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**ORIGINAL RESEARCH ARTICLE****Incultating Core Competencies in Physiology in a Playful Learning Environment***Neeta Nanaware<sup>1</sup>, Ajay Gavkare<sup>2</sup> and Baban Adgaonkar<sup>3</sup>**Assistant Professor of Physiology, SRTR Government Medical College Ambajogai<sup>1</sup>,**Associate Professor of Physiology, MIMSR Medical College Latur<sup>2</sup>,**Professor and Head of Physiology, MIMSR Medical College Latur, Maharashtra, India<sup>3</sup>*

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**Abstract:****Background:**

Medical Council of India emphasizes the need for self directed active learning among undergraduate students. Traditional lectures alone are poor means of transferring/acquiring information less effective at skill development. Hence it is the need of time to incorporate innovative teaching learning strategies in undergraduate MBBS curriculum so we planned to undertake a study to incorporate flipped classroom model in teaching Human Physiology.

**Methodology:**

One hundred and fifty students of first MBBS were divided two groups of 75 students each (Batch A and B) as per their roll calls. For the present study, students from Batch A (n = 75) were taken as cases and Batch B (n = 75) students were taken as controls. The control group attended traditional classes that involved didactic sessions while study population was exposed to Flipped classroom model. Student's perceptions to Flipped classroom were obtained. Performance of students in flipped classroom is compared with that of the control population.

**Result:**

Students involved in the study group showed better performance and understanding of subject matter.

**Conclusion:**

Flipped classroom model make active student participation incultating key concepts in physiology in a playful learning environment making it an enjoyable, lovable learning experience.

**Key Words:** Flipped class room, active learning, undergraduate education

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**Introduction:**

Medical Council of India in its regulations on Graduate Medical education emphasizes the need to provide enough experiences for self directed learning so as to cultivate logical and scientific habits of thought, clarity of expression and independence of judgment, ability to collect and analyze information and to correlate them.

Traditional lectures alone are generally not adequate as a method of training and are a poor means of transferring/acquiring information and even less effective at skill development and in generating the appropriate attitudes<sup>(1)</sup>. Hence it is the need of time to incorporate innovative teaching learning strategies in undergraduate MBBS curriculum which will encourage students to learn in small groups through peer interactions so as to integrate knowledge, formulate plans, use higher-order thinking skills<sup>(2)</sup>, so that students will be confident enough to work as a team to solve complex cases fulfilling the vision of

Medical Council of India about developing a future medical graduate.

**Rationale:**

At present, students attend lectures without prior preparation of the topic. Lecturer delivers a 'one – size – fits – all' lecture. Grasping of knowledge and development of desirable attitudes is variable among learners. In this type of teaching learning activities there is no interaction, teamwork or leadership. Best thing about it is that learners will know the contents of the topic but will forget all but 20% of it tomorrow<sup>(3-5)</sup>.

Flipped classroom is an innovative instructional strategy that has becoming popular now a days<sup>(6-8)</sup>. It involves a blended learning method such that the activities carried out during traditional didactic lecture session and self directed learning by the students are reversed or flipped i.e. self – directed learning phase (individual phase) precedes the classroom – instruction phase (Figure 1).<sup>(9)</sup>

In 1998, Barbara Walvoord and Virginia Johnson Anderson in the book

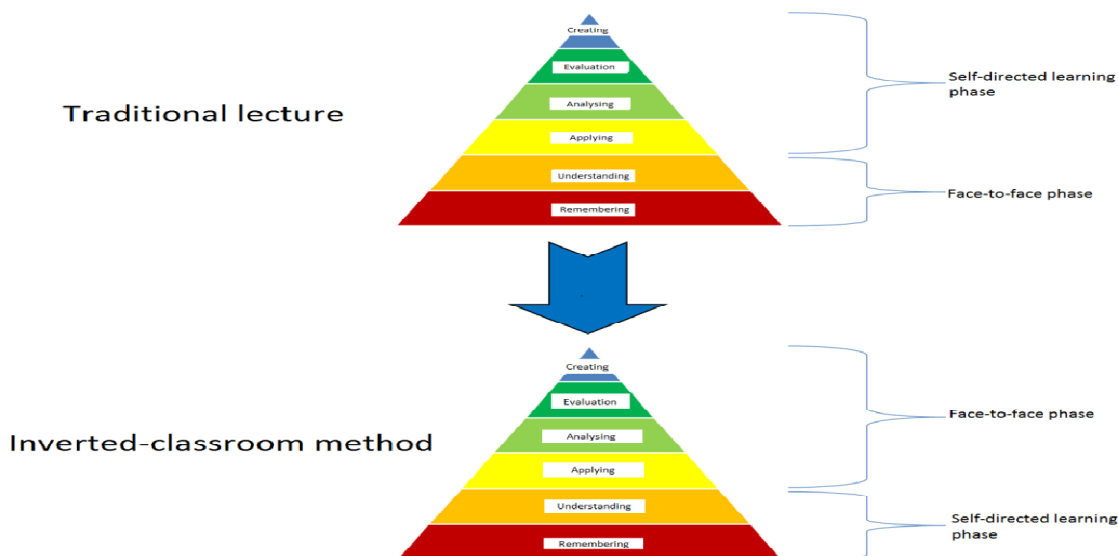
“Effective Grading” introduced an idea of flipped-class room model for the first time to teach fundamentals from history, physics and biology.<sup>(10)</sup>

