

# Evaluation of Computer-assisted Learning Module for Undergraduate Pharmacology Practical Classes

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## ABSTRACT

**Introduction:** Undergraduate training in pharmacology recently has been reformed with adoptions of new methods of teaching that focus on supportive learning through novel teaching approaches like computer-assisted learning (CAL), integrated teaching, learning by problem-based clinical scenarios.

**Materials and methods:** This study was done on 125 second-year professional MBBS students after taking their informed consent. They were first given a pretest questionnaire and then divided into two groups, viz., group I and group II based on their performance in pretest. The CAL sessions were used to teach them experimental pharmacology topics. The performance of the students in the two groups in both pre- and posttests was compared. Students' perception on the use of CAL for delivering experimental pharmacology training was also assessed.

**Results:** A statistically significant difference in performance was seen among the students in the pre- and posttests in both the groups. Average scores for groups I and II in the pretest were 11.73 and 19.48 respectively. However, in posttest, the average scores for both the groups increased to 18.91 and 24.79 respectively. About 97% students strongly agreed that CAL sessions were interesting and easy to retain. The students' knowledge about the disadvantages of CAL was sound.

**Conclusion:** The study concludes that CAL is a promising teaching option for undergraduate practical sessions in pharmacology. It provides a platform for students to develop a near to real idea of actual experimentation and hence bridges the gap in isolated animal experiments and didactic demonstration classes.

**Keywords:** Computer-assisted learning module, Experimental pharmacology practicals, Isolated animal experiment.

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## INTRODUCTION

Demonstration of the effects of drugs on tissues or whole animal is an integral component of undergraduate pharmacology practical classes.<sup>1</sup> Medical students often face difficulty to visualize the various aspects of experimental pharmacology exercises. Though animals have been extensively used in the past in experimental pharmacology, gradually, live animal experiments are decreasing in most medical colleges in India.<sup>2,3</sup> A few reasons for the same are that animal experiments are tiresome with several practical constraints, availability of animals, maintenance of an animal house, and ethical clearance needed for animal experiments.<sup>3</sup> Due to numerous constraints with the use of animals for academic purpose, the other method available for teachers is the interactive multimedia software.

Computer-assisted learning (CAL) software seems to be a promising option for undergraduates, as it not only provides them in-depth knowledge to visualize live animal experiments on a computer screen but also helps them to self-assess their acquired knowledge through a series of multiple choice questions.<sup>4</sup> The present study has been conducted with the aim to assess the knowledge gained through CAL sessions and to find out if the students of Mahatma Gandhi University find CAL as a useful learning tool for experimental pharmacology.

## MATERIALS AND METHODS

### Study Design

This questionnaire-based study was approved by the Institutional Ethics Committee of Mahatma Gandhi Medical College and conducted during January and February 2017. In the experimental pharmacology demonstration class, all the second-year students were briefly explained the aims and objectives of the study and the importance of participation in the study. A written informed consent was sought from those who wished to participate. Neither threat nor any pressure was generated on the students who declined to participate. A total of 125 medical students volunteered for this study. The volunteers were first given a prevalidated questionnaire containing 10 multiple choice questions on each of the following topics: The effect of drugs on rabbit eye, the

effect of drugs on blood pressure of dog, and the effect of various drugs on frog’s heart, and they were instructed to answer all the questions independently in 20 minutes’ time. Following that, students were divided into two groups based on their performance in the pretest. Group I included average and good performers who scored more than 50% marks, while group II included underperformers who scored 50% marks or less than that in the pretest. Both groups were together taught these three practical exercises in three consecutive practical classes in the CAL laboratory. The Expharm Pro and Xcology Pro Animal Simulator—Pharmacology software developed by Elsevier India was used to deliver the lecture to the students. After the completion of each practical session, the same questionnaire was given to both groups of students to assess their knowledge gained. The students were instructed to answer all the questions independently in the same duration as that of the pretest.

The performance of the students in the two groups after pre- and posttests was then compared and analyzed. In the last practical class, the perception of all the students on CAL as a teaching method in experimental pharmacology was analyzed using a 5-point Likert scale (ranging from strongly disagree to strongly agree) as depicted in Flow Chart 1.

