

Original Research Article

A comparative study between flipped classroom and traditional lecture-based classroom in first year medical students

Kavita Aggarwal¹, Bhaskar Thakur², Mahesh Agrawal^{3*}, Sumit Jhajharia¹,
Himanshu Madaan⁴, Sri Krushna Mahapatra¹

¹Department of Biochemistry, Kalinga Institute of Medical Sciences, KIIT University, Bhubaneswar, Odisha, India

²Department of Biostatistics, Dana Farber Cancer Institute, Harvard Medical School, Harvard University Boston, Massachusetts, USA

³Department of Anaesthesiology, Utkal Institute of Medical Sciences, Bhubaneswar, Odisha, India

⁴Department of Biochemistry and MEU co-ordinator, Kalpana Chawla Govt. Medical College & Hospital Karnal, Haryana, India

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*Correspondence:

Dr. Mahesh Agrawal,

E-mail: agrawal.mahesh1402@gmail.com

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ABSTRACT

Introduction: Flipped classroom is a new pedagogical model in which students are provided with study resource material to develop a basic understanding of the topic before class, and in-class precious time is used for learner-centric activities. Accordingly the study objectives were to compare the effect of flipped and traditional classroom teaching method and to determine the student's perception of flipped and traditional teaching method.

Method: This was a non-randomized experimental study. A detailed multiple choice question based test was used to assess the knowledge gain. Another structured questionnaire on students' perception on flipped classroom teaching and traditional teaching technique was used for both the groups.

Results: A total of 112 students participated in this study. The mean assessment scores in the flipped and traditional classroom were not statistically significant. We observed in the current study that the qualitative response was better as compared to quantitative response.

Conclusion: As per our qualitative observation, a hybrid of both traditional and flipped classroom teaching method can be used in the transition period until the acceptance for new innovative methods increase. Long term learning gain may be attained by improving motivation and engagement of students in learning process.

Keywords: Biochemistry, Didactic lecture, Innovative teaching, Flipped Classroom, Teaching methods

INTRODUCTION

The existing medical education system in India for first year medical students is based on traditional model of teaching which include engaging students in didactic lecture in classroom and laboratory setting. Didactic lecture is the oldest and the most popular method of teaching. Traditional didactic lectures have their own advantages like transmitting

knowledge and information, but in current era, students can assess unlimited amount of information through books and internet at their own comfort.

Didactic lecture is teacher centric rather than learner centric method, learner plays a passive role of listening and making notes. Very less or no time is available for questioning and interaction, this can lead to loss of interest, concentration and

motivation. There is a felt need among the medical teachers and students for some new innovative methods that can ensure more active involvement of the learner and teacher both. Lectures can be made more effective and interesting by making small modifications like providing lecture content in advance and involving students in discussion during the lecture time.

Many new innovative teachings and learning methods like Case Based Learning (CBL), Self-Directed Learning (SDL), Problem Based Learning (PBL), Flipped Classroom and Concept Mapping have been adopted worldwide to improve the learning outcome.

According to the Vision 2015 of Medical Council of India (MCI), Medical education is shifting from traditional objective-based curriculum to Competency based curriculum.¹ The essential skills required for Competency-based medical education (CBME) are self-directed and life-long learning.² Flipped Classroom is one such innovative teaching learning method which can develop the habit of self-directed learning in medical students.

A Flipped classroom is a new pedagogical model in which students are provided with study resource material like teacher prepared notes, paper handouts, power points, videos as “pre-class assignment” to develop a basic understanding of the topic before class, and in-class, precious time is used for learner-centric activities such as presentation, clearing doubts, problem solving, group discussion and case discussion.³ The teachers’ roles is to monitor, guide, and support the learning process of their students.⁴

The model was made popular by Eric Mazur emphasizing that the learning gains are approximately tripled with flipped class approach that focuses on the student and interactive learning.⁵

Flipped classroom is becoming increasingly popular teaching learning method in medical education. Flipped classroom can develop lifelong learning skills like independent identification, appraisal, analysis, and synthesis of knowledge desirable of modern physicians. Flipped class provide equal opportunity for slow pace learners and fast pace learners, learning is self-paced rather than teacher paced. Students improved communication and collaborative effort could bring long term results.

