

Original Research Article

Flipped classroom teaching as a tool to enhance self-directed learning among first MBBS students

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ABSTRACT

Background: Medical education shifts from a teacher-centered to a student-centered which fosters self-directed learning, critical thinking, and problem-solving skills, especially in the scenario of a large classroom. Flipped classroom is a blended learning to increase student engagement with content, improve faculty contact time with students, and enhance learning. This study was conducted to compare the effectiveness of the flipped classroom method and didactic lecture on students' performance and to obtain students' and teachers' perceptions in teaching-learning biochemistry.

Methods: All participant students were randomly divided into two groups and subjected to the FC method and TDC method in module A and a crossover of groups was done in module B. Both groups were subjected to pre and post-tests after intervention in modules. Feedback was obtained from students and teachers on both learning methods.

Results: There was a statistically significant difference ($P < 0.0001$) after applying independent t-test in pre and post-test scores and module completion test in both learning methods. About 91% of participants were satisfied with using a flipped classroom and found it more enjoyable, creates interest in the subject, whereas faculties' feedback shows it requires more efforts and time.

Conclusions: Considering responses and results of the assessment, it can be concluded that the FC approach, effectively engage students in the learning process, inculcate the attributes to develop self-directed and lifelong learning skills. Also improved the students' performance and perceptions of the learning experience. Most of the students indicate that this approach is worth to use in future.

Keywords: Critical thinking ability, Flipped classroom, Medical education, Problem-solving ability, Self-directed learning

INTRODUCTION

The National Medical Commission (NMC) the regulatory board for medical education in India has rolled out the competency based undergraduate medical curriculum in the year 2019. CBME is an approach to ensuring that a medical graduate achieves the desired patient-centered outcomes during their training. CBME demands the development of all these competencies, such as problem -

solving ability, critical thinking abilities, and self - directed learning, in students. It also encourages innovative, flexible, creative and student-centred teaching approaches.

One of the prominent teaching methods of interactive learning is the flipped classroom. This is a type of blended learning where students are provided with a study material before the class in the form of recorded

lectures, videos, portions of textbooks, handout materials, etc., for learning at home, and they come prepared in the classroom for an interactive session. The class time is utilised for learning the core content, interactive discussion; students apply their learned knowledge to critical thinking for case studies and problem solving. The flipped classroom encourages students to be active in the class by giving them a variety of tasks to accomplish in class.¹

A challenge facing medical professors is the large content of medical education and limited classroom opportunities. Therefore, the flipped teaching model is the need of the hour which enables a medical graduate to develop the key competencies so as to deliver socially responsive health care.² Competency-based training, which is one of the skills required for cultivating the habit of self-directed and life-long learning.³ There is a need to introduce new and innovative methods that develop attributes of metacognitive skills, and the flipped classroom fulfils that demand.

Hence, this study was conducted with the objectives, to compare the effectiveness of the flipped classroom method and didactic lecture on students' performance in teaching medical biochemistry by MCQ test and to obtain students' and teachers' perceptions about the flipped classroom method in teaching and learning biochemistry.

METHODS

The current quasi-experimental study was conducted among the 1st - year medical undergraduate students to evaluate the effectiveness of the flipped classroom model (FCM) activity. The study was conducted in the Department of Biochemistry at Government Medical College, Pail. All 150 students enrolled in the first year MBBS course were included in the study after obtaining their informed consent and Ethics Committee permission. The study was conducted over a period of six months from March 2023 to August 2023.

Inclusion criteria

All students enrolled in the First year MBBS course were included in the study.

Exclusion criteria

Non-consenting or absent students were excluded from the study.

All participant students were randomly divided into two groups: Group A had 75 students and Group B had 75 students. All the students and departmental faculties have been sensitised and explained about the study course.

Though most of the students attended the class, there were still a few who were absent for various reasons. They were taken as non-responders to the study.

