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Original Research Article

# Comparison of structured interactive lecture (SIL) and flipped classroom method (FCM) in learning ophthalmology topics among undergraduate medical students

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ABSTRACT

**Introduction:** Structured interactive lectures (SIL) and Flipped classroom methods (FCM) are newer teaching learning methods which utilise pedagogical way of teaching. This study intends to compare efficacy of both methods in the understanding of ophthalmology topics among undergraduate novice.
**Objectives:** To compare the effectiveness in learning, conduct of classes and perception of students regarding both methods.
**Material and Methods**: Quasi experimental study. Duration – 6 months. Population- $6^{th}$ sem students, sample size – 45 in each group. Three topics selected (of varying complexities) and taught by SIL and FCM method. Pretest and posttest were conducted to assess the knowledge acquired. Feedback regarding the conduct of both sessions were taken in Likert's scale. Perception comparing both techniques were also evaluated.
**Results:** Difference between pretest scores were not significant. Difference between pretest and posttest scores were significant. SIL is better than FCM for undergraduate students posted for the first time in ophthalmology department. The students were enthusiastic with both methods. FCM was prefered by the students for motivation, subject retention, topic simplification and subject interest. The students narratives are discussed.
**Conclusion:** Structured interactive lectures are better for improving knowledge. Flipped classrooms kept students active. A hybrid method maybe more effective. Long term followup is needed to evaluate recall and performance in exams.



## 1. Introduction

Ophthalmology is a surgical subspeciality with its own varied and unique disease terminologies, diagnostic tests and specific management. Understanding of ophthalmology needs knowledge of basic sciences as well as the disease process. The conventional teaching methods are not effective in linking the basic concepts to its application, especially in the 6th semester when the students have their first exposure to the subject.

Structured interactive lecture (SIL) and Flipped classroom method (FCM) are the two new teaching learning methods suggested for large group teaching. This study is intended to compare the two different pedagogical methods of teaching namely Structured interactive lecture (SIL) vs Flipped classroom method (FCM) in understanding ophthalmology topics by the undergraduate novice.

## 2. Materials and Methods

A quasi experimental study was undertaken among the $6^{th}$ semester MBBS students to compare the efficacy of Structured interactive lecture (SIL) and Flipped classroom

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method (FCM) in the understanding of ophthalmology topics. Study approval was obtained from the institutional research board. There was no financial burden for the participants.

### 2.1. Hypothesis

Both Flipped classroom method (FCM) and Structured interactive lectures (SIL) are equally effective in the learning of ophthalmology topics among undergraduate medical students.

### 2.2. Objectives

1. To compare the effectiveness of structured interactive lecture and Flipped classroom method in understanding ophthalmology topics by the undergraduate novice.
2. To assess the perception of the students regarding the two teaching learning methods.

### 2.3. Sample size

Proportion of positive feedback was expected to be at least 54%.[1–3] Hence the sample size was calculated as 84 students (4pq/d 2 ) where p=54, q=100-p, d=20% precision. A convenient sampling technique was selected. The study period was six months.

100 students were enrolled in the study after informed consent (considering 10- 15% attrition). The sudents were alloted into 2 groups. Group 1 were given structured interactive lectures. Group 2 were exposed to flipped classroom method. The students in either groups were explained about the design and purpose of the study.

### 2.4. Structured interactive lectures

Three structured interactive lectures were planned. The classes were selected based on the complexity of the topic. Class 1 was on Lacrimal apparatus (easy to understand with minimal mentorship), class 2 was on management of corneal ulcer (can understand with moderate mentorship) and class 3 was on uveal inflammations (difficult to understand without mentorship). The topics were chosen by the concurrence of the teachers in the department. Students were informed about the topics to be discussed, in advance (48 hrs) before the lecture. They were given a list of basic knowledge topics which were expected to be covered during the lecture. Students were instructed to read the topic before they come to the lecture and note down the questions they have in that topic. A pretest was done on the day of lecture. Each structured interactive lecture was divided into three -four subtopics. After teaching a subtopic, students were encouraged to ask their queries. To increase the involvement of students a few questions were asked to the students and a buzz group discussion was prompted. This was followed by a second sub-topic. Each subtopic was discussed in the same way. At the end of the class a posttest was conducted using the same questionnaire. At the end of 3 sessions, the evaluation of the process was done by taking feedback on the conduct of SIL. This was done using a validated questionnaire[4] (on structured interactive lectures) and debriefing was done. The responses are based on the Likert scale (strongly disagree=1, disagree=2, neutral=3, agree=4 and strongly agree=5).

