Perception of Dental students towards 3D learning to make it easier for them to learn complex human anatomy.

Dr. Jasmohan Singh Sidana, Dr. Rohini Gaba

[1]*Professor, Oral Medicine & Radiology, Maharaja ganga Singh Dental College & Research Centre, Sri Ganganagar.*
[2]*Associate Professor, Periodontology, Maharaja Ganga Singh Dental College & Research Centre, Sri Ganganagar.*

ABSTRACT: Anatomy is considered the foundation of Medical Curriculum on which the understanding of knowledge regarding other basic sciences, pre-clinical sciences and clinical subjects is built upon. This study was conducted for assessing the perception of dental students towards 3D learning to make it easier for them to learn complex human anatomy. Out of total 65% of them were males and 35% were females. The mean age of the medical students was 19.68 years. 46 percent and 58 percent of the students had good opinion about microscopic structures of anatomy and gross anatomy respectively.

I. INTRODUCTION

The arrival of social media, mobile devices, personal computers, clinical technologies and visual technologies has modified how and where education occurs. These technological resources allow students to access information easily, to re-use learning materials, to study at a distance, and simulate training environments. While limitations still exist, mainly because of the costs involved in the acquisition of this technology, dental education has now incorporated technology-based resources into its training and one key example is 3D technology. Moreover, current curricular trends in dentistry consider simulation-based learning as an essential part of training. Therefore, the development of technological resources is in high demand.[1-3]

As dental schools adapt to the sudden transition in dental education, little is known about how this shift has affected students, and whether e-learning can be considered as effective as the usual face-to-face tutorials or not.[4]Dental education is at a critical juncture; changes in demographics, advances in biological sciences, fundamental changes in health care delivery systems and modern economy are forcing the dental educators to question the appropriateness of retaining the current dental curriculum in 21st century. Thus, it is necessary to take dental students views in consideration to bring about appropriate changes in the dental curriculum.[5]

Bertolami states that dental education needs revision because of a simple observation that students do not, in general, like dental school. Medline review encompassing 1978-2003 identified twenty-eight interview- or survey-based studies for dental education which included issues like student values, student and graduate perceptions for professional roles, evolution of attitudes about career choice, perceptions of training in various oral health specialties, self-perceived competence at graduation, use of technique taught in dental school, graduate perception of their profession and themselves as care providers, perception of students on providing dental care to others outside dental faculty, impact of learning environment on student perception of stress, student perception on various curriculum delivery formats including online instructions and other aspects of electronic curriculum, students assessment of curriculum change on school closing, and impact of learning environment on students values.[5-7]

Hence; the present study was conducted for assessing the perception of dental students towards 3D learning to make it easier for them to learn complex human anatomy.

II. REVIEW OF LITERATURE

Jain et al in 2011determined students' perceptions of the learning environment, intellectual climate and teacher student relationships in dental school. Their study was conducted among 341 dental students of two dental college of Udaipur, Rajasthan, India. Response rate was 85%. In this study, the dental version of Medical Student Learning Environment Survey has been used. The questionnaires were divided in to 7 subscales like flexibility, student to student interaction, emotional climate, meaningful

experience, organization, supportiveness, and breadth of interest. The results were statistically analysed and differentiated in to preclinical and clinical phases. The preclinical and clinical students rated the student to student interaction as the most favourable whereas the lowest score was given to flexibility by both preclinical and clinical students. Preclinical students rated emotional climate as the lowest after flexibility whereas clinical students rated breadth of interest and meaningful experience as the lowest score after flexibility. The study emphasized the areas of improvement in dental school learning environment based on students' perspective by making these required and much needed changes in the curriculum.[7]

Oweis Y et al in 2015 assessed the students' perception of the Dental Anatomy practical module course teaching modalities to evaluate their usefulness and the need for future changes or improvement of the course with the goal of developing the course to meet the needs of the students. Students' opinions were sought upon completion of the Tooth Morphology sessions using a questionnaire that probed into their views about different aspects of the course. The replies to the questionnaire suggest that students were generally satisfied with the course and instructors; they had positive attitudes towards the carving exercise though they had some comments about the quality of material used for tooth carving and the demonstration given in addition to the overall grading. It was concluded that new methods for teaching dental anatomy need to be implemented keeping, at the same time, the old techniques which are important for the development of manual skills. Innovative changes have already been introduced to the course that is hoped to help meet the students' learning needs.[8]

Bandyopadhyay R et al in 2017 elicited the perception and attitude toward teaching approaches in the Anatomy curriculum among first year medical students. A cross-sectional, descriptive study was undertaken with the help of predesigned, pre-tested questionnaire to elicit knowledge in four domains of classroom teaching which were: a) gross anatomical structure; b) organ identification; c) topography; and d) radiological anatomy and self-assessment of acquired skills in respective fields among 114 first year students. A total of 57% of students opined good in gross structure of anatomy. A 60.5% of students preferred chalk and board method and 33.3% with LCD projector. Regarding acquiring knowledge, 72.8% of medical students gathered knowledge in gross anatomical structure domain whereas 58.8%

in radiological anatomy. The overall mean score of attitude of the students regarding incorporating newer techniques in Anatomy teaching is 14.17 ± 2.26. The perception of Anatomy teaching and attitude among medicos have been studied and opinion from them had thrown light for incorporation of newer techniques in their teaching curriculum.[9]

