SECOND YEAR MBBS STUDENTS' VIEWS ABOUT FLIPPED CLASS ROOM PRACTICE IN NEUROANATOMY COURSE

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ABSTRACT

Objective: To assess students' insights about flipped classroom approach for neuroanatomy course and evaluate the effect on their performance in the end unit test.

Methodology: This study was conducted at the Department of Anatomy, Liaquat University of Medical & Health Sciences for the academic session 2014. Neuroanatomy was chosen to evaluate the flipped classroom model for second year medical students. Three hundred and forty fourth semester medical students attended course. Students were divided into six groups and course contents were delivered into traditional lectures followed by flipping the small group classes. In lectures teacher delivered the topics with the help of multimedia and in flipped class students were encouraged to participate actively. They were provided case scenarios and teaching material before scheduled class. Students' perceptions were assessed by asking them to fill questionnaires. The post unit test was conducted to evaluate the effectiveness of this method.

Results: Ninety-six percent of students believed that the flipped classroom approach was better in targeting learning objectives than the conventional teaching, 95% thought that the work-sheet with questions provided before class enabled a better understanding of the subject and 85% were of the opinion that the flip class approach was useful to understand the anatomical basis of neurological problems. The unpaired t test showed highly significant differences between the post unit test scores of this batch in comparison to previous batch who were only taught neuroanatomy with traditional teaching modes.

Conclusion: Student response to the flipped classroom structure was very positive, signifying the importance of this approach as attractive method to pursue in future years for medical studies.

Key Words: Flipped class room, Student perception, Neuroanatomy

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INTRODUCTION

The considerable portion of available teaching time in medical course is engaged in educational teaching sessions which include lecture delivered by subject expert to varying size of group of students[1]. The teaching aids used in such sessions may include traditional chalk and board, multimedia, and audiovisual aids. In such type of learning the student's participation is minimal and is reduced to listening, making notes with minimum opportunity to directly interact with teacher. As a result the facilitator is clearly incapable to convene demands of every student during sessions[1].

To overcome these problems and to better utilization of available teaching time in favour of student learning and active involvement, the concept of "flipped classroom" or "inverted class room" approach was introduced[1]. The traditional teaching time and self study time are reversed in this model. However this model of learning could be implemented in various ways and usually involves student's active involvement by attending the class well prepared through notes or other teaching related material provided before the class time. The class time is utilized for interactive sessions and solving the problems, which led the teacher to become facilitator or guide by the side[2]. Studies suggest the beneficial aspects of this type of approach by demonstrating the awareness in students regarding their own learning process which enable them to adjust their activities and focus on targets for better performance in the course[3].

This flipped class model has been implemented by several world renowned teaching institutions and leading universities and student performance and views regarding this model have been published in several student cohorts[4]. During their medical course, in initial years of their studies, undergraduate medical students have very little amount of knowledge of the subjects taught; this could be considered as major obstacle for using flipped classroom approach. There have been no studies conducted on this cohort of students which demonstrate the response of students to this model of teaching in Pakistan. This study was conducted to evaluate the second year MBBS student's views about traditional lectures followed by interactive sessions in neuroanatomy teaching sessions using flipped classroom approach.

METHODOLOGY

The module chosen to assess the flipped classroom model for second year MBBS students was neuroanatomy in the Department of Anatomy at Liaquat University of Medical & Health Sciences Jamshoro, Pakistan. A total of three hundred and forty second year medical students comprising of 189 girls and 151 boys participated in the study. Students were divided in to six groups (with 56 students per group) according to the number of teaching faculty and teaching aids available. The teaching of neuroanatomy unit consisted of two parts, the first, offloading content in traditional lectures and the second, creating a learner centered classroom. For the first part, subject topics were first taught in traditional lecture followed by series of small group classes. Traditional lecture series include one way teaching with use of multimedia and written slides in lecture hall with capacity of 350 students. In small group or demonstration classes or learner centered classes, of two hours per day for five days a week. In these sessions, the classes were flipped in such a way that students were allocated time to discuss the topic taught in the lecture series and also given the time to discuss the already provided case scenarios related to Neurological disorders with different anatomical complexities. Students were encouraged to generate different possible questions from the case scenario. Group teacher in these sessions stood by the side and played the role of facilitator not a traditional teacher and helped the students where required. Anatomical teaching aids for example models, diagrams, charts and prosections were provided to the students in each group.

