

Impact of Flipped Classroom Model for Teaching Anatomy to Dental Undergraduates

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ABSTRACT

Objective: The flipped classroom was developed in an effort to more effectively utilize the available teaching-learning time and to better serve the needs of students by encouraging active participation. It evokes students to access study material that can be utilized by them as and when the need arises. The purpose of this study was to evaluate the efficacy of flipped classroom activities as a teaching-learning strategy.

Methods: The study was conducted among dental undergraduate students of Anatomy at Jawaharlal Nehru Medical College Aligarh after taking informed consent. The students were divided into 2 groups of 17 students each during the lecture. Both groups were provided a related short video and ppt of the topic, one before the lecture and the other after the lecture. Pre-test and post-test were given to both groups. The students and teachers were then asked to provide feedback regarding this approach and the continuation of it for future classes.

Results: Sixty-seven percent of students strongly agreed that flipped classes are more engaging than traditional classes. Seventy-one percent strongly agreed that more such classes should be conducted in the future. The mean \pm standard deviation of the pre-test was 3.68 ± 1.43 and the post-test was

6.43 ± 1.02 . This difference was found to be statistically significant ($t=12.67$ and $p=0.00$).

Conclusion: The students' and teachers' feedback were largely positive and suggested for the continuation of these classes in the future also.

Key Words: Flipped Classroom, Students' Perception, Faculty Feedback, Pre-Test, Post-Test.


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INTRODUCTION

Historically, regardless of nation or specialization, anatomy has been a core component of medical education.¹ The majority of the time spent teaching and studying in medical courses is dedicated to lectures. The "flipped classroom (FC)" or "inverted classroom" approach emerged as a result of active participation in the teaching-learning process.²

Students learn in a blended environment using the internet and a controlled face-to-face campus setting called a "flipped classroom" (FC). Prior to class in FC, students get basic material, enhancing their readiness for the lesson. As directed by their professors, they can take notes while watching video lectures, listening to podcasts, viewing PowerPoint presentations, or using any other online learning resources.³

Three things should be accomplished in a successful flipped classroom: developing students' capacity for critical thought; ensuring active involvement of students as well as teachers; and encouraging the growth of a thorough knowledge of the subject.⁴ It is crucial to emphasize that this definition does not include flipped

learning as the primary use of pre-class reading materials. Text-based materials cannot "closely mimic what students in a traditional setting would experience"⁵ because the explanation and elaboration of the contents by the teacher are not included. A book "doesn't really walk through the steps on how to do something," according to Muir and Geiger.⁶ However, using video lectures allows the instructors to elaborate on the course material just like in a conventional lecture.⁷

This model has been adopted by several of the top institutions in the world, and studies of the effectiveness and perception of the flipped classroom model in various student cohorts have been conducted.

There may be some difficulty implementing the flipped classroom strategy for this group of students because undergraduate students in the first year of a medical course have little prior understanding of the material they are taught. Studies assessing the viability or reactions of first-year medical students to the flipped classroom learning paradigm are lacking.⁸

MATERIALS AND METHODS

The study was conducted among dental undergraduate students of Anatomy at Jawaharlal Nehru Medical College, AMU, Aligarh. Informed consent of the participants was obtained. The intake capacity for dental students each year is 50 seats. In the present year, total of 34 students were regular in attending lectures. All those 34 students were oriented to the “Flipped Classroom model.” The students were divided into 2 groups of 17 students each during the lecture. Both groups were provided a related short video and power point of the topic, one before the lecture and the other after the lecture.

The Google Form URLs were distributed using the Gmail accounts that the college administration had provided to each student. Due to some students' technical difficulties signing in, a WhatsApp group was also created and utilized to distribute the links. An efficient presentation of the topic was made using Google Slides, an e-learning application.

Flipped Classroom Model

Pre- Class Activity

Google Forms was used as a tool for pre-class activity. The Google Form consisted of three sections. In the first section, PowerPoint presentation slides were shared. Slide content was based on the topic (Development of Tongue) and was aligned with learning objectives. It was a guided reading for students. Students had to read the presentation thoroughly. Replication of materials from both pre-class and in-class was avoided. The PowerPoint slides were shared so that students were knowledgeable regarding the topic before coming to class. Two such different Google Forms were made for 2 days in-class session topics. Links for Google Forms were shared via e-mail and WhatsApp 2 days before the in-class session. Through this pre-class activity, it was ensured that students had a fair knowledge of the topic which is one of the main principles of the “flipped classroom model”.

In-Class Activity

To teach two subtopics, two in-class sessions on separate days were scheduled. 60 minutes were allotted for each session. A brief introduction typically kicked off a teaching session. Then a pre-test was given and for the next 30 minutes, development of the tongue was discussed, and it covered all the questions from the google form also. At the end of the class, video and summary of the topic were discussed.

Method of assessment

To measure the learning amongst students, 10 marks question paper was set as a pretest. It consisted of six MCQ-type questions, one true/false statement, one image-based question, one short answer question, and one fill in the blanks question. A post-test was done after a week of teaching to assess their retention of knowledge. After the post-test, student feedback was taken on the “flipped classroom model” using 9 items 5-point Likert scale (Grading: 1 – strongly agree, 2 – agree, 3 – neutral, 4 – disagree, and 5 – strongly disagree). Open-ended questions, namely “how the model helped in understanding the topic, in the retention of knowledge and gaining interest in Anatomy,” were incorporated to explore students' views on learning through the flipped classroom model.