### 2.5. Flipped classroom method

Three flipped classes were planned. The classes on the same topics were taken.. The students were provided with the lecture material in the same 3 topics, 48hrs prior to the classroom activities. It included notes, powerpoint presentations, videos or animations (created or selected from the various credible online sources for which links were provided) depending on the topic to be covered. Case reports with relevant details were provided in advance and the areas of importance/ discussion was emphasised for preparation. The time needed to be spend was around 15 minutes for reading handouts /ppt and less than 10 minutes for the video. A student was expected to spend not more than 1 hour preparing. But each student was encouraged to read beyond the materials provided at his or her will and interest (slidesshare, youtube, text etc). A pretest was done before starting of the classes. The class activity included discussion about each subtopic based on the clinical case scenario provided for self learning. At the end of 3 sessions, the evaluation of the process was done by taking feedback on the conduct of FCM. This was done using a validated questionnaire[4] (on flipped classroom activities) and debriefing was done. The responses are based on the Likert scale (strongly disagree = 1, disagree=2, neutral=3, agree=4 and strongly agree=5).

Switch over- At the end of the 3 classroom activities, the batches were switched over and the process repeated (for ethical reasons). At the end of 6 sessions, the students were given a questionnaire on their perception about either methods.

Inclusion criteria- 6th sem MBBS students willing to participate in all the 3 sessions of teaching.

Exclusion- students not willing to participate or those who are absent on the day of atleast one class.

Study tools- short answer questions (SAQ), questionnaire with Likert scale

### 2.6. Analysis

The data was entered in excel and statistical analysis done using PSPP version 14. Continuous variables were analysed (mean) by unpaired T test. The difference between pre and post test scores were evaluated for effectiveness. The perception (Ordinal variables) were analysed (median) by

Mann whitney test.

## 3. Results

100 students of the $6^{th}$ semester MBBS course participated in the study. Out of them, 90 students attended all the classes.

Comparison of pretest score and posttest score after SIL and FCM classes are given in Table 1. It was observed that the pretest score before SIL and FCM classes were comparable. The posttest score was better after SIL classes as compared with FCM group.

The pretest and posttest scores were better for sessions which were easy to understand and prepare without guidance. The scores progressively decreased as the difficulty of the classes increased. The two scores were similar after class 1. Though statistically not significant, the difference was obvious after class 2. The difference between the post test scores after SIL and FCM classes were statistically significant after class 3 (Table 1).

The feedback of the students after each session (in Likert scale) is given in Table 2. The pre reading materials suggested prior to the class was appreciated as adequate by the majority of SIL group. But they needed extra time for preparation. They felt that the pre reading materials were relevant for the class. However, the majority of those in the FCM group opined that the activities during the session improved understanding of the key concepts. Both the groups were not satisfied with the conventional classroom arrangements. 45.54% of the SIL group wanted more SLI classes. 57.50% among the FCM group requested similar classes. Instructors could clarify better with FCM and engage the students better with SIL. In both methods the instructor was able to expand the pre reading material.

Perception of the students regarding the two methods of teaching is given in Figure 1. The students were asked which method they would choose for the various qualities listed. FCM was the preferred method for developing interest in the subject, simplification of the topic and motivation for self study. SIL was better for performance in exams. FCM was preferred for retention of topic though the difference was marginal. These observations were statistically significant (p 0.001).

Student's narrative about the aspects they liked and disliked about SIL classes and FCM classes are listed in Table 4 respectively.

