

A Comparison of Effectiveness of Interactive Methods over Traditional Methods in Teaching Biochemistry to Undergraduate Medical Students

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Abstract: Background: New MCI curriculum has been introduced from August 2019 which is known as competency based medical education. Interactive teaching methods, which are given emphasis in CBME, can be used in large groups, small groups, pairs and individuals. The main aim of this study was to assess the effectiveness of utilization of interactive tools in medical teaching. **Aims:** The aim of the study was to evaluate the effectiveness of interactive teaching and learning (ITL) methods over traditional teaching methods in understanding the biochemistry subject and also the perception of students towards them. **Methodology:** It was a cross-sectional intervention study with crossover design. Pre-designed and pre-validated semi-structured needs assessment and feedback questionnaire were used as study tools. After the needs assessment survey, an ITL module was developed including choosing topics, allocating teachers, interactive T/L methods, time, and assessment questionnaire for each topic. Four different interactive teaching learning methods were compared with traditional teaching learning including, think pair share, buzz session, case based learning and pass the problem. **Results:** 75% of the students responded as facing difficulty in understanding the content in biochemistry and having the view that traditional methods are not sufficient. 91 % of the students felt that biochemistry should be taught using interactive methods and 56% responded that biochemistry is the most difficult subject in first year. In student performance analysis after introducing ITL sessions (TPS, BS, CBL, and PTP), it was revealed that 15%, 19%, 20%, and 18% of the students scored >75% in the intervention group compared to only 9%, 5%, 3%, and 2% in the other group where traditional teaching was carried out. This difference was statistically significant for sessions 1, 3 and 4. **Conclusions:** It was seen that student performance was increased in the interactive sessions. Therefore, it is recommended that there should be more inclusion of interactive teaching methods in undergraduate medical education.

Keywords: CBME, medical education, interactive teaching methods.

Introduction

Change in medical education is currently a worldwide phenomenon. It is needed to prepare doctors to fulfill the expectations of society, to cope with the exponential growth of medical and scientific knowledge, to inculcate physicians' ability for lifelong learning, to ensure mastery in information technology and to adjust medical education to changing trends in the health care delivery system [1]. These trends have been introduced in the new MCI curriculum from August 2019 [2] which is known as competency based medical education. However, such a shift from traditional approach to a need-based approach requires a fundamental change of the roles and commitments of educators [3]. Interactive teaching methods can be used in large groups, small groups, pairs and individuals [3].

The main aim of this study was to assess the effect of utilization of interactive tools in medical teaching.

Aims

The aim of the study was to evaluate the effectiveness of interactive teaching and learning (ITL) methods over traditional teaching methods in understanding the biochemistry subject and also the perception of students towards them. Basically, it was aimed to compare traditional and interactive teaching methods in classes conducted for undergraduate medical students in a medical college in New Delhi, India.

Methodology

This study was conducted in the department of biochemistry, Vardhaman Mahavir Medical College, New Delhi in November 2019 including first year MBBS students. It was a cross-sectional intervention study with crossover design. Students who consented to be part of the study were randomly allocated to study and control groups comprising of 25 students in each group (a sample size of convenience was taken). Pre-designed and pre-validated semi-structured needs assessment and feedback questionnaire were used as study tools. The needs assessment survey had questions regarding socio-demographic information, perception toward the subject, difficulty in learning the concepts of biochemistry compared to other parallel subjects (anatomy and physiology) in a scale of 1–5, where 1 is very easy and 5 is very difficult, reason of missing classes, and need of the intervention. Similarly, feedback questionnaire also had questions on socio-demographic information, detail information about the session content, duration, organization, its future implication, satisfaction of students, and perception of students toward the effect of interactive teaching sessions in Likert scale. After the needs assessment survey, an ITL module was developed including choosing topics, allocating teachers, interactive T/L methods, time, and assessment questionnaire for each topic.

