

Flipped Classroom Teaching and Learning in Anatomy: Impact and Perception of Online Delivery in Phase I MBBS Students

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Abstract

Objective: A study was conducted to assess learning outcomes and perception of phase I MBBS students towards online interactive teaching using flipped classroom and its effectiveness in their learning process in comparison to traditional teaching methods

Methods: An interventional education study was conducted on 120 year I medical undergraduates after due approval with waiver of consent from the Institutional Ethics Committee. Students were sensitized towards the flipped classroom method. Comparative analysis was done between online teaching done via traditional didactic method and via flipped classed room.

Results: Analysis showed a significant difference between posttest scores of traditional and flipped classroom methods (p-value 0.045) whereas there was no significant difference between pretest scores of traditional and flipped classroom teaching methods(p-value 0.093) Satisfaction Index was 86%.

Conclusion: Perception of students towards the flipped classroom method was largely positive which encourages the educators to pursue it in the future.

Keywords: Flipped Classroom; Anatomy; Neuroanatomy; Perception; Feedback; Instructional design; Learning outcomes

Introduction

Didactic lectures were the mainstay of classroom instruction nationwide, yet they have been questioned by many authorities. Active learning is a more effective method of cultivating learning in students than traditional didactic lectures. Technological advances

have made it easier to implement innovative teaching methods and thereby increase active learning in the classroom [1]. There is always a relation between the teacher and the student. The student discovers the problems and makes strategies to solve it. It is teacher's responsibility to guide the student at every step. When the

learner comes to a solution, the teacher puts his or her opinion into it and guides them towards perfection thereby helping the learner to obtain various answers. Students will be motivated to study more effectively if they are continually exposed to diverse elements and receive correct answers with the support of their teachers. It is therefore necessary to allocate teaching-learning time to more effective use and to increase students' involvement in the teaching-learning process. This led to the evolution of the flipped classroom, or inverted classroom approach [3]. The Flipping Learning Network specifically defines the flipped classroom as "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space transforms into a dynamic, interactive learning environment where the educator guides students as they apply the concept and engage creatively in the subject matter [4]. In this method of teaching, students prepare for classes by watching prerecorded lectures or reading assigned materials, and the classroom time is spent on discussion and problem-solving activities. As a result, the teacher's role changes from that of 'guide by your side' to that of a 'sage on a stage [5]. Leading universities around the world have adopted this method of teaching and studied the perceptions and performances of various cohorts of students [5]. It has been observed that students taught via interactive methods develop a deeper learning approach, put in more effort in their studies, are more committed, drop out at a lower rate, and seem less tired during their study sessions. This method of learning may help lower-performing students improve their grades and gain knowledge more effectively. More research should be done in the future to improve the system and deliver the most benefits to all students.

Objective

The aim of our study was to

- Assess the learning outcomes and effectiveness of flipped classroom method in phase I MBBS students in comparison to traditional didactic lectures.
- To assess the perception of students towards the flipped classroom method.

Methods

An interventional education study was undertaken among first year MBBS students. Students who freely participated in the study met the inclusion criteria; while those who did not meet the criteria were excluded. Students who did not engage in the study were a

criterion. The study was conducted after getting the approval from the Institutional Ethics Committee (IEC No. 129/20) with a waiver of consent. A core committee of four members was constituted and the topics to be covered were deliberated upon. The committee decided the difficulty level of the topics which was aimed on to achieve the objectives of our study. Relevant MCQs from the subject material were prepared by all core committee members and final pre-test and post-test were decided by common consent which was same for the didactic as well as the flipped classroom. The topics selected for online didactic and flipped classroom were same. The topics covered were trigeminal nerve and facial nerve. The questionnaire and feedback were then sent to internal and external experts for validation. WhatsApp groups were created with the students, and they were sensitized towards the flipped classroom method. Online lectures on two neuroanatomy topics were taken using traditional didactic methods, whereas learning on two topics was facilitated via flipped classroom method using the Zoom Pro platform.

Preparation of flipped classroom module

Outside the Classroom

Relevant pre-reading material such as links from e-books and YouTube videos were decided for the topics in advance and shared with the students' WhatsApp group 48 hours before the class.

Class Activity

Students were divided into groups of 10 students each. Groups were created by random distribution. A pre-test consisting of 10 items with a single best response type was administered to the students before the intervention. They were encouraged to participate actively in interactive discussions where the students were directed to find solutions to specific clinical problems. The interactive session was followed by a post-test. Their voluntary anonymous feedback for the flipped classroom was taken on a 5-point Likert scale. The validated feedback questionnaire consisted of 9 closed ended questions. A score of 1 indicated strongly disagree, a score of 2 indicated agreements, a score of 3 indicated neutrality, a score of 4 indicated neutrality, and a score of 5 indicated strongly agree. An open-ended question was also given at the end of the questionnaire to get qualitative responses from the students about their experience of learning in the flipped classroom. A satisfaction score was also calculated using the feedback form. A crossover of the 2 groups was done for the next session.

