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RESEARCH ARTICLE

Comparative evaluation of different techniques required to make a didactic lecture effective

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ABSTRACT

Background: Lectures being still important methods in teaching and learning in medical curriculum and need active participation from students. The traditional methods of lecture delivery need improvement in teaching patterns. By introducing some new lecturing techniques, we can enhance the knowledge retention and improve the overall performance of the students. **Aims and Objectives:** The aim of this study is to evaluate the effect of various techniques used to make didactic lectures interactive and to compare the effect of traditional versus structured didactic lectures (interactive lecturing) on the performance of undergraduate students. **Materials and Methods:** This is a prospective, single-blind, interventional study. A total of 146 1st MBBS students (controls-73 and study-73) participated in all the activities of the study. Each lecture was structured and planned according to the technique to be used during didactic lecture to make it interactive. Pre-/post-test was prepared on the decided topics. Pre-test was given before the lecture and post-test after interactive lecturing. Four different techniques, putting questions in stipulated form, point of the day, muddiest point, and distributing handouts, followed by discussion were used to make the lecture interactive. Each technique was introduced in a separate set of lectures for the study group participants. **Results:** The results showed significant improvement in post-test scores of the study group for all the four techniques used. Class average normalized gain (measure for effectiveness and robustness of an educational intervention) was more than 0.7 (70%) for putting questions in stipulated form and muddiest point. While it was more than 0.5 (50%) for point of the day and handouts with the discussion. **Conclusion:** Intervention in the form of interactive lecturing techniques in physiology was moderately effective for "point of the day" and "handouts followed by discussion" techniques, while intervention in the form of putting questions in stipulated form and muddiest point were highly effective. All four techniques were well perceived by the students. The interactive lecturing techniques improve the student's performance as compared to the traditional lecturing.

KEY WORDS: Point of the Day; Muddiest Point; Handouts; Interactive Lecturing

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INTRODUCTION

Didactic lectures are important methods of the teaching-learning process in medical education. It is also an effective and practically feasible technique for large group teaching where a vast syllabus has to be covered.[1]

Recently, learner-centered approaches in education are recommended, and several questions have arisen regarding the appropriateness of lecture. There is a need for some modifications that would make lectures more effective so as to improve the performance of the students in the current model of learning and teaching.[2,3]

Introduction of various techniques in a lecture session has not only created interest in the subject but also has increased the overall performance of the students in terms of marks scored in the subsequent examinations. Faculties which are teaching large classes should try to include constructive, cooperative, and active teaching methods in their courses whenever possible. The active and collaborative teaching methods are not only desirable to many students but they also appear to produce significant improvement in terms of learning outcomes.[4]

Active learning strategies not only improve student's comprehension in undergraduate teaching but also improve the content knowledge and their self-efficacy.[5]

The major concern regarding didactic lecture is that it is criticized for one way passage of information and lack of active participation by students. The educational value of didactic lecture can be enhanced by making it more participatory and interactive with the students. There are few innovative methods that can be adapted to make the lecture more effective without actually disturbing the traditional lecture patterns. Interactive and effective lecturing is possible by doing a meticulous work on planning and creativity so as to bring about few noticeable changes in routine traditional pattern of lecturing.[6,7]

Many techniques can be used to make the lecture effective and to trigger the engagement of the students. These techniques will definitely help the students to maintain and enhance the attention in the class, which usually decrease and show a downfall after a slot of 10-15 min after the commencement of a lecture. Interactive lectures can be an effective method for promoting deep learning, which in turn helps in proper understanding, recall, and application of knowledge.

