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Original Research

Perception of dental students regarding digital problem-based learning in Oral Medicine

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ABSTRACT

Objective: To assess the perception of dental students regarding digital problem-based learning (PBL) in Oral Medicine. **Methodology:** This educational research study is comprised of ninety-six dental students, which were randomly divided into two equal groups (A and B). Both the groups were subdivided into six groups each (Eight students in each small group). Group A was studied via cases presented in paper-form, and the Group B was studied via digital form cases. Both the groups were given the same simulated patient scenarios designed not to convey a definite diagnosis, but to present a complex situation and to elicit sequencing problems. A pre-test and post-test questionnaires comprised of ten questions in each test were used to record the perception of students. Results were statistically analyzed. **Results:** In Group A, the difference in mean scores between pre and post-test is observed to be statistically significant for only four questions, whereas, in Group B, it was significant for nine questions. Students in the digital groups exhibited better performance in answering the post-test questionnaire. 94% ($n = 90$) students agreed that digital PBL is better because they are getting accurate idea of something. **Conclusions:** Digital media can be used as an innovative and effective tool for learning clinical cases in Oral Medicine.

KEY WORDS: Digital problem based learning, problem-based learning, teaching-learning modality

INTRODUCTION

Problem-based learning (PBL) is defined as a student-centered, small-group tutorial in which students work through health care scenarios. PBL creates the students, who are self-directed learners and sophisticated problem-solvers [1]. One of the purposes of PBL is to provide a motivating and enjoyable approach toward medical education that promotes the development of lifelong habits of self-directed learning. The process begins with the discussion of a case or scenario directed by the content of the curriculum. The discussion by students generates a hypothesis that motivates further learning. After a period of independent, self-directed study, the students meet to share and discuss the issues about which they are learning, under the supervision of the facilitator [2-4].

PBL has been extensively implemented in various medical curricula. Recently PBL has achieved popularity as one of the innovative teaching learning method in dental education too. However, this teaching-learning modality can be further strengthened with the inclusion of digital media during its conduction to enhance the student's learning experience [5,6].

Previous studies suggested that the addition of multimedia to PBL scenarios makes them more realistic and thereby more motivating and stimulating for the student to process [5,7]. This may help to enhance the student's learning experience [1]. Thus, this study was conducted with following aims and objectives. (1) Short term goal of the study was to evaluate the perception of undergraduate dental students regarding digital PBL cases in Oral Medicine. (2) Long-term goal of this study was to include digital PBL as a teaching-learning method for clinical cases in Oral Medicine.

METHODOLOGY

This Institutional Ethical Committee (Datta Meghe Institute of Medical Sciences University) approved educational research

study comprised of 96 final year dental students (76 females and 20 males) in an age range of 21-22 years. They were randomly divided into two equal groups (A and B). Both the groups were subdivided into six groups each, so as to comprise eight students in each small group. Informed consent was taken from all the students. Group A was studied via cases presented in paper-based descriptions of the cases, identified as the "conventional PBL teaching." The Group B students were studied by "digital PBL teaching," which included the use of digital media in learning process.

Both the groups were given the same scenarios and triggers. The cases were the simulated patient scenarios designed not to convey a definite diagnosis, but to present a complex situation and to elicit sequencing problems. For example, a case called "herpes zoster involving maxillary branch of trigeminal nerve" started with a patient in the clinic complaining of intermittent deep pain in left maxillary region and the eye globe, which referred to the temporal and frontal region without cutaneous or mucosal lesions. This was followed by cutaneous erythema and presence of multiple discrete elevated blisters on the same side in the same region after 3 days. For digital PBL class, simulated scenarios were prepared by means of video and photography of actual patient.

All fragments were edited to create different digital cases. Each case was divided into 6 phases: (1) patient encounter (general information of patient such as age, residence, occupation, economic status etc.); (2) illness presentation included the history of illness from the day of onset till the day of patients visit to hospital; (3) review of body systems which included history of any systemic disease (4) personal, familial, and social background; (5) physical examination (photographs of introral and extraoral findings were used); and (6) laboratory findings and other diagnostic procedures were recorded in power point presentation. Fragments were presented to the students in succession, and new learning issues were generated. Facilitators were responsible for facilitating the group discussion but not for providing the content. Their role was to correct factual errors. The PBL faculty members switched from their traditional role of "teacher-instructor" to that of "facilitator of learning."

