

Original Research Article

Introduction of Computer Simulation Models in Experimental Physiology in IST M.B.B.S

Dr. Jitendra Kumar Gupta¹, Dr. Nivedita Gupta², Dr. Kapil Gupta³, Dr. Shivankan Kakkar⁴, Dr. Umesh⁵,

¹Assistant Professor, Department of Physiology, SMS Medical College, Jaipur, Rajasthan

²Assistant Professor, Department of Biochemistry, SMS Medical College, Jaipur, Rajasthan

³Assistant Professor, Department of Physiology, SMS Medical College, Jaipur, Rajasthan

⁴Senior Demonstrator, Department of Pharmacology, SMS Medical College, Jaipur Rajasthan

⁵Assistant Professor, Physiology, GMC, Kota, Rajasthan.

*Corresponding author

Dr. Jitendra Kumar Gupta

Email: drjitendragupta007@gmail.com

Abstract: Animal experiments were conventionally a part of teaching in undergraduate physiology in India. Need was felt to design computer based simulation software as an alternative to animal use due to growing concern and stringent laws imposed by animal ethical bodies. The medical council of India had also advocated use of computer aided simulation models for animal experiments in recent amendments. Hence, the onus to bring the change lies on us as teacher. Aim and Objectives: 1. to assess effectiveness of computer simulation models in teaching of experimental Physiology as compared to conventional interactive demonstration. 2. To evaluate feedback of students regarding perception of teaching with computer simulation models in experimental Physiology. Methodology: A written informed consent to participate in the study was taken from the available students (n=227) of first MBBS (Batch of 250). The students then were subjected to Pre test comprising of MCQ and SAQ tests. Thereafter they were randomly divided into two equal groups. Control group (n=114) was taught by conventional demonstrations of experimental Physiology while test group was taught by computer simulation models. Post test of both the groups comprising of MCQ and SAQ was taken. Marks of pre and post assessment test were compared. Summary of results: The results of the present study showed that the computer simulation teaching method is an effective method of teaching as compared to conventional method of teaching. Majority of the students felt that the computer simulation session is a good way of teaching from various point of views and all of them agree that it is necessary in medical education from 1st MBBS. Conclusions: We conclude that teaching by the computer simulation method better achieves the desired outcome of understanding the fundamental concepts of Neuro-Muscular physiology experiments as compared to conventional method and are regarded as highly effective learning tool.

Keywords: Animal Experiments, Undergraduate Physiology, Conventional interactive demonstration, Computer simulation models

INTRODUCTION

Physiology courses continue to rely on laboratory observations to provide students with practical information to correlate with their developing base of conceptual knowledge [1]. Traditionally, laboratory exercises in physiology have associated use of animals such as frog, rat, guinea pig, dog etc as tools to learn firsthand aspects of the subjects [2].

Animal experiments were conventionally a part of teaching in undergraduate physiology in India.

Need was felt to design computer based simulation software as an alternative to animal use due to growing concern and stringent laws imposed by animal ethical bodies [3]. There is global trend in reduction in animal experiments in medical undergraduate training [4]

Physician committee for responsible medicine (PCRM) in US is stressing upon replacement of animal labs with no animal alternatives. Majority of the medical schools in USA (68%) are not using live animals in any of their physiology, pharmacology or

surgery courses [5]. On the other hand, it is also increasingly being felt that physiology teaching should be more practically oriented. The psychomotor skills that a student acquires in training course in experimental Physiology are important for the in-depth understanding of the subject.

Although computer simulation models are available, they are not being used. We feel that these models are implementable and can be used for experimentation during training. Hence, this study is designed to implement simulation models in undergraduate physiology teaching.

The Medical Council of India (MCI) had also advocated use of computer aided simulation models for animal experiments in recent amendments. Hence, the onus to bring the change lies on us as teacher [2]

AIM & OBJECTIVES

- To assess effectiveness of computer simulation models in teaching of experimental Physiology as compared to conventional interactive demonstration.
- To evaluate feedback of students regarding perception of teaching with computer simulation models in experimental Physiology.

METHODOLOGY

The study was planned to be conducted in the Department of physiology, SMS medical college, Jaipur, India. The study was subject to approval by the Head of the Department and clinical trial screening committee (CTSC) and ethical committee S.M.S. medical college and attached hospitals Jaipur. A written informed consent to participate in the study was taken

from the available students (n=227) of first MBBS (Batch of 250). The students were subjected to Pre test comprising of MCQ and SAQ tests. Thereafter they were randomly divided into two equal groups.

Control group (n=114) was taught by conventional demonstrations of experimental Physiology while test group was taught by computer simulation models. Post test of both the groups comprising of MCQ and SAQ was taken.

Marks of pre and post test were compared.

