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Introduction & Evaluation of Flipped Classroom- a Teaching Learning Method in Anatomy among MBBS Students in Phase-I on Brachial plexus

Pratishtha Potdar[1], Uday Kumar Gupta[2], Benazeer Zohra[3], Mithila Dayanithi,[4] Dinesh Kumar[5]
[1]Professor & Head, [2]Associate Professor, [3]Ph.D Scholar, [4,5]Professor
[1,3,5]Department of Anatomy, [2]Department of Biochemistry, [4]Department of Community medicine &
[5]Head of Department of Medical Education
[1,4]Noida International Institute of Medical Sciences, Noida International University, Greater Noida, U.P
[2]Rama Medical College Hospital & Research Center, Hapur, U.P
[3]School of Medical Sciences & Research, Sharda University, Greater Noida, U.P
[5]Maulana Azad Medical College, New Delhi

***Corresponding Author:**
Dr Pratishtha Potdar
Professor & Head, Department of Anatomy, NIIMS,
Noida International University, Greater Noida

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Abstract

Background - A flipped classroom concept involves inverting the classroom teaching activities. Flipped classroom is a form of blended learning in which students learn core content online by watching Video, lectures Ppt at his own will .

Objective -The aim of the current study was to evaluate the effectiveness of the flipped classroom for teaching anatomy of Brachial plexus & it's applied anatomy .

Methodology -The flipped classroom teaching model was implemented for MBBS PHASE I at Noida International Institute of Medical Sciences, Greater Noida aimed to enhance knowledge, critical thinking & its clinical application. Utilizing one group for traditional teaching & other group with flipped class then posttest MCQs were designed.

Result –Flipped classroom shows significant improvement with knowledge test score rising from 46% to 92% with more faculty satisfaction. Additionally 90 % of students preferred the flipped classroom over the traditional lecture in which highlighting its effectiveness in promoting deeper learning & critical thinking & improvement in learning. Mean score showed that after flipped classroom, 92% of students liked flipped class & showed improvement in knowledge & understanding. 58% students showed improvement in critical thinking with increased in their performance.

Conclusion – Flipped classroom makes a positive impact in active learning during medical undergraduates training of anatomy concept

Keywords: Anatomy, Blended learning, Brachial plexus, Flipped classroom, Student ,Teaching

Introduction

The classroom is flipped so that "students gain first exposure to new material outside of class, usually via reading or watching lectures videos, and then use class time to do the harder work of assimilating that knowledge, through problem-solving, discussion, or debates in the presence of instructor or facilitator"1 . The model was popularized by Eric Mazur claiming that the learning gains are nearly tripled with this approach that focuses on the student and interactive learning2. The idea of Flipped classroom is very

important to shift from passive learning to accelerated learning to foster skills at cognitively demanding levels such as analysis, synthesis and evaluation3. It has positive effect on active learning and on providing more opportunities for students to engage in critical thinking. It helps them to independently facilitate their own learning and effectively interact and learn from their peers and teachers. One of the well-studied benefits of the flipped classroom approach is increased learner satisfaction with the ability to access pre-class assignments and learn at their own pace as well as enjoy the greater focus on discussions and hands-on activities during class when compared to the traditional lecture formats4. As per previous studied on Flipped Classroom, it is expected that on implementing this Teaching Learning Method, students showed actively engagement and improvement in their Formative Assessments5. Anatomy is a difficult subject to understand. However; it is the keystone of all the subjects learnt in medical education, so more emphasis needs to be laid for better learning of the subject6. There is a paradigm shift in the role of a teacher as 'sage on the stage' to the 'guide on the side'7.The Flipped Class Room 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 Flipped Class Room to undergraduate students for teaching clinical anatomy as well as assessing the students' perception and feasibility to teach clinical anatomy. The purpose of this study was to evaluate and compare the effectiveness of Flipped class study enhancing Teaching learning in anatomy as Students were not involved in actively participation & critical thinking skill & Faculty was also unable to interact, motivate & engage students. Thus, this study was done with the idea that Flipped classroom will increase student's participation, motivation & satisfaction so that they have better understanding of the topic and it will improve teaching learning method both in students & faculty.

