

Medical Education / Original Article

## Implementation and Evaluation of Priming as a Teaching-learning Tool for Enhancing Physiology Learning Among Medical Undergraduates

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### Abstract

**Background:** It has been observed over the years that despite the best efforts of the teachers in reinforcing key concepts in their lectures, the outcome in terms of students' performance is not commensurate with the efforts, especially when the students in question are mediocre. Our study focusses on a teaching innovation that is more student-centric (active) than teacher-centric.

**Objectives:** To demonstrate the benefits of priming students before delivering formal (didactic) lecture on key concepts.

**Methods:** Students were randomly divided in two groups (A and B). Both the groups were primed on different topics with an open-book MCQ based test, before didactic lectures. This was followed by didactic lectures on these topics and subsequent MCQ based assessment of both the groups, where one group serving as a control for the other and vice-versa. Marks obtained were compared between the groups using Mann Whitney U test. Questionnaire was also administered to elicit their views on the method.

**Results:** The mean marks scored by "Group A" primed on Nerve-Muscle topics ( $17.08 \pm 1.85$ ) were significantly higher ( $p=0.0037$ ) than the marks scored by the unprimed group ( $15.94 \pm 1.82$ ). Improvement was observed in "Group B" primed on Blood-Immunity topics also but was statistically non-significant. ( $17.28 \pm 1.73$  Vs  $16.74 \pm 1.81$ ,  $p=0.1351$ ). The students' declared the 'self-priming' process as an effective way of learning, which helped in better orientation during class-room lectures.

**Conclusion:** The study proves the combination of student-centric priming model and didactic lecture as superior to the conventional, teacher-centric method alone.

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### Introduction

Medical Education in India is fast progressing and the primary focus is on acquiring competencies by medical students through self-directed learning and

is promoted by the active learning approach. Active learning is a way of improving student learning in the classroom by involving the student directly in the learning process (1). It is anticipated to initiate meaningful learning, improve attitudes toward learning and science, increase knowledge and memory, as well as motivate them to become self-regulated, independent learners (2, 3). Active learning is believed to promote higher order cognitive skills and increases self-efficacy of the students (4-6). Despite the promises active learning holds, the system of medical education is sceptical in adapting this change in pedagogy. Teachers as well as students still primarily rely on the conventional didactic means of instruction. The best approach for bringing the change in pedagogy is to combine active learning, where teacher can act as facilitator, with traditional teaching methods (2, 3, 7, 8). It has been shown that testing is a powerful means of improving learning, not just assessing it (9, 10).

Priming' means preparing or readying - the activity of putting or setting in order in advance of some act or purpose. Priming also refers to a technique in psychology used to train a person's memory. It was used as an active learning strategy in our study.

We planned this task for the class with the above-noted concerns and process. We tried to combine active learning (open book MCQ test before lectures: priming) with didactic mode of learning. The broad objective of the present project is to demonstrate the benefits of 'priming' students before delivering formal (didactic) lectures on key concepts.

## Methods

The evaluation study was commenced after obtaining ethical clearance from the Institutional Ethics Committee and was carried out in undergraduate medical (1<sup>st</sup> semester) students of our institute. Students were explained in detail about the project, and written informed consent was obtained. Out of 100 students, 99 consented to participate. Residents and other faculty members were sensitized by discussing the proposed plan of study with them. The activity was carried out during tutorial hours and did not interfere with regular

teaching schedule. The methodology was accomplished according to the protocol as depicted in the flowchart (Table I).

Topics were chosen from Blood-Immunity and Nerve-Muscle Physiology for the activity. The task assigned for "Priming" was multiple choice questions (MCQ) based open – book examination (OBE). The MCQs were of assertion-reasoning type (type E), which can test much more than simple facts. These were chosen from the question bank, already validated on the basis of difficulty and discrimination indices, the one with moderate difficulty level were selected. The entire activity was carried out with due diligence under the watchful eyes of the invigilator/investigator (monitored self-paced study leading to priming). The final assessment after didactic lectures was also type-E MCQ based, the students were assessed through another set of MCQs of same difficulty level. The maximum attainable marks were 100%.

Statistical analysis was performed using the Graph Pad Prism 5 and SPSS 21. The data was tested for normality. The mean and standard deviation of marks obtained was calculated and scores in the 2 methods were compared using Mann Whitney U test. A  $p < 0.05$  was taken as statistically significant.

