

Knowledge, Attitude, and Perception of Undergraduate Dental Students on Information and Communication Technology and Computer-assisted Learning

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ABSTRACT

Introduction: The use of information and communication technology (ICT) in education and clinical purposes is growing immensely. The usage skill, attitude of dental students, and difficulties faced by students are important concerns to be addressed.

Objective: The study was designed to investigate the knowledge, attitude, and skills of ICT of undergraduate dental students *via* assessing the ease of computer and internet use among students, the level of computer skills and training of the students, and usage pattern of computer activities.

Materials and methods: A cross-sectional survey was conducted among students of three dental colleges in Haryana using a self-designed questionnaire having sections related to demographics, devices, softwares and search engine usage, ICT skills, ICT attitude, and educational and social use.

Results: The response rate was 81.96%. A total of 99.1% of the individuals responded affirmatively to the usage of mobile phones, 48.4 and 13.1% for laptops and tablets, respectively. The average duration of use of smartphones per day was 4.2121 ± 2.834 hours. Google was opted as the most popular search engine used and PubMed the least popular. Only 12.9% of participants showed a negative attitude toward the use of ICT in studies. More social use than academic use was observed. Attitude scores showed a significant correlation with the educational use of ICT ($r = 0.89, p = 0.003$).

Conclusion: Most of the participants were well acquainted with the usage and had a positive attitude toward ICT for educational purposes. Sensitization and training in scientific literature search and basics of ICT and their practical utilization in dental education, research, and practice should be included in the curriculum.

Keywords: Computer-assisted learning, Dental curriculum, Dental education, Educational use of information and communication technology, Information and communication technology, Undergraduate dental students.

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INTRODUCTION

The last decade has witnessed a paradigm shift in the usage of information technology (IT) by people around the world. Earlier, the usage of the internet was limited to devices like personal computers and laptops. The advent of Android technology and affordable smartphones along with economical high-speed internet (4G) has enabled the use of information and communication technology (ICT) by the masses anytime and anywhere.¹

The internet has evolved as a medium which connects people across the world. It provides a wide range of applications like emailing, real-time chats, conferencing, internet banking, online shopping, entertainment, and education. The ICT has permeated our everyday life immensely.^{2,3} The field of dentistry and dental education is no exception. The recent advances in computer technology have changed the study environment and practice of dentistry drastically.⁴ Whether it is the patient appointment system,⁵ patient data management, training videos,⁶ or journal articles, everything has moved online. A lot of study material is available online in the form of eBooks, dictionaries, journal articles, training videos, dedicated web pages, blogs, and PowerPoint (PPT) presentations. This type of learning for dental students is more focused on communication, interactivity, and displaying clinical images and videos.⁷ As a result, many dental programs worldwide have incorporated ICT as a part of the learning method for students.⁸ Therefore, it is important that the students who are

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going to be subjected to the ICT-learning method be competent to handle ICT resources.^{9,10} Even, individual characteristics such as IT proficiency are likely to influence students' perceptions of their learning experience.

The opportunity for unlimited, rapid access to vast quantities of knowledge *via* the internet is dependent upon us. However, while access to the internet is exciting and unrestricted, information on the internet is generally unevaluated. There is an equally great opportunity to be misleading and time-wasting. This prevailing, widespread web of knowledge will have a significant impact on how dentists process and present information in the coming decades.

Observational studies on students' competence with ICT are few and are carried out mostly in countries where informatics is well developed. There have been very few studies on ICT in education involving dental schools in India. Hence, this study is proposed to investigate the current skills, attitudes, and usage of information communication technology (ICT) by undergraduate students of the dental colleges of Haryana.

The study was conducted just prior to the COVID-19 pandemic when online classes were a rare event and the use of ICT was not a must so it reflects the prevailing training and attitude substantially. The rapid inculcation and absorption of online modality don't state the overall efficiency of students in the use of ICT in all domains of academic use. Though these changes got incorporated drastically, understanding where we stood and building the system retrospectively now with a strong foundation can give great insights to the education system and institutes in laying permanent infrastructure. Thus, this study can provide valuable insights into various aspects of improvement and requirements in the current scenario where we have to increasingly rely on ICT resources for educational purposes.

