</b> | 41<br>(16.21%) | 29<br>(11.46%)    | 24<br>(9.89%)  | 66<br>(26.09%) | 93<br>(36.76%) | <b>16.23</b>     | <b>0.845</b> |
|                                                                                  | <b>MDS</b> | 11<br>(9.73%)  | 18<br>(15.93%)    | 26<br>(23.0%)  | 38<br>(33.63%) | 20<br>(17.70%) |                  |              |
| 2. Dental apps are superior to dental textbooks                                  | <b>BDS</b> | 68<br>(26.88%) | 39<br>(15.42%)    | 49<br>(19.37%) | 44<br>(17.39%) | 53<br>(20.95%) | <b>46.21</b>     | <b>0.021</b> |
|                                                                                  | <b>MDS</b> | 9<br>(7.96%)   | 14<br>(12.39%)    | 18<br>(15.93%) | 29<br>(25.66%) | 43<br>(38.05%) |                  |              |
| 3. Dental apps can serve as supplement to dental textbooks                       | <b>BDS</b> | 51<br>(20.16%) | 32<br>(12.65%)    | 36<br>(14.23%) | 48<br>(18.97%) | 86<br>(33.99%) | <b>48.27</b>     | <b>0.030</b> |
|                                                                                  | <b>MDS</b> | 15<br>(13.27%) | 17<br>(15.04%)    | 20<br>(17.70%) | 31<br>(27.43%) | 30<br>(26.55%) |                  |              |
| 4. All dental students should own a smart device for dental data management      | <b>BDS</b> | 29<br>(11.46%) | 24<br>(9.49%)     | 52<br>(20.55%) | 56<br>(22.13%) | 92<br>(36.36%) | <b>17.35</b>     | <b>0.683</b> |
|                                                                                  | <b>MDS</b> | 11<br>(9.73%)  | 15<br>(13.29%)    | 19<br>(16.81%) | 36<br>(31.86%) | 32<br>(28.32%) |                  |              |
| 5. Dental apps provide useful literature for academic/competitive examinations   | <b>BDS</b> | 33<br>(13.04%) | 39<br>(15.42%)    | 47<br>(18.58%) | 68<br>(26.88%) | 66<br>(26.09%) | <b>24.32</b>     | <b>0.341</b> |
|                                                                                  | <b>MDS</b> | 9<br>(7.96%)   | 13<br>(11.50%)    | 16<br>(14.16%) | 41<br>(36.28%) | 34<br>(30.09%) |                  |              |
| 6. All dental students should receive training for access to                     | <b>BDS</b> | 59<br>(23.32%) | 42<br>(16.60%)    | 32<br>(12.65%) | 64<br>(25.30%) | 56<br>(22.13%) | <b>38.77</b>     | <b>0.241</b> |