## 4. Discussion

Structured interactive lecture (SIL) and Flipped classroom method (FCM) are the two new teaching learning methods in large group teaching. These techniques help to avoid boredom and stimulate interest and interaction in the lecture classes.

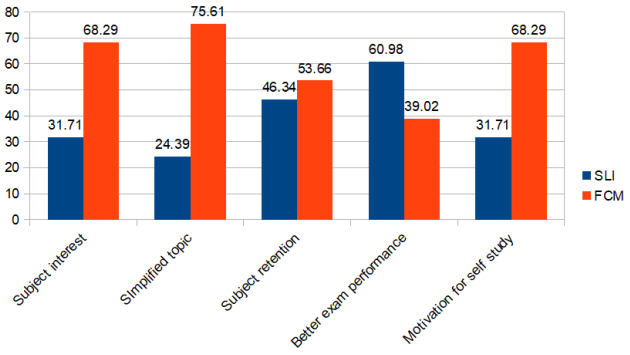


**Fig. 1:** The responses to the perception questionnaire

In structured interactive lectures, the topic to be covered is divided into subtopics. Each subtopic is covered by ensuring active interaction and participation of the students. The methods used include brainstorming, Buzz group, think- pair- share, question – answer sessions, mobile based e learning etc.[1,2,5,6] This study utilised the question – answer session and buzz group technique for interactive lectures.

Flipped classroom is a new method being experimented and successfully implemented in the realm of medical education. The Flipped Classroom approach asks participants to do their homework before attending the event. Rather than having a lecturer deliver key concepts, the students cover these topics ahead of the class through reading or multimedia materials. The class time is utilised to analyze the information, answer questions, and practice applying it. Though a pedagogical way of teaching, flipped classroom method is student centric, active learning method which increases retention, comprehension and recall.[3,7–10]

In literature, though utility of each method has been compared with traditional lectures, these methods have not been compared to each other. It was observed that structured interactive lectures are better than flipped classroom for teaching ophthalmology topics which need mentoring especially among $6^{th}$ semester MBBS students. The posttest score was better after SIL classes as compared with FCM group. The pretest and posttest scores were better for sessions which were easy to understand and prepare without guidance. The scores progressively decreased as the difficulty of the classes increased.

The pre reading materials suggested prior to the class was appreciated as adequate by the majority of SIL group. But they needed extra time for preparation. They felt that the pre reading materials were relevant for the class. However, the majority of those in the FCM group opined that the activities during the session improved understanding of the key concepts. Both the groups were not satisfied with the conventional classroom arrangements.

FCM was the prefered method for developing interest in the subject, simplification of the topic and motivation

**Table 1:** Comparison ofpretest score and posttest score after SIL and FCM classes

| | | SLI | | FCM | | P value |
|---|---|---|---|---|---|---|
| | | mean | SD | mean | SD | |
| Class 1 diseases of lacrimal apparatus (Easy) | Pretest | 4.32 | 3.04 | 3.96 | 3.41 | |
| | Posttest | 8.96 | 2.03 | 8.88 | 1.87 | 0.837 |
| Class 2 management of corneal ulcer (Intermediate) | Pretest | 2.49 | 2.04 | 3.40 | 2.91 | |
| | Posttest | 8.58 | 1.65 | 7.89 | 1.30 | 0.060 |
| Class 3 uveal inflammations (Difficult) | Pretest | 2.78 | 1.81 | 0.98 | 0.97 | |
| | Posttest | 8.42 | 2.06 | 5.83 | 1.21 | 0.000*** |