Consent was obtained and both students and teachers were sensitized. Students were randomly allocated to study and control groups. Two different topics (glycolysis and glycogen synthesis) were taught using two ITL methods (think-pair-share and buzz sessions) in the intervention group (A) and TTL method (PowerPoint) in another group (B). After a wash out period of 15 days, the crossover of groups was done to reduce students' bias, where two different topics (diabetes mellitus and hepatitis) were taught using two ITL methods (CBL and pass the problem) in the intervention group (B) and TTL method (PPT) in other group (A). Each session was followed by the assessment multiple choice questions and short answer question (MCQs and SAQ) of both the groups to compare the results [Figure 1]. To decrease the subjective bias, the teachers were also crossed over after each session. Feedback of students was done at the end of all the sessions.

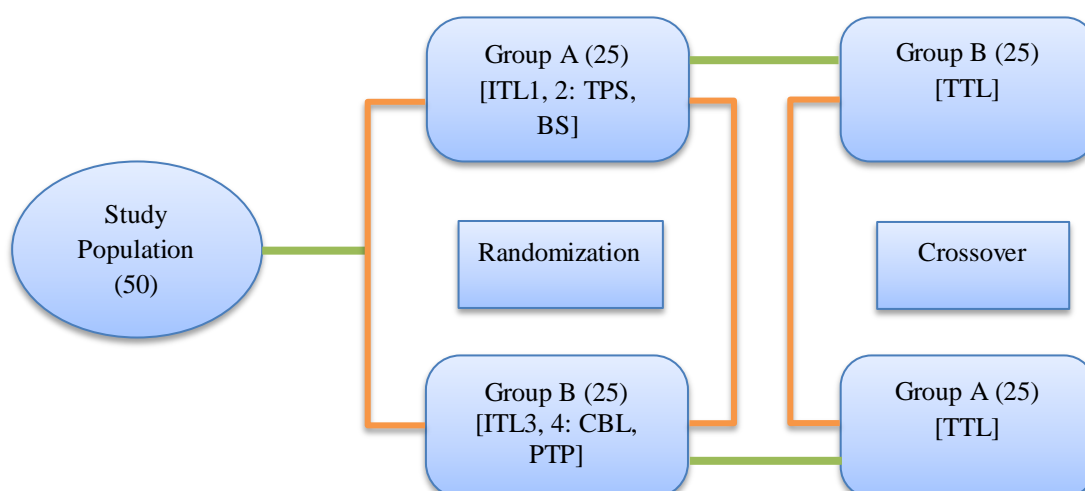


Figure 1. Study plan including group A and group B (with randomization and crossover).

ITL: interactive teaching learning, TPS: think pair share, BS: buzz session, CBL: case based learning, PTP: pass the problem, TTL: traditional teaching learning.

Intervention (Interactive T/L methods)

Think-pair-share

Students share and compare possible answers to a question with a partner before addressing the larger class [4]. Study group A students divided into 12 pairs and gave individual subtopics to discuss (steps and site, enzymes involved including rate limiting step, energy kinetics, regulation, clinical application). After that, each pair shared their answers in the large group which was facilitated and compiled by the teacher 1.

Buzz session [5]

First used by Dr. Donald Phillips, it can be applied whenever a large assembly of people is divided into small groups (usually of no less than three and no more than eight) which, for a limited time and simultaneously, discuss separate problems or various phases of a given problem [6]. If possible, recorders from each of the groups report their findings to the reassembled large group.

In our study, the study group students were divided into 5 subgroups: each group having five students each. Then, subtopics were given to individual group for discussion (steps and site, enzymes involved including rate limiting step, energy kinetics, regulation, clinical application). Teacher 2 was facilitating the discussion by visiting each table. At the end, all the group leaders shared their summary of discussion moderated by teacher.

Case based learning

Using clinical cases to aid teaching has been termed as CBL [7]. It links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods Thistlewaite et al. [8]. 2 diabetic case scenarios were given for discussion to study group B and each student from each group presented different aspects of the case. Teacher 1 facilitated the presentation afterward discussing the issues related to it and the management of the given case in different scenarios.

Pass the problem

Divide students into groups. Give the first group a case or a problem and ask them to identify (and write down) the first step in solving the problem or analyzing the case (3 min). Pass the problem on to the next group and have them identify the next step. Continue until all groups have contributed [9]. Group B students were divided into four subgroups each having 5-6 students. Four different case scenarios were given related to hepatitis. Each subgroup had to solve part of the problem given (pathophysiology, classification of hepatitis, clinical presentation, laboratory investigations and management) by passing the problem. At the end, the teacher interacted with all discussing the detail of cases.

