

A COMPARATIVE STUDY OF CAL (COMPUTER ASSISTED LEARNING) VERSUS CONVENTIONAL METHOD FOR TEACHING EXPERIMENTAL PHARMACOLOGY.

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Abstract/Executive summary

Title - A comparative study of CAL (Computer Assisted Learning) versus conventional method for teaching experimental pharmacology.

Introduction - CAL or computer assisted learning demonstrates all the steps of the experiment in the form of a simulation. The students perform the experiment virtually and observe the effect of different drugs by themselves in computer lab.

Aims and objectives - To compare the effectiveness of CAL versus conventional method for teaching experimental pharmacology by assessing the students' understanding of the practical exercise.

Methodology – A comparative study was carried out on 102 2nd year MBBS students who were randomized in two groups. One group was exposed to conventional method and another group was taught using CAL. Both the groups underwent an MCQ test pertaining to the experiment. The groups were then crossed over for the next experiment. This was also followed by an MCQ test. A feedback regarding their perception about CAL v/s conventional teaching was taken from both students and faculty. Statistical test was applied to compare the results of the two groups. All required ethical permissions were taken.

Results – There was a statistically significant difference (p value < 0.001) between the MCQ scores of the two groups. It clearly indicated that students could understand the experiment better when taught by CAL. The feedback given by both students and faculty favored the use of CAL.

Conclusion – Results of the study showed that students learn better by using CAL so it should be implemented as the teaching and learning method in experimental pharmacology.

Key words – simulation, teaching, experimental pharmacology

Introduction

Pharmacology curriculum is incomplete without practical sessions. Practical sessions demonstrate the effect of drugs on isolated tissues or intact animals thus strengthening the theoretical concepts taught in lectures. Thus laboratory based practical classes are an important aspect of both teaching and learning pharmacology^(1,2) Previously, a large number of animals were required and were sacrificed during each experiment for demonstrating the already established action of drugs.⁽³⁾ There were representations from the organizations like PETA which opposed such cruel use of animals. In India, animals for experiments were being procured from unauthorised small vendors but modified CPCSEA guidelines ban the procurement of animals from unauthorized sources.⁽⁴⁾ All this made the animal experiments

difficult to demonstrate to the undergraduate students. The Medical Council of India (MCI) has issued guidelines underlining that at undergraduate level, animal experiments need not be performed and instead use of CAL should be incorporated.

As a CAL laboratory is not available in most institutes, they have replaced the animal experiments with theoretical teaching of the experiment. There is lecture on the procedure of the experiment and the response of the drug is shown by drawing it on the blackboard or by showing older tracings of the experiment. Many students find it difficult to learn theoretical concepts of autonomic nervous system in the absence of a robust practical experiment. As students are well versed with the use of computers, they find CAL convenient, easier to perform and user friendly. It has an interactive interphase where drug effects can be visualized very clearly. Students can work in groups and observe the experiment at the same time.^{(5,6) (7)}

There are studies which describe CAL as a teaching-learning tool and students perception about it.^{(2) (8) (9)}. However, studies regarding its effectiveness are limited.^{(1) (5) (10)}

This study was undertaken to evaluate the effectiveness of CAL as compared to the theoretical conventional method of teaching experimental pharmacology by assessing the student's understanding of the pharmacology practical on drugs acting on autonomic nervous system. A secondary objective was to assess the perception of undergraduate students and faculty of Pharmacology Department regarding CAL.

Methodology

A prospective comparative interventional crossover study was conducted at Department of Pharmacology, AMC MET Medical College, Ahmedabad during the period of 6 months from October 2017 to March 2018. The study was approved by Institutional review board. The study included 102 undergraduate medical students (2nd year MBBS). A written informed consent for the study was taken from the students.

Inclusion criteria

All students who give informed consent.

Exclusion criteria

The students who were absent in any of the practical session during the study period.

Study procedure

It was decided that two experiments (one in vivo and in vitro each) namely "Effect of drugs on rabbit's intestine" and "Effect of drugs on dogs BP" would be included in the study.

Faculty involved in the study was familiarized with CAL software and its use.

Authors prepared MCQ tests for both the experiments to test the knowledge and skills acquired about the experiment and mechanism of action of various drugs. A feedback questionnaire for both students as well as faculty was prepared to assess their perception regarding CAL was prepared and validated by the senior faculty of the department.

The students were divided into two batches A and B. of 51 each. For the experiment "Effect of drugs on the rabbit intestine" Batch A was taught using the conventional method. In conventional method the students were explained the experiment orally and the response of the drug was drawn on the blackboard. They were also shown the old tracing of the experiment. Batch B was taught using CAL software Ex-Pharm Pro. This software has programs of various experiments. This software explained the choice of animal for the experiment, equipment used in the experiment, drug of choice for anesthesia in case of in vivo experiment. It has an interactive interface showing the effect of various drug and their different doses on the isolated tissue or different parameters like BP, heart rate, respiration in intact animal. The user can conduct experiments and collect data. Each program can be run in

two modes (a) Tutorial mode (b) Examination mode. The students worked in a group of 4 on one computer.