Data were analyzed using SPSS version 21, IBM Corporation, South Asia, India. Descriptive statistics were presented by the mean, standard deviation (SD), and proportion. The difference between the marks was analyzed using an appropriately paired t-test or unpaired t-test and the significance was found.

RESULTS

All 34 dental undergraduates were enrolled in the study. Two Google Forms were used for two pre-class activities. All 34 students responded to the google form questionnaire and their responses are attached as images of those forms.

Seventy-six percent of students strongly agreed that flipped classes encouraged active participation. Seventy-one percent of students strongly agreed that more such classes should be conducted in the future. Seventy percent of them strongly agreed that this method of teaching gives them the confidence to apply knowledge into practice. The mean ± standard deviation of the pre-test was 3.68±1.43 and the post-test was 6.43±1.02. This difference was found to be statistically significant (t=12.67 and p=0.00). Sixty-six percent of teachers were of the view that this approach to teaching encouraged communication between them and students. Sixty-four percent strongly agreed that this activity encouraged active participation from the students. Sixty-eight percent of them strongly agreed that this innovative teaching method should be implemented for future classes. It is important for teachers to plan and consider the academic time taken to deliver any topic using flipped classroom approach.

Table 1: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test marks	3.689	35	1.4350	0.2426
	Post-test marks	6.431	35	1.0292	0.1740

Table 2: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre-test marks & post-test marks	35	0.501	0.002

Table 3: Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Pre-test marks – post-test marks	-2.7429	1.2802	.2164	-3.1826	-2.3031	-12.675	34	0.000

Table 4: The questionnaire distributed to the students with their responses to the flipped classroom approach.

1. Flipped classroom encouraged active participation	23(67.6)	8(23.5)	1(2.9)	0(0)	2(5.9)
2. Flipped classroom encouraged teacher-student interaction	23(67.6)	9(26.5)	0(0)	0(0)	2(5.9)
3. Flipped classroom improved understanding of key concepts	22(66.7)	8(24.2)	2(6.1)	0(0)	1(3)
4. Flipped classroom helped to apply knowledge into practice	23(67.6)	8(23.5)	1(2.9)	0(0)	2(5.9)
5. Flipped classroom gives the confidence to apply knowledge into practice	25(73.5)	6(17.6)	1(2.9)	0(0)	2(5.9)
6. More modules should be organized in the future	23(67.6)	8(23.5)	1(2.9)	0(0)	2(5.9)
7. Flipped classroom is beneficial for absentees	21(61.8)	9(26.5)	2(5.9)	0(0)	2(5.9)
8. Flipped classroom is more engaging than traditional teaching	21(61.8)	9(26.5)	1(2.9)	1(2.9)	2(5.9)
9. Flipped classroom is time-consuming for students	7(20.6)	4(11.8)	6(17.6)	10(29.4)	7(20.6)

Values are presented as number of responses to each statement (%).

Response: 1, strongly agree; 2, agree; 3, neutral; 4, disagree; 5, strongly disagree.

DISCUSSION

There have probably never been more calls for reforming conventional higher education teaching and for changing the sage on the stage into the guide on the side in order to make room for student-centered active learning strategies. The flipped classroom has been suggested as a solution to this situation. According to a number of studies, using a flipped classroom as a teaching strategy may increase student involvement and encourage a more active style of learning in higher education. The results of this research support those studies' findings and highlight additional benefits of the flipped classroom model.⁹

Although the FC model has received a lot of support, educators who are not familiar with this instructional strategy might find it difficult to pinpoint its proper uses and possible drawbacks. The relative effectiveness of the FC for knowledge dissemination, when compared to a "traditional" lecture approach, should also be fully understood by prospective FC adopters.¹⁰

Teaching high-order Bloom's objectives, like analysis or evaluation, may not be the best course of action for teachers to take when using TC or isolated e-learning. An FC or blended learning strategy using both TC and e-learning seems to be preferred and leads to greater learning with these more complex objectives. This is especially true when case-based or self-assessment tasks are used to supplement in-class active learning.¹¹⁻¹³

Additionally, relatively new research by Morton et al.¹¹ indicates that FC is more suitable for teaching knowledge analysis or application than memorization of general facts. By maximizing a learner's germane cognitive load, the FC model can promote focused learning in these higher-order skills when it is applied in a way that builds upon fundamental ideas or already-learned information. Like any curriculum, the FC model must be used in conjunction with high-quality pre-class readings and in-class exercises that are tailored to the requirements and levels of the learners and are in line with the course's goals and objectives. Although students had a favorable overall opinion of the FC model, they also noted that the design and execution of the curriculum were crucial for success. Learners appreciated pre-class materials that were created especially for the FC model, were simple to use and access, contained information that was brief, pertinent, and delivered in a variety of ways.^{14,15}

Additionally, since departing from this method can have a negative effect on learners, teachers must be thoroughly educated in the FC model and consistent in their delivery and expectations. In order for the sessions to be most effective, care must be taken to

ensure an adequate transition between pre-class and in-class work while avoiding both redundancy and the introduction of entirely new material in the in-class part. In order to enhance our knowledge of the ideal practices for classroom didactics, more research comparing the outcomes of FC, TC, or a blended approach using both of these strategies is required.

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