The session in small group teaching started with clearly defined learning objectives and students were provided with all teaching material pertained to relative topic. Subsequently, students were divided in to two subgroups and each case scenario was projected and a member of each group randomly chosen by the facilitator to read out the case and students were given time to discuss the case and identify the anatomical basis of problem. Efforts were made to facilitate participation of every student. At the end of neuroanatomy session, a unit test was performed and results were compared to previous batch with only traditional teaching style.

The experience of the students about this model of teaching and learning was assessed by a questionnaire. Secrecy of responders was maintained. The first questionnaire comprised of close ended and open ended questions with yes and no choices. Also teaching was assessed by rating staring from below average to excellent. Open ended questions were asked for further suggestions and improvements in teaching methodology. The number of students, responded, was recorded. The mean was calculated for each item. The unit test was conducted to evaluate the students' performance. Test comprised of single best questions and short essay questions and was conducted ten days after the end of session.

The questionnaires were analyzed by descriptive statistics for students' satisfaction feedback about traditional lecture and flipped classes. Beside this, scores obtained by the present batch of students on the summative exam (after the flipped classroom session) was compared with scores obtained by the previous batch that only had traditional didactic teaching. The previous batch of students had the same course content but the instructors are different set of experts in traditional teaching. For comparing the test results of both batches students unpaired t test was applied using statistical software Prism 5™. The $p<0.05$ was considered statistically significant for all cases.

RESULTS

Total 340 students responded to the questionnaires. The mean age of the students were 20 years and majority were females n=189 (55%). The responses to each statement are summarized in table 1. It is evident that 323 students agreed that class objectives were clearly defined (95%) and same is true for other questions such as start and finish time (n=324, 95%), adequate use of teaching aids (n= 320, 94%) and scope of the subject (n=312, 92%). However half percentage of students replied that no clinical scenarios were discussed in the lecture (n=180).

In addition 20 percent students (n=81) agreed this mode of teaching for whole class at one time. Only 29% students (n=97) replied yes to the question regarding discussion of single best questions etc in the lecture. Out of 340 students only 17 (5%) enjoyed this mode of teaching/learning style for neuroanatomy course.

As shown in table 2, for small group classes where the flipped method was applied, 96% students (n=325)

agreed that the objectives were clearly defined. Similarly 95 percent (n= 324) replied yes to the question about supplementation of worksheets and related material before the class.

Majority of the students compared this mode more engaging, active learning and student centered than traditional lecture. 95% students (n=324) were able to understand anatomical basis of neurological disorders. Most of the students also replied positive about discussion on case scenarios, teacher assistance and teaching aids. About ninety seven percent of the students (n=330) felt that this flipped classroom approach was more enjoyable fulfilling the stated learning objectives than the conventional didactic teaching, 95% (n=324) felt that this mode of teaching enabled them to work in a team and target of better understanding of the subject was achieved. Ninety-six (n=326) percent of students gave opinion that more such flipped classroom sessions should be organized in the future. Overall answers of the students suggest that they appreciated flipped classroom approach. As far as student satisfaction is concerned, more than eighty percent students were satisfied with number of lectures (n=278) and small group classes (n=284) throughout the course, contents of the topic discussed in the classes, better understanding of the subject and help in examination. Seventy one and seventy six percent pupils (n=243 and 260 respectively) were happy with speed of lectures delivered and time allotted for different topics respectively as shown in table 3.

The mean±SEM of tests conducted this batch and previous batch with only traditional teaching approach were 52.02±1.280 and 44.44±0.9086, respectively. The unpaired t test showed that there was a significant difference ($P < 0.05$) between the neuroanatomy examination scores of present batch after the flipped classroom session than those of the previous batch that had only traditional teaching as shown in graph 1 and table 4.