An MCQ test consisting of 10 items was given in both the batches after the practical. Students had the choice of being anonymous and were informed that the marks of the MCQ test will not be included in internal marking. The batches were crossed over for the next experiment "Effect of drugs on dog's Blood pressure" after 1 week and were again given an MCQ test of 11 items.

The same faculty member conducted the experimental practical by conventional method for both the batches. Same applied for the experiment conducted using CAL.

After both the batches had been exposed to CAL a feedback regarding their experience and preference for the teaching methodology was taken from students as well as faculty by using a feedback questionnaire based on Likert Scale

Evaluation was done by assessing the performance of the students in the given test in both the batches. Mean score of the students of both the batches for both experiments was calculated. Comparison was done between the results of tests of conventional study group and CAL group using unpaired t test and p value was calculated. The p value of <0.05 was considered significant

The feedback form filled by students as well as faculty was also assessed and percentages were calculated for different responses on the Likert scale.

RESULTS

The marks of both the MCQ test of the 102 students were calculated. It was found that the mean score in the MCQ test of 10 marks for the experiment "Effect of different drugs on rabbit's intestine" was 6.56 ± 1.58 for the CAL group, while it was 5.31 ± 2.053 for the group taught by traditional method. Unpaired t-test was applied and the p value was found to be < 0.001 which is statistically significant. (Table 1)

Mean score in the MCQ test of 11 marks for the experiment "Effect of different drugs on dog BP" was 5.41 ± 1.94 in the CAL group as compared to 3.87 ± 1.36 in the traditional teaching group. The p value was found to be <0.0001 which is statistically significant. (Table 1)

The response to the feedback questionnaire filled by the students showed that 64.65% students preferred CAL as the teaching learning method as compare to conventional method for experimental pharmacology. A majority of the student found CAL a more time efficient (65.51%) and interesting way of learning (66.37%) experimental Pharmacology as compared to the conventional method. (Fig.1) The result of the questionnaire elucidate that the students prefer CAL over conventional teaching method.

In the feedback form students were required to grade CAL as teaching learning method compared to conventional method regarding clarity of procedure, student's involvement, material used and understanding of the concept. Majority students graded CAL as "very good" or "good" teaching learning method regarding clarity of procedure (30% & 40.5% respectively) students' involvement (20% & 48% respectively), material used (25% & 50% respectively) and understanding the concept (28.50% & 44% respectively) as compared to the conventional method (Fig.2)

Faculty feedback was taken regarding their perception about CAL as teaching learning tool for experimental pharmacology. The faculty feedback also favoured the use of CAL as a teaching learning method. The faculty felt that student enjoyed the teaching learning experience using CAL. They also responded that it was a more time efficient and interactive way of teaching experimental pharmacology. The limitations of the use of CAL was that

technical support in the form of computer lab, antivirus programme is required. Secondly it is a costly software. Moreover, it shows only the preprogramed experiments so any new experiment cannot be performed using CAL.

TOPIC	TRADITIONAL METHOD	COMPUTER ASSISTED LEARNING
EFFECT OF DIFFERENT DRUGS ON RABBIT INTESTINE	MCQ (10) 5.31±2.053	MCQ (10) 6.56 ± 1.58
	P VALUE <0.001	
EFFECT OF DIFFERENT DRUGS ON DOG BP	MCQ (11) 3.87±1.36	MCQ (11) 5.41± 1.94
	P VALUE <0.0001	

Table 1 Mean score in MCQ test

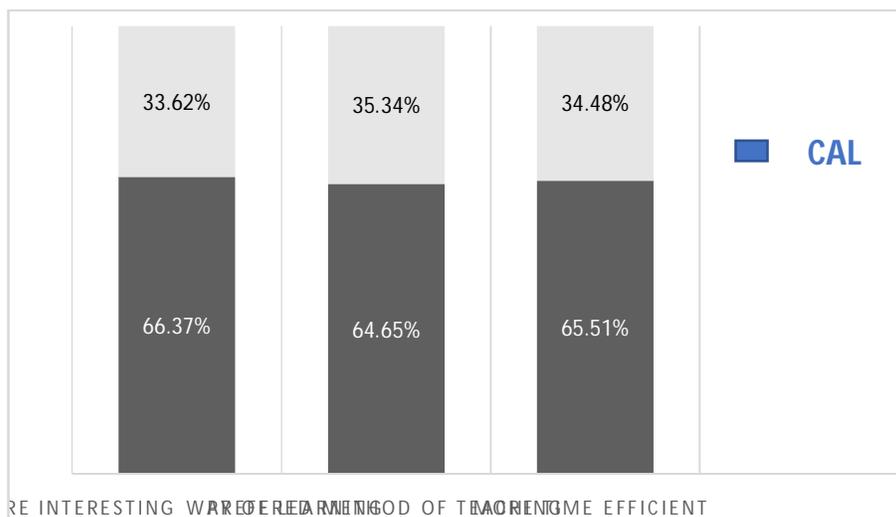


Fig.1 students' feedback regarding CAL as compared to conventional method.

