

Impact of Flipped Classroom Model for Teaching Anatomy to Medical Undergraduates

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ABSTRACT

Background: The flipped classroom is a teaching method in which the traditional lecture and assignment components of a course are reversed. Before class, the course material is introduced to the students in the form of a video or notes. It enables teachers to engage students, support self-directed learning and encourage critical thinking all of which results in a better understanding of the subject.

Materials and Methods: The study was conducted among medical undergraduate students of Phase I at Jawaharlal Nehru Medical College Aligarh. The students were divided into 2 groups of 50 students each during the lecture. Both groups were provided with a related short video of the topic, one before the lecture and the other group after the lecture. The students and teachers were then asked to provide feedback regarding the flipped classroom approach and the continuation of it for future classes.

Results: The perception of students and teachers regarding flipped classes was evaluated. 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.

Conclusion: Both teachers' and students' response were largely positive regarding the effectiveness of flipped classroom as compared to traditional teaching.

Keywords: Effectiveness, Flipped Class, Students' Perception, Teachers' Feedback.

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INTRODUCTION

"Flipping the classroom means that students first become familiar with new material outside of class, typically through reading or watching lecture videos, and then use class time to do the more difficult work of assimilating that knowledge, through problem-solving, discussion, or debates in front of the instructor or facilitator.¹ The instructional method has been gradually changed by medical educators, who have reduced the number of classes, added self-directed learning, used online technology, and encouraged inter-professional education. The FC, also known as inverted classrooms, are among the many learning styles, strategies, and methodologies that have gained significant recognition. Because of easier access to the required material in the digital age, self-regulated learning is now more in line with learning objectives. Students are given foundational material in FC before class so they can enter the class with a stronger knowledge base. They can take notes while viewing video lectures, podcasts, PowerPoints, or using any other online

learning resources as directed by their instructors.² Three objectives should be met for a flipped classroom to be effective: (1) develop students' capacity for critical thought; (2) fully engage both students and teachers; and (3) promote the growth of a thorough understanding of the subject matter.³ Teaching is divided into two phases: the content attainment phase and the concept application phase. The content attainment phase involves students developing their conceptual understanding in the context in which they are learning it. The concept application phase involves students learning to apply and/or evaluate those concepts in novel situations. In a traditional classroom setting, the instructor facilitates learning of the material in various ways. The responsibility for applying the ideas is then placed on the students, typically in the form of homework assignments. In a flipped model, the roles are reversed, with students being responsible for attaining the content before coming to class, at which time the teacher facilitates the application process. These models appear

to vary primarily in how the instructor facilitates either concept application or content acquisition.⁴ There is evidence showing that students who are instructed using this method are more conscious of their own learning process. In order to perform at their best during the course, they could make changes to their activity and concentration thanks to this awareness.⁵ This model has been used by a number of the top institutions in the world, and studies have been done on how well it works and how students react to it. 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. There haven't been any studies that assess the viability of or how first-year medical students will react to the flipped classroom learning approach.⁶ We conducted a study to assess the perception of MBBS students to flipped classroom module.

The development of technology, practical learning terminals, abundant network resources, and practical network transmission environments are some of the factors that have made the flipped classroom so popular in developed nations. Second, because educators and psychologists have studied students' learning activities in-depth, they reject the traditional model of instruction that emphasizes teachers imparting knowledge and students accepting it passively and instead place an emphasis on what students actually master and their capacity for application. This has sped up the adoption of flipped classrooms.⁷

Moreover, accreditation standards now formally demand that medical programs include opportunities for medical students to work in active learning environments, so that they can develop lifelong learning skills (independent identification, appraisal, analysis, and synthesis of knowledge) desirable of modern physicians. Finally, there is now increased emphasis in formal medical curricula on developing competencies related to professionalism, medical ethics, the humanities, interprofessional collaboration, and other areas, resulting in less curricular face-to-face time devoted to many of the basic and clinical sciences.⁸

MATERIALS AND METHODS

The study was conducted among medical undergraduate students of Anatomy at Jawaharlal Nehru Medical College, AMU, Aligarh. Informed consent of the participants was obtained. The intake capacity for MBBS students each year is 150 seats. All these students were oriented to the "Flipped Classroom model." The students were divided into 2 groups of 75 students each during the lecture. Both groups were provided with 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.

