Original Research Article

A questionnaire based comparative study on dry lab versus wet lab among second year medical undergraduates in a tertiary care hospital of Bihar

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ABSTRACT

Background: Objective of the study was to identify whether there is any benefit of integrating dry lab/computer assisted lab (CAL) tool with conventional teaching/wet lab in experimental part of pharmacology.
Methods: A questionnaire based study was conducted among 158 second year medical undergraduates in the department of pharmacology. The questionnaire was distributed among students with proper prior instructions in practical class. Students willing to participate in the study were included.
Results: Total 94.9% were in the favour of replacing conventional teaching with CAL lab learning, 74.7% felt conventional lab to be more complex, 92.4% has the opinion of CAL lab result has less error along with that majority student felt it to be less time consuming, need lesser assistance and enhance learning. 67% student also felt real experimentation can't be learned by CAL tool and 83.5% have their thought that CAL lab can never help them in exercising real experiment.
Conclusions: Although there is no substitution of conventional teaching methods, in this new era of information and technology CAL lab can be the saviour to students in making better understanding and enhancing the performance without help of experimental animals.

Keywords: Computer assisted lab, Tool, Dry lab, Pharmacology, Wet lab

INTRODUCTION

Today information technology have become the essential commodities of everyday life, even the undergraduate medical students are benefitted with the use of computers in various disciplines such as anatomy, physiology, pharmacology, surgery etc.[1] Pharmacology is a branch of science that deal with the study of various aspects of drugs properties such as pharmacokinetic, pharmacodynamics, drug interaction, indication, contraindication and adverse drug reaction (pharmacovigilance).[2] The teaching in pharmacology consist of two approaches doctrinaire as well as laboratory based practical approaches which involve in vitro and in vivo experiment (wet lab) and both require animals. Recently, the use of animals has been discouraged because of all ethical issues such as pain, distress and death experienced by animals.[3] Moreover, there are many drawbacks of animal experimentation such as require skilled staff, animal house, time consuming protocol and high cost maintenance. To overcome all these drawbacks a strategy of 3 rs (i.e reduction, refinement and replacement) is applied for laboratory use of animals.[4] Computer assisted lab (CAL) learning (dry lab) 5 tool comes under the replacement in one of the 3 rs and have

become one of the most effective replacement acquired by most of the medical colleges for learning of the undergraduates.[6] Now, this CAL technique include series of animal experiments to understand the effect of drug at molecular level. Students get the freedom to choose various drugs at various doses to see its effect at in vivo and in vitro level.

In India the syllabus of pharmacology of undergraduate MBBS students as per MCI guidelines includes both in vivo and in vitro experiments. In vivo experiments such as demonstration of effects of different drugs on rabbits' eye, eddys hot plate, rota rod etc. and in vitro experiments such as demonstration of different drug on rabbit ileum, frog's perfused heart and dog blood pressure preparation.[7]

Various studies shows CAL offers a strong potential in increasing the student learning which is further evidenced by the fact that CAL has been included in the 95% of medical schools in US and 100% in united kingdom and Canada.[8] However, few studies has been carried out in developing countries like India to generate a potential data which can evidence its potential and efficacy.

METHODS

A questionnaire based study was conducted during one month (October 2019 to November 2019) among 158 students of second year medical undergraduates of third and fifth semester in the department of pharmacology at All India Institute of Medical Science, Patna. A well validated questionnaire was prepared for making a comparative study between CAL learning and conventional lab learning. The questionnaire was distributed among students with proper prior instructions in practical class. All questionnaire feedback form sheets were collected at the end of practical class by the respective teacher taking the scheduled practical class.

Students willing to participate in the study were included in the study. Unfilled forms, students unwilling to participate, students absent in the class were excluded from the study. Microsoft excel was used to analyse data.