In a meta-analysis by Hew and Lo they concluded Current evidence suggests that the flipped classroom approach in medical education yields a significant improvement in student learning compared with traditional teaching methods.⁶

A recent review on learner perceptions of flipped classrooms in health professions education found an

overwhelming positive response from students who attended flipped classes.⁷

Though flipped method seems to be advantageous, there can be several limitations. It needs to be assessed whether students can find time or take interest in power point or videos, provided days earlier to the class. Even if they take interest, how much they can grasp from study material of completely new topics needs to be evaluated. Further, accessibility to multimedia can be limiting factor if videos are provided. For some students it can be an additional burden, time consuming and putting undue stress on them. Flipped classroom may not be appropriate for factual knowledge.

Biochemistry is considered as a difficult and volatile subject to study, students often have a problem in recognizing the clinical relevance of basic science subjects such as biochemistry in the pre-clinical stage of their studies leading to an unsatisfactory learning outcome. Studies on biochemistry related learning outcome focusing mainly on flipped classroom methods are rarely reported globally and evidences from India is lacking.^{8,9} Therefore engaging the students more actively in learning process of basic sciences such as Biochemistry for improving the learning outcome, this study is designed. Accordingly, the objectives of the current study were to assess the effect of flipped classroom method as compared to the traditional classroom method as well as to determine the perception of flipped classroom and traditional lecture based classroom method as a pedagogical tool among the 1st year MBBS students.

METHODS

A Non-randomized experimental study was conducted in the Department of Biochemistry, KIMS, KIIT University, Bhubaneswar, Odisha, India. Study was conducted for the period of February 2019 - July 2019 (6 months). Study participants- 150 first year MBBS students of Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India

Inclusion criteria

First year MBBS students who consented and were present in the class during study.

Exclusion criteria

Students who refused to participate in the study or were absent in the class during study.

Initially a total of 150 students were divided equally into two groups namely group A (flipped classroom method consisting of 75 students) and group B (traditional classroom consisting of 75 students) based on their registered roll numbers assigned in alphabetical order. The concept of Flipped classroom and traditional classroom teaching methods were explained to all the participating students. A

written consent was obtained from each of the students after explaining the study purpose. Anonymity of all the study subjects was maintained.

Out of 150 students only 52 consented students were present in the flipped classroom and 60 students in traditional classroom teaching method. Group A students were exposed to Flipped classroom (FC) teaching whereas Group B students were exposed to traditional classroom teaching on the same topic by the same teacher. Teaching for both the groups was held on the same day in subsequent hour (i.e. Group B was taught immediately after the Group A). Group A students were provided with the power point and video two days prior to the class. Group B was told about the specific topic and instructed to read the topic from book prior to the class. Group A students were instructed not to share the provided resources with the Group B students prior to completion of the teaching and evaluation process among both the groups.

Tools

A detailed multiple choice question based test was designed keeping in mind the learning objective to assess the knowledge gain on the chosen topic. Immediately after the completion of teaching part, topic related knowledge gained was assessed in both the groups. This questionnaire was designed by an independent teacher who was not be involved in the teaching process of the chosen study topic and a teacher who taught the students was blinded for the content of assessment/questionnaire.

Another structured questionnaire on students’ perception on flipped classroom teaching and traditional teaching technique which is based on five point likert scale ranging from strongly disagree to strongly agree was used for both the Groups.

Statistical methods

MS Excel spreadsheet was used to create the database. Mean±Standard Deviation (SD) was used to summarize the scores. Independent t-test was used to compare the scores between two groups. Frequency and percentage was reported for students’ response on both methods. A P value of <0.05 was considered as statistically significant. Stata 15.1 was used for data analysis.

RESULTS

Out of the 150 first year MBBS students, 112 students completed the study of which 52 students were in flipped classroom group and the rest 60 students were in traditional classroom teaching group.

Table 1 shows that independent t-test comparing the mean assessment scores in the flipped and traditional classroom indicated no evidence of statistical difference

(p >0.05) between these two groups of study. Learning gain was not affected by the method of teaching.

Table 1: Comparison of assessment score between traditional and flipped method.

Parameter	Traditional method Mean±SD	Flipped Method Mean±SD	P Value
Assessment Score	8.02±1.98	8.17±1.79	0.664

All the 112 students responded to the perception questionnaires. The response to each perception statement for the flipped classroom method and traditional classroom are summarised in table 2 and table 3 respectively.