DISCUSSION

The concept of flipping the class is not very old and the term flipped classroom was assigned by two high school chemistry teachers in Colorado, USA in 2012 after they started this learning model in 2007 in their chemistry classes. Since then this concept had spread to various other branches of learning and education around the globe. The perception of students for this system of learning has been evaluated for several subjects but the literature about students' views in human anatomy particularly neuroanatomy is very scarce.[5]

The feedback obtained after traditional lecture showed that the students considered this mode of teaching less enjoyable, less interactive and less useful for understanding the learning objects and course as whole. The results of questionnaire regarding flipped class mode reflect data from other studies[5]. The key answers of the students are that it helped them to understand better, they were actively engaged throughout the session and therefore understood the subject well and the availability of plenty time and chances to discuss and clarify their queries with the facilitator. This might be due to the fact that they were fully aware about the topic before start of the class as they were given teaching material and scenarios prior to enter the class. Students agreed that proper teaching aids and assistance was provided which was useful or them.

The essential element for the success of this type of flipping method is independent responsibility the students take for their learning. However this system has

Table 1: The questionnaire distributed to the students with their responses to the traditional lecture. Values are presented as number of responses to each statement (%). Responses are presented as yes or no

Sample No.	Content and structure	Response		Total
		Yes	No	
1	Class objectives were clearly defined	323(95%)	17(5%)	340
2	Lecture started and finished in time	324(95%)	16(5%)	340
3	Teaching aids such as multimedia was used	320(94%)	20(6%)	340
4	Lecture material followed the prescribed text book	323(95%)	17(5%)	340
5	Topics discussed were within scope of the course.	312(92%)	28(8%)	340
6	Clinical points were discussed adequately	180(53%)	160(47%)	340
7	Appropriate to conduct lectures for whole class	81(24%)	259(76%)	340
8	Single best questions/ OSPE questions about various topics were discussed	97(29%)	243(71%)	340
9	Enjoyable way of learning	17(5%)	323(95%)	340

Table 2: The questionnaire circulated to the students with their responses to the flipped classroom approach. Values are presented as number of responses to each statement (%). Responses are presented as yes or no

Sample No.	Content and structure	Response		Total
		Yes	No	
1	Class objectives were clearly defined	325(96%)	15(4%)	340
2	The worksheet given prior to the session was very useful to understand the topic	324(95%)	16(5%)	340
3	This method was more engaging and interesting in comparison to traditional class	326(96%)	14(4%)	340
4	Models and diagrams were shown on regular basis	323(95%)	17(5%)	340
5	Proper time and teacher assistance was provided for models and diagrams	320(94%)	20(6%)	340
6	Case scenarios were provided before class	330(97%)	10(3%)	340
7	This module provided sufficient knowledge of anatomical basis of neurosurgical disease localization and approaches	324(95%)	16(5%)	340
8	This method made me participate actively with the subject	328(96%)	12(4%)	340
9	Enjoyable way of learning	330(97%)	10(3%)	340
10	The team based activity enabled me to go through the topic before entering to the class	323(95%)	17(5%)	340
11	These sessions should be organized in future	325(96%)	15(4)	340

Table 3: The questionnaire circulated to the students with their satisfaction to the Neuroanatomy Unit teaching. Values are presented as number of responses to each statement (%). Responses are presented as yes or no

Sample No.	Content and structure	Response		Total
		Yes	No	
1	Satisfied with the number of lectures and demonstrations during the course period	273(80%)	67(20%)	340
2	Satisfied about the contents of topics discussed in lectures and demonstrations	276(81%)	64(19%)	340
3	Satisfied with the speed of lectures/demonstrations delivered	243(71%)	97(29%)	340
4	Satisfied with the time allotted to different topics	260(76%)	80(24%)	340
5	Satisfied with the teaching method will help in better understanding of subject	278(81%)	62(19%)	340
6	Satisfied that this is going to help students in examinations	284(84%)	56(16%)	340

both advantages and disadvantages. Advantages of this approach include an increase in opportunities for interaction between students and teachers, a shift in the responsibility for learning onto the students, the freedom to prepare for the class at a time that suits them, the opportunity to revise the material and as many times as required. Furthermore, this mode of teaching enables students to work in team which develops their team spirit and leadership qualities.

As with every method of teaching this flipped approach as possible disadvantages as well as this approach require more time and resources, for both

Figure 1: Mean difference of scores of both batches in unit test where p value is highly significant.