MATERIALS AND METHODS

The research was conducted in accordance with the ethical principles enshrined in the World Medical Association's Declaration of Helsinki. This was a cross-sectional survey-based study conducted in the duration of 1 year (December 2018–2019). Undergraduate students of three dental colleges in the state of Haryana, India were included in the study. The purpose of the survey was briefed to them. After obtaining the informed consent, printed survey forms were distributed. Participation in this study was completely voluntary and anonymity was maintained.

A self-designed questionnaire in the English language was used. The questionnaire had sections of questions related to demographic and academic details, devices, softwares and search engine usage, ICT skills, ICT attitude, and educational and social use.

Expert opinion was sought to validate the questionnaire. The Cronbach α coefficient was used for reliability. Its value for items 4–13 (ICT skills) was 0.776, for items 14–32 (attitude) was 0.844 and for items 33–43 (usage) was 0.727.

The participants were asked to rate their confidence level in the usage of various softwares and applications such as Microsoft Word, Microsoft PPT, Microsoft Excel, Paint, Adobe Reader, Internet browsers, Adobe Photoshop, CorelDraw, and YouTube on a scale of 1–10.

The participants were also asked to rank websites/webpages (Google, Yahoo, Bing, Wikipedia, PubMed, and Medline) in the order of utility.

The ICT skills of the students were analyzed based on 10 questions (items 4–13) based on a 4-point Likert scale. The questions were related to the ability of the students to perform certain tasks like setting up directories on the computer, being able to find previously downloaded files, installing software,

setting up email accounts, fabricating PPT presentations, etc. The responses were coded as never = 1, sometimes = 2, often = 3, and very often = 4.

The attitude of the students toward learning using ICT was determined by a set of 19 questions (items 14–32) based on a 5-point Likert scale. The responses were coded as strongly agree = 2, agree = 1, neutral = 0, disagree = -1, and strongly disagree = -2. The negatively stated items were reverse-coded. The usage of ICT for educational and social purposes was determined by items 33–43.

The data was analyzed using Microsoft Excel 2007 and IBM Statistical Package for the Social Sciences Statistics 20 (IBM Corp., New York, United States of America). For analytical purposes, the respondents of Bachelor of Dental Science (BDS) 1 and 2 years were coded as preclinical and BDS 3, 4 years and internship as clinical.

The primary outcome measures were skill score, attitude score, educational use, and social use score. Bivariate associations (e.g., based on gender and year of study) were tested for statistical significance using an independent *t*-test. Correlations were calculated using the Pearson moment correlation test. In general, *p*-value < 0.05 was considered significant.

RESULTS

A total of 1,082 responses were received, that is, the response rate was 81.96%. The demographic characteristics of the participants are presented in Table 1. A major proportion of the participants were females (73.7%) and from clinical years (66.7%). A total of 99.1% of the individuals responded affirmatively to the usage of mobile phones, 48.4% to the usage of laptops and only 13.1% to the usage of tablets. The average duration of use of a smartphone per day was 4.2121 ± 2.834 hours with a mean confidence level of 8.256 ± 1.924 . There was no significant difference among the genders. However, the duration of use of smartphones amongst clinical students was significantly higher than in the case of preclinical students (*p* = 0.000) (Table 2).

The mean confidence score was highest for YouTube (8.776 ± 1.893) and least for CorelDraw (3.19 ± 3.835). There were no statistically significant differences in the mean scores based on gender or year of study (Table 3).

The websites/pages in the order of utility (most to least) were Google, Wikipedia, Yahoo, Medline, Bing, and PubMed.

The mean skill score calculated from items 4–13 was 31.058 ± 5.380 (Table 4). The maximum skill score was 40 (1.9% of participants) and the minimum score was 16 (1.3%). The majority of participants, that is, 95.8% participants had skill scores >20. No statistically significant difference between gender and year of study was observed.