Structuring and planning the lectures using lecturing techniques can be utilized for making lecture effective.[8,9]

In the present study, we used four interactive lecturing methods:

1. Putting questions in stipulated form:[10] The purpose of good questioning in medical students is (a) to promote active participation of students, (b) to encourage and give opportunity to the students to express their own ideas and thoughts regarding the topic taught, and (c) to allow students to hear about in-depth knowledge of other students about the topic which ultimately makes them a good thinker. Good questioning also helps the teachers to evaluate their student's understanding and knowledge retention about the topic. Questioning cycle was used to ask the questions.
2. Point of the day: Students were asked to write on a paper, one important point that they learnt at the end of each part of the lecture and then they can exchange their papers and see what others have learnt.
3. Muddiest point: This technique was used to find what the students have not understood. In this technique, the students were asked to write what was the most difficult content of the lecture at the end of teaching on a slip of paper. The paper was then transferred from one student to other in a musical parcel like game for at least 8-9 times and then stopped. Then, the student was asked to read the content from the slip which was present then in his hands. This allows the student to put forward their difficulties without being actually exposed in front of the whole class.
4. Distributing handouts followed by discussion: The notes on core area were distributed in the form of handouts, and at the end of the lecture, these important points were discussed.

Need for the Study

Although newer interactive small group teaching-learning methodologies have come up in the recent years, we cannot do away with didactic lectures. There are various disadvantages of didactic lectures. Passive learning and poor retention are two important problems with didactic lecture. There is a need to overcome these problems. This can be done using interactive lecturing techniques.

Hence, the present study was conducted to enhance the student learning by introducing interactive lecturing techniques.

MATERIALS AND METHODS

Ethics Committee Approval

This study was conducted after obtaining approval from the Institutional Ethics Committee, and an informed consent was obtained from the participants.

Locus of Study

The study was conducted in the Department of Physiology, Jawaharlal Nehru Medical College and School of Health Professionals Education and Research, Datta Meghe Institute of Medical Sciences (Deemed University), Sawangi (Meghe), Wardha.

Study Design

This is a prospective, single-blind, interventional study.

Study Population

The study population was undergraduate medical students (1st semester I MBBS students). Of 160, only 146 could participate in all the activities of the study. Data obtained from remaining 14 students were discarded. The response rate was 91.25%. Out of 146 participants who participated in this study, 73 belonged to study group, whereas remaining 73 were in the control group. This grouping was done using convenience sampling.

Exclusion Criteria

The repeaters were excluded from the study, due to lack of their regular attendance.

Study Material

The study material like pre-/post-test questionnaire and handouts was prepared and validated before it was used.

Methodology (Interactive Lecturing)

Students and involved faculty members were first sensitized about the technique to be used during didactic lecture. Convenience sampling was used to form control and study groups. Students of Batch A (participant no. 1-73) formed the control group while Batch B students (participant no. 74-146) formed the study group.

Before exposing the study group participants to the intervention, both the groups were exposed to pretest. Lectures with various techniques used to make them interactive were started for the study group participants. Four different techniques were used to make the lecture interactive. Each technique was introduced in a separate lecture. Not more than one technique was introduced in a single lecture. Each interactive technique was introduced and checked in two different lectures. Hence, the four different interactive techniques were experimented in total of eight lectures, two for each technique. Each lecture was structured and planned according to the technique to be used to make it interactive. At the end of intervention of each technique, post-test was given to the study as well as control group participants. Traditional didactic lectures were conducted for the control group participants.

Data Analysis and Statistics

Evaluation of these techniques was done using Kirkpatrick's Evaluation Model.[11] The pre- and post-test scores were compared using students paired *t*-test in both study and control groups, and *P* value was calculated to find the significance. A $P < 0.05$ was considered as statistically significant. Pre- and post-test scores were also used to calculate learning gains. Absolute learning gain (% posttest score-% pretest score) and relative learning gain (% posttest score-% pretest score/% pre-test score) were calculated. Effectiveness of intervention was evaluated by class average normalized gain (g) =([% posttest score-% pretest score]/[100-% pretest score]. Class-average normalized gain (g) of 0.3, i.e., 30% was considered as statistically significant as per Hake's criteria for effectiveness of an educational intervention.[12]