Results

A needs assessment survey was conducted in which 50 students participated. 55% percent were male and 45% were female. 88% of the students were following standard books. 63% of them did not like to read biochemistry subject and the main reason being (68%) not able to understand the content followed by other reasons such as subject being boring (21%) and lack of imagination (11%).

75% of the students responded as facing difficulty in understanding the content in biochemistry and having the view that traditional methods are not sufficient. Moreover, 91 % of the students felt that biochemistry should be taught using interactive methods and 56% responded that biochemistry is the most difficult subject in first year (Table 1).

Table 1. Needs assessment survey: Difficulty level of 3rd-year professional

Subject	Difficulty Rating Scale				
	1	2	3	4	5
Anatomy (%)	0	0	4	9	3
Physiology (%)	0	0	4	12	5
Biochemistry (%)	0	0	5	2	56

MBBS part 1 subjects in a scale of 1-5 (where 1 is very easy and 5 is very difficult)

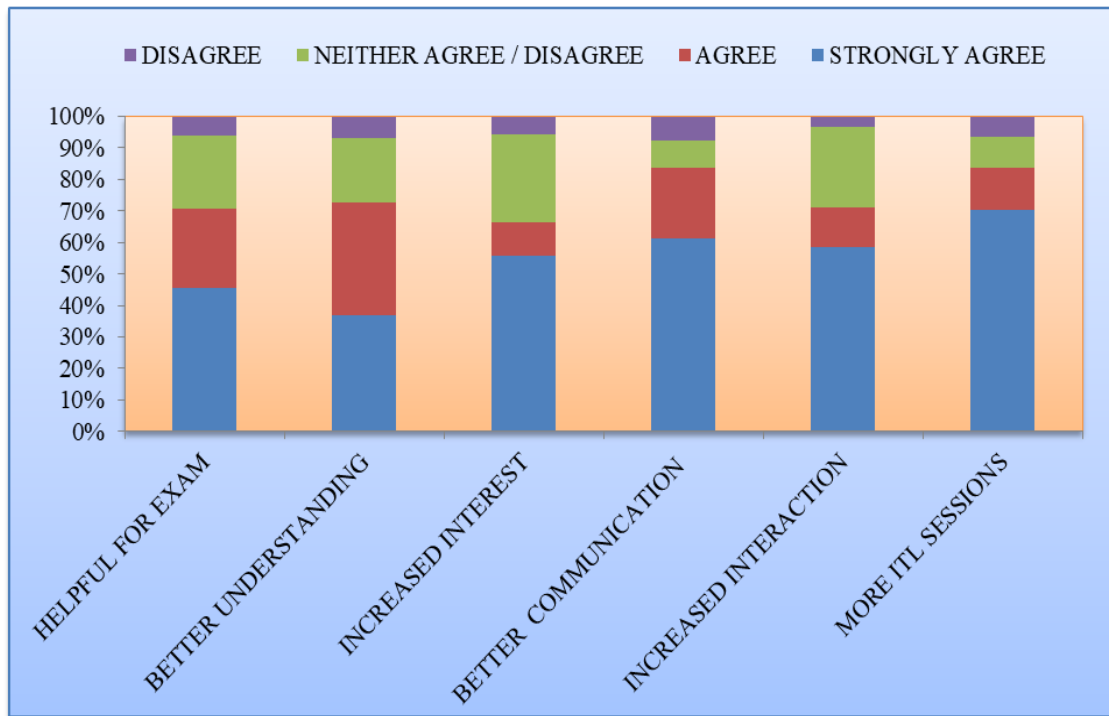


Figure 2. Perception of students toward the effect of interactive teaching and learning sessions on the Likert scale

Table 2. Perception of students toward the effect of interactive teaching and learning sessions on the Likert scale

	Strongly Agree (%)	Agree (%)	Neither Agree/Disagree (%)	Disagree (%)
Helpful For Exam	45.5	25.3	23.3	5.9
Better Understanding	36.9	35.7	20.6	6.8
Increased Interest	55.7	10.5	28.2	5.6
Better Communication	61.3	22.5	8.7	7.5
Increased Interaction	58.5	12.4	25.7	3.4
More Itl Sessions	70.3	13.5	9.8	6.4

In student performance analysis after introducing ITL sessions (TPS, BS, CBL, and PTP), it was revealed that 15%, 19%, 20%, and 18% of the students scored >75% in the intervention group compared to only 9%, 5%, 3%, and 2% in the other group where traditional teaching was carried out [Table 3].