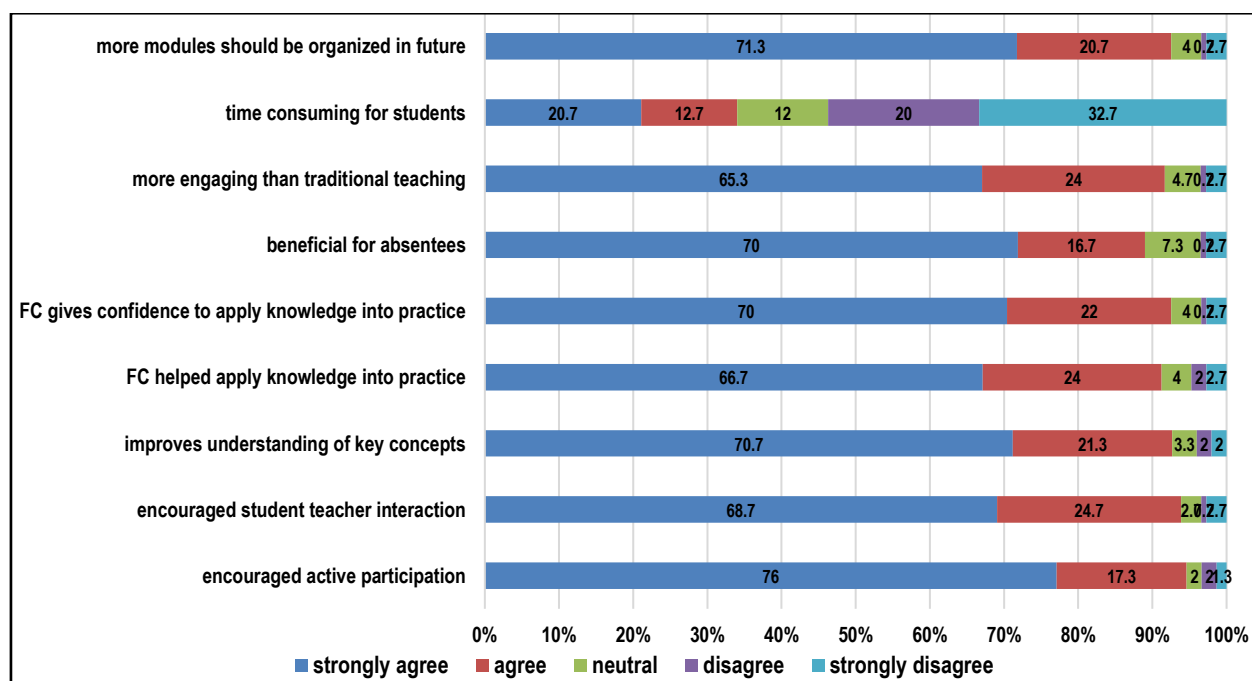


Fig 1: Student's perception regarding the importance of flipped classroom teaching

Table 1: Flipped classroom encouraged active participation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	114	76.0	77.0	77.0
	2	26	17.3	17.6	94.6
	3	3	2.0	2.0	96.6
	4	3	2.0	2.0	98.6
	5	2	1.3	1.4	100.0
	Total	148	98.7	100.0	
Missing	System	2	1.3		
Total		150	100.0		

Table 2: Flipped classroom encouraged teacher student interaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	103	68.7	69.1	69.1
	2	37	24.7	24.8	94.0
	3	4	2.7	2.7	96.6
	4	1	.7	.7	97.3
	5	4	2.7	2.7	100.0
	Total	149	99.3	100.0	
Missing	System	1	.7		
Total		150	100.0		