Aims & Objectives

This study was done to Evaluate Effectiveness of implementing flipped classroom in teaching & Learning Anatomy in MBBS Phase I with the following parameters -

1. To develop the flipped classroom as a teaching module in anatomy.
2. To assess the effectiveness of implementing a flipped classroom approach in improving student learning outcomes.
3. To compare Flipped classroom with traditional teaching learning in first year MBBS Phase I undergraduates

Methodology

Study Design: Experimental (Interventional) study with a cross over design.

Study subject: MBBS Phase 1 students' Batch 2024-2025.

Study place: Noida International Institute of Medical Sciences, Greater Noida.
Sample size : 150 students

Duration: 5 months (Oct 2024 to Feb 2025)

Inclusion criteria –All the 150 students with access to the internet, who can view the videos & teaching material before class, were included.

Exclusion criteria – Any students who remain absent in either of the class & who are unable to assess internet during flipped activity were excluded from the study.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee (IEC).Participants confidentiality were maintained. Informed consent was taken from all students participating before the start of the study.

The study was started on 150 MBBS students of phase I batch 24-25 from Oct 24 to Feb 25 in the Anatomy department of NIIMS, Greater Noida (U.P). Total 150 students in the study were divided into two groups Group A (Roll numbers: 1–75) and Group B (Roll numbers: 76–150). All the students and departmental faculties were sensitized & explained about this new Teaching Learning Method of flipped classroom.

A traditional teaching learning method on brachial plexus for 1hour was taken on Group A. Group B was given study material like Handouts, animated videos, Power Point 2 days prior to session & then they have interactive session on Brachial plexuses for 1 hour session.

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Similarly, Group A was provided with study material on the topic applied anatomy of Brachial plexus 2 days prior to the planned intervention. The Study material like Handouts, animated videos, Power Point was shared with Group A. Following this, Group A was taken an interactive 1 hour session on applied anatomy of brachial plexus. At the same time Group B was taught through Traditional Teaching Method on the topic applied anatomy of Brachial plexus.

Module development-

1.Faculties were sensitized for the development of E - Learning module.

Following steps involved were:

a. Selection of Competency and define SLO

b. Finalize Resource material (technology & infrastructure)

c. Teaching learning methods and Activities for the sessions.

2. Development of E Module- online content which may include brief Content, video, pictures, presentation, and practice MCQs and an offline contact session.

3. The curriculum for both the traditional and interventional teaching method was remain same.

4. The module was validated by the 3 subject experts and 2 Students who have passed MBBS. Phase 1

5. Questionnaires for the immediate assessment of knowledge and perception were prepared and then validated by the subject experts.

6. Faculties were sensitized about the implementation of E-learning module and the assessment tools using feedback Google forms by both students & faculty.

Posttest include students feedback questionnaire was generated via Google form that was given immediately after the lecture to compare the effectiveness of study after the intervention.

Evaluation Of Learning

Assessment of the concept learnt was done by multiple choice questions, immediately after conventional class learning & similarly after flipped classroom learning by 20 MCQs on Brachial Plexus. Apart from memory based questions, MCQ tested logical & inferential thinking & score of 50% was considered to be passing. Feedback form were assessed immediate response regarding the flipped classroom concept. A Pre-validated feedback on a five-point Likert scale was taken from Students for evaluation of the Teaching Learning Method. Total 21 questions were asked in feedback Google forms questionnaires. Data were analyzed using appropriate software by applying appropriate statistical methods. Improvement in knowledge scores in all domains mainly cognitive domain was evaluated by questionnaire's feedback forms & its effect on students' integration in both the groups were analyzed. Marks obtained in the posttest assessments were expressed as mean and SD and comparison was calculated by appropriate t-test & Statistical significance was set at $p < 0.05$.Score of 50% were considered as pass & the number of students in pass and fail category were compared & analyzed.

Result

This study assessed various factors including engagement levels, confidence, knowledge retention, and ability to understand anatomical knowledge with more interaction & participation. Data were collected through structured questionnaires filled by participants in both groups and statistical analyses were conducted to identify significant differences between the two teaching methodologies. This data reveals that approximately all the students score increased in the post-test. Majority of students agreed that flipped classroom motivated them to learn, enhanced the thinking & deep understanding & thus facilitated their performance & encouraged learning.