Statistical analysis

The data was analyzed using the Paired T test in SPSS version 21 (IBM, Chicago, IL, USA.)

Results

A study involving 120 students of the year I MBBS program was conducted. On the pre-test for traditional and flipped classroom methods, the mean scores were $75.8 \pm 0.20\%$ and $77.1 \pm 0.16\%$, respectively, while on the post-test, they were $84.6 \pm 0.13\%$ and $93.8 \pm 0.12\%$ (Table 1). There is no significant difference between pre-test scores of traditional and flipped classroom teaching methods (p-value 0.093) whereas there was significant difference between post-test scores of traditional and flipped classroom methods (p-value 0.045) (Table 2). The score breakup showed 47 students (39%) and 100 students (83%) scored more than 80% marks in

pre-test and post-test of traditional teaching whereas for flipped classroom it was 43 (36%) and 106 (88%) respectively. Students obtaining 60% to 80% were 60 (50%) and 18 (15%) respectively for pre-test and post-test of traditional and flipped classroom methods and students who obtained less than 60% were 13 (11%) and 2 (2%) respectively in pretest and posttest of traditional and flipped classroom methods (Table 3). Students were very receptive towards the flipped classroom teaching method. Table 4 shows the response of the students towards the flipped classroom on 5-point-Likertscale. Some of the responses were "very interactive session," "session was interactive and helpful", "we should continue such method", "topic understanding increased after the class, "session was very interactive, which made it more interesting and easier to learn". A satisfaction index of 86% was calculate.

Category	Pre-Test		Post-Test	
	Mean	Std Dev	Mean	Std Dev
Traditional Method	75.8%	0.20	84.6%	0.13
Flipped Classroom Method	77.1%	0.16	93.8%	0.12

Table 1: Mean Scores of Pre and Posttests of Traditional Classroom and Flipped Classroom Methods.

Category	Mean		p value
	Pre-Test	Post-Test	
Traditional Method	76%	85%	0.039
Flipped Classroom Method	77%	94%	0.028
p value	0.093	0.045	

Table 2: Significance Levels between the Pre and Posttests of Traditional Classroom and Flipped Classroom Methods.

Score Break-up	Category	Number of Students	
		Pre-Test	Post-Test
More Than 80%	Traditional method	47 (39%)	100 (83%)
	Flipped method	43 (36%)	106 (88%)
In Between 60% to 80%	Traditional method	60 (50%)	18 (15%)
	Flipped method	61 (51%)	11 (9%)
Less Than 60%	Traditional method	16 (13%)	3 (2.5%)
	Flipped method	13 (11%)	2 (2%)

Table 3: Count of the Students based on the percentage scores for Traditional Classroom and Flipped Classroom Methods.

Questions	Answers					Mean Rating
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Your knowledge increased post session	25.00%	71.67%	1.67%	0.83%	0.83%	4.2
More such sessions should be conducted	20.00%	64.17%	13.33%	1.67%	0.83%	4.0
Session was interactive	35.00%	52.50%	10.83%	0.83%	0.83%	4.2

Session was well organised	33.33%	55.83%	10.00%	0.00%	0.83%	4.2
Involvement in session was high	23.33%	52.50%	20.00%	3.33%	0.83%	3.9
Session developed more confidence on the topic discussed in the session	32.50%	52.50%	13.33%	0.83%	0.83%	4.2
Session was valuable for your understanding of the subject	30.83%	60.00%	5.83%	2.50%	0.83%	4.2
Teacher received adequate feedback of your work	28.33%	60.00%	10.00%	0.00%	1.67%	4.1
Teacher explained the conduction process adequately	41.67%	48.33%	8.33%	0.83%	0.83%	4.3

Table 4: The Feedback Responses of the Students Towards the Flipped Classroom Method.

Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree

Discussion

Flipped classroom as a teaching methodology was first introduced by Jonathan Bergmann and Aaron Sams, two high school chemistry teachers from Colorado, USA, in the year 2012 [4]. This model was then taken up by various educational fields around the world. The success of the flipped classroom approach can be attributed to the fact that students are responsible for their learning and that this very process transforms them into lifelong learners. It is postulated that a learner undergoes five stages during his education, and the teachers' responsibilities change accordingly [2]. The first stage is dissonance, in which the learner's prior information is challenged and incomplete. This challenge might be internal, in which a student thinks through the problem on their own, or external, in which the teacher provides the challenge. It concludes when students evaluate and identify their own specific learning goals. We included this phase in our study by providing relevant pre-reading material in advance which was shared with the students' WhatsApp group. The second phase is the refinement phase, where learners search for possible explanations or solutions to a problem. Therefore, by completing tasks and discussions, the student learns new concepts. We involved the students in this phase by engaging them in active discussion and encouraging them to find the answers to the specific questions. The third stage is the organization phase, in which the learner reconstructs the newly acquired information into increased ideas. It consists of two elements, reflection in action, in which hypotheses are tested and re-tested, and organization of information, in which the information is arranged into schemas that can be better understood by the learner. This phase