The mean attitude score was calculated from items 14–32 (Table 4). Only 12.9% of participants showed a negative attitude

Table 1: Demographics

Total participants		1,082
Gender	Male	285 (26.3%)
	Female	797 (73.7%)
Year	Preclinical	361 (33.4%)
	Clinical	721 (66.6%)
Mean age (years)		21.34 ± 1.655

Table 2: Usage of various devices by students

		Smartphone	Laptop	Tablet
Usage	Yes	1,072 (99.1%)	523 (48.4%)	142 (13.1%)
	No	10 (0.9%)	558 (51.6%)	939 (86.9%)
Mean duration of use per day (hours)		4.2481 ± 2.921	1.6042 ± 1.629	1.361 ± 1.870
Male		4.3542 ± 2.958	1.6443 ± 1.609	1.325 ± 1.633
Female		4.2220 ± 2.975	1.5869 ± 1.641	1.379 ± 1.984
Significance		0.521	0.710	0.855
Clinical		3.7125 ± 2.975	1.2900 ± 1.124	1.161 ± 1.3521
Preclinical		4.565 ± 3.094	1.734 ± 1.782	1.452 ± 2.0605
Significance		0.000*	0.004*	0.335
Mean confidence level		8.256 ± 1.924	7.13 ± 2.866	5.66 ± 3.989

The * value is already cited in the text which is denoted by *p*.

Table 3: Confidence levels of usage of commonly used softwares and applications by students

Confidence level of softwares	Mean	Male	Female	Significance	Preclinical	Clinical	Significance	Rank order of confidence
Microsoft Word	6.89 ± 3.104	6.92 ± 3.193	6.88 ± 3.071	0.878	7.06 ± 3.246	6.80 ± 3.033	0.347	6
Microsoft PPT	7.287 ± 2.7078	7.115 ± 2.988	7.347 ± 2.604	0.339	7.264 ± 2.8034	7.297 ± 2.6694	0.888	4
Microsoft Excel	6.33 ± 3.292	6.36 ± 3.499	6.32 ± 3.207	0.906	6.43 ± 3.318	6.28 ± 3.282	0.634	7
Paint	7.158 ± 3.3242	6.957 ± 3.674	7.236 ± 3.179	0.399	7.313 ± 3.3585	7.077 ± 3.3085	0.453	5
Adobe Reader	7.322 ± 2.757	7.236 ± 2.748	7.357 ± 2.762	0.605	7.300 ± 2.8070	7.334 ± 2.7339	0.880	3
Internet browser	8.317 ± 2.205	8.411 ± 2.012	8.282 ± 2.271	0.443	8.459 ± 2.2009	8.240 ± 2.2046	0.161	2
Photoshop	4.908 ± 3.710	4.944 ± 3.751	4.890 ± 3.696	0.893	5.367 ± 3.5447	4.671 ± 3.774	0.085	8
CorelDraw	3.19 ± 3.835	2.99 ± 3.764	3.28 ± 3.876	0.551	2.81 ± 3.798	3.35 ± 3.850	0.285	9
YouTube	8.776 ± 1.893	8.898 ± 1.843	8.733 ± 1.909	0.238	8.7194 ± 2.0893	8.8050 ± 1.78461	0.512	1

Table 4: Mean scores of skills, attitude, educational, and social use

	Mean	Preclinical	Clinical	Significance	Male	Female	Significance
ICT skills	31.058 ± 5.380	31.493 ± 5.374	30.818 ± 5.380	0.053	31.160 ± 5.470	31.003 ± 5.357	0.673
Attitude	8.568 ± 7.288	9.105 ± 7.363	8.291 ± 7.234	0.084	8.452 ± 7.142	8.603 ± 7.338	0.765
Educational use	4.653 ± 3.790	4.905 ± 4.205	4.528 ± 3.561	0.123	4.463 ± 3.216	4.722 ± 3.976	0.323
Social use	15.545 ± 3.932	15.844 ± 3.761	15.397 ± 4.008	0.078	15.470 ± 3.874	15.572 ± 3.954	0.707

toward ICT in their studies. No statistically significant difference between gender and year of study was observed.

Scores for educational use and social use were calculated (Table 4). No statistically significant difference between gender and year of study was observed. It was observed the most commonly reported frequency for the usage of ICT for educational purposes like searching for information for assignments or homework or study work and watching educational videos was “weekly.” On the contrary, the most commonly reported frequency for the usage of ICT for social purposes like texting, chatting, and watching videos for entertainment was “daily.”