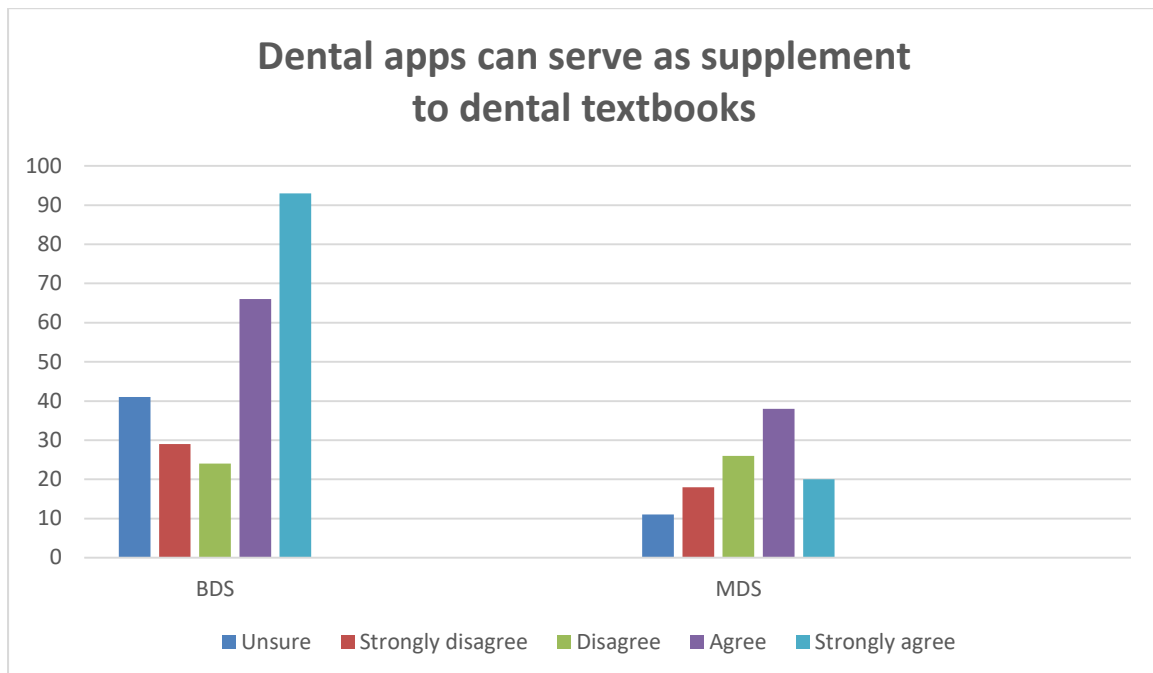
|                                                                             |            |                |                |                |                |                 |              |              |
|-----------------------------------------------------------------------------|------------|----------------|----------------|----------------|----------------|-----------------|--------------|--------------|
| dental apps                                                                 | <b>MDS</b> | 12<br>(10.62%) | 19<br>(16.81%) | 24<br>(21.24%) | 33<br>(29.20%) | 25<br>(22.12%)  |              |              |
| 7. Free dental apps are inferior in quality as compared to Paid dental apps | <b>BDS</b> | 49<br>(19.37%) | 33<br>(13.04%) | 39<br>(15.42%) | 62<br>(24.51%) | 71<br>(28.06%)  | <b>48.52</b> | <b>0.004</b> |
|                                                                             | <b>MDS</b> | 19<br>(16.81%) | 11<br>(9.73%)  | 16<br>(14.16%) | 29<br>(25.66%) | 38<br>(33.63%)  |              |              |
| 8. Belief regarding potential threat/data breach for of using dental apps   | <b>BDS</b> | 46<br>(18.18%) | 35<br>(13.83%) | 21<br>(8.30%)  | 72<br>(28.46%) | 79<br>(31.23%)  | <b>49.62</b> | <b>0.012</b> |
|                                                                             | <b>MDS</b> | 10<br>(8.85%)  | 16<br>(14.16%) | 18<br>(15.93%) | 32<br>(28.32%) | 37<br>(32.74%)  |              |              |
| 9. Improve and enhances your clinical decision making                       | <b>BDS</b> | 30<br>(11.86%) | 21<br>(8.30%)  | 22<br>(8.70%)  | 67<br>(26.48%) | 113<br>(44.66%) | <b>32.41</b> | <b>0.136</b> |
|                                                                             | <b>MDS</b> | 16<br>(14.16%) | 9<br>(7.96%)   | 9<br>(7.96%)   | 46<br>(70.73%) | 33<br>(29.20%)  |              |              |
| 10. Less time consuming and can be revised as many times as desired         | <b>BDS</b> | 33<br>(13.04%) | 48<br>(18.97%) | 56<br>(22.13%) | 89<br>(35.18%) | 27<br>(10.67%)  | <b>54.26</b> | <b>0.001</b> |
|                                                                             | <b>MDS</b> | 9<br>(7.96%)   | 18<br>(15.93%) | 17<br>(15.04%) | 34<br>(30.09%) | 35<br>(30.97%)  |              |              |
| 11. Allow faster access to clinical practice guidelines                     | <b>BDS</b> | 28<br>(11.07%) | 35<br>(13.83%) | 31<br>(12.25%) | 66<br>(26.09%) | 93<br>(36.76%)  | <b>17.25</b> | <b>0.692</b> |
|                                                                             | <b>MDS</b> | 14<br>(13.39%) | 18<br>(15.93%) | 26<br>(23.01%) | 36<br>(31.88%) | 19<br>(16.81%)  |              |              |
| 12. Help in making differential diagnosis                                   | <b>BDS</b> | 28<br>(11.07%) | 44<br>(17.39%) | 29<br>(11.46%) | 94<br>(37.15%) | 58<br>(22.92%)  | <b>19.55</b> | <b>0.886</b> |
|                                                                             | <b>MDS</b> | 11<br>(9.73%)  | 12<br>(10.62%) | 17<br>(15.04%) | 29<br>(25.66%) | 44<br>(38.94%)  |              |              |

|                                                                 |            |                |                |                |                |                |              |              |
|-----------------------------------------------------------------|------------|----------------|----------------|----------------|----------------|----------------|--------------|--------------|
|                                                                 |            |                |                |                |                |                |              |              |
| 13. Allow faster access to reliable sources of dental knowledge | <b>BDS</b> | 36<br>(14.23%) | 31<br>(12.25%) | 30<br>(11.86%) | 75<br>(29.64%) | 81<br>(32.02%) | <b>18.87</b> | <b>0.641</b> |
|                                                                 | <b>MDS</b> | 17<br>(15.04%) | 11<br>(9.73%)  | 9<br>(7.96%)   | 37<br>(32.74%) | 39<br>(34.51%) |              |              |
| 14. Allow faster access to reliable sources of clinical skills  | <b>BDS</b> | 39<br>(15.42%) | 41<br>(16.21%) | 49<br>(19.37%) | 68<br>(26.88%) | 56<br>(22.13%) | <b>19.24</b> | <b>0.710</b> |
|                                                                 | <b>MDS</b> | 14<br>(12.39%) | 9<br>(7.96%)   | 14<br>(12.39%) | 31<br>(27.43%) | 45<br>(39.82%) |              |              |
| 15. Allow faster access to evidence based dental practices      | <b>BDS</b> | 37<br>(16.62%) | 39<br>(15.42%) | 45<br>(17.79%) | 72<br>(28.46%) | 60<br>(23.72%) | <b>34.02</b> | <b>0.05</b>  |
|                                                                 | <b>MDS</b> | 13<br>(11.50%) | 16<br>(14.16%) | 22<br>(19.47%) | 30<br>(26.55%) | 32<br>(28.32%) |              |              |
| 16. Produced by a medical publisher                             | <b>BDS</b> | 46<br>(18.18%) | 33<br>(13.04%) | 34<br>(13.44%) | 69<br>(27.27%) | 71<br>(28.06%) | <b>17.69</b> | <b>0.236</b> |
|                                                                 | <b>MDS</b> | 7<br>(6.19%)   | 25<br>(22.12%) | 15<br>(13.27%) | 36<br>(31.86%) | 30<br>(26.55%) |              |              |
| 17. Regularly updated                                           | <b>BDS</b> | 54<br>(21.34%) | 46<br>(18.18%) | 21<br>(8.30%)  | 50<br>(19.76%) | 82<br>(32.41%) | <b>34.56</b> | <b>0.07</b>  |
|                                                                 | <b>MDS</b> | 19<br>(16.81%) | 11<br>(9.73%)  | 13<br>(11.50%) | 27<br>(23.89%) | 43<br>(38.05%) |              |              |
| 18. Authors are listed & Properly referenced                    | <b>BDS</b> | 49<br>(19.37%) | 37<br>(16.62%) | 36<br>(14.23%) | 52<br>(20.55%) | 79<br>(31.23%) | <b>39.52</b> | <b>0.08</b>  |
|                                                                 | <b>MDS</b> | 17<br>(15.04%) | 14<br>(12.39%) | 22<br>(19.47%) | 41<br>(36.28%) | 19<br>(16.81%) |              |              |
| 19. Feedbacks are possible                                      | <b>BDS</b> | 32<br>(12.65%) | 48<br>(18.97%) | 49<br>(19.37%) | 61<br>(24.11%) | 63<br>(24.90%) | <b>17.87</b> | <b>0.136</b> |
|                                                                 | <b>MDS</b> | 14<br>(12.39%) | 10<br>(8.85%)  | 8<br>(7.08%)   | 27<br>(23.89%) | 54<br>(47.79%) |              |              |