To the first perception questionnaire “I have gone through the provided study material”, there was more positive response in flipped classroom group (44.2% agreed and 28.8% strongly agreed) that they have gone through the provided study material while in the traditional classroom only 26.7% agreed and 3.3% strongly agreed whereas students from both the groups were equally agreed about the utility of study materials. Around 48% of the students in traditional groups responded that it would have been better if they were provided with extra study materials by the teachers instead of reading from the book. Both the class were equally engaging and improved the learning motivation in student. When asked for whether the class give them the opportunity to communicate with other students, proportion of students on strongly disagree was observed very less in flipped method (7.7%) as compared to traditional method (13.3%). Students perceived that the communication between the student and teacher is better in flipped class method. Higher proportion on agreement was observed (67.3%) in flipped method when they were asked about whether they are able to keep pace with the teacher.

Students in the flipped group were more satisfied (63.5%) with the course content as compared to the students of traditional group (58.3%). Surprisingly, agreement compliance on the understanding of biochemical basis of diseases was observed higher in tradition teaching method (70%) as compared to flipped teaching method (48.1%). Around 50% of students belonging to flipped group were agreed on such innovative teaching method to be applied for the future classes. Only 27% students were agreed that the class was time consuming and no additional burden/pressure was perceived by the majority of the students in flipped group. 28.8% of students in the flipped group preferred the traditional teaching method while 48% disagreed to adopt the traditional teaching method. Similarly, 18% of the students in the traditional teaching group were not satisfied with the current method and these students wanted to change their current teaching method with some innovative method.

Some open suggestions/feedback by the students in the flipped group in their own languages is summarized below-

I like the way slides and video were given before the class to us, it helped me to prepare for the class; In the class, students have to do two works - understanding the concept and writing it on the notebook, so it's difficult. "I think flipped classroom is the solution. Flipped classroom is better than traditional one and it improves knowledge and communication. Flipped method is more convincing, not only because it helps to communicate with teacher but also motivates to read the chapter before class and

thereby helps complete the course simultaneously. Flipped classroom technique is good but i feel it would be better if applied for small topics and not major topics." "Good technique, it compelled us to read the slides and the things i don't understands in slide, arise questions in our mind. Traditional teaching method is inefficient, in just one hour the students are expected to read, write and understand simultaneously with haste and in vain.

Table 2: Frequency and percentage of Student's perception towards flipped classroom teaching methods.

Various perceptions	SD	D	N	A	SA
	N (%)	N (%)	N (%)	N (%)	N (%)
I have gone through the provided study material	1 (1.9)	3 (5.8)	10 (19.2)	23 (44.2)	15 (28.8)
Provided study material was useful	1 (1.9)	2 (3.8)	9 (17.3)	27 (51.9)	12 (23.1)
Flipped classroom was engaging and improved my learning motivation	0 (0.0)	9 (17.3)	15 (28.8)	15 (28.8)	13 (25.0)
Flipped classroom gave me opportunity to communicate with other students	4 (7.7)	9 (17.3)	15 (28.8)	18 (34.6)	6 (11.5)
Flipped classroom gave me opportunity to communicate with the teacher	1 (1.9)	5 (9.6)	9 (17.3)	21 (40.4)	16 (30.8)
I was able to keep pace with the teacher	0 (0.0)	2 (3.85)	15 (28.8)	23 (44.2)	12 (23.1)
I am satisfied with the course content covered	1 (1.9)	4 (7.7)	14 (26.9)	20 (38.5)	13 (25.0)
Flipped class improved my understanding on biochemical basis of diseases	3 (5.8)	11 (21.1)	13 (25.0)	17 (32.7)	8 (15.4)
I would like flipped classroom to be applied in future classes	4 (7.7)	6 (11.5)	17 (32.7)	12 (23.1)	13 (25.0)
Flipped class was time consuming	8 (15.4)	21 (40.4)	9 (17.3)	11 (21.1)	3 (5.8)
Flipped class gave me too much burden and pressure	13 (25.0)	15 (28.8)	17 (32.7)	4 (7.7)	3 (5.8)
Prefer the traditional teaching over the flipped classroom	17 (32.7)	8 (15.4)	12 (23.1)	6 (11.5)	9 (17.3)

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

Table 3: Frequency and percentage of Student's perception towards traditional classroom teaching methods.