Whereas, only 3%, 2%, 1%, and 3% of the students scored <50% in the intervention group compared to 11%, 15%, 18%, and 16% for the other group with traditional teaching. This difference was statistically significant for sessions 1, 3 and 4 as shown in table 3.

Table 3. Comparison of assessment scores between intervention and control groups (expressed as number and percentage)

Session	Score (Post session assessment)			p-value
	>75%	50-75%	< 50%	
ITL1 (TPL)	15	7	3	0.032*
TTL1	9	5	11	
ITL2 (BS)	19	4	2	0.461
TTL2	5	5	15	
ITL3 (CBL)	20	4	1	0.012*
TTL3	3	4	18	
ITL 4 (PTP)	18	4	3	0.002*
TTL4	2	7	16	
p<0.05 was considered as significant (*statistically significant)				

Discussion

Several innovative methods have been developed over the years to address these challenges including various levels of integration of instruction that diminishes and removes boundaries within subjects both horizontally in a phase and vertically across phases. While appreciating the value of these approaches, the proposed Graduate Medical Education Regulations (GMER) 2019 [10] has sought to strike a balance that will retain the strength of traditional subject-based teaching and the reality of subject based assessment while providing the relevance, opportunity to understand the interconnectedness and reduce redundancy in the subjects being taught.

This promotes active learning, heightens attention and motivation, gives feedback to the teacher and student, and increases satisfaction for both [11]. To improve the classical didactic lecture, numerous methodologies have been devised. Multimedia has been incorporated in lectures to convey information. Although this has enabled more content to be placed intuitively, an inappropriate usage of the presentation tool can make the students paradoxically more inattentive [12]. Students who are actively involved in the learning activity will learn more than students who are passive recipients of knowledge. 63 % of them did not like to read biochemistry subject and the main reason being (68%) not able to understand the content followed by other reasons such as subject being boring (21%) and lack of imagination/stories (11%). It could be due to the lack of practice of ITL methods in old curriculum which has been revised in new competency based medical education (CBME) curriculum which encompasses the use of various ITL methods [13].

The study also revealed that ITL methods were successful in increasing the interaction (58.5%) and communication (61.3%) among students along with interest (55.7%) and understanding (36.9%) of the contents in biochemistry. Around 45.5% of the students found it helpful for examinations. The same findings were observed in a study where interactive teaching promotes a higher level of thinking which includes analysis and synthesis of material, application to other situations and evaluation of the material presented [14].

In student performance analysis after introducing ITL sessions (TPS, BS, CBL, and PTP), it was revealed that 15%, 19%, 20%, and 18% of the students scored >75% in the intervention group compared to only 9%, 5%, 3%, and 2% in the other group where traditional teaching was carried out. Similar findings were encountered in a study where it was observed that true interaction enhances learning and knowledge retention among students [15].

Further it was observed by the teachers that there was an increased teacher–student interaction, student–student interaction, engagement, communication, and positive attitude towards the subject in the interactive sessions. However, limited time, losing control, unfinished content, lot of planning, and paperwork were the big concerns [16]. Also, challenges related to organization, resources, staff,

fear of not covering all topics were encountered. It was also realized that number of facts need to be reduced in order for a lecture to become interactive.

Conclusions

Thus it can be concluded from this study that student performance was increased in the interactive sessions and that overall satisfaction was good. Therefore, it is recommended that there should be more inclusion of interactive teaching methods in undergraduate medical education.

Limitations

The study had a small sample size, few sessions and only four interactive methods were used.

Conflict of Interest: The authors have no conflicts of interest to declare.

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