

Flipped Classroom Approach in Undergraduate Medical Education: The Need of the Hour

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ABSTRACT

Introduction: In the era of changing medical education system, our teaching methods are not able to cope up with ongoing evolution of medical education. There is a definite need of introducing newer techniques of teaching-learning methods to improve the learning process to higher levels of Bloom's taxonomy.

Aim: To explore the perceptions and attitudes of final year undergraduate medical students and teachers in paediatrics towards Flipped Classroom (FCR) model.

Materials and Methods: The present prospective observational study was conducted at the Mahatma Gandhi Institute of Medical Sciences Sevagram, a rural tertiary care institute of central Maharashtra, India from December 2020 to November 2021. The full class strength of 100 undergraduate final year medical students and all eight faculty members participated to conduct FCR sessions on Paediatric infectious diseases. Prereading study material in the form of videos and reading materials was provided for asynchronous learning, while classroom time was spent on solving problem-based questions based on "think-pair-share"

with the faculty as facilitators. Student and faculty feedback was recorded via a five-point Likert's scale. Consequently, small-group discussions were carried out to know the students' reflections. The data was analysed using Statistical Package for the Social Sciences (SPSS) version 21.0 software.

Results: The students showed overall encouraging response to the flipped classroom method with active participation. Eighty two students (82%) were happy about the content of the reading material and time spent on preclass activity. More than 75% of students agreed it to be more interactive with peers and teachers and that it enhanced active learning with development of interest in the given subjects. Seventy-five students (75%) gave positive responses towards the utility of flipped model for future classes as it helped in self directed learning. The faculty members also enjoyed this activity, though they found it time-consuming.

Conclusion: FCR is an effective way to motivate and enhance active and self-directed learning. Unlike didactic lectures, it helps the students in conceptual understanding of the subject and makes the teaching-learning experience enjoyable.

Keywords: Inverted classroom, Learning strategies, Self-directed learning

INTRODUCTION

Lecture-based teachings along with practical classes have been the mainstay of undergraduate medical education, which tends to overload the students with information. The conventional classroom approach is teacher-centered involving one-way delivery of information from teachers to students, rather than making the subject understood to the conceptual levels [1]. Bigger classroom with large strength of students also hampers the interaction between teacher and students leading to diminished interest in learning, as the students are only the listeners. With the advance in education technology and looking into the current trends, it is imperative that we change our traditional teaching style and increase the use of newer teaching learning strategies which are millennial student-friendly to promote active self-directed deeper learning [2]. The FCR or inverted classroom model is one such innovation where reading and understanding are carried out outside the class and class time is utilised for higher levels of learning like analysis, synthesis, and evaluation [3].

The phrase 'flipped learning' was popularised by chemistry teachers Bergman J and Sams A [4]. The FCR model is an approach where students gain first exposure to new material outside the class usually via reading or watching videos at their convenience and repeatedly if required to understand the concept and then use class time to do harder work of assimilating that knowledge in presence of teacher or facilitator [5]. This learner-centered approach provides flexible environment with good intellectual contents and learning culture by professional educators who play a vital role as facilitators. So, there is a paradigm shift in role of teacher as "sage-on-the-stage" to the "guide-on-the-side" [6]. FCR provides the opportunities for the students to actively participate in their own learning by increased peer interaction, peer learning, deeper engagement with the subject

material and development of higher cognitive skills [6-8].

Literature showed an overwhelming positive response from students who attended flipped classes [9-11]. Although positive student perceptions, faculty enthusiasm, and gain in learning outcomes have been depicted in various disciplines, it is still unclear how the FCR is received by undergraduate medical students [9]. This educational research project aimed to explore the perceptions and attitudes of final year undergraduate medical students and teachers in paediatrics towards FCR model at our medical college along with its utility for future classes.

MATERIALS AND METHODS

The present prospective observational qualitative study was conducted in the Department of Paediatrics at the Mahatma Gandhi Institute of Medical Sciences, Sevagram Wardha, Maharashtra, India during December 2020 to November 2021 after obtaining approval from the Institutional Ethical Committee (IEC) [MGIMS/IEC/PED/35/2021 dated 16/01/2021].

All the eight faculty members of the Paediatric department participated in this study. A separate sensitisation workshop, led by our departmental head and the institutional medical education unit experts, was organised to help them familiarise about the concept of the FCR model. Regarding student participation, the entire strength of the class (n=100 final year undergraduate medical students) were included in the study. They were sensitised about the FCR model through dedicated small-group discussions and written informed consents were obtained from all. Since each student had a Google-based MGIMS email id, and faculty, students and administrative staff were connected on intramail through an "mgims.ac.in" id, better interpersonal communication at each stage of the study became easy.