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FLOW CHART

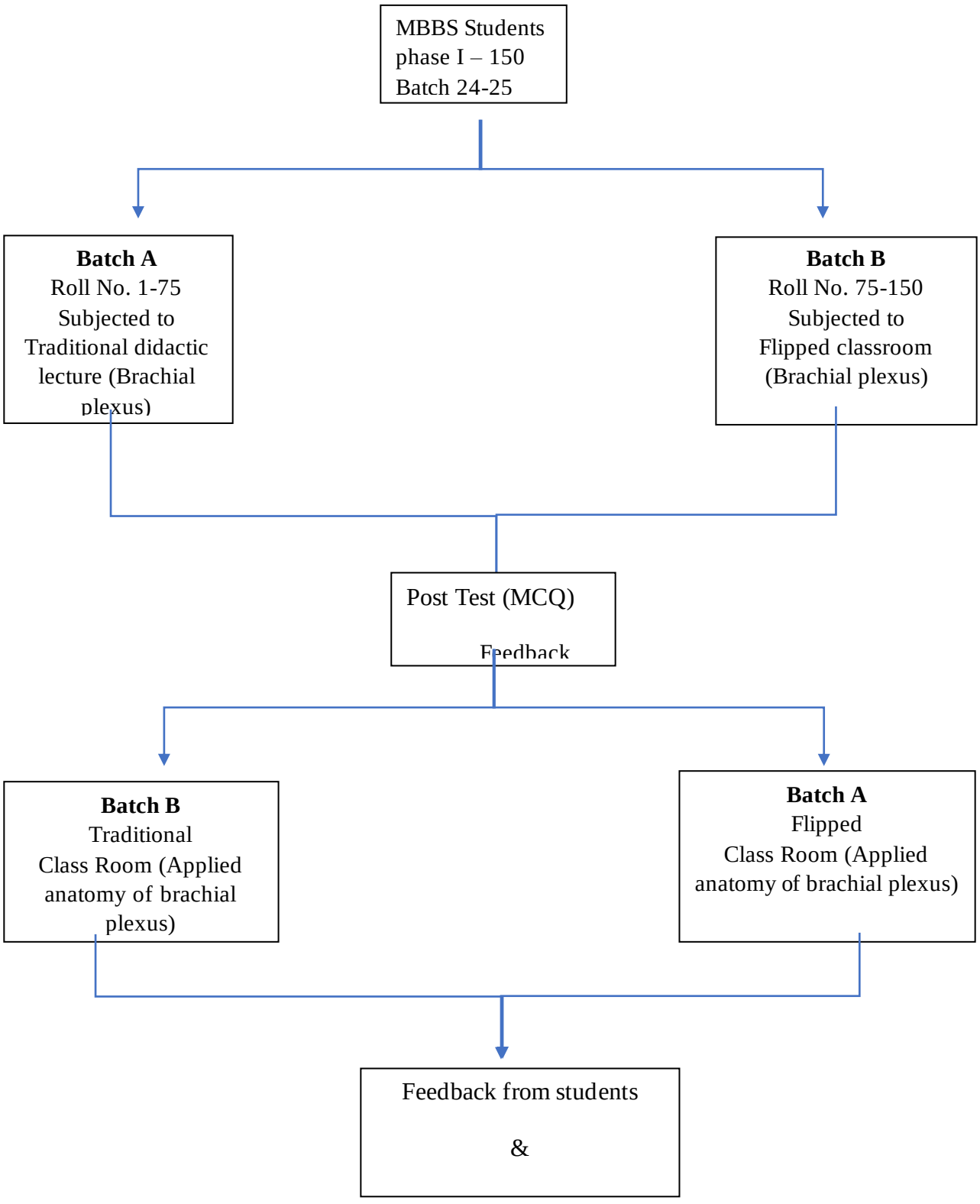

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Fig 1 -This Bar graph shows the Students feedback on Likert scale showing strongly disagree ,disagree ,neutral ,agree, strongly agree .

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Table 1 Stratification of students according to marks scored in MCQS Test on Brachial Plexus (MARKS 20)

Marks	Group-I		Group-II	
	Frequency	Percent	Frequency	Percent
0-10	12	8%	81	54%
11-20	138	92%	69	46%
Total	150	100	150	100

This table represent the performance of students in the MCQs test showing frequency of flipped class were 138 students who score marks more than 10 after flipped class & only 69 students score more than 10 in traditional method .