Table 3: Flipped classroom improved understanding of key concepts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	106	70.7	71.1	71.1
	2	32	21.3	21.5	92.6
	3	5	3.3	3.4	96.0
	4	3	2.0	2.0	98.0
	5	3	2.0	2.0	100.0
	Total	149	99.3	100.0	
Missing	System	1	.7		
Total		150	100.0		

Table 4: Flipped classroom helped apply knowledge into practice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	100	66.7	67.1	67.1
	2	36	24.0	24.2	91.3
	3	6	4.0	4.0	95.3
	4	3	2.0	2.0	97.3
	5	4	2.7	2.7	100.0
	Total	149	99.3	100.0	
Missing	System	1	.7		
Total		150	100.0		

Table 5: Flipped classroom gives confidence to apply knowledge into practice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	105	70.0	70.5	70.5
	2	33	22.0	22.1	92.6
	3	6	4.0	4.0	96.6
	4	1	.7	.7	97.3
	5	4	2.7	2.7	100.0
	Total	149	99.3	100.0	
Missing	System	1	.7		
Total		150	100.0		

Table 6: More modules should be organised in the future

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	107	71.3	71.8	71.8
	2	31	20.7	20.8	92.6
	3	6	4.0	4.0	96.6
	4	1	.7	.7	97.3
	5	4	2.7	2.7	100.0
	Total	149	99.3	100.0	
Missing	System	1	.7		
Total		150	100.0		

Table 7: Flipped classroom is beneficial for absentees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	105	70.0	71.9	71.9
	2	25	16.7	17.1	89.0
	3	11	7.3	7.5	96.6
	4	1	.7	.7	97.3
	5	4	2.7	2.7	100.0
	Total	146	97.3	100.0	
Missing	System	4	2.7		
Total		150	100.0		

Table 8: Flipped classroom is more engaging than traditional teaching

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	98	65.3	67.1	67.1
	2	36	24.0	24.7	91.8
	3	7	4.7	4.8	96.6
	4	1	.7	.7	97.3
	5	4	2.7	2.7	100.0
	Total	146	97.3	100.0	
Missing	System	4	2.7		
Total		150	100.0		

Table 9: Flipped classroom is time consuming for students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	20.7	21.1	21.1
	2	19	12.7	12.9	34.0
	3	18	12.0	12.2	46.3
	4	30	20.0	20.4	66.7
	5	49	32.7	33.3	100.0
	Total	147	98.0	100.0	
Missing	System	3	2.0		
Total		150	100.0		