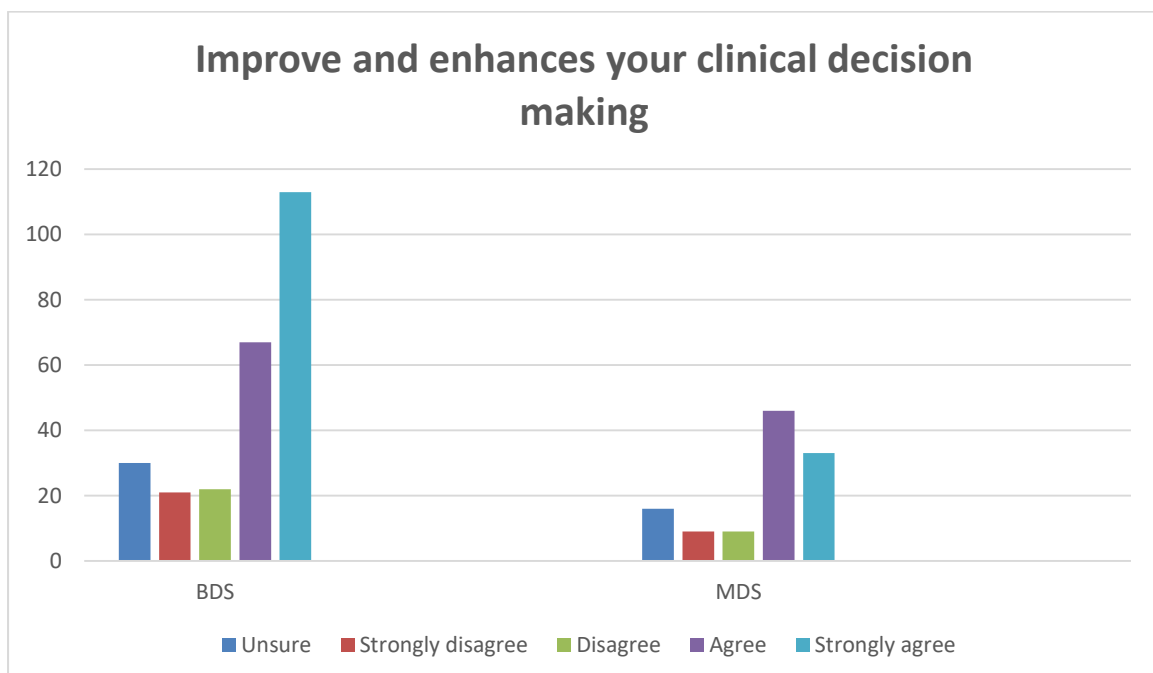
|                                                  |            |                |                |                |                |                |              |              |
|--------------------------------------------------|------------|----------------|----------------|----------------|----------------|----------------|--------------|--------------|
| 20. Contents are peer-reviewed                   | <b>BDS</b> | 59<br>(23.32%) | 38<br>(15.02%) | 33<br>(13.04%) | 47<br>(18.58%) | 76<br>(30.04%) | <b>19.66</b> | <b>0.742</b> |
|                                                  | <b>MDS</b> | 21<br>(18.58%) | 17<br>(15.04%) | 14<br>(12.39%) | 22<br>(19.47%) | 39<br>(34.51%) |              |              |
| 21. Recommended by mentor, university or College | <b>BDS</b> | 44<br>(17.39%) | 33<br>(13.04%) | 38<br>(15.02%) | 59<br>(23.32%) | 79<br>(31.23%) | <b>54.56</b> | <b>0.05</b>  |
|                                                  | <b>MDS</b> | 14<br>(12.39%) | 11<br>(9.73%)  | 13<br>(11.50%) | 36<br>(14.23%) | 39<br>(34.51%) |              |              |
| 22. Meant for health professionals               | <b>BDS</b> | 37<br>(14.62%) | 26<br>(10.28%) | 31<br>(12.25%) | 72<br>(28.46%) | 87<br>(34.39%) | <b>56.89</b> | <b>0.04</b>  |
|                                                  | <b>MDS</b> | 18<br>(15.93%) | 14<br>(12.39%) | 19<br>(16.81%) | 37<br>(32.74%) | 25<br>(22.12%) |              |              |