Fig-2. Showing the frequency of students passed in Flipped class & Traditional class

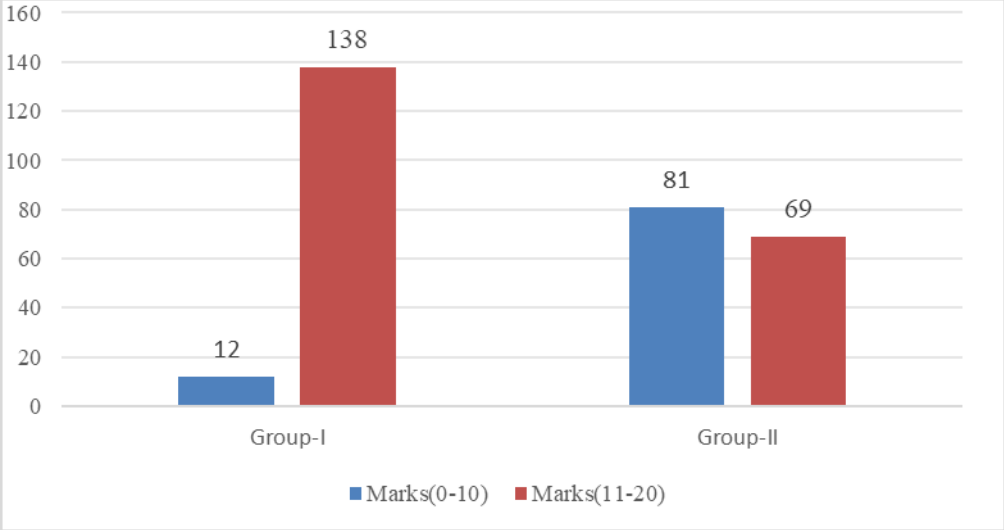

Table 2 Showing the mean & standard deviation after scoring marks of MCQs on brachial plexus

FLIPPED CLASS (Group I) & TRADITIONAL CLASS (Group II)					
Group	N	Mean	SD	t value	p value
I	150	14.37	2.57	10.22	0.001*
II	150	11.31	2.61		
T-test significant*showing p value 0.001					

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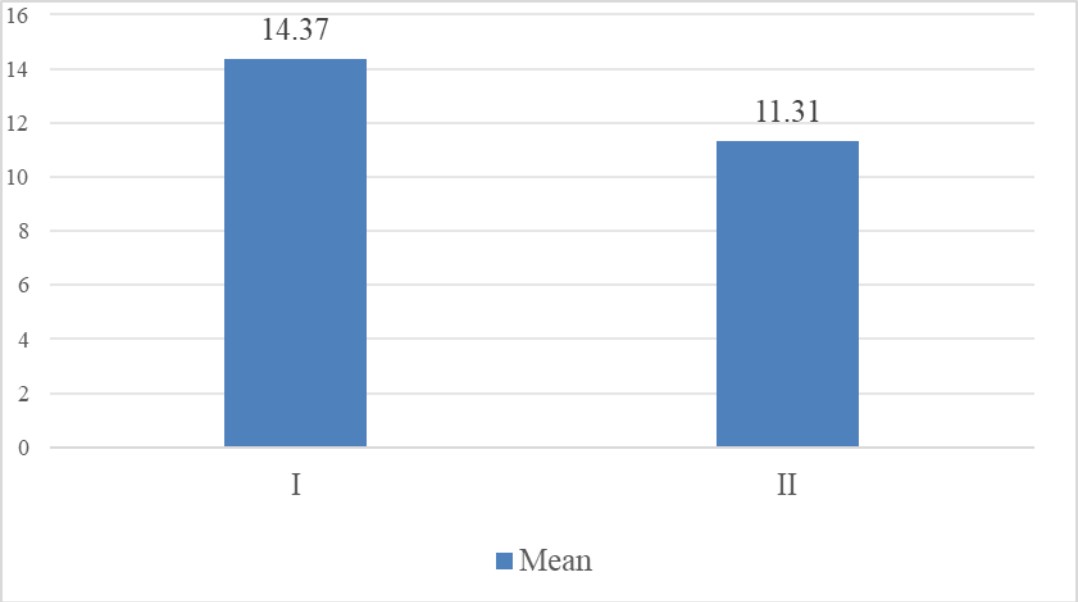
Fig 3. This Bar diagram showing the mean score marks in Flipped & Traditional class



Mean scores after regular and flipped classes were 14.37 (SD ± 2.57) and 11.31 (SD ± 2.61) respectively. 92% students passed after flipped classroom teaching and 46%students passed after regular class. The number of students passing after flipped class as compared to regular class is statistically significant.