RESULTS

Pre-test and Post-test Analysis

1. Technique 1: Putting questions in stipulated form: In control group, the mean of pretest was 4.38 ± 1.93, and for posttest, it was 6.36 ± 1.64. The mean post-test score improved significantly after educational intervention. In both the groups, it was statistically significant with $P < 0.05$.
2. Technique 2: Used for interactive lecturing: Point of the day: In both the groups, the post-test scores were significantly higher than the pretest scores, but the difference in performance was more evident in the study group ($P < 0.05$). The mean post-test score improved significantly after educational intervention in the form of interactive lecturing using point of the day technique. The mean of pre-test in the study group was 3.61 ± 1.99, and for posttest, it was 7.55 ± 1.89.
3. Technique 3: Muddiest point: In both the groups, the difference between means was statistically significant with $P < 0.05$, but the difference in performance was more evident in the study group.
4. Technique 4: Used for interactive lecturing: Handouts with discussion: In both the groups, the difference between means was statistically significant with $P < 0.05$.

Comparison of Mean Pre-test Scores of Control and Study Groups for Four Different Techniques

Mean pretest scores of control and study groups were compared for all the four different techniques (Figure 1). Asking questions in stipulated form was used in Lecture 1, point of the day in Lecture 2, muddiest point in Lecture 3, and handouts followed by discussion in Lecture 4. Pre-test score was significantly lower for control group as compared to study group for Lecture 1 ($P < 0.05$). While the pretest score was significantly higher for control group as compared to study group for Lecture 2 ($P < 0.05$). For Lecture 3 and Lecture 4, pretest scores of control groups were higher than the pretest scores of study group, but the difference was not statistically significant ($P > 0.05$).

Comparison of Mean Post-test Scores of Control and Study Groups for Four Different Techniques

Mean post-test scores of control and study groups were also compared for all the four different techniques (Figure 2). Post-test scores of the study group were significantly higher

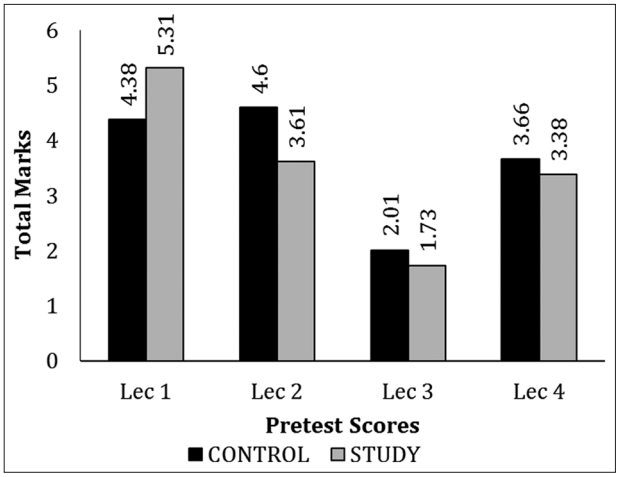

Figure 1: Mean pre-test scores of control and study groups for four different techniques

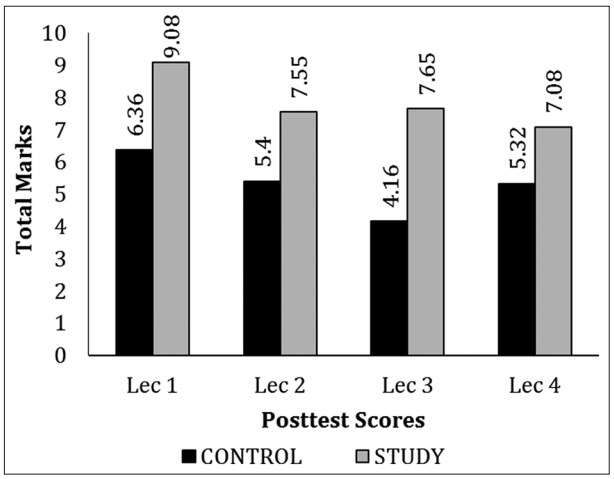

Figure 2: Comparison of mean post-test scores of control and study groups for four different techniques

as compared to the post-test scores of control group for all the four lectures ($P < 0.05$) (Tables 1-4).