But in recent years and in the era of Digital India Mission rapid expansion of internet availability has made implementing this instructional modality possible, scalable and customizable in the field of medical education as a means for improved instructional efficiency.

Several renowned educational institutes and universities in the world are implementing this model and students’

performance, perception has been studied. However in Indian scenario there have been no studies that assess the practical applicability of this student centric instructional innovative modality in teaching Physiology to first year medical undergraduate students.

Keeping this view in mind, we planned to undertake a study to incorporate flipped classroom model in teaching Human Physiology to 1<sup>st</sup> year medical undergraduates so as to analyze its effectiveness in overall academic performance of 1<sup>st</sup> year undergraduate students.



**Figure 1: The schematic comparison of traditional lecture and the Flipped / inverted classroom model as per Bloom’s revised taxonomy<sup>(9)</sup>**

**Objectives:**

- 1) To incorporate flipped classroom model in teaching Human Physiology for better learning.
- 2) To assess the impact of flipped classroom on development of cognitive, affective and psychomotor domains.
- 3) To compare teaching learning outcomes using flipped classroom - a student centric activity and traditional didactic lectures – a teacher centric activity.
- 4) To give suggestions about effective implementations of flipped classroom model for better learning in Human Physiology.

**Materials and methods:**

A non – randomized interventional study carried out in the Department of Physiology involving First year MBBS students. After getting Institutional Ethical Committee clearance, informed consent was taken about participation in the study. One hundred and fifty students of first MBBS were divided into two groups of 75 students each (Batch A and B) as per their roll calls. For the present study, students from Batch A (n = 75) were taken as cases and Batch B (n = 75) students

were taken as controls. The cases included 34 male and 41 female students between the age group of 17 – 18 years. Control group had 32 male and 43 female students between the age group of 17 – 18 years. No participant had previously been exposed to flipped classroom teaching.

**Controls:**

The students belonging to control group attended traditional classes that involved didactic sessions. The topics chosen were 1) Transport across cell membrane 2) Action potential 3) Skeletal muscle contraction and 4) Cardiac Output. Learning objectives of each of these topics were defined at the beginning of each class and intellectual content related to each topic was explained in the lecture of one hour duration. At the end of the class summary of the topic and key points were highlighted. Most likely questions on each topic were told to them as a part of homework. Finally Students were given opportunity to ask if they have any difficulty about the topics. After one week these learners were subjected to a summative assessment exam.

**Cases:**

Cases (n = 75) were subjected to flipped classroom model with same above

topics as were taught to controls. Students were divided into three subgroups (with 25 participants in each) two weeks prior to the planned session.

The general lesson plan and learning objectives were stated well in advance. The module consisted of two parts – offloading contents by self directed learning and second, creating a learner centered interactive classroom.

For the first part, involving self study as well as group discussion, study material in the form of relevant lecture notes was provided to each participant in each subgroup. All the students were instructed to go through the given study material outside the classroom. Students working in isolation or in small groups come prepared with the topic.

In the second part of this flipped classroom model, a learner centered classroom was planned over two hours. At the beginning of each session, an objective type written pre – test was administered pertaining to the topic of discussion. A case scenario related to each of the topic prepared by students in first part of the flipped classroom was projected to each group as case handouts. An example of one such case scenario is as follows:

A 43 – year – old man presents to the physician’s clinic with complaints of epigastric pain. After a thorough workup, the patient is diagnosed with peptic ulcer disease. He is started on a medication that inhibits “proton pump” of the stomach.

Questions:

- What is the “proton pump” that is referred to above?
- What type of cell membrane transport would this medication be blocking?
- What are four other types of transport across a cell membrane?

Now the learners having basic background knowledge of the topic prior to actual class sessions working in groups discussed among themselves about the given case scenario. Here in the class they spent their time on higher order thinking skills like problem solving, worked in collaboration, constructing knowledge with the help of their teachers and peers as teacher’s interaction was more often personalized and less didactic.

A member of the group was randomly chosen by the facilitator to explain the answer to each question which was discussed amongst rest of the students in the class. Supplemental

information was provided by the faculty members as mentor.