Study Procedure

A total of 12 sessions from the final year Paediatric syllabus were planned to be “flipped” during this period requiring conceptual thinking. These included various infectious diseases commonly encountered in children at our regional tertiary care centre. The preclass activity material (on-line content videos, power-point presentations, text-based resources, standard guidelines) was created separately by the faculty members. It was assessed and rated by the subject experts for the authenticity and the quality before designing the classroom activities. It was then emailed to the students atleast one week prior to the scheduled class. Also, assignments in the form of multiple-choice questions (prepared by the Paediatric faculty and validated by experts from medical education team) were given to the students two days prior. They were also encouraged to read the material provided and complete the assignments before every FCR session.

During the classroom activity the topics were discussed in the form of problem-based questions and case-based scenarios on the principle of “think-pair-share” where the faculty became facilitators [3]. At the end of each session the students were asked to randomly summarise the topic in accordance with the pre set specific learning objectives. After completing all the 12 sessions a surprise test on the topics covered was taken to assess the retention and conceptual knowledge.

Feedback questionnaires (11 closed-ended and one open-ended questions for students, five closed-ended and one open-ended questions for the participating faculty), based on the perceptions of the participants, was devised and validated by the subject experts in consultation with the local medical education unit faculty. A study from literature was referred while designing this questionnaire [10]. The standard five-point Likert Scale (5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree) was used to record perceptions of the students and the faculty regarding inverted learning experiences. Furthermore, a surprise multiple-choice question test was planned at the end of all sessions to assess the students’ critical thinking skills and retention of knowledge.

STATISTICAL ANALYSIS

The data was analysed using SPSS version 21.0 (IBM, Chicago, IL, USA). Frequencies were calculated and presented as percentages via graphical representations. Open-ended questions were given at the end of the questionnaire to get the qualitative responses about their experiences of using the FCR model.

RESULTS

A total of 100 final year undergraduate medical students participated in the FCR study with a male: female ratio of 68:32; their mean age was 22.6 years. A total of eight faculty members, with their mean age of 42.5 years, participated in conducting 12 FCR sessions in all. The results of the study were as under.

(A) Students’ perceptions: About 65 students (65%) were happy about the clarity of the FCR instructions; twenty-six (26%) revealed neutral responses. Only 50% of students were successful in completing the given assignments on time. However, with repeated reminders, many of them (83%) were able to complete it before the classroom activity in subsequent sessions. Overall, 82% students agreed that pre-class material provided for the FCR sessions were relevant and useful and a significant time was spent on pre-class activity. Seventy (70%) students agreed that the FCR leads to better understanding of the topics covered. Seventy-eight (78%) and eighty-five (85%) students agreed that the FCR is more interactive with peers and teachers, respectively. The views of the students after completing all sessions regarding developing interest in the given topic, better attention, understanding of the topics and active learning were noted. Seventy (70%) of the students revealed the FCR led to development of interest in the given topic and helped in active learning. Seventy-five (75%) students were impressed with this FCR activity and were willing to continue this for future classes not only in paediatrics but in other subjects too. However, twenty (20%) students gave neutral response to the FCR activity, and five (5%) students disagreed to continue the FCR model [Table/Fig-1].

Eighty-two students (82%) were satisfied about the preclass activity material regarding its content and relevance and agreed that it helped a lot in understanding the subject better and developing

Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Students’ perceptions					
Q1. I developed better understanding of the subject.	22	48	26	4	0
Q2. I developed increasing interest in the topics covered.	25	45	22	8	0
Q3. FCR helped me increase my active participation in the classroom activities.	22	48	24	6	0
Q4. FCR is more interactive with peer groups.	18	60	15	7	0
Q5. FCR improved my practical knowledge and the problem-solving skills about the lessons taught.	21	50	18	11	0
Q6. FCR allows more interaction with the teachers.	21	54	22	3	0
Q7. Pre-classroom material was good and relevant.	30	52	15	3	0
Q8. Pre-classroom activity time was adequate and helpful.	20	60	16	4	0
Q9. I received clear instructions about FCR.	20	45	26	9	0
Q10. I feel FCR is better teaching-learning method.	21	54	20	5	0
Q11. I would prefer FCR for future classes.	21	54	20	5	0
Q12. Please provide suggestions for improvements and any other opinions.					
Faculty perceptions:					
Q1. I feel FCR is feasible teaching-learning method.	3 (37.5%)	4 (50%)	1 (12.5%)	0	0
Q2. I observed with FCR the students developed better understanding and interest in the subject.	2 (25%)	4 (50%)	2 (25%)	0	0
Q3. FCR is a time-consuming method.	3 (37.5%)	4 (50%)	1 (12.5%)	0	0
Q4. FCR leads to extra workload for the teachers.	2 (25%)	5 (62.5%)	1 (12.5%)	0	0
Q5. I recommend FCR model for future classes.	2 (25%)	4 (50%)	2 (25%)	0	0
Q6. Please provide suggestions for improvements and any other opinions.					