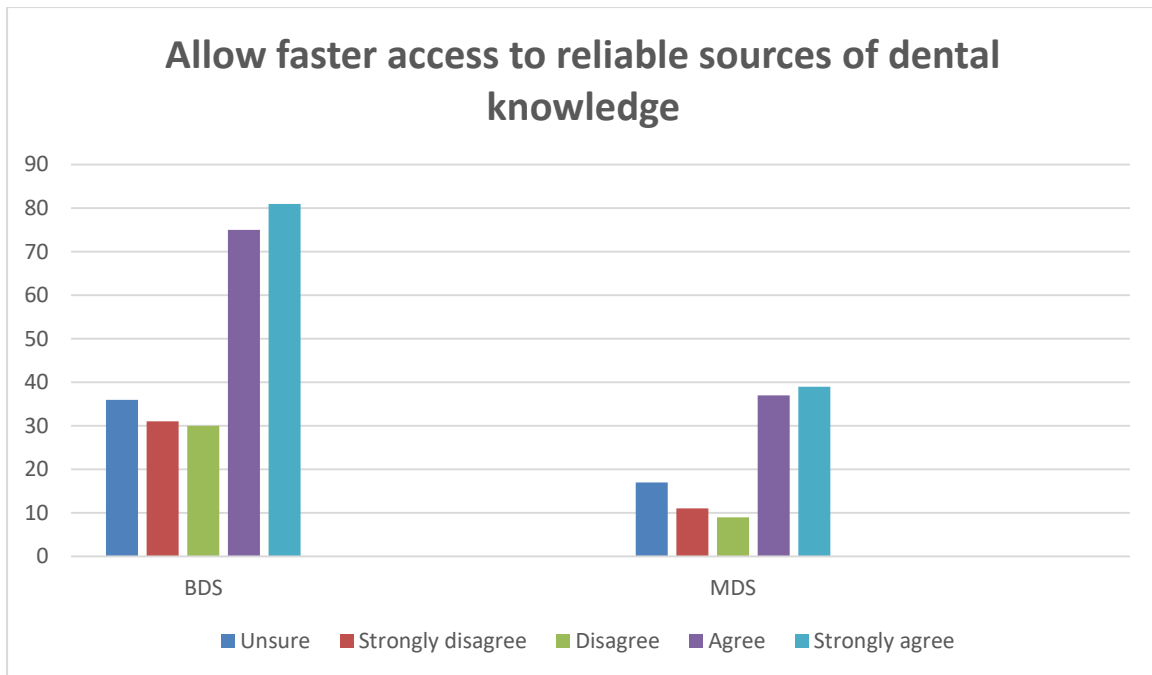
**Graph 4: Response of participants to question that Dental apps are essential tools for dental undergraduate/ postgraduate studies**



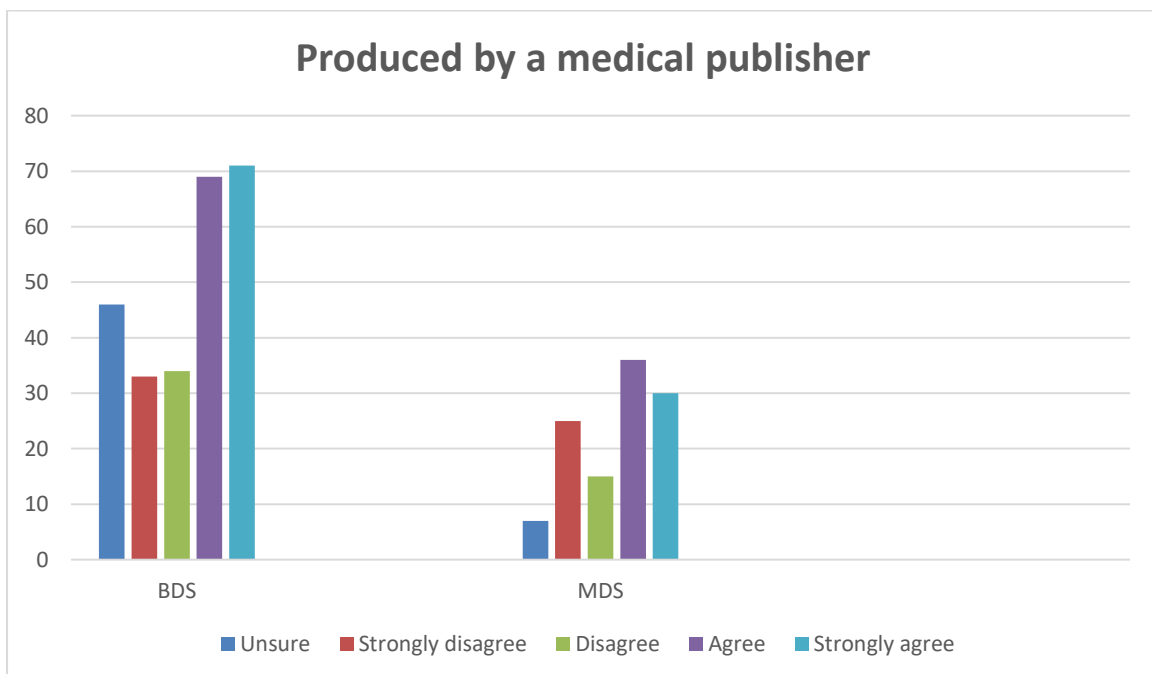
**Graph 5: Dental apps can serve as supplement to dental textbooks**