Correlational analysis was done to determine the predictors for increased educational use. The factor showing a significant correlation with the educational use of ICT was the attitude score ($r = 0.89, p = 0.003$).

An open-ended question was asked from the students about the factors restricting their use of ICT. Among these factors; distraction was the most common factor followed by addiction, network issues, lack of knowledge and training in ICT, time-wasting, erroneous and confusing information, books having enough knowledge, health issues, advertisements, and free Wi-Fi not being available in the campus.

When the students were asked about the suggestions to boost the usage of ICT for educational purposes the most common response was training in ICT and making it part of the curriculum. Other suggestions like a college website where notices and PPTs are available should be launched, videography of every lecture should be made available online, students should be informed about the websites which provide accurate and precise information, interactive classes with related videos and pictures should be taken by teachers, measures should be taken to restrict distractions, provide laptop and Wi-Fi to every student, and availability of free eBooks were given by the students.

DISCUSSION

The pace of evolution of newer applications in ICT is very fast. It has a major role to play in all domains of everyday life of students, working professionals as well and businessmen providing easy solutions to their basic needs. The field of dentistry has also not remained untouched by this new paradigm, whether it is the acquisition of theoretical knowledge of the basics of dentistry or the newer advancements and recent updates, whether it is learning some basic skills by undergraduate students or advanced level learning by established practitioners or it is clinic maintenance, patient

appointment management, patient record keeping or managing finances all domains are powered by technology.

Thus, building a strong foundation and the right temperament toward the use of ICT from the beginning of undergraduate dental education courses is a must to produce updated clinicians, academicians, and researchers of the future. Thus, we planned to assess the level of competence, ease, and educational use of ICT by undergraduate dental students identify problems faced by them and gather suggestions regarding the same. Moreover, the COVID-19 pandemic has affected individuals from all walks of life. It forced the community to hurriedly metamorphosize the education system and brought the classrooms online. The acquisition and acceptance of modalities like online classes and teledentistry became the need of the hour. But still, certain background questions remained unanswered and analyzing retrospectively where we stood prior to the pandemic can give a great insight to prepare a sound infrastructure for a strong foundation for education and availability of ICT resources which has become now the new normal.

In our study, the majority of participants were females which correspond to the current admission pattern in the BDS course in India. The mean age of the participants was 21.34 ± 1.655 . The majority of these undergraduate students were using smartphones. This trend very well corresponds to the current lifestyle of teenagers and young adults in the country. As reported by a survey in 2019, 37% of smartphone users in India were in the age-group of 16–24 years which was the highest among all age-groups.¹¹ Our results were also in agreement with Sen et al.¹²

The average daily use of the internet reported was 4.21 hours which is in consensus with Issrani et al. who observed that 56% of undergraduate students reported using of internet for 1–3 hours per day.¹³ Moreover, we observed that clinical students were using smartphones for longer duration per day as compared to preclinical students which was also reported by Kumar et al.¹⁴ The greater use by clinical students could be because more assignments need to be done by individuals during clinical study years which requires literature search. Moreover, Warmling et al.¹⁵ also reported a similar pattern, that is, increased use of smartphones after joining college in comparison to school days.

On analyzing the data on the softwares and applications which are being used, we observed that the usage of YouTube was the highest. Similar results were observed by Burns et al.¹⁶ The pattern can be explained by the fact that because of the audiovisual format YouTube videos provide better understanding and more clarity. Moreover, it has a very user-friendly interface which makes searching for content quite easy. However, such content should be reliable and subjected to quality checks. To provide the greatest benefit to the students, efforts should be made to plan and post, approved content by subject experts, and authorized staff of universities. Also, the confidence level in the usage of important applications like Microsoft Word, Microsoft PPT, and Microsoft Excel was quite high. This was in agreement with Mohebbi et al.¹⁷ and Kumari et al.¹⁸

Among the sites used as search engines, Google was the most commonly used. This observation was concurrent with Warmling et al.,¹⁵ Rahman,¹⁹ and Issrani et al.¹³ While sites like Medline and PubMed which are specialized, authentic, and reliable sites for finding relevant scientific information were not considerably used. This was similar to the results of Mohebbi et al.¹⁷ where only 10% of subjects were using PubMed and other dental and medical sites.