Various perceptions	SD	D	N	A	SA
	N (%)	N (%)	N (%)	N (%)	N (%)
I have gone through the provided study material	20 (33.3)	15 (25.0)	7 (11.7)	16 (26.7)	2 (3.3)
Provided study material was useful	1 (1.7)	1 (1.7)	14 (23.3)	30 (50.0)	14 (23.3)
It would have been better if I was provided with extra study material by the teacher	6 (10.0)	9 (15.0)	16 (26.7)	17 (28.3)	12 (20.0)
The class was engaging and improved my learning motivation	0 (0.0)	7 (11.7)	21 (35.0)	18 (30.0)	14 (23.3)
The class gave me opportunity to communicate with other students	8 (13.3)	11 (18.3)	12 (20.0)	22 (36.7)	7 (11.7)
The class gave me opportunity to communicate with the teacher	3 (5.0)	3 (5.0)	15 (25.0)	28 (46.7)	11 (18.3)
I was able to keep pace with the teacher	2 (3.3)	8 (13.3)	16 (26.7)	24 (40.0)	10 (16.7)
I am satisfied with the course content covered	0 (0.0)	3 (5.0)	22 (36.7)	26 (43.3)	9 (15.0)
The class improved my understanding on biochemical basis of diseases.	2 (3.3)	3 (5.0)	13 (21.7)	34 (56.7)	8 (13.3)
The class was time consuming	13 (21.7)	17 (28.3)	16 (26.7)	9 (15.0)	5 (8.3)
The class gave me too much burden and pressure	20 (33.3)	19 (31.7)	12 (20.0)	6 (10.0)	3 (5.0)
I am satisfied with the current teaching method	6 (10.0)	5 (8.3)	21 (35.0)	20 (33.0)	8 (13.3)

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

Classroom must be the place of intellectual enlightenment and not dictating or copying notes. Class discussion is very important for better understanding of the topic. A small MCQ based test should be provided after each chapter for self-evaluation.”

Similarly, open suggestions were provided by the traditional group students as listed below-

“The new method of teaching is better as i read and come and by discussion, our knowledge will improve but in traditional method,” I do study but don’t pay much attention in the class as i don’t know much about the topic. I can either listen to the teacher explaining or copy down the notes, I cannot do both the things simultaneously, thus sometimes blindly copying down without understanding anything. “Traditional lecture method is boring, and i agree with the new explained method Traditional teaching method is also useful up-to some extent like we get time to prepare our-self for proper understanding of the topic and making notes during class but class are a bit fast.” I think the innovative method is much better as it gives us a task to perform for the next class. Though i think the new method would be more useful, but it is not practical because of many tests, practical files that a medical student has to complete. He/she might not always find the time to read the topic beforehand and then the class would not turn out to be useful for them.”

So, “I feel traditional method is more useful, however new method could still be applied for some chapters where the teacher feels that the student needs some knowledge before the class for better understanding. Self-study is really important.

Teacher should provide power point slides before the class this helps the student to go through them at least once.

DISCUSSION

The current study dealt with the comparison of the assessment score on biochemistry topic i.e. “free radical and anti-oxidant” among the first year MBBS students divided into flipped and traditional classroom teaching method. In addition to the score assessment, the closed as well as open ended perception feedback for both the methods was also taken from the students.

Health care and medicines is changing at rapid pace both in content and relevance of medical education. The goal of medical education is to develop not only knowledge but communication skill and attitude. Learning should be an active instead of being a passive process where teacher role would be to mentor and facilitate such learning process.

In this study, overall assessment score for flipped classroom method was neither better nor worse when compared to traditional teaching method. We observed through feedback that either flipped method was

preferred or a mixed of two methods. In a similar study done by Ojennus DD it was documented that though the learning gain was not affected but students reported a high satisfaction and support for the flipped method.⁸ Kuhl SJ et al, observed that the acceptance of flipped classroom method is good for biochemistry seminar among the medical students.⁹ A similar mixed opinion is documented about the utility of the two methods in various medical institutions.¹⁰⁻¹⁴ Veronica Gillispie observed that the flipped classroom is more feasible and useful than the traditional method for the new generation.¹⁵ Veeramani R et al, concluded a positive feedback indicating the flipped method is worth to apply in coming future.¹² Another study from community medicine showed a significant change in the knowledge of medical students in flipped teaching method.¹⁶

In this result shows that if students are provided with precise and high quality study material, there is a high probability that they will read the material before the class. Kuhl SJ et al, also stressed upon the importance of high quality study material.⁹ This finding also shows that flipped classroom has the potential to promote the self-directed learning which is an important part of competency based medical education.