Comparison of Learning Gains of Four Techniques

Comparison of learning gains by four different techniques used to make the lecture interactive was done (Table 5). Maximum learning gain was found by the technique muddiest point used to make the didactic lecture interactive. The "g" was maximum for Tech-1, i.e., putting question in stipulated form followed by Tech 3, i.e., muddiest point.

DISCUSSION

The pre-/post-test analysis showed significant improvement in posttest score. Class average normalized gain (measure for effectiveness and robustness of an educational intervention) was more than 0.7 (70%) for putting questions in stipulated form and muddiest point. This showed that educational intervention in the form of interactive lecturing using these techniques was highly effective. While the class average normalized gain was more than 0.5 (50%) for point of the day and handouts with the discussion. This showed that educational intervention in the form of interactive lecturing using these techniques was moderately effective. Students very well accepted these techniques used during didactic lectures as they found it interesting, motivating, innovative, feasible, and relevant.

Table 1: Mean pre-and post-test scores in control and study groups

Score	Mean±SD (*n*=73)	
	Control group	Study group
Pre-test score (% pre-test)	4.38±1.93 (43.8)	5.31±1.76 (53.1)
Post-test score (% post-test)	6.36±1.64 (63.6)	9.08±1.13 (90.08)
P	0.0001*	0.0001*

P<0.05 was considered statistically significant, *S (significant).
SD: Standard deviation

Table 2: Mean pre- and post-test scores in study group

Score	Mean±SD (*n*=73)	
	Control group	Study group
Pre-test score (% pre-test)	4.60±1.55 (46.0)	3.61±1.99 (36.1)
Post-test score (% post-test)	5.40±1.51 (54.0)	7.55±1.89 (75.5)
P	*P*=0.001*	*P*=0.0001*

P<0.05 was considered statistically significant, *S (significant).
SD: Standard deviation

Table 3: Mean pre- and post-test scores in control and study groups

Score	Mean±SD (*n*=73)	
	Control group	Study group
Pre-test score (% pre-test)	2.01±1.32 (20.1)	1.73±1.44 (17.3)
Post-test score (% post-test)	4.16±2.13 (41.6)	7.65±2.0 (76.5)
P	*P*=0.001*	*P*=0.0001*

P<0.05 was considered statistically significant, *S (significant).
SD: Standard deviation

Table 4: Mean pre- and post-test scores in study group

Score	Mean±SD (*n*=73)	
	Control group	Study group
Pre-test score (% pre-test)	3.66±1.82 (36.6)	3.38±1.86 (33.8)
Post-test score (% post-test)	5.32±2.07 (53.2)	7.08±2.28 (70.8)
P	*P*=0.001*	*P*=0.0001*

P<0.05 was considered statistically significant, *S (significant).
SD: Standard deviation

Activity was conducted in four sessions using four different techniques which are asking questions in stipulated form using the question cycle, point of the day, muddiest point, and distributing handouts followed by discussion.[13-15]

Amato and Quirt[16] conducted the study on the 3rd year medical students, in which they found that the process

Table 5: Comparison of learning gains of the four different techniques used as intervention

Score	Putting questions in stipulated form	Point of the day	Muddiest point	Handouts with discussion
ALG (%)	37.7	39.4	59.2	37.0
RLG (%)	69.6	109	342	109.4
Class average normalized gain (g %)	0.788 (78.8)	0.616 (61.6)	0.715 (71.5)	0.558 (55.8)

ALG: Absolute Learning Gain, RLG: Relative Learning Gain

of lecture handouts helped the students by enhancing the performance, but there were some disadvantages in it. In an another study by Carpentor,[17] the faculty who were involved in teaching large classes tried to include those methods which are constructive and incorporated by active teaching in their courses whenever possible, for example, jigsaw, case study, team projects which proved to be beneficial to enhance the knowledge gain, the findings go in accordance with our study.