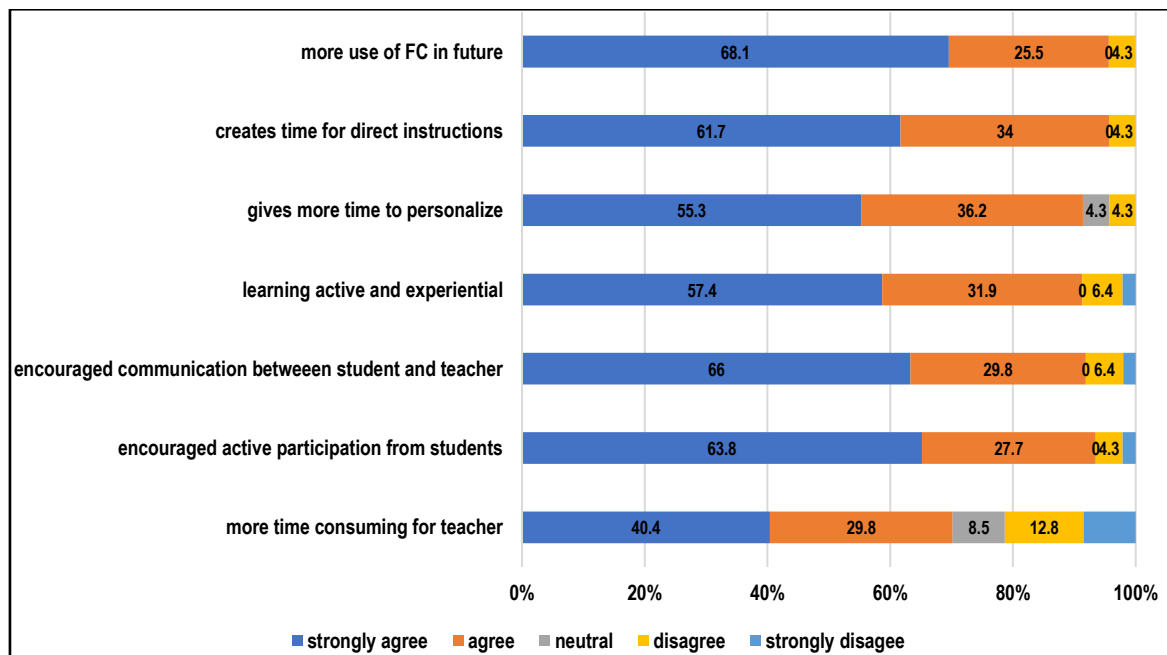


Fig 2: Impact of flipped classroom model for teaching Anatomy to medical undergraduates

Table 10: Flipped classroom is more time consuming for teacher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	19	40.4	40.4	40.4
	2	14	29.8	29.8	70.2
	3	4	8.5	8.5	78.7
	4	6	12.8	12.8	91.5
	5	4	8.5	8.5	100.0
	Total	47	100.0	100.0	

Table 11: Flipped classroom encouraged active participation from students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	30	63.8	65.2	65.2
	2	13	27.7	28.3	93.5
	4	2	4.3	4.3	97.8
	5	1	2.1	2.2	100.0
	Total	46	97.9	100.0	
Missing	System	1	2.1		
Total		47	100.0		

Table 12: Flipped classroom encourages communication between student and teacher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	66.0	66.0	66.0
	2	14	29.8	29.8	95.7
	4	2	4.3	4.3	100.0
	Total	47	100.0	100.0	

Table 13: Flipped classroom learning is active and experiential

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	27	57.4	58.7	58.7
	2	15	31.9	32.6	91.3
	4	3	6.4	6.5	97.8
	5	1	2.1	2.2	100.0
	Total	46	97.9	100.0	
Missing	System	1	2.1		
Total		47	100.0		

Table 14: Flipped classroom gives more time to personalise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	26	55.3	55.3	55.3
	2	17	36.2	36.2	91.5
	3	2	4.3	4.3	95.7
	4	2	4.3	4.3	100.0
	Total	47	100.0	100.0	

Table 15: Flipped classroom creates time for direct instructions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	29	61.7	61.7	61.7
	2	16	34.0	34.0	95.7
	4	2	4.3	4.3	100.0
	Total	47	100.0	100.0	

Table 16: There is more use of flipped classroom in future

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	32	68.1	69.6	69.6
	2	12	25.5	26.1	95.7
	4	2	4.3	4.3	100.0
	Total	46	97.9	100.0	
Missing	System	1	2.1		
Total		47	100.0		

RESULTS

All 150 students responded to the questionnaire. The responses of students are attached via the google form images and on the basis of those responses' charts are plotted.

Seventy-six percent of students strongly agreed that this method of teaching encouraged their active participation. Seventy-one percent of them were of the view that more modules should be organized in future. Seventy percent of students were able to understand the key concepts better when taught through flipped classroom. As the prerecorded videos were made available in the WhatsApp group beforehand seventy percent of students were of the view that it was beneficial for the absentees as well. Approximately Sixty-nine percent students strongly felt that such teaching encouraged their interaction with the teacher. Sixty-five percent of them had the perception that the technique of inverting the classroom is more engaging than traditional teaching. We received Seventy one percent feedback for organizing more modules in future through "flipping the classroom."