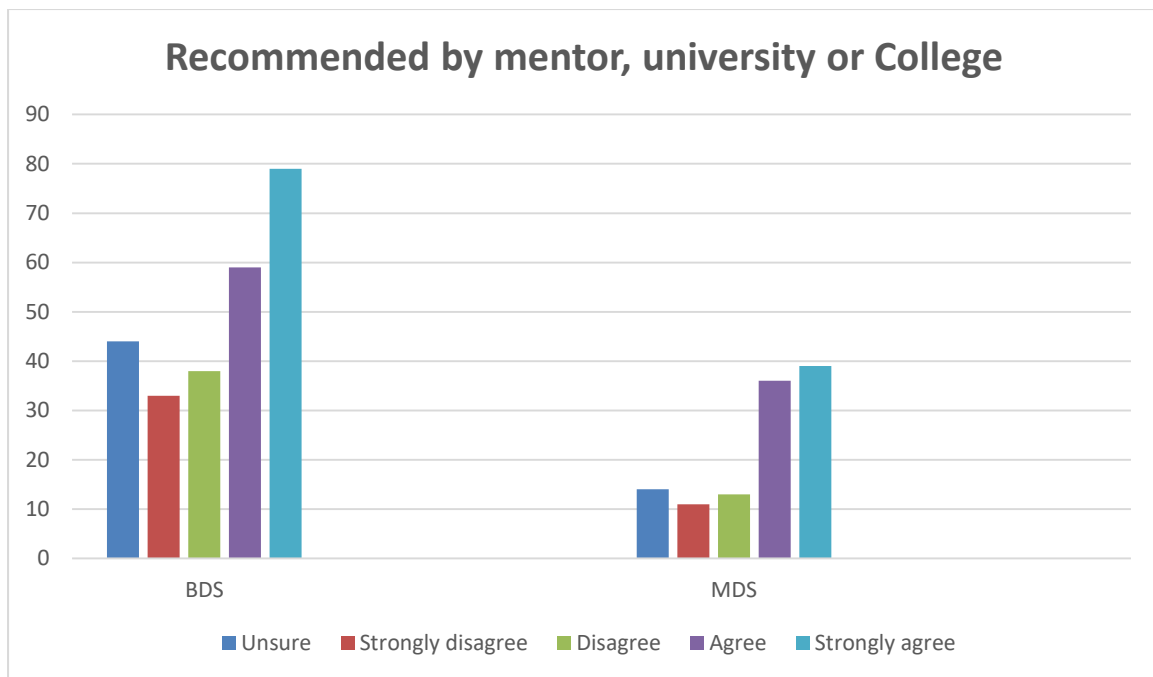
**Graph 6: Improve and enhances your clinical decision making**



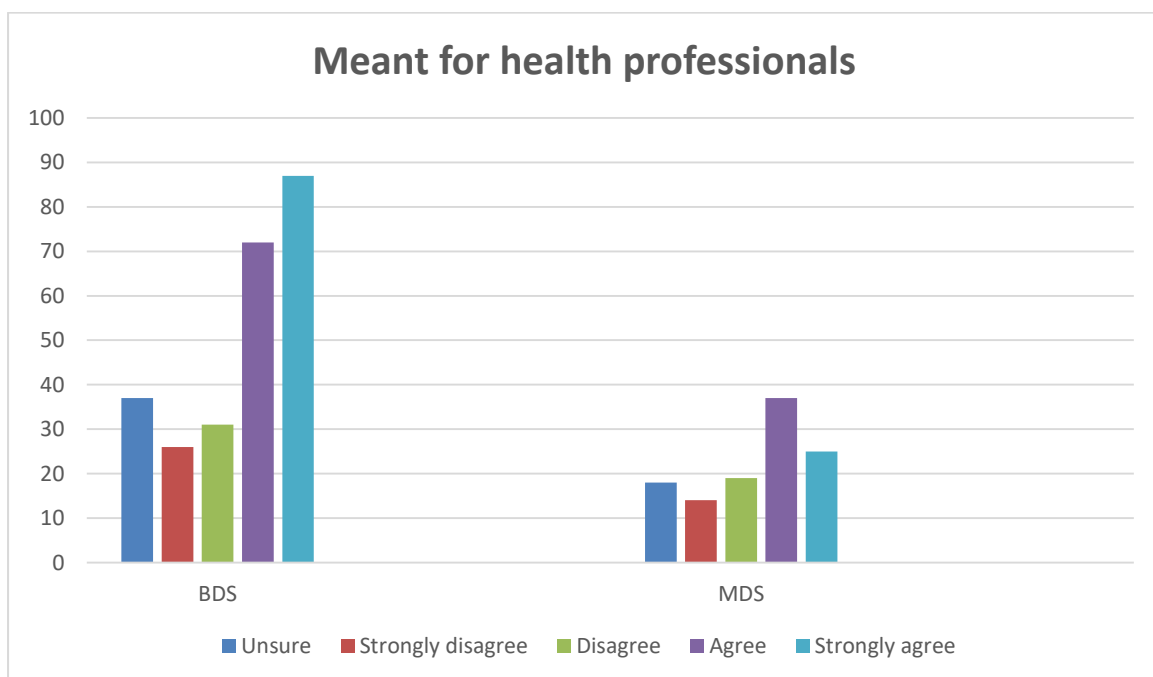
**Graph 7: Allow faster access to reliable sources of dental knowledge**