Marty M et al in 2018 evaluated a 3D printed model for pediatric dentistry training and compare it to the reference model used in their faculty. 3D models were obtained by modifying and printing the CT scan of a young patient using the Voco® Solflex 350 3D® printer and Voco® V-print resin. Thirty-four students were asked to perform a pulpotomy and preparation for a stainless steel pediatric crown on tooth 85 on both the 3D printed model and the industrial model (Frasaco®), and then to answer a questionnaire. Both models obtained high scores. The learning potential and its applicability to clinical practice showed no statistically significant difference. Although the color and the simulation of the proximal area disturbed the students ($p=0.009$), the 3D models were seen as a good idea ($p= 0.012$). When it came to model design, the students appreciated the simulation of caries on 3D models ($p=0.0001$) and considered the use 3D of models as a more realistic experience ($p= 0.017$). Discussion Although this study has some limitations (number of participants, choice of the models to be compared), it constitutes the first attempt to compare students' perception of 3D and series models. It shows that 3D technology makes it possible to obtain models of similar quality while offering a more realistic experience.[10]

In a previous study conducted by Poblete P et al (2020), authors identified topics (knowledge and skills) from the dental curricula that would benefit from having a 3D learning resource using an exploratory sequential design method. The first phase targeted stakeholders from a Scottish dental school. Seven focus groups and three interviews disclosed 97 suitable topics for 3D technology development. These results were used to construct a survey that was sent to final year dental students, newly dental graduates and academics from three Scottish universities. The survey asked participants to rank each item based on the perceived benefit that a 3D learning resource would have for dental education. Results revealed that detailed anatomy of the temporomandibular joint, dental anaesthesiology, dental clinical skills techniques, dental occlusion and mandibular functioning were top priorities. Gender differences only appeared in relation to 'Extraction techniques: movements and force' ($p < 0.05$), this topic was considered to be

more beneficial by females than by males. No statistical difference was found when comparing results of graduates with undergraduates. These results serve as a starting point when developing a new 3D technology tool for dental education, considering users demands and perceived needs has the potential to benefit dental students and dental education directly.[11]

Hassan R et al in 2022 evaluated the perceptions of clinical dental students on the role of online education in providing dental education during the COVID-19 crisis.A cross-sectional online survey was sent to four Egyptian dental schools. Survey questions included the demographics, uses, experiences, perceived benefits, and barriers of distance learning in dentistry during the COVID-19 pandemic. Responses were collected from the clinical dental school students. Three hundred thirty-seven clinical dental students across four Egyptian dental schools responded. Most students used either Google Classroom or Microsoft Teams to access the online content. The data showed that the COVID-19 pandemic affected the academic performance of most participants (97.4%) with varying degrees. On average, students were neutral when asked to rate the online lectures, but did not find online practical education as effective (81.3%) as online theoretical teaching. The commonly described barriers to online teaching included loss of interaction with educators, inappropriateness in gaining clinical skills, and the instability of the internet connection.[12]

Anjum A et al in 2022 assessed the prevalence of using YouTube in learning gross anatomy, neuroanatomy, embryology and histology among male and female medical students of first and second year MBBS and first year BDS students. The questionnaire inquired about the demographics of the participants, their general information regarding YouTube, the area of Anatomy they mostly view on YouTube and their perception about using YouTube as a learning tool. The results reveal that more than 95% students use YouTube to learn anatomy. Medical students use YouTube to learn 'Gross Anatomy' whereas, dental students use YouTube majorly to learn 'Embryology'. The results conclude that YouTube is an effective learning tool for Anatomy and it has positive perceptions amongst medical and dental undergraduate students.[13]

III. MATERIALS & METHODS

The present study was conducted for assessing the perception of dental students towards 3D learning to make it easier for them to learn complex human anatomy. A cross-sectional, descriptive study was conducted among all first year students (total 100 students), who have already passed their first professional examination. Data was collected using a pre-tested schedule consisting of two parts:
• The first part includes the personal characteristics of the students, like age, sex, place of residence, type of family.
• The second part includes feedback questions regarding the method of teaching used in four fields of anatomy like gross structures, identification of organs, topography and radiological anatomy among students who have passed the first professional examination. The aids included were chalk and board, overhead projector, LCD projector, Visceras and specimens, models and plasticines. Self-assessment of acquiring skills in the above fields and opinion of integration with other disciplines and early clinical exposure were also explored among them.
• Early clinical exposure means learning using electronic media mainly internet providing study materials and even online classes, seminar etc. It also means effective use of multimedia. Early clinical exposure means exposure to students to clinical problems through patients earlier in their first years. This will help them to correlate medical and surgical problems, procedures, raise interest and understanding in the related subjects both in anatomy and clinical disciplines.The content was discussed with the students and the questions were framed and validated by the experts in the field of Anatomy.