Regarding ICT Skills, the mean skill score was on the higher side. Our results are in consensus with Albararak and Yami²⁰ with 78.8% reported to be familiar with the basic computer skills. While

Rahman¹⁹ reported 51.33% had graded themselves as having good computer skills and 41.19% of participants were using email daily.

With respect to attitude in terms of ease, comfort, understanding, and reliability of information majority of students reported a positive attitude. According to Warmling et al.,¹⁵ majority of students preferred books over ICT and distraction while using ICT was a major hindrance. The students reported that while they are using ICT for educational purposes their attention gets diverted to social or entertainment sites mainly due to the presence of advertisements on various sites so to avoid this and devote more time to studies they prefer to read using conventional methods (books and notes). However, the students had a unanimous opinion that the use of ICT during the class (PPT presentation, pictures, videos, and 3D models) helps in a better understanding of the topic. Also, the students raised a concern that they are not aware of the sites from where they can download eBooks or the sites which provide authentic information.

In regard to the education and social use of ICT, the majority of students were using resources for social purposes compared to academic use, similar results are reported by Marya et al.,²¹ Warmling et al.,¹⁵ Mohebbi et al.,¹⁷ and Albararak and Yami.²⁰ There was a positive correlation between attitude and educational use of ICT while Albararak and Yami²⁰ reported a significant correlation between using the computer for academic activities and skills, also in using a computer for email and personal use along with skills and attitude ($p < 0.01$).

Although the students had a positive attitude toward ICT, there are certain factors which are restricting its use for educational purposes. The major inhibitors included—questionable reliability of information, distraction, addiction and lack of formal training in ICT, and lack of knowledge of authentic websites with valid content. The students reported that while they are using ICT for educational purposes their attention gets diverted to social or entertainment sites mainly due to the presence of advertisements on various sites so to avoid this and devote more time to studies they prefer to read using conventional methods (books and notes). According to Rahman¹⁹ only 57.88% of participants reported that reliable information is available on the internet. As every technology is a double-edged sword, safe, and effective usage of resources like the internet should be incorporated in training itself.²²

CONCLUSION

Most of the participants were well acquainted with the usage of computer softwares, applications, and internet browsers. The participants agreed that ICT can improve their understanding of the topics and help finding answers to their queries proving that the participants have a positive attitude toward the usage of ICT. However, it was observed that the use of ICT for educational purposes was lesser than that for social purposes. Staying updated with technological advancements very essential in every profession including dentistry as it penetrates every aspect of human life. Students will turn into efficient clinicians if the basics are taught to them during the course. Thus, the basics of ICT and their practical utilization in the study, research, and practice management should be taught right from the inception of undergraduate courses. The students should be given hands-on experience in searching the scientific literature on a particular topic and their search results should be graded for relevance and validity. The students should be encouraged to fill in their patient details in patient data management softwares so that they cultivate a habit of maintaining patient records and understand the utility of such softwares. To accomplish these objectives changes should be made in the Dental Council of India

(DCI) curriculum making ICT an essential subject for undergraduate students. To aid the growth of students in this direction, it should be mandated that every dental college should maintain a website on which important notices, information, lecture notes, eBooks, and other study materials should be published from time to time. A team of subject experts should be formulated with the intent to develop peer-reviewed educational content for students in audiovisual and interactive formats. Such content should be published on the DCI website or any other regulated website developed for the education of dental students.

Limitations of the Study

The study was conducted on the students of dental colleges in North India only. Future studies which include students of dental colleges from various regions of India will provide more clarity about the level of computer literacy of the students and how sensibly are the students using the technology for their career growth. The second limitation of the study is that the sample was collected prior to the COVID-19 pandemic. The advent of the pandemic suddenly changed the methodology of teaching in dental institutions and has increased the use of ICT.

Recommendations Based on the Study

- Formal training for judicious and academic use of ICT by making ICT a part of the DCI curriculum.
- Imparting thorough training in scientific literature search and awareness about authentic information sources should be inculcated in the curriculum.
- The ready availability of eBooks on the college website.
- Moreover, high-speed internet connectivity and Wi-Fi campus are important needs of the hour especially in the pandemic time when online teaching modalities have shifted from being an auxiliary means to mainstream.

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