A total of 10 topics of clinical application were chosen for the study. 5 topics for the FCM teaching method and 5 topics for traditional lecture method. Pre- and post-test were conducted for both methods of teaching. A comparative analysis of the FCM teaching method with lecture-based sessions was done by obtaining the scores of the students. In the first part of the study, Group A attended a lecture assisted by a flipped classroom and Group B attended the didactic lecture. Topics were taught by two separate teachers in two separate classrooms. The students were given the same pre-test and post-test before and after the class. In the second part, two groups were swapped. Group A attended a didactic lecture, and Group B attended a flipped class.

Students came prepared with the topic for the flipped class. They were provided with resource materials for the allotted topic 1 week prior in the form of pre-recorded lectures, Power Point presentations, reading material, and videos that were shared on their "WhatsApp group." During the 1- hour flipped class period, the students were allowed to brainstorm their difficulties and doubts for about 15 minutes. The doubts raised by students were encouraged to be clarified by peer students. The teacher facilitated the discussion and guided the students whenever required.

The FCM activity consisted of discussion in the form of solving cases through clinical reasoning, completing the blank flowcharts, and problem-solving exercises. Students were subdivided into groups of 6-7 students each to facilitate group interaction by projecting problem-solving questions and case scenarios for a given period of 20 minutes for the discussion among the group members. The answer was discussed with the rest of the class. At the end of the discussion, supplemental information was provided by the teacher for better understanding of its clinical relevance and summarised the topic. In each session, they were administered the same pre-test and post-test 20 MCQs before and after the class on a Google Form.

Apart from the pre- and post-test at each session, students' performance was evaluated by structured essay questions, which were conducted after each month of module completion. In addition, in the end, pre-validated feedback form was obtained from the students and from the faculties regarding their perceptions of FCM activity using a 5-point Likert scale in the form of a questionnaire.

This questionnaire was adapted from a questionnaire developed by Pierce and Fox and modified and revalidated appropriately as per the needs.⁴ The Questionnaire consisted of items asking about student's feedback and reflection about the ease, effectiveness, value, and clarity, as well as their view of whether flipped classes enhance their understanding and performance. The questionnaire also contained open-ended questions at

the end, asking for their comments, difficulties, suggestions, and remarks.

Data analysis

The results were analysed using SPSS software version 23. The mean scores of the pre- and post-test for each session were compared and analysed using an independent t-test. Also, scores obtained by the flipped class batch and the traditional class batch, at the end of the module completion test, were compared using an independent t-test. $P \leq 0.05$ was considered statistically significant. The evaluation of the teaching tool was done using the Kirkpatrick model. Students and faculty's perceptions of the flipped classroom approach for teaching learning method were collected via a questionnaire based 5-point Likert scale (minimum score = 1, maximum score = 5) and open-ended questions. Cronbach's alpha was used to measure the questionnaire reliability, which was 0.873, which indicated a high level

of internal consistency. Responses to the Likert-scale questions were analyzed with descriptive statistics.

RESULTS

A total of 150 students were enrolled in the first MBBS batch, there were 86 (57.33%) males and 64 (42.66%) females students. Two students were frequently absent due to various reasons (one male and one female). The pretest and post-test scores showed statistical differences within each group (Table 1).

The independent t-test, which compared the pretest and post-test scores as well as module completion test of the studied groups, showed that there were statistically significant differences between group A and group B with $p < 0.0001$, also results were statistically significant ($p < 0.0001$) for each module in the FC method of learning (Table 2).

Table 1: Comparison between two teaching learning methods.

	Teaching learning method	N	Mean	Std. deviation	Std. error mean	t
Pretest score	Flipped classroom lecture group A	75	49.82	18.156	2.096	6.3035
	Traditional lecture group B	73	32.41	15.279	1.788	
Post test score	Flipped classroom lecture group A	75	78.85	16.242	1.875	11.2241
	Traditional lecture group B	73	52.31	12.177	1.425	

Independent t-test two tailed **P < 0.0001

Table 2: t-test results of the two teaching learning methods for module completion test.

Teaching method	Number of students	Mean score	Standard deviation	t	df	Remarks
Flip class	75	78.8	9.8	69.63	74	Significant P<0.0001
Traditional	73	54.4	8.6	54	72	

Table 3: Results of theoretical knowledge and clinical reasoning skills in the study.