**Graph 8: Produced by a medical publisher**



**Graph 9: Recommended by mentor,university or College**



**Graph 10: Meant for health professionals.**

# DISCUSSION

The integration of technology in dental education has transformed traditional learning methodologies, offering students a more interactive, flexible, and accessible way to acquire knowledge and skills. The current study focuses on assessing the impact of mobile dental application-based learning on dental students and its influence on their clinical practice. The survey highlights the perceptions and experiences of Bachelor of Dental Surgery (BDS) and Master of Dental Surgery (MDS) students regarding mobile dental applications. The findings provide valuable insights into the effectiveness, challenges, and potential of these tools in dental education and clinical practice.

The 22-item questionnaire containing three sections was pre-tested and was applied after the pilot survey report, social and demographic details were also collected and compiled. The study group compiled of total 366 students, who were using smart phones installed with mobile dental apps among which 69.13% were BDS and 30.87% were MDS students and most of them believed that dental apps are essential learning tools which indicates broad acceptance of mobile apps as integral to dental education, particularly in accessing resources and enhancing understanding among the students.

In our survey 38.4% BDS and 63.71% MDS students agreed that mobile dental apps are superior to textbooks ( $p = 0.021$ ) which is in accordance with the study conducted by **Wallace S et al.**<sup>28</sup> which reported that the majority of participants (96%) agreed with the statement: 'smartphones will increase in usage in the future of medical education' (students 95%, residents 99% and faculty 89%). Many participants strongly believed that they can supplement the dental/medical education and practice ( $P = 0.030$ ) and anticipated that these devices will soon replace the use of traditional textbooks, and that they would soon be used as a routine part of clinical care. This reflects the complementary role of mobile apps, offering flexibility and interactive features that enrich traditional learning resources.

Study conducted by **Bullock et al.**<sup>29</sup> reported that participants strongly agreed or agreed that they would feel comfortable using a mobile device containing textbooks in front of patients which is similar to our findings in which 58.49% BDS and 60.18% MDS students strongly agreed or agreed that every student should own smartphone with mobile dental apps. These findings indicate that access to a mobile app enables timely, internet-free access to key textbooks and supports the learning and practice of newly qualified doctors during this critical phase of development. It also underlines the necessity of technological access to optimize the benefits of dental apps.

When the students were asked whether they should receive training for access to dental apps for better management and training, most of them agreed to it (47.43% BDS and 51.32% MDS) which is similar to the study conducted by **Ala Al-Musaw et al.**<sup>30</sup> on knowledge improvement via use of mobile dental app for avulsed tooth management, in which participants learned using app had higher significant mean score. Similar model was also used by **B Underwood et al.**<sup>31</sup> for oral hygiene education via Brush DJ app. This underscores the importance of institutional support in integrating apps into the curriculum effectively.

In our survey about 62.85% and 48.69% agreed that it allows faster access to clinical practice guidelines, 61.66% and 67.25% agreed that it allows faster access to reliable sources of dental knowledge and 49.01% and 67.25% agreed that it allows faster access to reliable sources of clinical skills among BDS and MDS students respectively which is in accordance with the study conducted by **Wallace et al.**<sup>28</sup> and **Paul et al.**<sup>32</sup> in which participants commonly used the devices to manage their time, by accessing schedules and calendars “on the go” (students 81%, residents 84%, and faculty 56%). Apps allow faster access to clinical guidelines, evidence-based practices, and differential diagnoses, facilitating informed decision-making in real-time scenarios.

In the present study, 60.07% BDS and 64.60% MDS students believe that it helps in making differential diagnosis which is similar to the study conducted by **Jigar M et al.**<sup>33</sup> which suggested that utilization of smartphones in oral and maxillofacial surgery facilitate in differential diagnosis, treatment, follow-up and prevention of the disease. It also provides improved quality of health care for the patients who have difficulty in accessing the oral and maxillofacial care due to remoteness, inability to travel, or lack of health care facility.

Survey conducted by **Md. Shooriabi et al.**<sup>34</sup> among the Iranian dental students interpreted that 91% of cases believe that smartphone improves their access to the content of their courses and educational content, 88% of cases believe that smartphone assists them in having a more independent learning process. Finally, 86% of cases think that university professors should pay more attention to the use of smartphone for educational purposes, whereas in our survey results 62.85% BDS and 51.33% MDS students agreed that smart phones & mobile dental apps are essential learning tools for undergraduate and postgraduate dental studies, 52.97% BDS and 66.37% MDS students agreed or strongly agreed that they provide useful learning tool for academic as well as competitive examination and 54.55% BDS and 48.74% MDS students believe that ideal dental apps should be recommended by mentor or university. This demonstrates the capability of apps to offer quick references, quizzes, and multimedia content, crucial for exam readiness.

