ORIGINAL ARTICLE

Use of Computer Assisted Learning as an Alternative to Experimental Pharmacology Teaching: Student's Opinion

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Abstract

To evaluate student opinion on use of CAL in the MBBS 2nd professional experimental practical pharmacology curriculum. Also to get their views on the advantages and disadvantages of using CAL over traditional methods. A cross-sectional questionnaire based study was conducted at HIMS, Dehradun and Uttarakhand. After explaining the purpose of the study, voluntary inform consent was taken from the subjects before the start of the study. Students were instructed on experiments followed by computer simulation of the same. Thereafter a validated self-designed questionnaire form was duly filled by each respondent. Out of the total 98 students, 88 (90%) of these thought that CAL is an effective method of teaching practical aspects. They also agreed to the fact that CAL should be conducted as an adjuvant to practical classes. Majority of students agreed that using CAL was advantageous to them .CAL is accepted as a welcome change by undergraduate students. However on the other hand practical knowledge of how to do the experiment is lost.

Key Words

Alternative, Animal Experiments, CAL, Pharmacology Education

Introduction

Attempts have been made all over India to make the teaching of experimental pharmacology more interesting and relevant. (1) Various assessment tools like feedback may help to know about the pros and cons of teaching and assessment methods. Presently, student's feedback represents the primary means used by most programs to assess their methodology. (2, 3)

Animal experiments, for long, have been an integral part of the pharmacology education at medical colleges in India. (4) Thousands of animals were used annually in educational institutes despite efforts by concerned teachers and activists to reduce this number. Traditionally used laboratory based practical classes which included demonstration of drug effects on tissues, has been the central feature of undergraduate (UG) pharmacology learning since a long time.(5) These experiments are expensive, time consuming and tedious. (6, 7) Also, the availability of animals is becoming sparse. Guidelines by Committee for the Purpose of Control and Supervision

of Experiments on Animals (CPCSEA), University Grants Commission (UGC) and the Medical Council of India (MCI), suggest 3 Rs i.e., replacement, refinement and reduction in animal experiments, with the fourth R added, that is their rehabilitation, as an added measure for their care.(8-10)

In the recent years the UG training in pharmacology has been revolutionized with the adoption of several innovative teaching approaches such as small group discussions, role plays, computer assisted learning (CAL) and use of audiovisual aids. (11) The use of animals for teaching and learning of basic sciences has shown a downward trend over the last decade.(12)

In this changing scenario, development of alternatives is the need of the day. The use of live animal experiments is decreasing in many medical colleges across India.(13) These are gradually being replaced by certain alternatives that are available at relatively low cost and with proven educational efficacy. Computer assisted learning through

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software obtained from Elsevier Animal Experiments under animal simulator which comes as a promising alternative. It is an interactive computer assisted learning program without the involvement of real experimental tools. In the era of rapidly changing trends in teaching methods and practices, CAL comes as a mixed bag of package with both advantages and limitations.The program can be repeated over and again, any number of times without the unnecessary use of animals. (5) It is increasingly felt that sacrificing animals for the assessment of student's cognitive skills rather than psychomotor skills is clearly unjustified. On the other hand the availability of animals is also becoming sparse and expensive. Maintaining of animal houses as per CPCSEA guidelines (8) has become furthermore a difficult task. The animal experiments are tedious, time consuming and biological responses vary from animal to animal. (3)

On the other hand the development of computer based learning materials requires expertise in content and in technical aspects of design and delivery. Trained personnel's offering the technical design may overlook important educational principles and those who focus on content may expect the technology to deliver their impossible imaginative ideas.

To explore all these aspects from a student's perspective, this study is planned to gather their view on the pros and cons of CAL usage as an alternative to animal experimentation.

Material and Methods

This cross-sectional study was conducted in the Department of Pharmacology, Himalayan Institute of Medical Sciences, Swami Ram Nagar, Dehradun, Uttarakhand among 98 second professional MBBS students after obtaining informed consent.

CAL software obtained from Elsevier Animal Experiments under animal simulator was included in the MBBS 2ndprofessional practical curriculum as an alternative to experimental pharmacology.

Interactive demonstration sessions were conducted to orient the departmental faculty, which covered the methodology and instructions for the CAL. A schedule for one and half month was prepared for the students for doing the experiment using CAL, so that the experimental work could be done within the time allotted for the same.

In the first part of the study, 98 students were (1st step) given theoretical instructions on different animal experiments that dealt with the action of autonomic drugs were selected. It involved the rabbit eye, the frog heart and the rabbit intestine.

It was followed by (2nd step) further learning of the procedure and recordings their observations on the computer using software by the students themselves. Each computer had a maximum of 3 students to avoid over-crowding. The acceptability, advantages and disadvantages of using CAL as an educational tool was then assessed by using a validated pre-designed questionnaire.

Statistical Analysis

The questionnaire was analyzed using descriptive statistics in the form of bar charts .

Results

The respondents were students enrolled in the department of pharmacology for 2nd professional examination.Out of the total 98 students, between age group of 19-21 years, the majority (65%) of respondents were female.

90% of these respondents thought that CAL is an effective method of teaching practical aspects of pharmacology. Same number of them also agreed to the fact that CAL should be conducted as an adjuvant to practical classes.

Majority (90%) of them welcomed CAL as a change from traditional laboratory animal experiments.Among all the students 93% agreed that using CAL was advantageous to them whereas 89% stated that use of CAL was disadvantageous. (*Fig: 1*)

Exploring the views of students regarding various advantages of using CAL, 93 (95%) of the respondents stated that with its help, many experiments could be performed in a short time and also the use of animals is avoided. Majority of them (95%) agreed to the points that the exercises which are otherwise difficult to conduct in the laboratory can still be demonstrated using CAL and many students can observe it at a given time. They also felt (94%) that experiments can be repeated over and again without the loss of animals and also that the experimental errors are minimized according to 95% of students.