[Table/Fig-1]: Participants’ feedback questionnaire. Students’ readings are in percentages

interest in the subject and encouraged them for active learning, as well. Initially, for two sessions, students had not shown a significant interest in preclass activity and on time completion of assignments as they might be more used to traditional lecture format. However, they picked up the pace in subsequent sessions with repeated reminders and interaction with faculty members.

When a surprise multiple choice questions test based on clinical case scenarios on taught topics was conducted after completing all the flipped sessions, 60 (60%) students scored more than 75% marks and 30 (30%) students scored more than 60% marks.

Eighty (80%) students suggested few topics to be covered in future with the FCR activity and they were overall happy about its interactive nature with peers and teachers. Online videos were preferred and suggested by students than the reading material as they added fun in learning, for future classes.

(B) Faculty perception: Seven (87.5%) of the faculty members reflected that the FCR is a feasible method to develop interest and active learning in students than traditional teaching methods. One (12.5%) senior faculty revealed a negative response. Six (75%) teachers noted that with the FCR model students develop better understanding and interest in the subjects. Seven out of eight faculties (87.5%) experienced extra workload and time-consuming nature of this model. Overall, six (75%) faculty revealed positive response to implement this FCR model for future classes [Table/Fig-1]. Varied responses received from the faculty on open-ended questions during the feedback questionnaire were noted [Table/Fig-2].

DISCUSSION

The results of this study revealed an overall positive response to support for the FCR as an effective mode to teach certain topics in paediatrics. Majority of the students believed that the FCR was more

engaging and interesting and encouraged them for active learning. This mode of teaching kept the classroom atmosphere 'alive!' Students agreed that the FCR was a better learning experience, and it should be routinely used along with traditional teaching-learning methods for a diverse set of topics in medical curriculum.

Several studies have indicated that medical undergraduate students perceive that the FCR approach benefits their knowledge and learning [3,9,11]. The FCR method has been helpful in teaching sensitive topics such as childhood disabilities and special education to undergraduate medical students, [12] for teaching specialised topics such as glaucoma and ocular trauma, [13] for learning electrocardiogram, [14] and provides opportunity to think critically [15].

As for the pre session material provided, the students suggested that they were more comfortable and preferred watching video lectures rather than reading. This may be attributed to the fact that video lectures provide flexibility in learning and students can review and repeat the sessions [16]. However, one should be cautious about the threat of the online lectures' inability to build the foundation of knowledge for medical students [17]. Students perceived that self-directed active learning, self-motivation, and more peer interaction were some of the non-knowledge-based benefits of the FCR [16].

Similar to present study findings, a study conducted at Aga Khan University, Pakistan using a similar pedagogy to teach second year MBBS students, six flipped sessions on Neurosciences modules reported that students found the FCR as a better mode of teaching in their set-up as well [10]. Moreover, several studies in the recent literature, including present study, revealed number of definite benefits of flipped elements over traditional teaching modules [Table/Fig-3] [18-23].

The fact that present study results are promising we can implement this innovative method to our students for active self-directed

Themes	Faculty comments
FCR model	"FCR innovated our way of teaching." "Our role was switched." The flipped learning model stimulated us to become more learner centric." "I was happy to be involved and implement this new model." "It will not be easy to teach all topics using the flipped classroom model."
Video and reading material	"The flipped model raised our responsibilities." "To prepare compliant preclass material was challenging and time-consuming task." "I started using technology more effectively."
In-class activity	"This teaching method allowed us to use in-class time more effectively." We could focus on students' specific needs like better understanding of the content, improving their critical thinking skills." Interactive nature made it live and interesting for students and teachers."
Unmotivated students	"Some students did not come prepared, for the initial sessions; but picked up the pace in later sessions." "Suboptimal student preparation and lack of motivation may limit the student-centered benefits." "It gave students more control over their learning, as opposed to the teacher having a more kind of didactic approach."

