

Medical Education

Teaching clinical anatomy to medical students by flipped classroom

AARTI, KAMAL SINGH, SURESH KANTA RATHEE

ABSTRACT

Background. We aimed to introduce the flipped classroom approach for teaching clinical anatomy and to assess its perception and feasibility among medical undergraduate students.

Methods. Our study included 151 MBBS students of the first professional. We took written informed consent after the study was approved by the Ethics Committee. Selected topics of clinical anatomy were taught using the flipped classroom (FCR) method. It involved pre-class, in-class and post-class activities. In pre-class activity, pre-reading material was given to the students 1 week before the class. An assignment was given 2 days before the class in the form of solving multiple-choice questions, drawing well-labelled diagrams, etc. In-class activity included a pre-test followed by a discussion of the topic in the form of problem-based questions in the class on the principle of Think–Pair–Share. Post-class activity included summarization of the topic by students in the form of a group activity followed by a feedback session. Feedback was collected using a pre-validated feedback questionnaire on Google forms. Data collected were analysed using SPSS 21.0 and Microsoft office 2010. The response to close-ended questions was expressed as percentage. Open-ended questions were analysed by grouping of qualitative responses.

Results. We found FCR to be a feasible, interesting and necessary pedagogical tool for medical education. Most students (95%) agreed that FCR is a useful technique for better understanding of clinical anatomy. They learnt better from FCR than other teaching methods and their in-depth understanding of the topic improved with FCR.

Conclusion. FCR is an established teaching–learning tool but it needs to be implemented in undergraduate teaching of clinical anatomy for better understanding of the topics. Didactic lectures do not touch upon clinical correlations in a case-based manner, which can be easily discussed in FCR.

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INTRODUCTION

Anatomy is a difficult subject to understand.¹ However, it is the keystone of all the subjects learnt in medical education, so more

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emphasis needs to be laid for better learning of the subject. Traditional methods are used to teach undergraduate students which include didactic lectures and practical classes.² This teacher-centred approach involves passive one-way delivery of information from teachers to students. Passive learning does not last long and is a way of imposing the information on the student rather than making the subject understood well by the learner.³ Switching to a student-centred approach would help in developing the insight of students with regard to the topic, rather than gathering information in bits and pieces. There is a paradigm shift in the role of a teacher as ‘sage on the stage’ to the ‘guide on the side’.⁴ The flipped classroom (FCR) method has been advantageous by providing opportunities for students to actively participate in their own learning by increased peer interaction, peer learning and deeper engagement with the subject material and development of higher cognitive skills.⁵

The concept of flipped learning was introduced by Eric Mazur in the 1990s. He named it ‘Just in time teaching’. The term ‘FCR’ was popularized by Bergman and Sams in 2012.⁶ The perception of students towards FCR has been studied in various disciplines but this modality is relatively new to undergraduate medical education.^{4–5,7–8} Due to implementation of the competency-based medical education (CBME) curriculum, it is imperative to use different pedagogical models for teaching, using technology to overcome the lacunae of traditional teaching methods.

The FCR has been a well-established teaching–learning method in western countries but the literature is deficient in the Indian context especially medical education, more specifically in teaching clinical anatomy. We planned to bridge the gap by introducing FCR to undergraduate students for teaching clinical anatomy as well as assessing the students’ perception and feasibility of FCR to teach clinical anatomy.

METHODS

Our study was done after taking approval from our Institutional Ethics Committee. We included 151 of 200 MBBS, first professional students who consented to participate in the study.

Prior work-up before implementation of FCR was done in the form of sensitization of faculty and students for this teaching–learning method, selection of pre-reading material, and formulation of validated feedback questionnaire, formulation of an online group of the students for sending the pre-reading material and receiving feedback.

Pre-class activity

- Pre-reading material was given to the students 1 week before the class.
- Assignment was given 2 days before the class.

In-class activity

- Multiple-choice question (MCQ) pre-test based on applied anatomy of the concerned topic was taken.
- The topic was discussed in the form of problem-based questions in the class on the principle of Think–Pair–Share.
- Then the problem was discussed in the class, and the students’ doubts cleared. Supplemental information was provided by the teacher to support the answers.