Characteristics	Theoretical knowledge	Clinical reasoning skills
Average score of flip class (Mean±SD)	85.56±5.80	83.44±5.97
Average score of traditional group (Mean±SD)	78.90±6.45	74.46±5.94
t	6.60	9.17
standard error of difference	1.008	0.979
P	<0.001	<0.001

There was a significant difference in the outcome between the two teaching-learning methods. Marks of flipped classroom-assisted lecture 78.8 ± 9.8 vs. traditional lecture 54.4 ± 8.6 ; $p < 0.0001$.

As shown in Table 3, the average score of the flipped class group in the theoretical knowledge test (88.56 ± 5.80) was significantly higher than that of the control group (81.90 ± 7.45) ($p < 0.001$). Similarly, the average score of the flipped class group in the clinical reasoning skills test (85.44 ± 5.97) was also significantly higher than that of the control group (78.46 ± 5.94) ($p < 0.001$).

A total of 148 students participated in the study, with a response rate of 100%. Feedback from students regarding their perceptions towards the FC method of teaching is detailed in Table 4 and Teacher perception in Figure 1. Both of the group responses were positive regarding FC as a method of teaching-learning.

An average of 88% said that they understood the topic well due to the FC method, which increased their interest in it. Almost 87% of students agreed that group activities helped them learn and that they were well-prepared for class. More than 94% of students liked how faculties communicated and directed discussion during FC method

teaching. Students strongly agreed that faculties had motivated them during FC teaching.

Table 4: Students perception on flipped classroom to closed ended questions.

Questionnaire	Response on Likert scale					Satisfaction index
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	
I understood the topic very well due to flipped classroom method of teaching.	68	63	12	3	2	88.51
Flipped classroom teaching increased my interest in Biochemistry.	68	66	8	4	2	90.54
Flipped classroom will cause higher retention of knowledge than routine didactic lectures for me.	62	69	12	2	3	88.51
I was able to learn through group activity in the class.	72	58	12	4	2	87.83
Due to flipped classroom method of teaching, I was usually well-prepared for class.	65	62	16	3	2	85.81
Flipped classroom improves my problem solving and critical thinking in clinical Biochemistry.	66	62	15	3	2	86.48
Adequate time was provided to spend on the pre-reading materials before the flipped classroom activity.	71	68	7	1	1	93.91
The material given to me for flipped classroom method was useful.	69	65	8	4	2	90.54
The flipped classroom session inspired me to pursue further learning.	73	62	8	2	3	91.21
The teacher effectively directed and stimulated discussion.	72	68	4	2	2	94.59
The teacher effectively encouraged us to ask questions and give answers.	75	60	7	3	3	91.21
I would prefer a flipped class over a traditional didactic lecture.	74	61	7	3	3	91.21
Learning through “Flipped Classroom” is time-consuming.	76	62	8	1	1	93.24
Flipped classroom method encouraged my active participation.	68	62	11	2	5	87.83
Flipped classroom method encouraged communication with other students and teacher.	71	64	9	2	2	91.21
More topics should be covered in the flipped classroom mode.	70	64	7	4	3	90.54

Table 5: Students comments/suggestions to open ended response.

Students comments/suggestions to open ended response	
1	Flipped classroom was not boring, had learn with fun during group discussion with friends.
2	I enjoyed discussion in the classroom as well interact with the teacher better as I had gone through the topic prior to class.
3	Repeated listening to videos make us to memorize and recall the modules.
4	Interactive class makes us open to ask questions to teachers.
5	Interactive sessions along with cases to help understand better
6	Flipped classroom enhance speaking skill in classroom and self-confidence.
7	Class was in question answer format than into a lecture which makes better to understand how to write answers in exams.
8	More such classes should be conducted in future which could help us to prepare for University examination.
9	The discussion made us more attentive in the class and made us understand the concepts clearly.

Continued.

Students comments/suggestions to open ended response	
10	FC should be carried out at least for difficult topics, as it would help us to understand the difficult concepts.
11	The pre-recorded lecture should be given prior to class so that we can hear at our own pace.
12	The pre-recorded lecture helped us to have a Pre knowledge of the topic, so we had a better understanding of the topic and more deeper learning.

[Likert 1: strongly disagree, 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly agree].