**Table 2:** The feedback of the students after eachsession (in Likert scale)

| | | Strongly disagree (%) | Disagree (%) | Neutral (%) | Agree(%) | Strongly agree(%) |
|---|---|---|---|---|---|---|
| Q1- Adequate pre-reading materials were suggested prior to class | SLI | 0 | 0 | 2.38 | 7.14 | 90.48 |
| | FCM | 0 | 0 | 0 | 27.50 | 72.50 |
| Q2- Adequate time was provided for preparation | SLI | 0 | 0 | 2.38 | 33.33 | 64.29 |
| | FCM | 0 | 0 | 7.50 | 25 | 67.50 |
| Q3- Pre-reading materials were relevant for the class | SLI | 0 | 0 | 2.38 | 26.19 | 71.43 |
| | FCM | 0 | 2.50 | 0 | 30 | 67.50 |
| Q4- The classroom arrangements were conducive for the class | SLI | 0 | 16.67 | 47.62 | 21.43 | 14.29 |
| | FCM | 0 | 10 | 30 | 40 | 20 |
| Q5- The activities during the session improved understanding of the key concepts. | SLI | 0 | 0 | 11.9 | 42.86 | 45.24 |
| | FCM | 0 | 2.50 | 7.50 | 32.50 | 57.50 |
| Q6- The class inspired me to pursue further learning for the module | SLI | 0 | 0 | 11.9 | 61.9 | 26.19 |
| | FCM | 0 | 0 | 12.50 | 50 | 37.50 |
| Q7- More lectures needed in this method | SLI | 0 | 0 | 11.9 | 45.24 | 42.86 |
| | FCM | 0 | 5 | 2.50 | 35 | 57.50 |
| Q8 - Instructor was able to engage me during the class | SLI | 0 | 0 | 4.76 | 23.81 | 71.43 |
| | FCM | 0 | 0 | 12.50 | 22.50 | 65 |
| Q9- Instructor was able to provide clarification on difficult concepts | SLI | 0 | 0 | 9.52 | 47.62 | 42.86 |
| | FCM | 0 | 0 | 10 | 32.50 | 57.50 |
| Q10- Instructor was able to expand on pre-reading materials | SLI | 0 | 2.38 | 11.9 | 26.19 | 59.52 |
| | FCM | 0 | 0 | 11.9 | 26.17 | 59.52 |

**Table 3:** Student's narrative about the aspects they liked and disliked about SIL classes

| Aspects liked most | Aspects liked least |
|---|---|
| "was kept engaged" | "Vast topics discussed over a short time" |
| "case based discussion" | "fast" |
| "pretest and posttest" | |
| "group discussions were a new experience" | |
| "tension free classroom environment" | |
| "interactive group work was interesting" | |
| "able to understand better" | |
| "relevant images were described and explained" | |
| "practical application of theory well explained by cases" | |
| "new experience" | |

**Table 4:** Student's narrative about the aspects they liked and disliked about FCM classes

| Aspects liked most | Aspects liked least |
|---|---|
| 'will be useful for exams' | "fast" |
| "Liked the new experience" | "interactions created a tense feeling in the class" |
| "learning materials are available for future use" | "vast topics discussed over short time" |
| "pretest and posttest" | "needed longer sessions with discussion of subtopics" |
| "interactive sessions and interaction with peers" | "difficult to follow without preparation" |
| "case based discussion" | "should have read and come- not able to understand the connections in between" |
| "Felt engaged and not sleepy" | "lack of continuity" |
| "explanation of the topic using cases with pictures" | "difficult to understand certain technical terms. The instructor should spell the word" |
| "easy to understand" | "the topic was tough to understand" |
| "friendly interaction" | |
| "pretest was an incentive to read" | |

for self study. SIL was better for performance in exams. FCM was prefered for retention of topic though the difference was marginal. Gulpinar et al discusses the pros and cons of SIL based on the feedback and narratives of the students after the classes.[11] Kahild K et al observed that Structured interactive lectures foster deep learning and critical thinking abilities in undergraduate medical students. Strategic use of interaction and assessments improved the academic performance and motivated students for self-regulated learning.[12] Lee et al compared the participants' independent goal setting and evaluation of beliefs and assumptions for the subscales of self-leadership and problem-solving skills after the flipped classes and the traditional classes. The results showed greater improvement on these indicators for the flipped learning group in comparison to the traditional learning group. The authors felt that the flipped learning method might offer more effective e-learning opportunities in terms of self-leadership and problem-solving than the traditional learning method in surgical nursing practicums.[13]