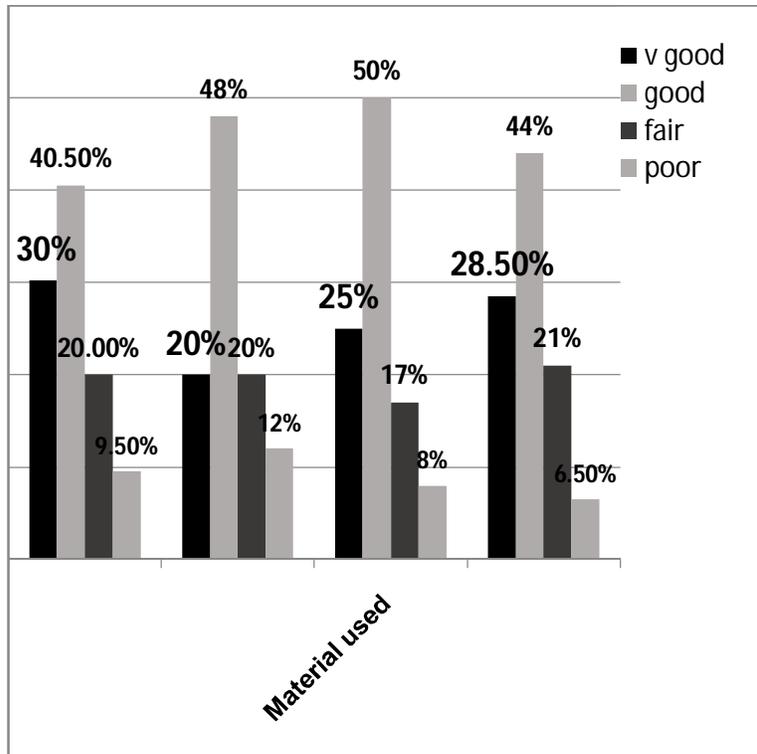


Fig 2 Students feedback regarding CAL on 4-point Likert scale.

Discussion

In this study done on the 2nd prof MBBS students it was found that there is statistically significant difference in the performance of the students taught using CAL as compared to the students taught by conventional method in the MCQ test given to both the groups.

The feedback given by the students in our study found that students favoured CAL over conventional method of teaching experimental pharmacology. CAL demonstrates the step wise process of the experiments starting from choosing animal, a video of the dissection of the animal in case of isolated tissue experiment, type of anaesthesia in case of in-vivo experiments, instruments used, and an interactive interface showing the effect of drug. The students found there was more clarity of the procedure of the experiment when using CAL as compared to the conventional method. These results concur with previous research done where students gave the feedback that the it was much easy to understand the procedure as they were able to visualise the process with CAL. ^{(1) (2)}

In the feedback given by the student as well faculty in our study CAL was a more time efficient way of demonstrating the experiments. Similar results were reported in the study by A. Kuruvilla et al. ⁽²⁾

In our study there is a statistically significant difference in the scores of the students taught by CAL as compared to those taught by conventional method. In a study done by Amirtha R. et al. improved performance of undergraduate students in terms of mean score and number of students scoring more than 50%, showed superiority of CAL over conventional teaching as a teaching tool. ⁽⁵⁾

As students nowadays are well versed in technology, they gave the feedback in favour of the material used in CAL. CAL is not only convenient to use but because of the interactive interphase students find this a more interesting way of learning. Similar findings were reported in earlier studies in India, Malaysia and Australia ^{(1) (5) (10) (8)}.

Faculty feedback also favoured use of CAL as CAL has better visual recall. They reported that this was an interactive way of teaching. The disadvantage of CAL reported in the faculty feedback in our study was dependence on the computer technical problems which may arise during the session. These findings have also been reported in the earlier studies ^{(1) (2) (11)}

Limitation of this study is that only two experiments were considered for the study. More such studies are required to establish the advantage of CAL over the conventional method of teaching experimental pharmacology

Conclusion

In this study CAL was found to be more effective than conventional method in teaching the concepts of autonomic experimental Pharmacology. Computer assisted learning of experimental Pharmacology can easily replace the conventional method. CAL is an active method of learning. Students learn by doing thus it improves their performance and overall learning experience.

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