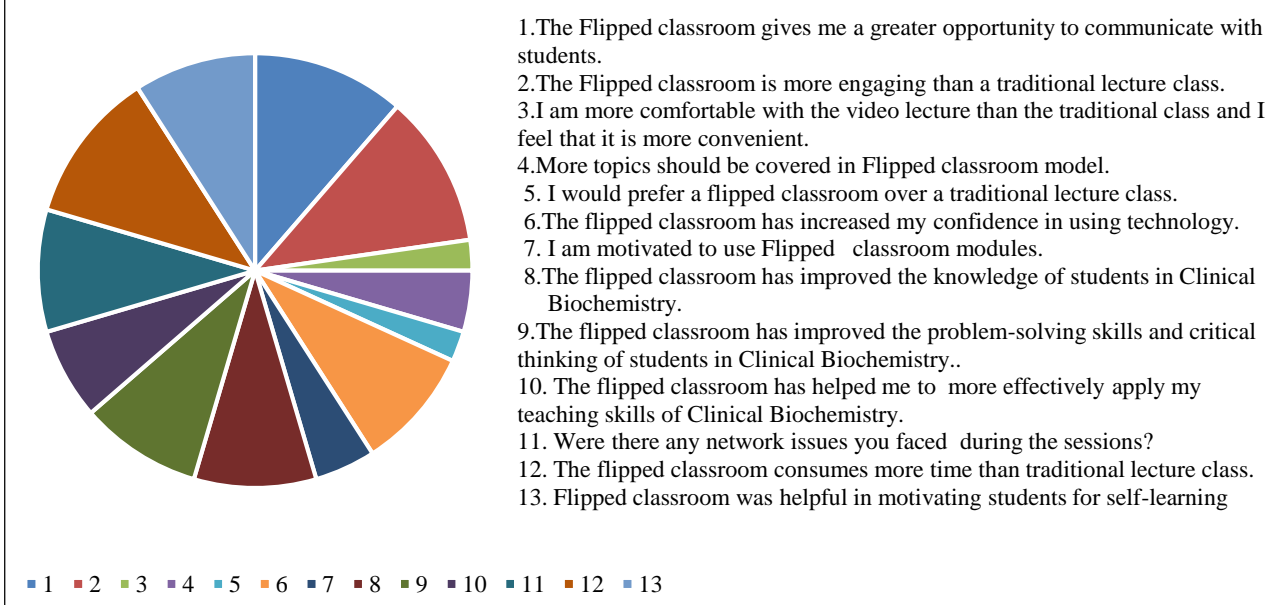


Figure 1: Teacher’s perception of flipped classroom to closed-ended questions.

Around 87% of students agreed that curiosity about topics and participate in the discussion increases. About 93% of students agreed that the FC method was time-consuming for learning. Students enjoyed and engaged in learning through this method, which helped them think critically. The last part of the feedback form was open-ended and asked for any other suggestions or comments (Table 5). According to (Table 5), more than 90% of students agree that flipped classes are engaging and

motivating and improve their problem-solving skills, critical thinking skills.

Four teachers were actively involved in this FC activity, and their feedback on the conduct of this teaching modality was taken (Table 6) shows that, overall, teachers participating in the study gave positive responses of strongly agree and agree to the items about the impact of flipped class on students' learning.

Table 6: Teachers perception on the impact of flipped learning on students' learning" open-ended response.

Questionnaire	Responses
The Flipped classroom gives me a greater opportunity to communicate with students.	All four strongly agreed that class time was spent in engaging in discussion, more interactive sessions for exploring learned knowledge so more time to communicate with students.
The Flipped classroom is more engaging than a traditional lecture class.	All four strongly agreed that, when students are studying in group setup, performing tasks, or discussing the subject in flipped classes or lectures, they are more engaged. In traditional classrooms, the teacher would often provide all of the information.
I am more comfortable with the video lecture than the traditional class and I feel that it is more convenient.	Two strongly agreed and two agreed that, the initial time and effort required by a teacher for preparing flipped class material is greater than in a typical class. The material, on the other hand, can be reused in the next year. So once all learning material is prepared than its more convenient.
I would prefer a flipped classroom over a traditional lecture class.	All four faculties unanimously agreed that FC conduction required more effort than the traditional lecture. Interestingly, for preference of FC two teachers were neutral on this and two agreed.