Miller et al.[2] introduced team-based learning, and there were many qualitative improvements through including an increased perceived effectiveness of lectures, decrease in distractions during lecture, and increased confidence with the material, the findings were similar with those observed in our study.

In our study, pre- /post-test was conducted for each technique separately to determine the knowledge gain during the interventions, in the form of interactive lecturing techniques during didactic lecture. Analysis showed highly significant improvement in the posttest scores for the study group.

In the present study, absolute learning gain and relative learning gain for each technique were calculated and were found to be highest for muddiest point 59.2% and 342%, respectively. Absolute learning gain and relative learning gain for point of the day were 39.4% and 109%, respectively. While for putting questions in stipulated form these were 37.7% and 69.6%, respectively. The RLG was less for this technique as the pre-test value was high. For handouts with discussion, these were 37% and 109%, respectively. We also calculated class-average normalized gain (g) as a measure of the effectiveness of an educational intervention as suggested by Stuart, (1988)[12] Class-average normalized gain was independent of the study group's pretest level of knowledge. Class-average normalized gain was categorized as 0.1-0.29 as low gain, 0.3-0.69 as medium gain, and 0.7-1.0 as high gain.

In our study, we observed that the class-average normalized gain was maximum (g = 0.788) for putting questions in stipulated form, inspite of having low absolute and relative learning gains (due to high pretest). This is because the class average normalized gain is independent of pretest scores of the study group. This proves that this intervention gave highest gain. For muddiest point, also the gain was high (g = 0.71). For point of the day and handouts with discussion, medium gain was obtained (g = 0.61 and 0.55, respectively), as the values were more than 0.3 but <0.69, as per defined criteria by Hake. This represents that educational intervention in the form of interactive lecturing techniques was highly effective for two techniques and moderately effective for other two techniques.

Effect of Intervention on Performance

Performance of the control and study group was also compared using the mean post-test marks for each technique, and it showed significantly higher mean score in the study group as compared to control group with a $P < 0.05$. This indicates that the intervention was highly effective. While, when mean pretest scores were compared, there was no significant difference for control and study groups for techniques muddiest point and handouts with discussion. While the pre-test scores of control group were significantly higher than the study group in case of point of the day. When the pretest scores of control and study groups were compared for putting questions in stipulated from the scores were significantly higher for study group as compared to the control group.

Strengths and Limitations

As far as strengths of this study are considered, these interactive lecturing techniques were well perceived by the students as evident from the pre- /post-test analysis. This activity, due to its many advantages, boosted up their self-learning ability and enhanced their efficacy and self-confidence. We did this innovative interventional project on interactive lecturing techniques with the objective of exploring the feasibility of implementation, and we found that these are quite feasible. We need to sensitize students and faculties toward this innovative approach of learning. Interactive nature of the activity, group discussion, and motivating students strongly appeal to medical educators to use such type of simple methodology in the form of interactive lecturing techniques during didactic lecture to promote active learning among students. However, it will be worthwhile to further explore the scope of interactive lecturing techniques on a larger number of participants with more number of lectures. Few challenges such as need for more preparation, loss of control over the students, anxiety at not knowing the answers to questions posed by students, time constraints, and fear of not covering all of the material

can restrict the teachers from such interventions in the form of interactive lecturing.

CONCLUSION

Intervention in the form of interactive techniques during didactic lectures in physiology was moderately effective for point of the day and handouts followed by discussion techniques, while intervention in the form of putting questions in stipulated form and muddiest point were highly effective. All four techniques were well perceived by the students. An active role in their learning process seems to be more pleasant and productive than usual method. Thus, active learning methodology should be adopted in the medical courses throughout. These techniques appear to foster effective learning during didactic lectures, possibly through the effect of having more engaged learners, but perhaps also through having more structured learning activities.

This intervention provides opportunities for richer, deeper exploration of concepts and ideas. Students gain experience with analyzing ideas and applying concepts to solve problems or achieve goals as opposed to acquiring abstract knowledge.

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