RESULTS

According to the feedback form assessed 94.9% of students find Conventional lab replaced by CAL lab is a good step for pioneer learning process. 97.5% students feel CAL procedures are easy to handle. Real experimental steps illustration can be depicted in CAL lab as per 84.81% students. On the other hand, 74.7% students didn't favour equipment based study may be due to its complexity and chances of more error as seen in Conventional lab. In this regard, less chances of error in results were being detected by 92.4% students in CAL lab procedures. During experiment, 75.9% didn't need any assistance whereas 25% students needed some assistance. 94.9% students think that stopping animal sacrifice only for mass scale learning is good stop. Tutorial mode of CAL lab so

designed help 86.08% students to solve post experiment queries and to 83.54% students to perform better in Practical examination. 82.3% students found CAL lab helping them to enhance learning through reasoning and multiple choice questions.

Apart from positive views of CAL lab many students pointed toward its limitation such as 67% students felt that real experimental procedures can't be learnt by CAL lab. Also, 83.5% students think that they can't expertise real experimental methods for further research learning as Conventional lab could help them to learn better. Also, one need to install expensive CAL software and high speed internet set up without undue interruption to run lab smoothly. If we compare output data then no variation in results were found by 74.68% students but 25.32% student faced problem due variation in results. Also 69.62% student found considerable lack in experience of working with live animal tissue whereas 30.38% didn't find it necessary at undergraduate level.
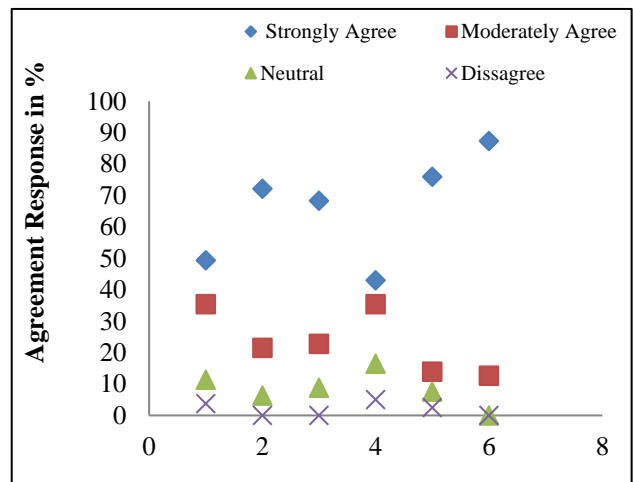

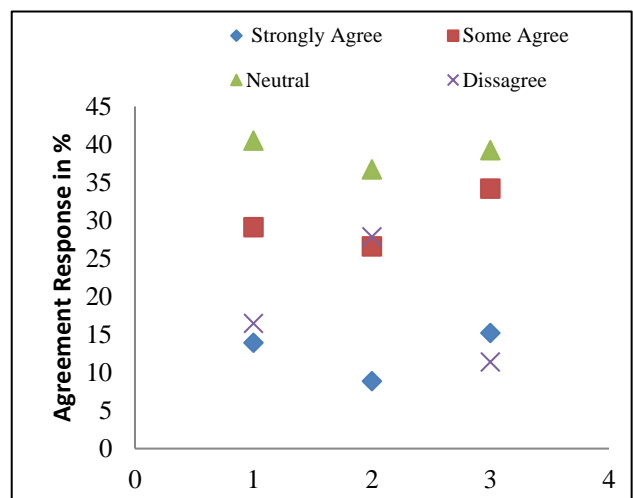**Figure 1: Questionnaires regarding CAL future prospect.**

Figure 2: Questionnaires regarding obstacle in CAL as future foundation.

Questionnaire regarding comparison on working experiences on CAL and conventional lab suggests that >90 % of students found CAL lab is more time saving, data more accurate, ease of repetition and more convenient to deal in examination. Majority also found CAL lab more convenient overall and help them better to explain experimental procedures with less experimental failure. But still they felt that conventional lab is more interesting, lively and learnable and allow more time for minute discussion between teacher and students.

Table 1: Students response in frequency and percentage for the various questions asked in questionnaire.