Continued.

Questionnaire	Responses
The flipped classroom has increased my confidence in using technology.	All agreed that to record class, requires a set of technical skills One of the faculty expressed the need for technical help to reduce initial fears of working with new technology.
I am motivated to use Flipped classroom modules.	Three felt that the effort required to make case scenarios as well as the Structured essay questions, to allow the student to apply higher learning, which motivated to make a question bank and find out the innovative ideas.
The flipped classroom has improved the knowledge of students in Clinical Biochemistry.	All four strongly agreed that FC brings more personalized learning among the students. The recorded videos and other interactive activities help them learn at their convenience. This helps them to focus more and improve their knowledge. There will be a deeper understanding of the material and the learning.
The flipped classroom has improved the problem-solving skills and critical thinking of students in Clinical Biochemistry.	All four strongly agreed that, asking open-ended questions during discussions that require students to explain clinical reasoning, justify their opinions, or explore different perspectives.
The flipped classroom has helped me to more effectively apply my teaching skills of Clinical Biochemistry.	All teachers agreed that they are equipped with knowledge from multiple sources as well applied different classroom strategies.
Were there any network issues you faced during the sessions?	One of the faculty expressed the need to be familiar with the platform being used, including guidance on how to enable security and privacy safeguards. One major issue was slow internet connection to upload recorded class.
The flipped classroom consumes more time than traditional lecture class.	All four strongly agreed that, as compared to traditional class ,the average time required was 8-10 hours for the development of Preparatory material and Video lecture. According to students feedback, for further session's improvement in learning resources is required.
Flipped classroom was helpful in motivating students for self-learning	Three strongly agreed where as one was agreed that even though there is a scope to improve the preparatory material but it definitely helped students to learn themselves.

DISCUSSION

Medical education is shifting from a traditional objective-based curriculum to a competency-based curriculum. The current trend changes from a teacher-centred approach to a learner-centred active participation approach.^{5,6} One of the skills required is cultivating the habit of self-directed and life-long learning. There is an immense need to introduce new, interactive, innovative, and student-centred methods that develop aspects of metacognitive skills. FC is a feasible, innovative, and motivating pedagogical teaching approach in large classroom settings.

In this study, we explored the effectiveness of FC and compared it to traditional lectures, which are often characterised by passive and transmissive modes of teaching. Also, we assessed students' and teachers' perceptions by administering a structured questionnaire regarding the FC approach to certain topics in biochemistry.

The effectiveness of this teaching model was evaluated by comparing the pre-and post-test scores as well as the module completion test to assess students' theoretical knowledge and clinical reasoning skills. The results indicated that the learning outcomes of students within a

flipped classroom were significantly better than traditional teaching setting ($p < 0.0001$). Furthermore, the responses to the student feedback questionnaire indicated that the flipped class group had a significant increase in their learning skills and developed critical thinking.⁷

In this study, as per (Table 1), when comparing the pre-and post-test scores, it was found that flipped classrooms achieved significantly higher scores in the pre-and post-tests. Moreover, the module completion test (Table 2) displayed a higher academic performance as measured by the total score for the course compared to those receiving traditional classroom instruction. The test was based on knowledge, case studies, clinical reasoning, and problem-solving in clinical biochemistry and was more effective and significant for students to learn theoretical knowledge and clinical reasoning (Table 3) skills, the FC method fostered students' abilities in analysing and solving clinical problems, therefore improving their cognitive abilities.⁷⁻⁹ Choi and Lee (2015) found in their study that the FC approach was more effective for students to learn knowledge and skills for instructional material production and that the effects were more observable for a difficult task.¹⁰ This suggests that FC methods of teaching work well in increasing the knowledge, critical thinking, and problem-solving abilities of the students.