Post-class activity

- The teacher/facilitator asked the students to summarize the topic in line with the learning objectives. This was followed by the MCQ-based post-test.
- After 15 days of completion of all the topics in the flipped class, a surprise test on taught topics was taken to assess the retention and conceptual knowledge in applied anatomy.
- Feedback was collected on Google forms using a pre-validated questionnaire.

Statistical analysis

Data were analysed using SPSS 21.0 and Microsoft Office 2010. The response to close-ended questions was expressed as percentage. Open-ended questions were analysed by thematic analysis of qualitative responses.

RESULTS

Of the 151 students who participated in the study, 55.6% were men (84). All the students were in the age group of 17–22 years with the majority <19 years old; 90% of the students resided in the hostel. The results of the pre-, in- and post-class activity are shown in Figs 1–3, respectively.

Comments of the students from open-ended questions revealed that FCR increased their attention span with increased interaction among students as well as with teachers. It also increased their understanding of clinical anatomy.

Students also suggested including more videos as pre-reading material, increase the number of flipped classes and start flipped classes from the beginning of the course. They also suggested that the FCR should be done for small groups.

All the students were in the age group of 17–22 years with the majority of 19 years. About 90% of students resided in a hostel while 10% students were day scholars.

Feedback obtained after the flipped classroom session showed the results similar to previous studies.^{9,10}

For pre-class activity

About 91% of students agreed that pre-class material provided was relevant and adequate.

About 83% of students agreed that they have paused the streaming of videos in between for better understanding of the