The individual score of each question is considered three for 'agree' response, two for 'neutral' and one for 'disagree' in the knowledge domain. So, the maximum overall mean score would be 18 in six approaches and three in each statement

After collecting the data, it was entered in Microsoft excel datasheet 2007. Data was organised and presented by applying principles of descriptive statistics. Analysis of the data was done by using IBM statistical package for social sciences version 20 (SPSS 20).

IV. RESULTS

Out of total 65% of them were males and 35% were females. The mean age of the medical students was 19.68 years.46 percent and 58 percent of the students had good opinion about microscopic structures of anatomy and gross anatomy respectively. 41 percent and 40 percent of the students had good opinion about central nervous system demonstration and developmental anomalies respectively.75 percent, 65 percent, 66

percent and 61 percent of the students had good perception about gross anatomical structures, identifying organs, marking surface topography and radiologic anatomy respectively.

Table 1: Opinion of the students regarding topics of human anatomy after classroom teaching

Topic	Opinion of the classroom teaching (%)		
	Good	Average	Poor
Microscopic structures of anatomy (histology)	46	51	3
Gross anatomy (Cadaver dissection)	58	41	1
Central nervous system (Demonstration)	41	55	1
Developmental anomalies (Model)	40	50	10

Table 2: Student's perception of acquiring knowledge in the anatomical domains

Anatomical domains	Good	Average	Poor
Gross anatomical structures	75	24	1
Identifying organs	65	35	10
Marking surface topography	66	29	5
Radiologic anatomy	61	35	4

V. DISCUSSION

The subject of anatomy is considered the foundation of Medical Curriculum on which the understanding of knowledge regarding other basic sciences, pre-clinical sciences and clinical subjects is built upon. The learning of anatomy is about the structure of human body and gives insight on the functional aspect as well. Without sound knowledge and understanding of the human structure either at gross level or microscopic, the student cannot understand the physiological aspects in the healthy individual and will never master the disease process in the patient. The human cadaveric dissection remains primary method for learning regional gross anatomy among medical and dental students for clinical practice. Other hands-on activities like using plastic models and virtual dissection are also very beneficial for students learning of anatomy. Computer assisted learning has emerged as a useful tool in learning anatomy.

Due to high quality modern imaging techniques radiologists are involved in teaching anatomy using interactive computer resources by means of virtual dissection and animations. Web-based tutorials have been used to facilitate learning of surface anatomical landmarks in the modern era.[14]Hence; the present study was conducted for assessing the perception of dental students towards 3D learning to make it easier for them to learn complex human anatomy.

In the present study, out of total 65% of them were males and 35% were females. The mean age of the medical students was 19.68 years. 46 percent and 58 percent of the students had good opinion about microscopic structures of anatomy and gross anatomy respectively. 41 percent and 40 percent of the students had good opinion about central nervous system demonstration and developmental anomalies respectively. Our results were in concordance with the results obtained by

previous authors who also reported similar findings. A study by Jaiswal Rashmi et al., in Bhopal showed that 54.26% students preferred multimedia teaching methods as a best anatomy teaching methodology and it relies on scientific and does not cause lack of attention. As for the teaching methodology majority of students feel that dissection hall teaching is the best method followed by slide projector/AV projection/Multimedia, conventional chalk and board methods as opined by Gholamreza Hassanzadeh, Narges Hassanpoor.[14, 15]

In the present study, 75 percent, 65 percent, 66 percent and 61 percent of the students had good perception about gross anatomical structures, identifying organs, marking surface topography and radiologic anatomy respectively. Given the increasing interest in 3D anatomy models as evidenced from the increasing number of published research in this area, there is a need for multi-institutional studies that examine theories behind learning by using 3D tools and impact of learning by 3D models on the enhancement of knowledge, comprehension, clinical skills, integration, and application. Currently most studies focused on testing knowledge learnt by answering quiz questions to evaluate their knowledge of 3D relationships, theoretical post-test examinations, and practical examinations. While these methods may provide limited information about the usefulness of 3D anatomy models, there is a need for in-depth research in this new area that can provide answers to questions about the purpose of using 3D anatomy models in the curriculum, and the place of 3D anatomy teaching in the undergraduate curriculum and how we can assess the impact of using 3D models on student's learning.[16- 19]A study at Warwick Medical School, UK, also showed that the majority of students (94%) deemed plastinated specimens as a "valuable resource" in learning anatomy. In addition, students welcomed the plastinated specimens because they were able to appreciate relevant details and relationships along with visualizing the specimens in real life.[20]

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