Tune J D et al. in another study suggested that the flipped learning method in surgical nursing practicums could offer more effective e-learning opportunities concerning the aspects of goal setting, accepting others' thoughts and modifying thinking, rational problem-solving skills, and deliberation in the e-learning process in comparison to the traditional learning method. Flipped learning in surgical nursing practicums could provide the benefits of allowing the sharing of prior learning and experienced problems for knowledge establishment due to prior learning and interactivity as well as prompt feedback through team-based learning.[14]

Simpson et al. considers FCM as an efficient method to improve interaction, motivation, retention of topic. They observed that more interactivity occured in flipped classrooms. All participating students reported similar workload during the course, whereas exam preparation after flipped classrooms was significantly less time-consuming. They wondered whether students trained in flipped classroom education turn out to be better problem solvers in their future careers.[15] Similar observations were made by Barbour C et al. and Barua et al.[4,16]

The SIL group opined that the classes kept them engaged, provided a tension free learning environment and better understanding of the subject. Group discussions, interactive group work and case based study was a new experience and well appreciated. Students said that interactive lectures keep them awake. However they felt short duration, vastness of stopics and fast coverage of topics within a short time span was conducive for the learning process. Structured interactive lectures were observed to be more effective as compared to traditional lectures by Prober et al, Chilwant et al, Sarwar et al.[17–19] Prober et al discusses various advantages of this system which they consider as a unique teaching experience in Lecture halls without lectures.[17] Chilwant et al notes that the students enjoy being actively involved in the lecture theater. The change of pace in interactive lecturing breaks the monotony of the lecture resulting in increased attention. Increased engagement and attention is helpful in developing interest in the subject matter. Interactive lecturing helps in developing thinking in students. Increased student involvement will lead to change in attitude and learning outcomes. Interactive lectures help to highlight common misconceptions held by the students and encourage students to question and thus increase the self efficacy of students which is linked to their academic achievements.[18] Sarwar et al considers SIL as an innovative approach in the present hybrid teaching system which is oriented in improving skills and applied knowledge with minimum teaching time promoting self directed learning and peer learning.[19]

The FCM group opined that the classes were engaging. Picture based discussion was useful. They did not feel sleepy. Students felt the methods will be useful for exams and were happy that the learning materials are available for future use. They commented that case based discussions

improved critical thinking. Interactive sessions and peer interaction was a novel experience. This is in concordance with Barbour et al who considers flipped classroom method as an effective part of curriculum for nursing students.[20] According to them FCM stimulates critical thinking and case/ scenario based knowledge and skill acquisition among nursing students. They discuss the constructivist model of the same. Gilboy MB et al, McLaughlin JE et al and Pierce R et al describe the utility and acceptance of FCM in various fields of medical education.[21–23]

However, topics covered in FCM classes were difficult to follow without preparation. Those who have not read, were unable to understand the connections. Discussion of subtopics gave a feeling of lack of continuity. However at the end of the class the students felt it would have been better if they had come prepared. This forms an active motivation for self directed learning. Similar observation was made by Lin H C et al.[24] Lin H C et al observed that the flipped learning method shifts the lecture time to the before-class time, allowing more time for teachers' guidance and skills practice in the class. However, if students do not have in-depth understanding in the individual learning space, their learning achievement is often not as expected.

## 5. Conclusion

Structured interactive lectures are better than flipped classroom for teaching ophthalmology topics which need mentoring especially among $6^{th}$ semeter MBBS students. As the ease of topic increases both methods perform well. The immediate pretest score and posttest score were marginally better with SIL classes and the difference increased as the toughness of the topic increased. The students were enthusiastic with both methods. However FCM helps in developing interest in the subject, simplification of the topic and motivation for self study and retention of the topic. Long term followup is needed to evaluate the recall and performance during exams as well as problem solving skills in later life.

## 6. Conflict of Interest

The authors declare no conflict of interest.

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