Description of the course

The students of each group met for 2 hours in a week for continuous 6 weeks. The students used one-third of the time to define problems, generate hypotheses and then formulate learning goals. Approximately, an hour was allocated to discuss about a case presented to them in both the teaching modalities.

During the week before the next meeting, the students collected additional information. When the group met again with the facilitator, the members synthesized the knowledge they had acquired and tested the hypotheses to solve the problem. In this process, one student chaired each discussion and a second recorded the hypotheses and learning goals.

Students in the PBL course used a wide range of resources, including journal articles, textbooks, educational websites, and multimedia CD-ROMs to analyze the problem presented by the case and to identify its critical contents. Each member of the group was encouraged to play an active role in this self-directed learning process.

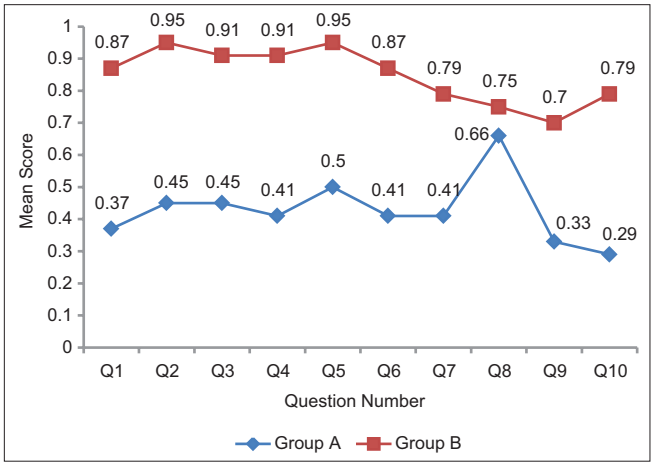
Evaluation

Knowledge acquisition was assessed using a pre-test and post-test questionnaire, which was made to record the perception of under graduate dental students regarding digital PBL. (Annexure 1) Statistical significance of pre-test and post-test questionnaire was then evaluated by using Student's paired *t*-test for comparison of mean scores of pre and post-test in Group A and Group B while Student's unpaired *t*-test was used to find out statistical significance of post-test scores between Group A and Group B. The student feedback was assessed by a feedback questionnaire (Annexure 2).

The questionnaire was filled out by each student at the beginning (pre-test) and end (post-test) of the scenario. Questionnaire was comprised of 10 questions, related to different domains such as basic sciences, clinical features, investigations and management of a problem. The student responses to the pre and post-tests were scored according to appropriateness of the answer. Scores of the pre-tests and post-tests were compared using Student's paired *t*-test and Student's unpaired *t*-test. The questions focused on the type of PBL were assessed on a 5-point Likert scale to allow learners to have a neutral choice if they had no strong preference about the question. They were told that the survey would not affect their grades so they could feel free to express their views. Complete confidentiality was maintained for feedback questionnaire.

RESULTS

The difference in mean scores between pre and post-test is observed to be statistically significant for only four questions in Group A, while in Group B, the difference in mean scores between pre and post-test was significant for nine questions. The mean pre-test and post-test scores for Groups A and B are shown in Tables 1 and 2. Students in the digital groups exhibited



Graph 1: Comparison of post-test scores between Group A and Group B (Student's unpaired *t*-test)

Table 1: Comparison of mean scores of pre and post-test in Group A

Question	Pre-test		Post-test		Student's paired *t*-test	*P* value
	Mean	SD	Mean	SD		
Q1	0.16	0.37	0.37	0.48	2.48	0.017, S, $P<0.05$
Q2	0.2	0.41	0.45	0.5	2.88	0.006, S, $P<0.05$
Q3	0.37	0.48	0.45	0.5	0.70	0.485, NS, $P>0.05$
Q4	0.16	0.37	0.41	0.49	3.95	0.000, S, $P<0.05$
Q5	0.2	0.41	0.5	0.5	4.39	0.000, S, $P<0.05$
Q6	0.25	0.43	0.41	0.49	1.83	0.073, NS, $P>0.05$
Q7	0.37	0.48	0.41	0.49	0.46	0.642, NS, $P>0.05$
Q8	0.62	0.48	0.66	0.47	0.46	0.642, NS, $P>0.05$
Q9	0.2	0.41	0.33	0.47	1.43	0.159, NS, $P>0.05$
Q10	0.25	0.43	0.29	0.45	0.53	0.598, NS, $P>0.05$