The superiority of flipped classroom teaching over traditional teaching could be attributed to multiple factors. First, educator readiness is an important factor in the success of a flipped classroom course; if educators do not feel capable or enthusiastic to flip, then it is unlikely to work.^{11,12}

Second video lectures can present boring and complex medical content in a vivid form, stimulating students' interest in learning and enthusiasm for autonomous learning.^{13,14} Thirdly, it allows the students to learn at their own pace at home, to make full use of their time in the classroom by taking part in interactive activities and learning, and thus gain better comprehensive ability. The success of FC method is dependent on students coming to class adequately prepared, having already primed and familiarised themselves with the material provided to them, so that in-class time can best be utilised to cement that knowledge, make connections via cases and examples, and clarify any gaps in knowledge that still exist.^{15,16}

However, some studies showed that no significant differences between FCM and traditional models were found in students' academic achievement.¹⁷⁻¹⁹ The explanation may be that FC was a new experience, and the FC group was having difficulty dealing with time management and had no time to watch videos outside the class.²⁰ Another explanation may be that, to gain knowledge, flipped learning places too much emphasis on the student's responsibility and wisdom. People's perspectives differs, as a result, some students may never open their pre-recorded courses.²¹

The effectiveness of FC is still controversial, and the different subjects or course designs might be the cause of the heterogeneity among these studies.²²⁻²⁴ However, the present study showed improvements in student performance when compared with the traditional teaching approach. To assess the effectiveness of a FC over a traditional didactic class, we obtained students' perceptions about the implementation of this method in learning biochemistry with available resources. After the end of the activity, the questionnaire was administered to count students' opinions, suggestions, and learning difficulties. The questionnaires were anonymous, and students expressed their ideas boldly.

Most students who experience flipped classes prefer an inverted class format containing hands-on, problem-solving activities in class as opposed to a traditional lecture format, and the satisfaction index (SI) was 91.21, which proves that the FC method was well accepted by students. Most of the students (SI:86.48) had accepted that FC enhanced their active interaction in the class, motivated for self-directed learning, and improved their critical thinking, as time spent in the classroom is an opportunity for students to better understand the reasoning, rather than the means of receiving information

this result agrees with Morgan et al and Yang et al hence, consider FCM an effective learning tool.^{7,25,26}

About 90% of the students strongly agreed that the flipped classroom increased their interest in biochemistry, they understood the topic very well (SI: 88.51), and they retained knowledge (SI: 88.51). The reason may be because the opportunity to pause and replay video lectures helped them understand the key concepts and retention of knowledge, but there was a large chunk of students (SI: 93.24) who felt that the FC method was time-consuming and difficult.

The reading materials were useful (SI: 90.54), and adequate time was provided to spend on the pre-reading materials before the activity (SI: 93.91), as students are in charge of the provided learning resources and it is convenient to learn recorded lectures and videos at their own pace at home, which makes them prepare thoroughly.

Since the learning environment was student-centered, flexible, more positive and less stressful, and interactive, not only teacher-student interaction but also student-student interaction, the flexibility of students working and learning individually, in groups, in peer-tutoring pairs, or other student arrangements based on learning style, needs, and abilities, encouraged them to participate more actively as it helped them to apply prior knowledge to contribute to the discussion so it increases their confidence.²⁷

Group discussion plays a vital role in understanding the topic. SI: 87.83 of the students strongly agreed that they were able to learn through group activities in the class. Discussing a topic with friends or classmates, facilitated by the teacher, helps students learn the topic with perfection and share their learning, which equally benefits all students. Group discussions promote a deeper understanding of a topic, increase long-term retention, and also help increase participants' attention and help maintain their focus by involving them in the learning process.²⁸

The overall feedback on the FCM session was quite encouraging, even though some students do not prepare for flipped class materials and very few students do not participate in questions and discussions. The majority of students felt that more topics should be covered in the flipped classroom mode (SI: 90.54). Most of them felt that more frequent interactions, with teacher-student and also peer-to-peer, had more opportunities in class to ask questions to the teacher or their class colleagues, which helped in improving their critical thinking and knowledge, as well as their learning and confidence for answering.^{29,30}

In the current study, four teachers were actively involved in the preparation and conduct of FC, and their feedback was also taken regarding the impact of flipped learning

on students' learning and performance, teachers' roles, and challenges facing its implementation. The feedback questions were similarly structured as those of the students and open-ended for any suggestions or comments.