**Robinson et al.**<sup>35</sup> revealed that medical students have more to learn than residents, who have more to learn than faculty. It follows that the percentage of each group that used smartphones to access textbooks, medical podcasts, and online lectures was in this sequence. The safety of online learning resources and information from hackers is the sole problem. Thus, cyber-security plays a pivotal role in preserving data and network security among its users. Consequently, many nations utilizing electronic health records employ

specialized handheld devices and intranet systems to address the challenges of data or identity theft affecting their consumers.<sup>36</sup>

Similar findings were observed in our study where 59.69% BDS and 61.06% MDS students expressed concern regarding potential threat/data breach in using dental apps ( $p = 0.012$ ). They agreed that medical publisher should produce mobile apps for education purposes and it should be regularly updated. This highlights the need for app developers to prioritize data privacy and compliance with regulations.

Chiswell et al<sup>37</sup> in their study conducted webinars and seminars through online platforms to present lectures and share case reports of various patients. While these methods are beneficial for education, there is growing concern regarding the privacy vulnerabilities they pose, which has become a topic of active discussion. Additionally, the Cariogram introduced in 2001 by researchers at the University of Gothenburg, Sweden evaluates dental caries risk profiles using specialized software, providing insights into caries prediction and demonstrating success across multiple levels. One of the most significant technical developments in the dental and medical sciences, tele-dentistry has also been utilized to diagnose and treat patients in remote areas.<sup>38,39</sup>

When it comes to publishing research papers or looking out evidence-based practices for clinical practice, a significant portion of faculty members now have access to mobile dentistry apps. In Northern America, a variety of surveys, interviews, and data recording are carried out using tablets or mobile apps that the organization offers for data storage and security. Reputable colleges all over the world have created numerous online courses on mobile apps especially for aspiring students or continuing education.<sup>40</sup> In order to support smoke cessation efforts, numerous nations have implemented mobile dental applications that offer users continual updates. These applications have frequently been effective in assisting users in quitting the habit.<sup>41</sup> There was no research of this kind

evaluating dentistry students' use of mobile applications for dentistry data management, even after a comprehensive literature search. This is the first experimental study of its kind to employ a mobile application and a questionnaire as an intervention .As a result, data analysis, interpretation, and assessment can be done later using more platform-focused research.

# **LIMITATIONS**

This study has a few limitations that should be considered. First, since data was collected through a self-administered questionnaire, there is a possibility of response bias, where participants may not have answered honestly or accurately. Second, the study was limited to dental students in Lucknow city, which makes it difficult to apply the findings to a broader population. To improve generalizability, future studies should include a larger sample from different regions. Lastly, the cross-sectional nature of the study only shows associations between variables and does not allow conclusions about cause and effect or the true impact of mobile applications on students' attitudes and practices.

# CONCLUSION

Mobile dental applications have made a notable impact on both dental education and clinical practice. They offer a flexible, engaging, and accessible platform for learning, which complements traditional teaching methods and enhances the clinical skills of students. Survey results indicate that these applications are widely regarded as valuable resources by both BDS and MDS students. Although they are not yet seen as substitutes for conventional materials like textbooks, their contribution to learning enhancement, clinical skill improvement, and decision-making facilitation is clear. Nonetheless, issues related to quality, data security, and the necessity for adequate training need to be addressed. Furthermore, their incorporation into dental curricula requires meticulous planning to overcome challenges and maximize their advantages. As technology progresses, the influence of mobile applications in dental education is expected to grow, providing increasingly advanced tools for learning and practice. This research highlights the importance of further investigation and innovation in this field to optimize educational results and enhance patient care.

# **RECOMMENDATION**

Mobile applications can be valuable tools in healthcare education when used to support traditional learning. To ensure quality, it's important to choose reliable, peer-reviewed apps and provide proper training for both students and educators. Ethical issues, such as protecting patient data and privacy must also be carefully addressed. Additionally, more research is needed to understand how healthcare professionals and students feel about using these technologies in clinical settings.

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# **ANNEXURE**



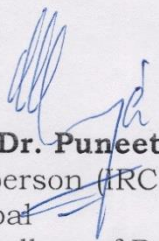
**BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES**

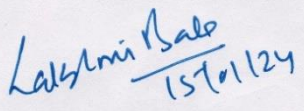
**(Faculty of BBD University, Lucknow)**

**INSTITUTIONAL RESEARCH COMMITTEE APPROVAL**

The project titled **“Mobile Dental Application Based Learning Among The Dental Students And Its Impact On Their Clinical Practice -A Questionnaire Study.”** submitted by **Dr. DIWAS RASAILY** Postgraduate student in the **Department of Public Health Dentistry** for the Thesis Dissertation as part of MDS Curriculum for the academic year 2022-2025 with the accompanying proforma was reviewed by the Institutional Research Committee in its meeting held on **16<sup>th</sup> October, 2023** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

  
**(Prof. Dr. Puneet Ahuja)**  
Chairperson (IRC)  
Principal  
BBD College of Dental Sciences  
BBD University, Lucknow

  
**(Dr. Lakshmi Bala)**  
Co-Chairperson (IRC)  
HOD Biochemistry  
BBD College of Dental Sciences  
BBD University, Lucknow.



**BABU BANARASI DAS UNIVERSITY**  
**BBD City, Faizabad Road, Lucknow – 226028 (INDIA)**

**Dr. Lakshmi Bala**

Professor and Head, Deptt of Biochemistry and

Member-Secretary, Institutional Ethics Committee (IEC) of BBD University, Lucknow

**Communication of the Decision of the VIII<sup>th</sup> Institutional Ethics Committee Meeting**

IEC Code: 07

BBDU/MDS/07/2024

Date: 07/03/2024

**Title of the Project:** Mobile Dental Application Based Learning Among The Dental Students And Its Impact On Their Clinical Practice -A Questionnaire Study.