At the end of the activity, a pre-validated feedback questionnaire was administered to the students (6), and their responses were recorded and measured on a Likert scale. Students were asked to complete the survey during class time in the presence of the tutors. They were asked not to record their names for anonymity. Feedback responses of the 99 students in both the group were recorded and satisfaction index for each item was calculated.

## Results

Mean marks scored by groups A and B in the topics are given in Table II. The marks scored by the group primed in nerve and muscle topics were significantly higher than the marks scored by the group that was not primed on that topic ( $p < 0.05$ ). No statistically significant difference in the marks was observed in Blood and Immunity topics in the two groups.

TABLE I: Flowchart showing the study protocol.

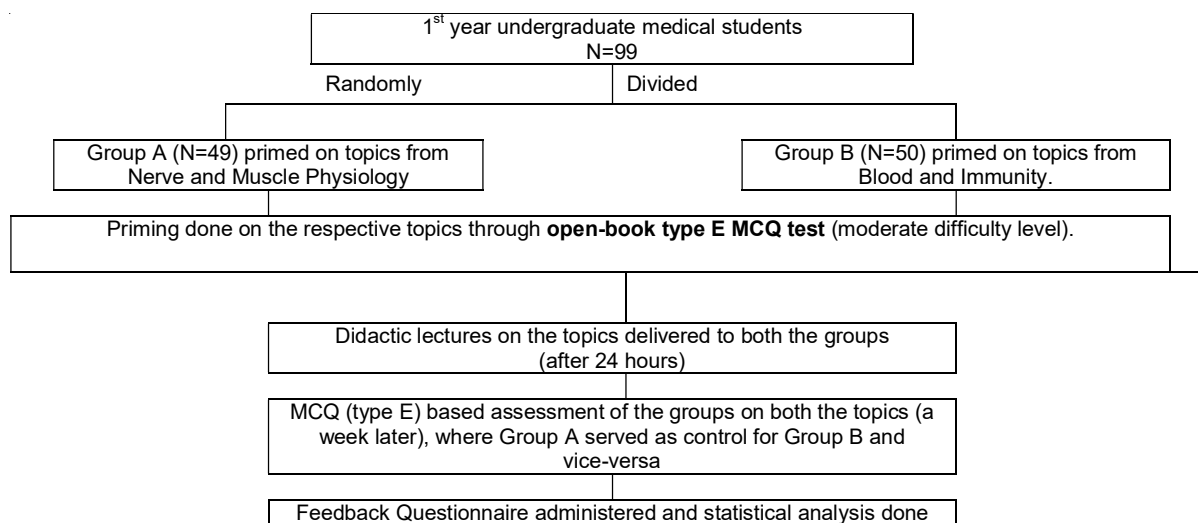


TABLE II: Marks (mean ± SD) obtained in nerve muscle and blood-immunity test by the primed and unprimed group. The scores were compared using Mann Whitney U Test, the significance level was set at P<0.05.

Topics (MM 20)	Marks obtained		Mann Whitney U Test p value
	Group A (Primed) N=49	Group B (Unprimed) N=50	
Nerve & Muscle test	Mean: 17.08 ± 1.85 (95% CI-16.55-17.61)	Mean: 15.94 ± 1.82 (95% CI-15.42-16.46)	0.0037
	Group B (Primed) N=50	Group A (Unprimed) N=49	
Blood & Immunity	17.28 ± 1.73(95% CI-16.79 ± 17.77)	Mean: 16.74 ± 1.81(95% CI-16.22-17.26)	0.1351

The feedback from students about the various aspects of the learning activity on a Likert scale is shown in Table III.

The minimum average rating was 3.64 for item 6, which specified that the activity is relevant in other subjects also. A maximum mean score of 4.44 was obtained for item 3, which stated that the activity helped them in better orientation during class room lectures.

The satisfaction index for each item was calculated using the following formula:

$$\frac{[(n_1 * 1) + (n_2 * 2) + (n_4 * 4) + (n_5 * 5)] * 20}{(n_1 + n_2 + n_4 + n_5)}$$

Where, n is the total number of students gaining the

score mentioned in the subscript for that particular item. It was highest (90.1) for item 3 and lowest (75.2) for item 4 on a 1–100 satisfaction index scale. All 10 items showed satisfaction indexes of 75 and above. Most of the students found the session interesting, according to them, it helped them in better comprehension, in better orientation during didactic lecture on the topic and in improving their analytical ability. Satisfaction Index as calculated from the above mentioned formula is given in Table III.