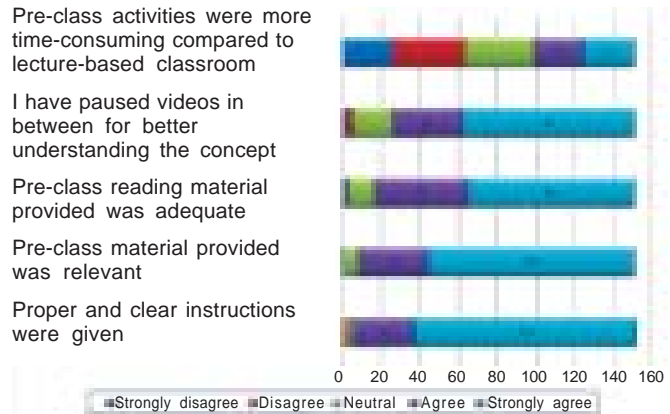


FIG 1. Responses of students for pre-class activity

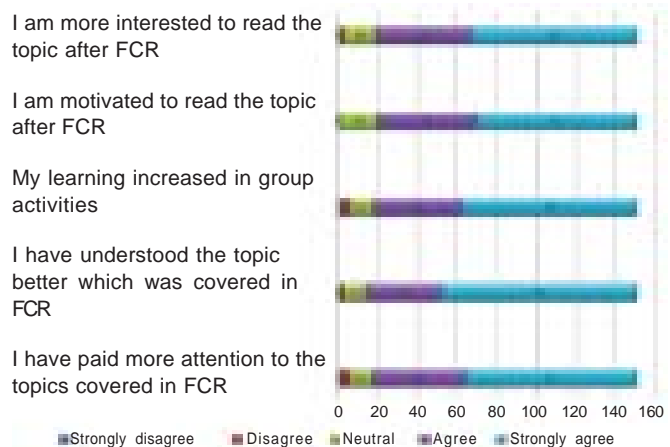


FIG 2. Responses of students for in-class activity

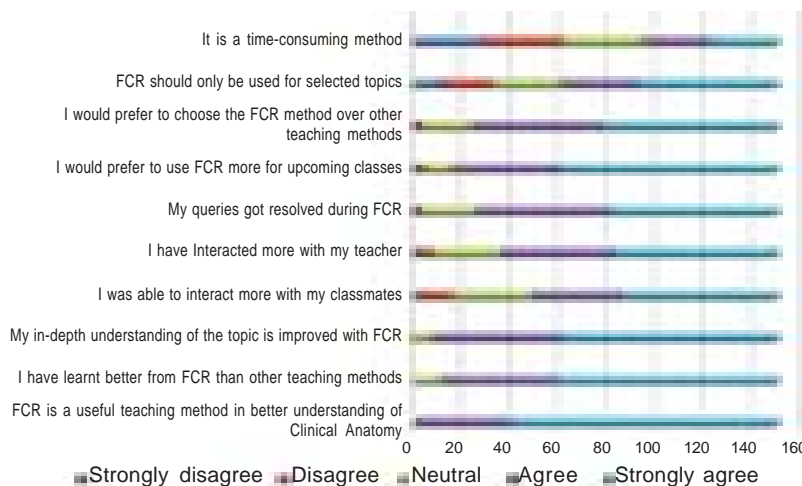


FIG 3. Perception regarding flipped classroom (FCR) effectiveness and acceptability

concept while 13.2% were neutral. The results are supported by Morton and Colbert-Getz who have stated that student evaluations of the pre-class anatomy videos were rated high.¹¹

Mixed response was obtained for the time consumption of FCR compared to didactic lectures. The flipped classroom as a pedagogical tool has been studied and evaluated in various disciplines at the international platform and the results are supported by Jovanovic *et al.*¹²

For in-class activity

The Think–Pair–Share technique was used for teaching the selected topics of clinical anatomy by using relevant MCQs. About 88% of students were of the opinion that they have paid more attention to the topics covered in FCR. More than 90% of students understood the topic better which was covered in FCR and felt motivated and interested to read the topic after FCR. These results are supported by Veeramani *et al.*⁹ and Singh *et al.*¹³

Regarding perception of FCR

More than 95% of students opined that FCR is a useful technique of teaching for better understanding of clinical anatomy and they have learnt better from FCR than other teaching methods. Similar results have been reported by various researchers.^{8,10,14,15}

It is observed that in-depth understanding of the topic is improved with FCR, along with an increased interaction among students and between student and teacher. Preference of students to use FCR over other teaching methods is supported by previous studies.¹⁸

It has been reported that the average attention span of students in a lecture is 15–20 minutes and the optimum length of a lecture should be 35–45 minutes rather than 60 minutes.^{17,18} Even the duller and dry teaching material can be presented in an interesting fashion with the help of using flipped classroom as it is the job of the teacher to provide knowledge-rich content along with a satisfying lecture experience for the students.¹⁹

Comments of the students in response to the open-ended questions revealed that FCR increased the attention span with increased interaction among students and teachers as well as increased the understanding of clinical anatomy.

Students also suggested incorporating more videos as pre-reading material, to increase the number of flipped classes, to begin flipped classes from the beginning of the course and to do it in small groups.

DISCUSSION

According to Bloom's Revised Taxonomy, classroom time is used in traditional lectures, which involve knowledge and comprehension of facts. While FCR provides an insight into students' needs and involves application, analysis, evaluation and actual long-term learning of the subject. It follows the principle of learning by doing.^{9,16}

We found FCR to be a feasible, interesting and necessary pedagogical tool to be introduced for medical education because it (i) helps students to learn at their own pace; (ii) utilizes technology for meaningful learning of the subject; (iii) motivates students for self-learning; and (iv) equips students with in-depth knowledge of the topic covered and helped in conceptual learning.

Limitations of FCR

We all are used to and acquainted with didactic lectures. Hence,

for implementation of the FCR, both the students as well as teachers need a lot of preparation. Increase in the workload as well as the time-constraint are the biggest limitations.

Students (i) need to be oriented towards self-learning; (ii) must come prepared for the class by going through the pre-reading material; (iii) must have internet availability and smartphones; and (iv) need to prepare the assignments.

Teachers (i) need to select relevant pre-reading material; (ii) prepare lecture material in the form of MCQs; and (iii) provide for logistics for the assignments such as flowcharts, diagrams, etc.

Conclusion

FCR has been an established teaching–learning tool but it needs to be implemented in undergraduate teaching of clinical anatomy for better understanding of the topics. Didactic lectures do not touch clinical correlations in a case-based manner, but can be easily discussed in FCR.

The road ahead

We propose to implement these findings in the upcoming batches for improvement in their conceptual learning and shifting from a teacher-centred to a student-centred approach. We will involve more faculty members and aim to introduce FCR students in all the professionals.

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