**Principal Investigator:** Dr. DIWAS RASAILY

**Department:** Department of Public  
Health Dentistry

**Name and Address of the Institution:** BBD University, Lucknow

**Type of Submission:** New, MDS Dissertation proposal

Dear Dr. DIWAS RASAILY

The meeting of the Institutional Ethics Committee (IEC) was held on 06-02-2024 in Conference room, First Floor, BBDCODS, BBD University, Lucknow. Following members were present:

|   |                                                                                                                             |                      |
|---|-----------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1 | Dr. Chandishwar Nath<br>Rtd. Chief Scientist, CDRI, Lucknow.                                                                | Chairman             |
| 2 | Dr. JS Srivastava,<br>Rtd. Chief Scientist, CDRI, Lucknow.                                                                  | Member               |
| 3 | Dr. Manodeep Sen,<br>Professor, Department of Microbiology, RMLIMS, Lucknow                                                 | Member               |
| 4 | Dr. Shaleen Chandra, Professor & Dean, Dental Sciences, Atal Bihari<br>Vajpai Medical University (ABVM University), Lucknow | Member               |
| 5 | Dr. Manuka Khanna,<br>Professor, Deptt. of Political Science, Lucknow University, Lucknow                                   | Member               |
| 6 | Mr Abhishek Chaudhary, Advocate, Lucknow                                                                                    | Member               |
| 7 | Dr. Puneet Ahuja, Professor of Oral Pathology and Principal, BBD<br>College of Dental Sciences, BBD University, Lucknow     | Member               |
| 8 | Dr. Lakshmi Bala, Professor & Head, Department of Biochemistry,<br>BBD College of Dental Sciences, BBD University, Lucknow  | Member-<br>Secretary |

The committee reviewed and discussed your submitted documents of the research proposal in the meeting. Following comments were suggested and communicated.

**Comments:**

1. In PID to mention: voluntary participation.

Thereafter, the proposal was revised by Principal Investigator and duly approved by the Supervisor and Head of the Department.

**Decisions:** The committee approved the above proposal from ethics point of view.

*Lakshmi Bala*  
*07/03/24*  
**(Dr. Lakshmi Bala)**  
Member-Secretary IEC  
BBD University  
Ethics Cell (Vth Floor, BBDCODS)  
ethics@bbdu.ac.in

Dr. LAKSHMI BALA  
Member-Secretary  
Institutional Ethics Committee  
BBD University, Lucknow-28

### 3.STUDY PROFORMA

#### **“ Mobile Dental Application based learning among the dental students and its impact on their clinical practice – A Questionnaire Study” .**

Kindly fill up the following details :

Name:

Gender :

Year :

1. Does dental apps serve as an essential tool for dental undergraduate/postgraduate studies ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

2. Can Dental apps serve as supplement to dental book ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

3. Do you believe that dental apps are superior to dental books ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

4.Do dental apps provide useful literature for academic/competitive examinations ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

5.Do you think that all dental students should receive training for access to dental apps ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

6.Are free dental apps are inferior in quality as compared to paid dental apps ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

7.Do you think that all dental students should own a smart device for dental data management ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

8.Do Dental apps allow faster access to clinical practice guidelines ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

9. Does dental apps improve and enhances your clinical decision making ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

10. Do dental student belief regarding potential threat/data breach for of using dental apps ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

11. Are Dental apps less time consuming and can be revised as many times as desired ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

12. Does Dental apps helps in making differential diagnosis ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

13. Do Dental apps allow faster access to reliable sources of dental knowledge ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

14. Do Dental apps allow faster access to reliable sources of clinical skills ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

15. Do Dental apps allow faster access to evidence based dental practices ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

16. Do you think that dental apps should be produced by a medical publisher ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

17. Do you think that dental apps should be regularly updated ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

18. Do you think that dental apps should have authors listed & referenced ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

19. Do you think that dental apps should have feedbacks ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

20. Do you think that dental apps should have peer-reviewed contents ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

21. Do you think that dental apps should be recommended by mentor, university or college ?

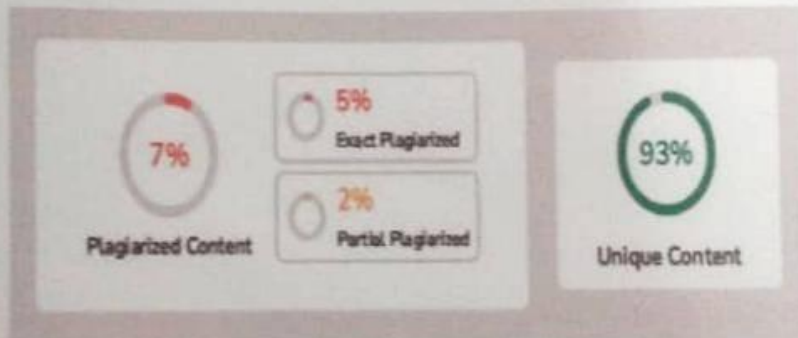
a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree .

22. Do you think that dental apps should only specifically mean for health professionals ?

a ) unsure b) strongly disagree c) disagree d) agree e) strongly agree.

## Plagiarism Scan Report By SmallSEOTools

Report Generated on: May 15, 2025



Total words 3281    Total Characters 22533    Plagiarized Sentences 2.8    Unique Sentences 37.2(93%)

*Approved*