Most common reasons given by the students (92%) as the disadvantage of CAL, was that experiment is programmed with prefixed doses so the exploration of the pharmacology relating to the variation of doses cannot be performed and in addition the lack of interaction with live animals was also seen as a negative point of using CAL.(*Table:1*)

Students (97%) believed that the experiments performed on living tissue in laboratory are much easier to remember. They also observed that CAL required

Fig.1 Use of CAL in Undergraduate Curriculum Student Opinion
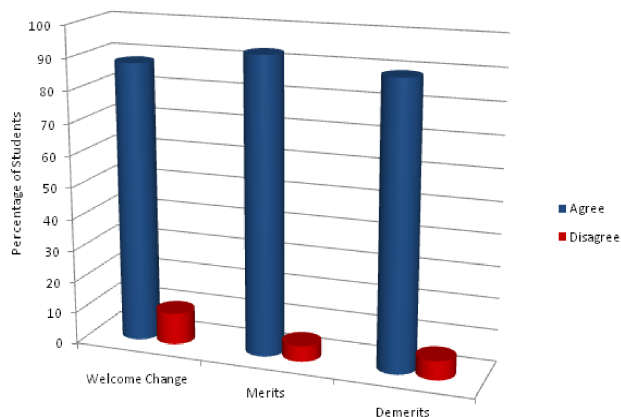
also in a shorter time, when they used CAL. Experiments can be observed repeatedly and independently without loss of animals according to 94% of student's opinion when the CAL was fully implemented .Large number of them can perform the experiment at the same time at their respective stations .whereas the animal experiments were usually conducted among groups of candidates and depending on the availability of animals the student's group size varies. In addition, the time spent on the experimental pharmacology sessions was significantly reduced .We were able to use this spare time for more-relevant, clinically-oriented practical classes. The implemented programme has now become an integrated part of the practical teaching of undergraduate pharmacology in our institution. Reduction in expenses involved with use of

Table 1 Student Opinion for The Use of CAL as Alternative To Animal Experiments

S.No.	opinion	Questions	Agree
1	Welcome Change	CAL is an effective method of teaching practical aspects.	88
		Experiment on Computed Assisted Learning is easier to remember.	87
2	Merits	No experimental errors are seen as in laboratory exercises.	93
		Experiments can be observed repeatedly without loss of animals.	92
3	Demerit	Experiment is programmed with prefixed doses.	90
		Practical knowledge of how to do experiment is lost	88

expertise to handle technical errors related to computers and is an expensive method of teaching. Practical knowledge of how to do experiment is lost was the opinion of majority 90% of the students.

Discussion

For a long time, animals have been used globally for teaching medical subjects; especially pharmacology.Undergraduate teaching to demonstrate effects of various drugs has been phased out in most institutes. (14) Typical experiments included effect of drugs on rabbit intestine, rabbit eye, frog heart and frog rectus. The latter have however declined owing to the ban on use of frogs. (6, 15, 16). Although in India, most medical colleges have begun using or in transition phase to implement alternatives to animal experiments in undergraduate courses. (4, 6, 17)

It is encouraging that the majority of our students were aware of CAL and familiar with the use of computers. The test scores and feedback at the end of practical sessions showed that the respondents gained a better understanding of the mechanisms of action of drugs and

animal experiments is a definitive advantage. (5,18) Studies have documented that computer simulations of animal experiments are more cost effective than establishing and maintaining animal houses.(5,15) Dewhurst DG *et al.* study results revealed that the cost of conventional teaching method with animal experiments ($540) was five times greater than that of CAL ($2598).(19)

Despite all the benefits of CAL, there are few associated disadvantages which were also shown by them. The virtual experiments and simulations have prefixed doses which hinder students (92%) to observe biological response at desired doses. In a virtual laboratory setting, there are certain skills that cannot be adequately taught, which pharmacology faculty consider necessaryl in pharmacology training.Practical knowledge of how to do experiment is lost according to 90% of respondents. These include pre experimental work up - making up of drug solutions in varying concentrations, setting up and use of experimental equipments, administration of test drugs and monitoring of the

physiological signs. (18, 19, 21) CAL also limits the direct interaction with the living tissue and observation of variations in responses in living tissue. The practical knowledge and experience of a real experiment is lost. (22) Despite all the benefits that CAL may bring, it is often easily forgotten in comparison to traditional animal experiments. (5) CAL is expensive in the initial stages of implementation in the curriculum. Dependence on computers and technical problems arising during class are other disadvantages with CAL.

Conclusion

CAL has the potential to bridge the gap between theory and practically doing experiments on animals, increasing the opportunity for students to develop a near to real idea of actual experimentation. Use of CAL as an alternative to animal experimentation is becoming an increasingly important area within undergraduate practical teaching in pharmacology, and this study shows that it is a welcoming change from the students. The incorporation of CAL in the student's curricula reduces the unnecessary wastage of time in experimental set up and alsowastage of resources like animals and instruments. There is increase in the time available to monitor individual student performance and which in turn helps in improving the student's attitude toward the course. Moreover CAL offers significant advantages in the reduction of instrumental errors and variability of responses from animal to animal and also provides opportunities for asynchronous learning thus offering learning in a student friendly way. With the aim of improving student's skills relating animal experimentation we conclude that incorporation of CAL into the curricula of undergraduate students of pharmacology would definitely prove useful and will make learning easier.

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