Teachers are a cornerstone in the teaching and learning process. They are integral to the success of educational initiatives related to classroom practices and are the final arbiters of classroom practices.³¹⁻³³ Table 6 and Figure 4 show that, overall, teachers participating in the study gave positive responses to the items about the impact of flipped classes on students' learning. All faculty members strongly agreed on the improvement of student's engagement, self-confidence, and motivation during class time because they come prepared and ready for the class with a basic understanding of concepts and allowing them to be active and self-confidence to participate in learning activities.³⁴⁻³⁶

Changing to a flipped classroom paradigm was actually more bothersome to faculty members than to students. Two faculty members struggled with releasing their reliance on their role as content-deliverers. However, the dedicated and enthusiastic faculties believed that the diversity of teaching methods kept their interest in the topic high even if they repeated it semester after semester.³⁷

This teaching style was difficult for the teachers as well, because none of the faculty members experienced this type of teaching as students. Since the preparation for a flipped class involves additional work and requires more time and effort, faculties have to take time away from their regular teaching schedule to record the initial video lectures. There were also difficulties in preparing for case-based questions, quizzes, structured essay questions, group-based learning, and creating the classroom environment. However, time investment should not be viewed merely as "extra work." The material, on the other hand, can be reused next year. Even though most of the students found the preparatory material beneficial and useful, but faculties in our study believed that there was a chance for more improvement and validation of the material.

The FC method relies totally on student's responsibility and wisdom for pre-planning their classes to gain knowledge. As with any new strategy, implementation, and execution of this teaching modality, more efforts were required by teachers for optimum usage of class time that ensured the active participation of all students and avoided chaos and indiscipline in the class. Also to meet the needs of students with different learning abilities, especially those with lower levels of ability who cannot keep up with the rest of the class. Faculty members made efforts to reach students who are struggling or who seek guidance, but enabling students who do not take it upon themselves to understand basic

concepts is detrimental to their development as professionals.

To do so, class time was fully focused on applied activities and learning, thus gaining better comprehensive ability, while the rest of instruction concentrated on developing deeper intellectual and clinical reasoning skills. In the discussion, students applied their learned knowledge of critical thinking to case studies and problem-solving. The faculty encourages students to be active in the class by giving them a variety of tasks to accomplish in class. Various strategies were used to facilitate discussion for critical thinking and problem solving, like group discussion and think-pair-share. Peer teaching: as teaching skills can be developed during in-class time with fellow peers as learners, difficulties asked by students were encouraged to be replied to by their peers, and faculty was there to facilitate the discussion whenever required by students.³⁸

Finally, there was a need to change the assessment methods. Since emphasis was placed on application and clinical reasoning, testing for only knowledge will lead to discord and likely result in students' disappointment. As students were always adjusting their learning habits to the incentives of grades, faculty members ensured that, as much as possible, grades reflected the knowledge, skills, clinical reasoning, critical thinking, and attitudes as desired. In addition to testing knowledge, MCQ was used for the pre-and post-tests. The module test, involving questions of clinical reasoning, critical thinking, and problem-solving by giving clinical scenarios, was assessed by a modified essay question (MEQ) or a constructed response question (CRQ). To assess critical thinking and reasoning, open-ended questions that require students to generate an answer in a few sentences were asked. The questions asked explain why (short-answer questions) were asked.

Elements that help to understand the topic are shown in (Figure 2). In this present study, the perception of students about the elements that help them to understand the module was asked, and 84% of students mentioned that problem-solving discussions help them to achieve academic excellence, significantly improve their analytical thinking, and facilitate gaining knowledge during the learning process.

The second element that enhanced the learning was the case-based scenario. It was to link theory to practice by applying knowledge to real-world scenarios. Students applied their knowledge to real-world clinical settings and hence built critical thinking abilities.

Better access to learning materials and content was the third choice. It's because some students no longer consult reading materials as their first port of call, instead preferring alternatives, such as online audio-visual learning resources. Video lectures were easy for them to

pause or rewind if they did not understand and beneficial to repeatedly watch.