CAL	Correctly answered 152 (96.2%)	Incorrectly answered 6 (3.8%)
Do you think that conventional lab replaced by CAL lab is a good step	Yes - 150	No - 8
Suggest your opinion regarding CAL lab – Agree "**Y**" Disagree "**N**"		
Easy to handle and learn.	Y-154	N-4
Real experimental illustration.	Y-134	N-24
Need no assistance.	Y-120	N-38
Less chances of error in results.	Y-146	N-12
Need no equipment based study.	Y-118	N-40
All experimental procedure can be learnt and discussed on software.	Y-134	N-24
Stopping animal sacrifice is a good step.	Y-150	N-8
Tutorial mode so designed help better to solve post experiment queries	Y-136	N-22
Tutorial mode helps to perform better in Practical examination.	Y-132	N-26
CAL helps to enhance learning through reasoning and MCQs.	Y-130	N-28
Drawback of CAL with which you agree		
Real experimental procedure cannot be learnt.	Y-106	N-52
Need expensive computer, CAL software and ethernet set-up	Y-108	N-50
Can't be expertise real experimental methods for further research learning.	Y-132	N-26
No variation in result as out-put data are almost same.	Y-118	N-40
Real working with live animal tissue can't be experienced	Y-110	N-48
Comparison between CAL and conventional experiment based on knowledge, practice and aptitude		
Which lab is easy and more convenient?	CAL 110	Conventional lab 48
Which lab procedure is less easy to understand facts and results?	CAL 78	Conventional lab 80
Where repetition experiment is easy to proceed with?	CAL 150	Conventional lab 8
Which lab data is with more accuracy with less chances of error?	CAL 148	Conventional lab 10
Which lab help better to explain experimental procedure?	CAL 100	Conventional lab 58
Which lab is more interesting and learnable?	CAL 74	Conventional lab 84
Which lab is more time saving?	CAL 152	Conventional lab 6
Which lab would be more convenient to deal in examination?	CAL 154	Conventional lab 4
Which lab has more experimental failure?	CAL 26	Conventional lab 132
Which lab allow more discussion and interaction between teacher and students?	CAL 66	Conventional lab 92

More than 75% students agreed that CAL will be more lucid and adoptable to present batches of students and helped them more discussion on procedure and results repeatedly. From the data obtained it was estimated that >90% students found CAL as more accurate and successfully handled program with least experimental error, also different and difficult exercises were found easy to perform through software programming facilitating with multiple access to repeat and revise at home too using software log in CAL as a modern learning tool and future asset in practical laboratory was deliberated by about 91% of students. Despite of positive feedback of CAL in laboratory set up, students opinion were found divided in few questions. According to 43% students, working and practical skill will hamper in CAL. Majority of students agreed or found neutral on increase in cost of learning and system and power failure situations that will be major hindrances in smooth running of such program. Hence, our present study reflect that challenges still persist in front of technology to sort out drawbacks and establish CAL system a noble laboratory asset for students learning.

DISCUSSION

In contrast to our study where majority of students are in the favour of CAL lab teaching a study conducted by

Sengupta et al have shown no significant difference in the two group taught by convetional and CAL lab method in a sample size of 1159. A similar study conducted by Hudson et al have shown computer aided learning lead to statistically significant improvement among medical undergraduate students to apply and retain knowledge in comparison to the control group who received only didactic lecture.[10] Another study conducted by David Dewhurst too show that although CAL lab help in achieving most of the learning objectives of wet lab, they are not effective in teaching animal handling, surgical/dissection and laboratory skills.[11] In our study where majority of the students were in the favour of CAL learning because of easy handling and less time consuming they too accepted that real experimental procedure cannot be learnt by CAL lab. Also in our study the major constraints that we came across were the poor attendance and unwillingness to participate in the study.

Limitations

The most important limitation of our study is the sample size which we could have overcome if we would have included 3rd and 5th semester student of other medical colleges of same northern part of India. Another flaw in our study is that we could have done the separate assessment using the same questionnaire form before starting of the CAL lab at the level of conventional study and another at the level of CAL lab aided learning at the end of study with a gap of 30 days.

CONCLUSION

Although in our study the majority of students were in favour of dry lab learning but we should always keep in mind that principal mode of teaching of a child always starts from conventional teaching. Also, in contrast although there is no substitution of conventional teaching methods, in this new era of information and technology CAL lab can be the saviour to students in making better understanding and enhancing the performance without help of experimental animals.

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