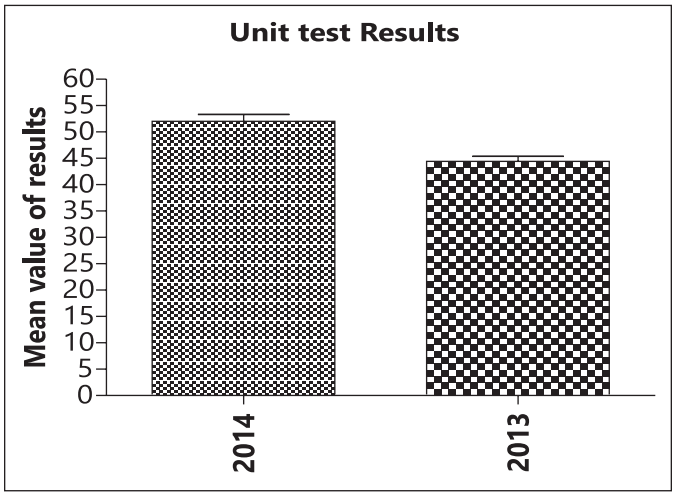

Table 4: Mean difference of scores of both batches in unit test where p value is highly significant

Mean±SEM of Batch 2014-15	52.02±1.280 N=338	Unpaired t test	
Mean±SEM Batch 2013-14	44.44±0.9086 N=291	P value	< 0.0001
Difference between means	7.577±1.617	P value summary	***
95% confidence interval	4.408 to 10.75	Are means significantly different	(P < 0.05) Yes

teachers and students to attain and acclimatize to the new skills required for this more dynamic and self-directed approach to learning.

Previous data on teaching modes show that the maximum length of lecture may be half an hour rather than one hour because the average attention span of student is only 15-20 minutes[6]. Due to this reason one hour lectures may be less useful to the students. Students can get more benefit and learn more information on their own under the guidance of instructor, which assist them in understanding the subject and motivate them. Also help them in solving problems, and encourage their learning[1]. This study also indicates that the students were more satisfied with small group teaching with spilt timings for discussions and question answer sessions.

Research also indicates that student's learning outcomes, thinking level, problem solving ability and critical analysis increased by active learning method of teaching[7]. Similar findings are also observed with current study as students were more able to understand the subject and were more able to detect the anatomical reason of clinical problems. One study on students of nursing evaluated improved learning of students with flipped class but at the same time did not satisfy the needs of individual students[8]. It is agreed that teaching aids like diagrams, videos, models are continue to expand since last couple of years. But it is questionable whether they will effectively fulfill the needs of students in future[9-11].

The major benefit of flipping the traditional class is to equip the students to develop their higher cognitive skills and improve the delivery of medical care[4]. For these reasons, it is necessary to plan flipped class approach to academic sessions.

In designing the flipped class room approach, there are certain limitations as well. In our experience students of second year always confuse about the neuroanatomy course as compared to other sessions of anatomy module and also have very little prior knowledge about the basic concepts of neuroanatomy. Another limitation in our curriculum is time allocated for this difficult module, students have to cover whole course in eight weeks time period. If students get overwhelmed by bulk of study material provided in limited time duration, this model of teaching will do little help.

In order to fully examine the benefits of flip class, a comparison may be made for same module by dividing the students randomly and taught in two separate teaching styles like traditional and flipped approach. It is obvious from this study that until such data becomes

available, a combination of didactic teaching sessions mixed together with flipped sessions may be ideal and good outcomes were observed as indicated by students answer to the flipped classroom structure was mostly positive, and student's performance after this inverted or flipped classroom approach encouraged effective learning and improved their ability to perform better in the test as obvious by the comparative results of unit test with previous batch that were taught neuroanatomy by traditional teaching.

CONCLUSION

The approach of involving both traditional lecture and flip method in small group teaching is worth pursuing for neuroanatomy and other courses of anatomy in future years.

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CONTRIBUTORS

SM conceived the idea, planned the study, and drafted the manuscript. PG and AII helped acquisition of data and did statistical analysis. SB supervised the study and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.