Students have more control over their learning and also benefit from being able to review difficult content

without getting left behind. Audiovisuals help in an effective learning process, and most of the students were interested in using lecture videos.³⁹

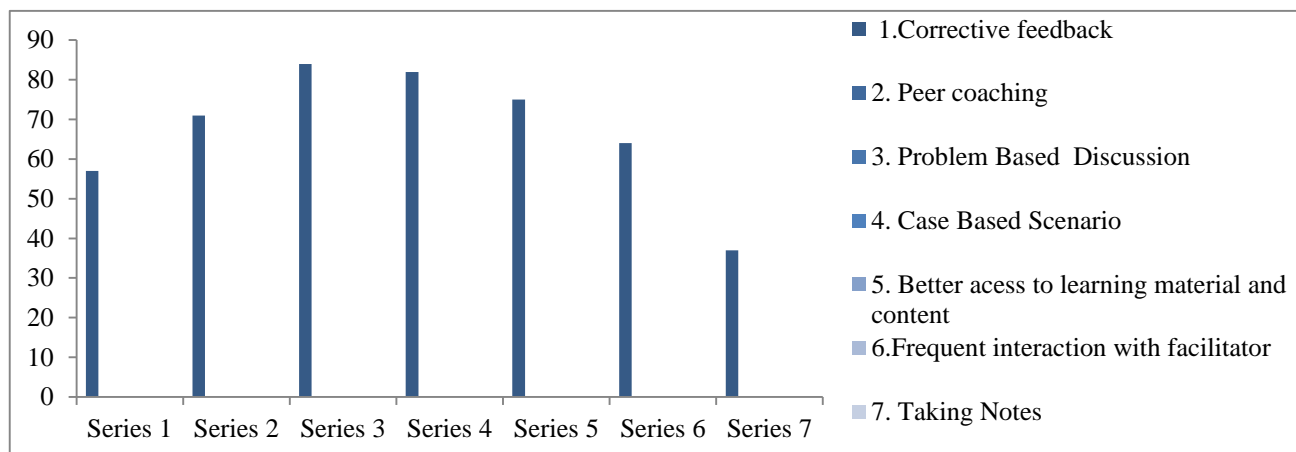


Figure 2: Element that help to understand the topic.

Most of the students felt that coaching by peers fosters their learning as it creates psychologically safe learning spaces, mutual understanding of difficulties, and different methods of explaining the learning content as per their needs.

Another factor is the frequent interaction with the facilitator; the role of the teacher was modified from information provider to facilitator of the learning process.⁴¹ Interactivity engages the students, improves motivation and attention, also encourages self-directed learning and better retention.

One of the elements was constructive feedback. Individualised feedback works as a useful tool to improve their knowledge and skills. Students are not always prepared to receive, and more importantly, accept, feedback. Feedback not only has the purpose of improving a student's performance; but also acts as a tool to cultivate self-assessment and reflection on performance.

The least preferred element was note-taking. It was considered one of the most effective learning methods. While taking notes, by listening to a lecture, understanding the lecture ideas, and writing down the main information in their own words, which enables them to retrieve information later.⁴²

This study has some limitations. The study was carried out only for one batch of first-year MBBS students over a period of the six month. The findings of this research are drawn from a single experience and therefore cannot be representative of current teaching and learning processes that drive student motivation. Another limitation was the

study material provided prior to class; whether all the students went through the material could not be tracked.

CONCLUSION

The student-centred medical education needs a method with more class activities belonging to students. The answer is a flipped classroom approach, which effectively engage students in the learning process and inculcate the attributes necessary to develop self-directed and lifelong learning skills. The present study shows that the implementation of the flipped classroom method is an effective teaching-learning method when compared with didactic lectures. The flipped classroom approach improved the students' understanding, performance, and perceptions of the learning experience. We also received overall positive subjective feedback from both students and teachers. Students not only became better in performance and attitude but also had the opportunity to interact and communicate with their instructors and peers in class and be more engaged by this new method. Most of the students indicate that this approach is worth using in the future for more topics. Initially, teachers felt it was extra work and time-consuming, but they are very satisfied with this approach. Further studies do need to be conducted to prove the long-term knowledge retention benefits of a flipped classroom.

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