The google forms were also provided to 50 faculties to get their feedback about their experience of teaching regarding this

innovative technique. The responses are attached via google form images and charts were plotted. Sixty-six percent of teachers were of the view that the flipped classroom technique encouraged their communication with the students, which is not as much in the traditional teaching method. Nearly Sixty-four percent teachers received active participation from students. Fifty-seven percent of the faculty strongly felt that the flipped classroom technique has made learning active and experiential for the anatomy students. Forty percent of teachers were of the view that this technique is more time consuming for them as the preparation of the prerecorded videos and sharing the google forms online took more time. However, Sixty-eight percent strongly agreed that they will utilize this means of teaching to instruct the students in future also.

The mean of pre-test marks was 3.99 and the standard deviation was found to be 2.10. The mean of post-test marks was 6.77 and Standard deviation was 1.00. Unpaired t test was used for analysis where t(F) was found to be 14.6025. The p value was 0.00 indicating that the difference in pretest and posttest marks was found to be highly significant.

DISCUSSION

Jonathan Bergmann and Aaron Sams, two high school chemistry instructors from Colorado, USA, first used the phrase "flipped classroom" in 2012. Beginning in 2007, they had started to flip the teaching and learning situations. Since then, the reversed classroom model—also known as the inverted classroom—has been adopted by numerous other fields and environments of learning and education around the globe. Although student attitudes toward the flipped classroom approach have been assessed across a variety of fields and learning levels, there is no information available for medical students regarding these views. More specifically, there is a dearth of information in the literature regarding the effectiveness of this model in the instruction of human anatomy, a subject that is taught in the first year.⁹

By encouraging active learning, flipped classes give instructors the opportunity to engage students, support their self-directed learning, and encourage critical thinking, all of which will improve their understanding of the topic.¹⁰

These studies' findings are supported by the findings of this research, which also identifies additional benefits of the flipped classroom model. Overall, it was discovered that the study's sample of students valued the flipped classroom. The most commonly valued reason for this was that the students appreciated learning through using video material, the opportunity to study in their own pace, flexibility and mobility brought about by accessible video lectures, and that learning is easier and more effective within the frame of the flipped classroom. The ability to stop and rewind the video lectures was found to be the feature that students valued the most when analyzing their experiences using video in more detail. In light of this, it is reasonable to draw the conclusion that low achievers who may find traditional lectures difficult and fast-paced (Young et al, 2009) were empowered by the flipped classroom model because they had more opportunities to think and learn at their own speed.¹¹

However, we discovered that the flipped classroom would be more successful if quizzes were given at the beginning of a face-to-face session. The quizzes were used to evaluate student understanding of the pre class learning materials and were made up of specific questions that the teacher had created in advance. This result may be explained by the fact that pre-class quizzes helped students remember the material they had previously studied. Prior knowledge has long been regarded as a significant influencing element on learning. In order to better understand new information by connecting it to what they already know, it is helpful to stimulate the recall of previous knowledge in students. Additionally, the act of retrieving information from memory strengthens the pathway to that information in memory, making it easier for the student to access that information later.¹²

Watching video lectures required a lot more time, according to students who preferred a traditional classroom. In a conventional class, lectures led by the instructor are how students learn about the material during class; in a flipped class, however, students are now required to view the video lectures before class. The pre-class videos were viewed as time-consuming by the students, who felt uncomfortable being requested to complete work that was typically completed in a face-to-face class format at home.¹³

Instructors who desire to use flipped classroom should first help students understand this novel method of instruction by outlining its purpose and any potential advantages.¹⁴ The duration of all

combined video segments may also be limited by instructors to no more than 20 minutes. The majority of students watched pre-class video lectures for up to 20 to 25 minutes on average, according to several studies^{15,16} on flipped classrooms that are not connected to the education of health professionals.

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