**Statistical Analysis**

The mean scores along with the standard deviation were calculated for both groups I and II and tested for significance. The collected data were analyzed using

Statistical Package for the Social Sciences for Windows, version 16.0 (SPSS Inc., Chicago), Excel 2010 with statistical significance evaluated using a two-sided p-value at a 5% level of significance.

**RESULTS**

The mean scores of each group increased from pre- to posttest with a p-value of <0.0001 (highly significant) for both groups. This appreciates the efficiency of CAL in experimental pharmacology as depicted in Table 1. The number of students with >50% score increased from 29 to 41 in pre- and posttests in group I (Graph 1), while in group II, the number of students with >70% scores increased from 4 to 67 (Graph 2). The perception of the students about the CAL module was appreciable. In all, 97% of the students felt that CAL sessions were interesting and impart a better understanding of the topic. All the students felt that through CAL, repetition is possible, while 95.2% felt that through CAL, the effects of the drugs are clearly visualized and easy to remember (Graph 3). The knowledge of the students regarding disadvantages of CAL is shown in Graph 4.

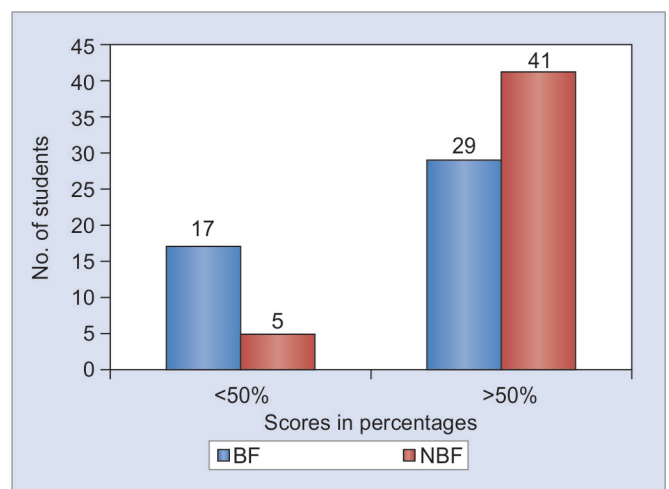
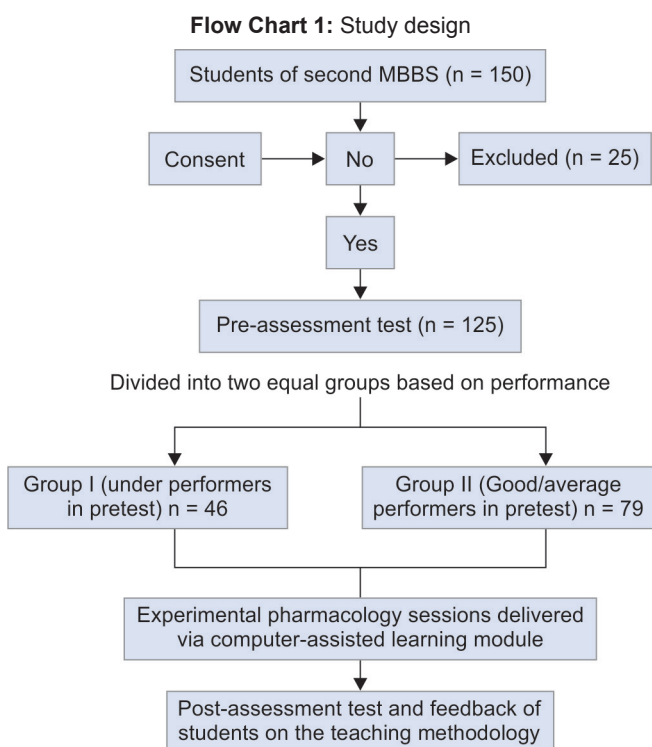
**DISCUSSION**

The zeal and enthusiasm with which the students participated in the study and their feedback on CAL sessions