of the flipped classroom methodology was achieved in our study by making the students taking a posttest and comparing the score with the pretest which was conducted before the initiation of the intervention in the form of Flipped Classroom method. The stage of the fourth and fifth stages include the feedback and consolidation phases. During the feedback phase, the learner's newly acquired knowledge is tested against the beliefs of peers and teachers. As a result of the feedback, either the learner will confirm or reconsider their schema after receiving new information. The consolidation phase refers to the stage in which the learner evaluates the entire process, not only in terms of increasing their knowledge, but also in terms of the learning process itself (reflection on actions). These phases were included by taking the students' feedback on 5- point Lickert Scale, which contained 9 closed ended questions and it also included one open ended question. This methodology also allows the learners to transform themselves from passive listeners to active learners. An important advantage of this teaching methodology includes an increased interaction between the teachers and students. It provides them with the flexibility to learn asynchronously at their own pace. So, flipping the traditional classroom is the need of the hour to educate students in a way that develops higher-order cognitive skills in them and thereby engages them in meaningful learning that will eventually improve the delivery of healthcare [6]. When students are self-motivated to study and the relevance of their learning is applied to patient care, it may push educators to apply more innovative teaching and learning approaches in the future, as is the case with more successful problem-based learning. The purpose of competency-based teaching is

for students to become self-directed and lifelong learners, which can be achieved by using flipped classroom teaching [3]. Although studies have been done to evaluate the perceptions of students towards the flipped classroom in various disciplines, sufficient data is still not available for medical students, specifically in anatomy, and very little for learning delivered online [3]. The results of our study are in concordance with other studies carried out in various parts of the world. Several studies have compared the scores of traditional and flipped classroom methods. Veeramani, *et al.* recorded the scores after traditional and flipped classroom methods, which were 70% and 89%, respectively. They also reported that students perceived an increased engagement towards the flipped classroom method and preferred it over the traditional classroom methods [3]. Viveka, *et al.* (2017) conducted a study to observe the effect of a flipped classroom on students' scores and recorded mean scores after traditional and flipped classrooms were 12.92 and 13.41, respectively. Moreover, 47 students passed after the traditional classroom method and 58 students passed after flipped classroom teaching [7]. Morton and Colbert-Getz (2017) compared the scores of knowledges, application, and analyzing components of Bloom's Taxonomy. The mean scores for the knowledge component for traditional and flipped classroom modules were 88% and 90%, respectively. For the application part, they were 88% and 87%, respectively, whereas for the analyzing part, they were 92% and 93%, respectively, and their group also recorded a perceptive rating of 4.15 out of 5 towards the flipped classroom method [8]. Fatima, *et al.* in 2017 in their study reported that students perceived flipped classroom "highly interactive, thought provoking and activity lead learning [9]. Kasat, *et al.* (2020) compared the long-term retention of subjects using the traditional and flipped classroom methods and found that there was a significant increase in students' scores after the flipped classroom method (52.33vs 59). Presently, we recorded the mean scores after traditional and flipped classroom methods as 84% and 93.8%, respectively. Various studies have also compared the perceptions of traditional and flipped classroom methods. The present study recorded a satisfaction index of 86% and students found the flipped classroom method highly interactive and engaging, which follows the trend of the previous studies [8]. There is much evidence to prove that engaging students in active learning has enhanced learning outcomes, higher-order thinking, problem-solving, and critical analysis, and also improved their motivation and attitudes [11]. This research will aid in the adoption of more

interactive teacher-student sessions. Students will gain a better understanding of their learning process and will be able to become lifelong learners.

Conclusion

The findings of the study suggest that this pedagogy can be an effective way of enhancing student engagement and learning. The contribution of this research towards the pedagogical science is to clarify the features, advantages and disadvantages of flipped classroom from the students' perspective. The preparation of flipped classroom allowed us to identify the most difficult types of activities for undergraduates. The study shows the difficulties that a student can face. Thus, in this fast-changing context, especially with the COVID pandemic disrupting traditional classrooms, this emerging educational modality can be a very effective tool for teaching and learning, and it can be integrated as a comprehensive system for lifelong education.

Limitations of the Study

Only two broad topics were chosen for the flipped classroom, which may not adequately assess the students' learning outcomes and perceptions.

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Conflict of Interest

The authors have none to declare.

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