SD: Standard deviation, S: Significant, NS: Non-significant

Table 2: Comparison of mean scores of pre and post-test in Group B

Question	Pre-test		Post-test		Student's paired t-test	*P* value
	Mean	SD	Mean	SD		
Q1	0.2	0.41	0.87	0.33	9.69	0.000, S, $P<0.05$
Q2	0.2	0.41	0.95	0.2	11.87	0.000, S, $P<0.05$
Q3	0.5	0.5	0.91	0.27	5.79	0.000, S, $P<0.05$
Q4	0.12	0.33	0.91	0.27	13.36	0.000, S, $P<0.05$
Q5	0.16	0.37	0.95	0.2	13.36	0.000, S, $P<0.05$
Q6	0.2	0.41	0.87	0.33	9.69	0.000, S, $P<0.05$
Q7	0.16	0.37	0.79	0.41	8.85	0.000, S, $P<0.05$
Q8	0.66	0.47	0.75	0.43	1.43	0.159, NS, $P>0.05$
Q9	0.12	0.33	0.7	0.45	7.00	0.000, S, $P<0.05$
Q10	0.16	0.37	0.79	0.41	6.76	0.000, S, $P<0.05$

SD: Standard deviation, S: Significant, NS: Non-significant

Table 3: Comparison of post test scores between Groups A and B

Question	Group A		Group B		Student's unpaired t-test	*P* value
	Mean	SD	Mean	SD		
Q1	0.37	0.48	0.87	0.33	5.847	0.000, S, $P<0.05$
Q2	0.45	0.50	0.95	0.20	6.385	0.000, S, $P<0.05$
Q3	0.45	0.50	0.91	0.27	5.515	0.000, S, $P<0.05$
Q4	0.41	0.49	0.91	0.27	6.065	0.000, S, $P<0.05$
Q5	0.5	0.50	0.95	0.20	5.836	0.000, S, $P<0.05$
Q6	0.41	0.49	0.87	0.33	5.293	0.000, S, $P<0.05$
Q7	0.41	0.49	0.79	0.41	4.025	0.000, S, $P<0.05$
Q8	0.66	0.47	0.75	0.43	0.893	0.374, NS, $P>0.05$
Q9	0.33	0.47	0.70	0.45	3.926	0.000, S, $P<0.05$
Q10	0.29	0.45	0.79	0.41	0.624	0.000, S, $P<0.05$

SD: Standard deviation, S: Significant, NS: Non-significant

better performance in answering the post-test questionnaire ($P < 0.05$) as compared to the students exposed to conventional PBL. The comparative mean scores of posttest between both the groups were significant for nine questions as shown in Table 3, Graph 1.

Amongst all students who participated in this study, satisfaction with their teaching model was greater in digital PBL group as compared to paper-based PBL. 94% ($n = 90$) students agreed that digital PBL learning is better than traditional PBL. They noted that the digital applications greatly stimulated their interest. 91% ($n = 87$) students affirmed that digital PBL helps in correlating basic sciences with clinical application and 90% ($n = 87$) students accepted that digital PBL helps in defining the objectives and help in patient assessment.

82% ($n = 79$) students stated that the protocol of digital PBL helped them to have a better and valuable exchange of ideas among fellow students. The additional observations of the study were that the students work well within their groups and there was improvement in interpersonal relationships amongst the students.

Students who disagreed with the digital PBL model explained that, although they were interested in this teaching model, PBL method itself took too long to complete.

DISCUSSION

Oral Medicine subject basically deals with the diagnosis and nonsurgical management of disorders affecting the oral and maxillofacial region. The proper history taking, clinical examination, evaluation and correct diagnosis of a clinical case are the requisites for appropriate treatment. In teaching-learning process, if the clinical cases are presented in a simple, easy and interesting manner that will have better impact on understanding a case, ultimately its diagnosis and treatment. PBL is an appropriate teaching-learning approach towards achieving this.

Traditionally PBL cases are paper-based descriptive cases which are consists of a description of a phenomenon that requires scientific explanation. Nevertheless imparting knowledge and education not only needs intellectual skill and subject knowledge but also ensure that the content matter is understandable to the student in a simple and easy manner [8].