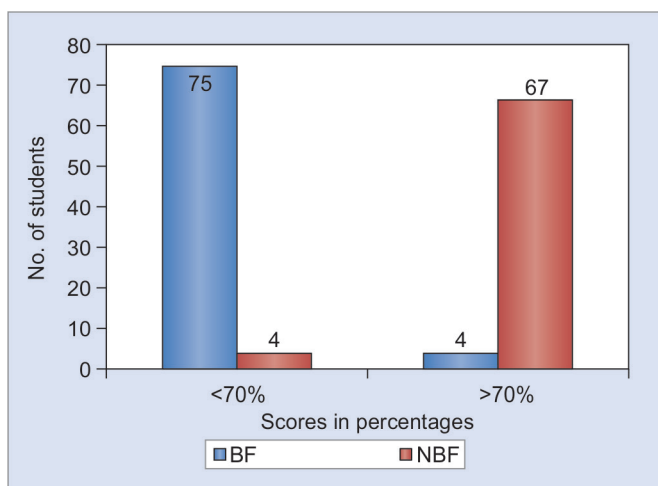
**Table 1:** Comparison of mean scores between group I (n = 46) and group II (n = 79) in pre- and posttest CAL sessions

	Group I	Group II
Pretest mean score with standard deviation	11.73 ± 3.28	19.48 ± 1.79
Posttest mean score with standard deviation	18.91 ± 2.18	24.8 ± 2.13
p-value	<0.0001 HS	<0.0001 HS

HS: Highly significant



**Graph 1:** Distribution of the students in group I (n = 46) according to percentage of scores in pre- and posttests



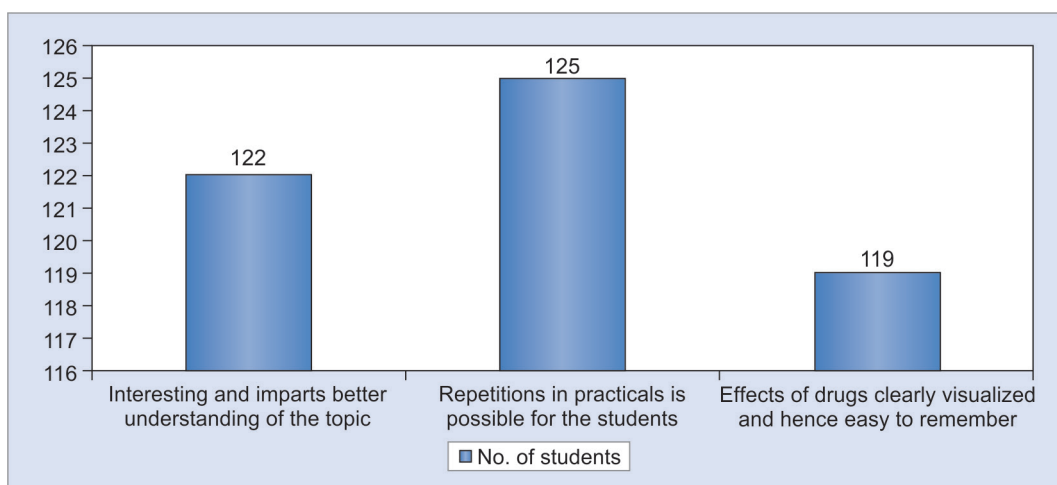
**Graph 2:** Distribution of the students in group II (n = 79) according to percentage of scores in pre- and posttests

clearly indicate the need to replace the traditional demonstration classes with a CAL module. Medical colleges in the USA, such as Mayo, Harvard, Columbia, and