Table 3 –Showing tabulation of number of students passing after assignment in both groups

Test Marks	Groups							
	I (Flipped Classroom)				II(Traditional classroom)			
	A(1-75)		B(76-150)		A(1-75)		B(76-150)	
	N	%	N	%	N	%	N	%
0-10	0	0.00%	12	100.00%	34	42.00%	47	58.00%
11-20'	76	55.10%	62	44.90%	42	50.90%	27	39.10%

After flipped class 76 students passed in group A & 62 students in group B while in traditional class 42 students in group A & 27 students in group B showing improvement in performance after Flipped classroom Study

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Fig 4-Showing bar graph of frequency of students improved in flipped classroom

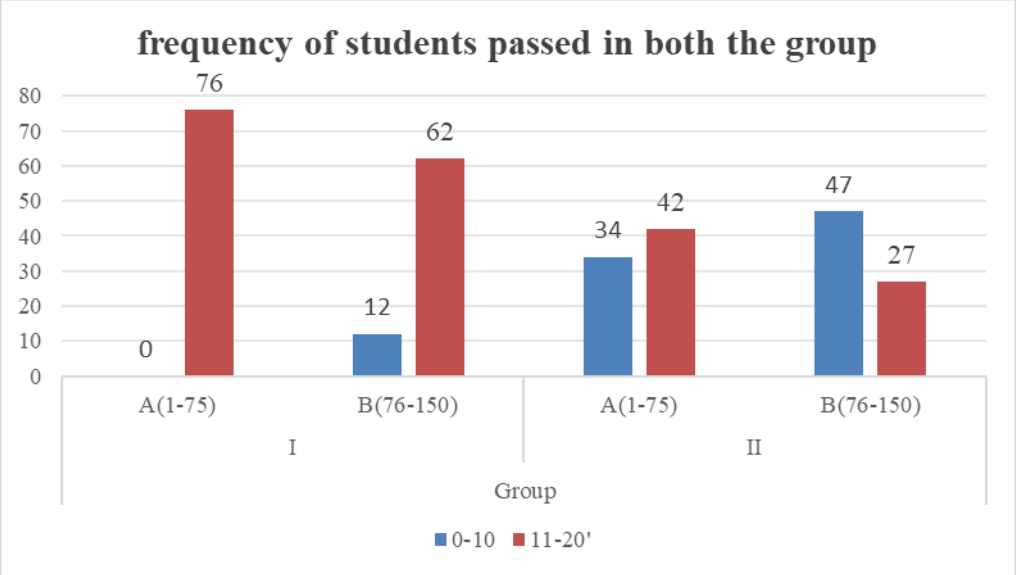
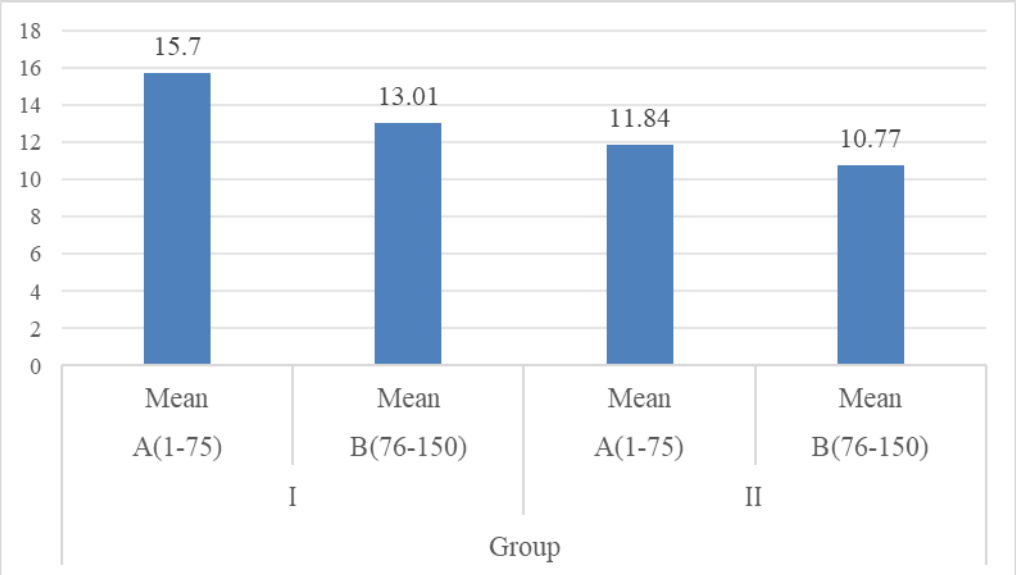