#### Data Collection:

Perception of learners towards this new learning model was evaluated by administering a questionnaire to be filled up by respondents. The questionnaire had a closed set of items graded using the Likert five - point scale. A 5 – point Likert scale with a score of 1 = poor, 2 = satisfactory, 3 = good, 4 = very good, and 5 = excellent was used to find out rating from the students. The number and percentage of students responding to each item was noted. The mean rating pertaining to each item was calculated. (Table 2)

Assessment part included a summative exam on the topics comprising short note and essay type questions scheduled a week after the flipped classroom session.

#### Statistical analysis:

Both pretest and post-test exam result of the study population was compared and using paired t test statistical significance of difference was calculated. Correlation between score of study population in post – test and in summative assessment was calculated by Spearman’s correlation coefficient. Performance of study population on summative assessment was compared with that of control population. During statistical analysis  $P \leq 0.05$  was considered to be significant.

#### Results:

All 75 students in study population responded to the questionnaire. The mean age of students was 17 years and majority was females. Contents of the items in the questionnaire delivered to participants in the study are given in table 1.

Table 1 : Questionnaire

Item No	Contents
1	Learning objectives defined prior to beginning of each session were helpful for preparation in self directed learning phase before actual classroom phase
2	The topic notes given prior to classroom session were very useful to understand it.
3	The additional references and web sources given in notes arouse interest to read in detail.
4	Compared to traditional didactic lectures, we were more engaged in flipped method
5	Deeper understanding of key physiological aspects and applied part of topic using flipped model

6	Such teaching learning activities should be organized again in future
7	Enough time allotted to each case
8	Helps actively participate with enjoyable learning experience in playful atmosphere
9	Pre class preparation of the topic enhanced ability to ask questions, difficulties and clear doubts of the topic.
10	Better University exam preparation for theory as well as practical ; makes students confident enough by minimizing pressure to perform, exam anxiety and stress.

Table 2 : Questionnaire Response Sheet

Item No	Response					Mean Rating	Total
	1	2	3	4	5		
1	45 (60 %)	15 (20 %)	12 (16 %)	3 (4 %)	0	1.5	75
2	54 (72 %)	16 (21 %)	5 (7 %)	0	0	1.3	75
3	57 (76 %)	16 (21 %)	2 (3 %)	0	0	1.3	75
4	59 (77 %)	15 (20 %)	2 (3 %)	0	0	1.2	75
5	53 (71%)	16 (21 %)	5 (6 %)	1 (2 %)	0	1.3	75
6	64 (85%)	6 (8%)	5 (7%)	0	0	1.2	75
7	51 (68%)	7 (9%)	6 (8%)	7 (9%)	4 (6%)	1.7	75
8	44 (58%)	15 (20%)	5 (7%)	7 (9%)	4 (6%)	1.8	75
9	55 (73%)	15 (20%)	5 (7%)	0	0	1.3	75
10	53 (71%)	15 (20%)	7 (9%)	0	0	1.4	75

Table 3: Pre and Post test Objective questions grades in Study group.

Grade	Pre test (N = 75)	Post test (N = 75)
A (90 – 100%)	14	26
B (80 – 89%)	36	39
C (70 – 79%)	21	9
D (60 – 69%)	4	1

### Discussion:

With advancement of technology there is paradigm shift in teaching learning methodology, methods of utilization of faculty, space, finances, and other resources which in turn are determinants of future of medical education.

Some of the most important aspects of training at medical colleges include problem solving, acquiring knowledge, developing bedside manners, teamwork, and interpersonal communication skills.<sup>(11)</sup> These aspects are in accordance with opinion of most of the medical practitioners and medical educationists all over the world and Association of American Medical Colleges.<sup>(12-14)</sup>

In this study, we assessed students perceptions and performance during flipped classroom model in first MBBS Physiology course. Flipped classroom design was based on principles of good teaching practices, active learning coupled with good interaction among students and also between faculty

members and students during group discussion.

Most of the students felt this new teaching method very favorable and interesting which made the students get engaged in the class. Students performance also improved during this new teaching technique.

similar findings and results were found with the studies from various health science educationists.<sup>(15-19)</sup> The feedback obtained after introduction of flipped classroom models mirrors the findings from other study.<sup>(20)</sup> The highlighting features which are noteworthy to mention in the study population are active student engagement, availability of ample time to discuss and clarify their doubts with the facilitator. Hence students perceived that flipped classroom approaches promoted active learning and acts as driving force to perform better in their exams compared to traditional didactic lectures. Last but not the least to mention is that this entirely new methodology



helped students to learn and inculcate physiological key concepts in a playful learning environment making it an enjoyable, lovable learning experience.

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