[Table/Fig-2]: Faculty opinions received on the open-ended questions at the feedback questionnaire.

S. No.	Author and year	Place of study	Sample size	Study design	Comparison groups	Parameters assessed	Main outcomes from flipped elements
1.	Bhai SA and Poustinchian B (2021) [18]	USA	404	Cohort study	Previous cohort vs. Flipped classes	Cumulative grade, OSCE* and practical examination performance	Significant improvement in students' physical examination skills. Facilitators experienced effective utilisation of classroom time.
2.	Rehman R and Fatima SS (2021) [19]	Pakistan	98	Interventional study	None	Pre and post-test performance and student satisfaction survey	Facilitation of synchronous and asynchronous learning empowered students' engagement and interactive learning. Students perceived this as a great learning experience.
3.	Choi J et al., (2021) [20]	South Korea	91	Mixed method design	Traditional component vs. Flipped sessions	Students' perceptions regarding student-centeredness and active learning environments in terms of teaching, social, and cognitive presences	Incorporating flipped classes to deliver respiratory system assessment content was feasible and considered acceptable by undergraduate nursing students.
4.	Shiau S et al., (2018) [21]	USA	150	Cohort study	Traditional component of the same course	Student characteristics, examination scores, and end-of-course evaluations	No significant differences in examination scores or students' assessment of the course. Flexible environment for pre-recorded lectures and the ability of section leaders to clarify targeted concepts were the observed strengths.
5.	Gillispie V, (2016) [22]	USA	60	Cohort study	Traditional component of the same course	Demographic information and examination scores for traditional teaching and flipped classroom groups of students	Flipped classroom was found to be a feasible and useful alternative to the traditional classroom. It embraced Generation Y's need for active learning in a group setting.
6.	Sajid MR et al., (2016) [23]	Saudi Arabia	239	Cohort study	Component of the same course	Summative assessment results were compared with previous year results as a historical control	Flipped model improved student satisfaction and replaced passive lecturing with active student-centred learning that enhanced critical thinking and application, including information retention.

7.	Present study (2022)	India	100	Prospective observational	None	Students' learning experiences about flipped sessions and faculty perceptions for its utility towards future classes	Flipped model enhanced students' active self-directed learning, developed interest in the subject with better understanding, and was more interactive. Faculty experienced hard work and its time-consuming nature.
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[Table/Fig-3]: Overview of studies from literature [18-23].
OSCE: Objective structured clinical examination

learning. In that context, research comparing the different modes of teaching revealed that incorporating problem-based learning and video-lectures could be an efficient way of teaching theory as well as clinical skills during medical education [24,25].

Although the overwhelming response from students exposed to the FCR approach is positive, few have shown concerns by giving neutral or negative responses. Time intensiveness for preclass commitment, inadequate preparedness, lack of motivation and accountability are some of the student factors that may compromise positive FCR effects. Similarly, the teaching skills, the inbound extra workload, and the time-consuming nature of the FCR activity could be some of the faculty factors for its negative response [9]. However, capacity building through proper planning, training sessions and effective implementation can cater for these issues.

Limitation(s)

This study has certain limitations. First, only few sessions were flipped, so it is difficult to determine long-term outcomes and feasibility of this model. Future longitudinal studies with a greater number of sessions involving varied subjects would yield better results. Last, due to time constraints, making pre-reading material for students was challenging for the teachers in this study. Low strength of faculty members and limited experiences about the FCR model could be adjudged as the restraints. Involving a greater number of faculties could be of much help to tackle this issue.

CONCLUSION(S)

FCR model is an effective teaching strategy for undergraduate medical students to enhance student engagement, interaction, and active self-directed learning. Seventy-five (75%) students were impressed with this FCR activity and were willing to continue this for future classes for other subjects too. Overall, six (75%) faculty revealed positive response to implement this FCR model for future classes. Also, it seems feasible for the faculty to implement and develop student interest in the subject, however, with an added workload to their day-to-day departmental commitments. Thus, this model merits inclusion in the present-day undergraduate medical teaching program.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Apr 08, 2022
- Manual Googling: Jun 16, 2022
- iThenticate Software: Aug 10, 2022 (12%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 03, 2022**

Date of Peer Review: **May 14, 2022**

Date of Acceptance: **Jun 21, 2022**

Date of Publishing: **Sep 01, 2022**