Table 4 –Showing the mean & standard deviation in both the groups

Groups							
Flipped Class Group I				Traditional Class Group II			
A(1-75)		B(76-150)		A(1-75)		B(76-150)	
Mean	SD	Mean	SD	Mean	SD	Mean	SD
15.7	1.83	13.01	2.53	11.84	2.53	10.77	2.6
Significant *							

Fig 5-Showing the mean students passed after posttest in both flipped & traditional class



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Discussion

The flipped classroom is a new term in teaching learning method, it is clear that it will carve out its own unique place in near future. The concept of Flipped instruction encourages interaction among students and between students and their Instructors[8]. This Flipped class approach leads to better learning outcomes. It helps students to effectively learn to acquire skill and knowledge, and also foster a positive attitude towards learning[9,10]. From a qualitative point of view, 92% of students responded that they liked this approach to learning and 51% felt that this approach helped them to understand learned material better. The study results indicated that 92% students showed improvement in their Knowledge, 58% showed improvement in Critical thinking & application & 70% of students were satisfied & showed increased interest with the flipped classroom. The present study also found that 52% of students more interesting in flipped classrooms and noted increased interaction between faculty and student More than 65% students showed that Flipped classroom increased student engagement& improved student performance, 51% agreed that flipped classroom more helpful for preparing exam,57% of the students felt that flipped classroom are more motivated them for studies , 58% agreed that it improved their understanding & gave them more opportunity to ask questions. These findings are supported by Veeramani *et al.*[11] and Singh *et al* [12]. The feedback is aligned with the Viveka et al [13] reported that the faculty also observed that students were more engaged because they had some prior knowledge to facilitate discussion regarding the topic. Finally, developing a flipped instruction is a collaborative process[14]. Over all, the data shows that the flipped classroom approach is more effective in promoting students success & better academic performance in under graduate's students of Phase I MBBS in subject of Anatomy. Similar results were reported by Morton and Colbert-Getz who had noted that student's rating of the pre-class anatomy videos were high.[15] There was a mixed feedback response regarding the time consumption of Flipped Class compared to traditional lectures. The flipped classroom as a pedagogical teaching tool has been studied and evaluated in various fields internationally ,with the results are supported by Jovanovich *et al.*[16] Even the dull and dry teaching content can be presented in an interesting way with the help of using flipped classroom as it is the teachers role to provide knowledge-rich ,informative content and create enjoyable lecture experience for the students.[17,18.]

Limitation Of Study

Two classes were conducted using flipped classroom approach. Student responses and their learning processes might not be accurately evaluated properly due to limited exposure to material. Therefore, to effectively implement the Flipped Classroom model, both the students as well as teachers require substantial preparation. The main challenges faced are increased in the workload as well as the time-constraint both are the biggest limitations.

Conclusion

Flipped classroom makes a positive impact in active learning during medical undergraduate training of anatomy concepts as Didactic lectures do not touch clinical correlations in a case-based manner, but can be easily discussed in FCR[11].Flipped classroom has resulted in marginal yet statistically significant increase in number of students passing in this study proving its effectiveness in learning anatomy. Majority of students agreed that flipped classroom helped them in understanding the topic better ,clearing the doubt & increased their interest& interaction during lecture .All faculty of Anatomy department are agreed that flipped classroom should be integral part of teaching Anatomy .Studies pursued for longer duration with broader subject coverage are suggested. We propose to implement these findings in the upcoming batches for improvement in their conceptual learning and shifting from a teacher-centered to a student-centered approach. The success of this shall be implemented in all Phases after approval from the Curriculum Committee of this college. According to the various research findings, holing training courses for professors and students regarding the flipped classroom, its importance and impact on learning and education, and the means of its implementation is recommended.

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