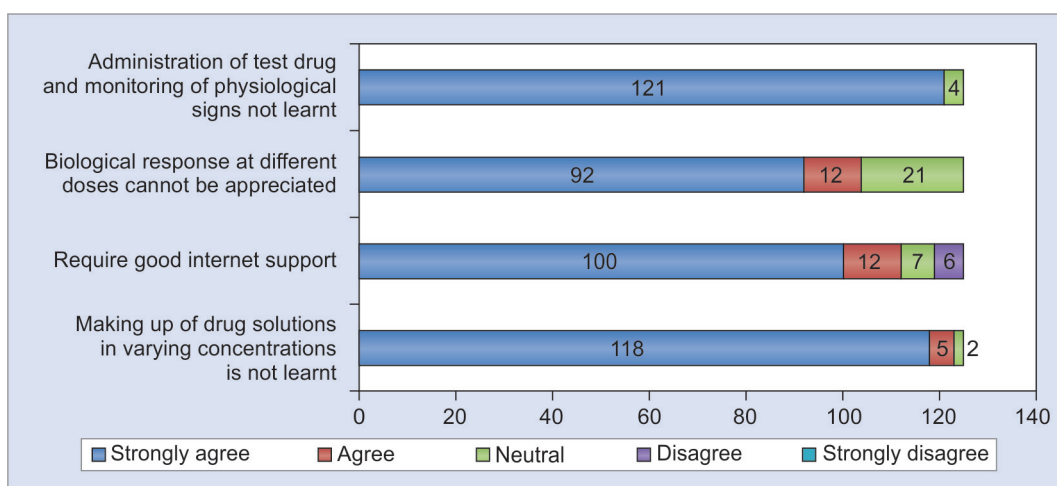
Yale, have no live animal laboratories now. The Medical Council of India has also suggested all medical colleges to use alternatives to animal experiments in the undergraduate medical course as per the 2009 amendment.<sup>3,5,6</sup>

The CAL plays an important role in imparting skills to the students, whether practical or theoretical. It has the qualitative and quantitative potential to raise teaching standards to new levels of sophistication which results in a better implementation of the skills and also improved outcome from the students. Moreover, its cost-effectiveness is another great advantage when compared with live animal experiments.<sup>7</sup>

The result of our study coincides with a study of Nettath<sup>8</sup> where an overall good outcome measure was derived from pre- and posttests in all types of students, whether average performers or good performers. The knowledge acquired through CAL sessions ultimately serves as a vehicle for the successful inculcation of practical and animal handling skills which otherwise could



**Graph 3:** Perception of the students (n = 125) regarding the CAL module for experimental pharmacology exercises



**Graph 4:** Knowledge of the students (n = 125) regarding the disadvantages of CAL module for experimental pharmacology exercises

be lacking in students nowadays due to no live animal experiments at the undergraduate level.<sup>9</sup>

In a previous study involving CAL, it was concluded that it is a good teaching and learning method in all the three groups of students and the average performers outdo the underperformers in terms of outcome analysis after CAL. Our findings are also congruent with these previous findings, but in our study, the demarcation of students into groups is based on the performance of the students in pretest rather than their first-year MBBS performances.<sup>8</sup>

In a study conducted by Govindaraja et al,<sup>4</sup> it was emphasized that 70% of students achieved the learning objectives, while in our study, 97% students responded that CAL sessions were interesting and imparted a better understanding of the experiment. In another study, it was highlighted that the students preferred CAL adjuvant to practical pharmacology teaching.<sup>10</sup>

Our study justifies the effectiveness of CAL sessions for learning for both the groups: The underperformers as well as average and good performers. The strength of the study is that the students were grouped into two according to their performance in a pretest and subsequently both groups were introduced to CAL sessions and then again assessed for their knowledge gained. The recruited students did not have any previous knowledge about these exercises, so the actual knowledge which they gained through these sessions was assessed. However, one limitation of this study was that the outcome was not compared with other teaching learning methods, such as traditional demonstration lectures, flipped classroom, and problem-based learning scenarios.

## CONCLUSION

Computer-assisted learning is a valuable tool. It strengthens the learning experience of the students. The CAL-like technologies may not replace the original isolated animal experiments; rather, they bridge the gap between didactic theory classes and practically doing experiments on animals, thereby increasing the opportunity for students

to develop a near to real idea of actual experimentation. By incorporating CAL in the student's curricula, the unnecessary wastage of time in experimental setup and also wastage of resources like animals and instruments will be reduced and will make learning easier.

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