The nature of student learning in PBL, to a large extent, depends on the quality of the case presented. Now students expect visuals in support of whatever they listen and read [8]. Thus, PBL cases should be presented in digital form. In the present study also, ninety four percent students agreed that digital PBL learning is better than traditional PBL because they are getting accurate idea of something.

Muneer *et al.* [8] stated that the advantages of digital PBL could be (i) to get accurate idea of something (ii) Pupil remember picture better than words they read (iii) students read words and see picture at the same time they remember even better.

In this study also the comparative mean scores of post-test between conventional and digital PBL groups were significant for nine questions. In contrast to this, there was lack of statistically significant difference between digital and paper based cases in the study by Jun Kong *et al.* [6].

By incorporating digital PBL for learning clinical cases in Oral Medicine, students are able to learn better since they use multiple sensory modalities, which make them more motivated to pay more attention to the information presented, better retain the information [7]. Few students mentioned that paper PBL gives descriptive information of orofacial lesion which they

usually get on reading text books but digital PBL provides the information how particular lesion looks like during its progress. Thus, digital PBL cases stimulate interest and motivate students to further improve diagnosis and problem-handling skills.

We have the same opinion as stated by Holland *et al*. [1] that by adopting a PBL approach thoughtfully, and in multiple courses across a curriculum, students will get better knowledge, and also to be better prepared to engage in more sophisticated coursework and authentic learning.

Ultimately, we hope that adopting a PBL approach for an entire curriculum has a variety of payoffs. Some are to the students, as they develop the skills, as well as mastering the content, that will prepare them for graduate study or careers in a rapidly-evolving field. However, we have also illustrated that there are payoffs to the instructors themselves. By developing the skill in our students to enable them to take significant responsibility for their own education. Our students showed improvement in interpersonal relationships amongst themselves and the students under-stood why they were responsible for their own learning, these findings are comparable to previous study by Chen *et al*. [9]. Few students (12%) expressed dissatisfaction and with the digital PBL model. They mentioned that, PBL method itself took too long to complete. This is true as PBL method itself has some shortcomings. Kinnunen and Malmi [10] have reported about the problems in PBL.

Muneer *et al*. [8] have evaluated the perception of the teachers about the significance of audio-visual aids in teaching. The participants opined that the use of audio-visual aids in teaching provides maximum use of various sensations and thus enhances understanding of the students. The majority of teachers emphasized that audio-visual aids in teaching have great impact on skills and attitude of the students in teaching.

One of the advantages of digital PBL, we would like to suggest is that the teaching aids can be stored and kept well. This will help the teacher to save his resources and reuse and renovate them for another time and another purpose for learning. It is unlikely to expose each and every student to rare oral diseases on actual patients in Oral Medicine but it is possible to give case scenarios of such rare entities to all the students through digital PBL.

CONCLUSION

Introducing digital PBL in Oral Medicine could improve the educational quality and effectiveness. Digital PBL needs to be the central focus of a PBL course as it helps the students to move along the trajectory of thinking like professionals.

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Pre-test/post-test Questionaire

1. Name the motor branches of trigeminal nerve.
2. Name the sensory branches of trigeminal nerve.
3. Enlist the causes of pain in head and neck region.
4. Name the condition causing trigeminal neuralgia like pain.
5. Name the indication for 5-hydroxy triptamine agonist.
6. Name the indication of CT-brain in head and neck pain.
7. Name the indications of ergot alkaloid.
8. Name the complications of post herpetic infection.
9. Name the treatment plan for herpes zoster.
10. Explain how early institution of antiviral agents in herpes zoster improve prognosis.

Annexure 2

PBL Feedback

Sr. no.	Questionaries	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	Digital PBL learning is better than traditional problem based learning					
2.	Helps to self-learning process					
3.	Helps to recognize weakness					
4.	Helps in correlating Basic sciences with clinical application					
5.	Helps in defining objectives					
6.	Helps in critical analysis of investigation					
7.	Helps in deciding treatment modalities					
8.	Helps in developing patient communication skill					
9.	Helps in patient assessment					
10.	Develop communication skill in group					
11.	Develop counseling skill					
12.	Helps to know content of written consent					