## Discussion

The primary focus of medical education is on acquiring competencies by the students through self-directed learning and is promoted by the active learning approach. “Priming” of students is one such active learning method used in our study. The concept of

TABLE III: Feedback responses of the 99 students and satisfaction index of each item.

S.N. Question	Strongly Disagree	Strongly Agree	Uncertain	Strongly Agree	Agree	Satisfaction Index
1. The 'Priming' session was interesting.	8	10	4	40	37	78.5
2. This activity was useful in better comprehension of the given topic.	8	12	5	41	33	76.8
3. This helps in better orientation during didactic lecture on the topic.	2	3	4	30	60	90.1
4. This session gives a broad overview of the topic.	10	12	3	43	31	75.2
5. This should be carried out for other topics in Physiology.	10	8	5	44	32	77
6. The activity has relevance in other subjects too.	10	7	22	30	30	76.4
7. 'Priming' helps in improving analytical ability.	6	16	5	40	32	76.2
8. 'Priming' is an effective way of learning.	8	12	5	39	35	77.2

"priming" or prior exposure to a topic for better comprehension and learning is new to medical education. In this study, we primed the students through open-book MCQ test on a particular topic on which the didactic lecture was not yet delivered. The students were informed beforehand that the marks of the priming MCQ test (type E) would count in the final internal assessment, so as to generate interest in the session. The students were permitted to refer to their text books to search the answers. To keep the concentration buzzing, we made certain that the task assigned to the student has the right difficulty level, i.e., not too difficult for the mediocre or academically weak students lest they should quit without attempting, and not too easy for the academically strong students lest they should take the exercise casually. According to Kember (2003), in experimental designs for naturalistic studies of innovative teaching in higher education, genuine control is impossible and practical difficulties in separating groups often result in contamination of designs (11). To overcome these issues, each group acted as a control for the other. Subsequently, both the groups were assessed on the topics after delivering didactic lectures. The marks obtained by the primed group on topics in Nerve and Muscle were significantly higher than the unprimed group, whereas no difference in the scored marks was observed in the Blood-Immunity between the two groups. The most probable reason for non-significant difference in the topics on blood and immunity could be prior exposure of the students to these topics during higher and senior secondary course, resulting in better performance in the control group as well. Tests not only measure the contents of memory, they can also enhance learning and long-term retention (9, 10). Through Open book examination

(OBE) before didactic lecture, we tried to enhance learning in the students. Another concept explaining our results is Bjork's (1994) hypothesis of introducing desirable difficulties to enhance learning. Bjork has proved that techniques that make initial learning slower or more effortful often enhance long-term retention (10). OBE is still not contemplated for summative or formative assessment in the medical field. But, using it as an active teaching-learning tool may be of some advantage, as shown in our study. Physiology is all about 'hows' and 'whys', where memorization of facts, rote and cramming have a little role to play. OBE can be considered as an active learning method when it is incorporated as a "priming" model. Here, on one hand it has an advantage of in-depth learning and understanding while searching for the answers, while on the other, the students are in-sync with the goings-on in the class during lectures due to prior exposure to the topic.

Our study emphasised on the fact that Physiology can be effectively taught by combining pedagogical and andragogical methods of teaching. There was a documented improvement in the students' performance in difficult topics by 'priming'. Furthermore, feedback of the students showed preference for this combined active and passive approaches of teaching. Many authors have also shared similar findings postulating the combined approach as the best way of teaching (2, 3, 12).

#### Limitations

Our study is limited by lesser number of sessions of the teaching-learning method involved. For carrying out this teaching method further, we would like to

select entirely new topics to which the students are not exposed, this would help in better comparison.

### Conclusions

Active learning is inevitable but we cannot ignore the importance of didactic lectures in the progression from simple to complex concepts in an organised manner. Better performance of the students in the primed group validates the combination of student-centric priming model and didactic lecture as superior to the conventional, teacher-centric methods alone. The strength of our study lies in the fact that this concept is being tested for the first time in Physiology. Weakness includes the reluctance of the faculty members in adopting this way of teaching-

learning as it requires extra time and effort on their part but they appreciated the feedback from the students and finally some have started practising this method. If this system is successfully followed, the present teacher-centric pedagogy should increasingly give way to student-centric activities where the teacher is only a facilitator.

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### Disclosures

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