Authors observed in the current study that the qualitative response was better as compared to quantitative response and this may be an indication of long term learning gain rather than short term gain by improving motivation and engagement of students in learning process.

Authors observed that an interaction between student and teacher was relatively better in flipped method as compared to the traditional one. Negative feedback to some response may be attributed to student’s reluctance and apprehension to adopt new teaching method. Students might be apprehensive to read the difficult topic for which they have little or no background knowledge. Such findings are well documented previously.^{8,10,13}

Limitation of this study Active learning increases student engagement and leads to improved retention of learning gain. A long term learning gain and communication skill acquired by the students in traditional and flipped class was not assessed in the current study. Such assessment may be more meaningful when applied for multiple topics and diverse subjects (including clinical subjects) under medical science.

CONCLUSION

In flipped classroom, learner is more aware and accountable of their learning process which may lead to encouraging results in long run. The success of any innovative teaching method depends upon its design and implementation. Implementation should be in accordance to the need and circumstances. In the transition period, a hybrid of both traditional and flipped classroom teaching method can be used until the acceptance for new

innovative methods increase. Long term assessment on multiple topics and diverse subjects may provide more meaningful information regarding the feasibility and utility of innovative teaching method like flipped classroom teaching technique.

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REFERENCES

1. MCI Booklet; Vision 2015 Available at www.mci.org. Assessed on 21 May 2019.
2. Mahajan R, Badyal DK, Gupta P, Singh T. Cultivating lifelong learning skills during graduate medical training. *Ind pediatr*. 2016 Sep 1;53(9):797-804.
3. Lucardie A, Busari J. The Flipped Classroom as a Pedagogical Tool for Leadership Development in Postgraduate Medical Education, *Education Sciences*. 2017;7(2);63.
4. Singh K, Mahajan R, Gupta P, Singh T. Flipped Classroom: A Concept for Engaging Medical Students in Learning. *Ind Pediatr*. 2018;55(6):507-13.
5. Mazur E. Education. Farewell, lecture? *Science*. 2009;323(5910):50-1.
6. Hew KF, Lo CK. Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Medical Education*. 2018; 18(1):38.
7. Ramnanan CJ, Pound LD. Student perceptions of the flipped classroom. *Adv Med Educ Pract*. 2017;8:63-73.
8. Ojennus DD. Assessment of learning gains in a flipped biochemistry classroom. *Biochemistry and molecular biology education*. 2016;44(1):20-7.
9. Kühl SJ, Toberer M, Keis O, Tolks D, Fischer MR, Kühl M. Concept and benefits of the inverted classroom method for a competency-based biochemistry course in the pre-clinical stage of a human medicine course of studies. *GMS J Med Educ*. 2017;34(3):1-27.
10. Riddell J, Jhun P, Fung C, Comes J, Sawtelle S, Tabatabai R, et al. Does the flipped classroom improve learning in graduate medical education? *J Grad Med Educ*. 2017;9(4):491-6.
11. Gopalan C. Effect of flipped teaching on student performance and perceptions in an Introductory Physiology course. *Advan physiol edu*. 2018 Nov 5;43(1):28-33.
12. Veeramani R, Madhugiri V, Chand P. Perception of MBBS students to “flipped classroom” approach in neuroanatomy module. *Anat Cell Biol*. 2015;48(2):138-43.
13. Tang F, Chen C, Zhu Y, Zuo C, Zhong Y, Wang N, et al. Comparison between flipped classroom and lecture-based classroom in ophthalmology clerkship. *Medical Education Online*. 2017;22(1):1395679.
14. Sreegiri S, Madhavi BD, Kumari L. Student’s Perception of Flipped Classroom Teaching Method in Andhra Medical College, Visakhapatnam.” *IOSR J Dental and Medical Sciences (IOSRJDMS)*. 2018;17(2):6-9.
15. Gillispie V. Using the flipped classroom to bridge the gap to generation Y. *Ochsner J*. 2016;16(1):32-6.
16. Bogam RR. Effect of Flipped Classroom Model on Knowledge of Medical Students in Context of Community Medicine. *IJARET*. 2015;2(3):1-8.

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