Later on, students in control group were also taught by computer simulation models and test group was given conventional teaching exposure to avoid ethical issues.

Feedback of students about the teaching by computer simulation models was taken by Likert 5 point scale. Data collection and analysis-

The scores were summarized as mean and standard deviation and were analyzed by using paired and unpaired 't' test by Primer of Biostatistics version 6.0. P value < 0.05 was taken as significant.

Descriptive analysis of feedback data was also done.

OBSERVATIONS AND RESULTS

The results of the pre and post evaluation test have been shown as mean ± S.D. In Table 1. The scores were summarized as mean and standard deviation and were analyzed by using paired and unpaired 't' test by Primer of Biostatistics version 6.0. P value < 0.05 was taken as significant.

Table-1: shown pre and post evaluation test

	N	Mean	SD	'p' Value*
Conventional teaching group (PreTest Score)	114	33.51	17.04	0.625
Computer simulation model teaching group (PreTest Score)	113	34.62	17.19	

*Unpaired 't' test

	N	Mean	SD	'p' Value*
Conventional teaching group (PreTest Score)	114	33.51	17.04	<0.001
Conventional teaching group (PostTest Score)	114	61.30	17.11	

*Paired 't' test

	N	Mean	SD	'p' Value*
Computer simulation model teaching group (PreTest Score)	113	34.62	17.19	<0.001
Computer simulation model teaching group (PostTest Score)	113	67.89	18.03	

*Paired 't' test

	N	Mean	SD	'p' Value*
Conventional teaching group (PostTest Score)	114	61.30	17.11	0.005
Computer simulation model teaching group (PostTest Score)	113	67.89	18.03	

*Unpaired 't' test

Before intervention, conventional and computer simulation model teaching groups are comparable ($p > 0.05$). After intervention, conventionally taught group showed significantly improved scores ($p < 0.001$) and scores of students taught with computer simulation models also improved significantly ($p < 0.001$). Post test scores of students taught by

computer simulation models was significantly higher than those taught by conventional method ($p < 0.05$). We gave a qualitative questionnaire with Likert 5 point scale to know the Students perception towards computer simulation model teaching. The responses of the feedback were expressed as percentage as shown in table 2.

Table-2: Student's perception about computer simulation

S.No.	About computer simulation	Strongly Agree %	Agree %	Neither agree nor disagree %	Disagree %	Strongly Disagree %
1	It supplemented the knowledge acquired in theoretical class	86	10	4		
2	It was helpful in creating interest in the topic	89	11			
3	My perception towards muscle and nerve Physiology improved	96	4			
4	Computer simulation promoted development of analytical thinking	81	7	10	2	
5	Computer simulation session motivated me to put in effort to find more about the topic	84	10	3	3	
6	Computer simulation session is necessary in medical education from 1 st MBBS	100				

Table showing student response to the feedback questionnaire (n=113)

Hundred and thirteen students responded to the feedback questionnaire. As is evident from the table most of the students agree or strongly agree to most of the questions posed to them about Computer simulation model teaching. 96% of the students felt that computer simulation model teaching supplemented the knowledge acquired in theoretical class. 88% students are of opine that Computer simulation promoted development of analytical thinking. 94% students felt that Computer simulation session motivated them to put in effort to find more about the topic.

All students felt that Computer simulation session was helpful in creating interest in the topic, improved perception towards muscle and nerve

Physiology and are necessary in medical education from 1st MBBS.

Summary of results

The results of the present study showed that the computer simulation teaching method is an effective method of teaching as compared to conventional method of teaching.

Majority of the students felt that the computer simulation session is a good way of teaching from various point of views and all of them agree that it is necessary in medical education from 1st MBBS.

DISCUSSION

Computer simulated models were used specifically to offer alternative student centered approach to teaching. The computer simulation teaching programmed is an easy to use laboratory simulation

software and lab manual that consists of exercises containing a number of physiology lab activities. It also allows us to repeat laboratory experiment as often as we like, perform experiments without harming live animals, and conduct experiments that are difficult to perform in a wet lab environment because of time, cost, or safety concern. The results of the present study reveals that before intervention, conventional and computer simulation model teaching groups were comparable ($p > 0.05$). After intervention conventionally taught group showed significantly improved scores ($p < 0.001$) and scores of students taught with computer simulation models also improved significantly ($p < 0.001$). Post test scores of students taught by computer simulation models was significantly higher than those taught by conventional method ($p < 0.05$). The results of the study are in accordance with the findings of Richa *et al.* [2] who stated in her study that the test results of the group taught by computer simulated model were better than the group taught by conventional method and there was a statistically significant difference in the marks obtained by both the groups of students. The Steps of each experiment help student make the connection between the activities and the physiological concepts. It is easy to use laboratory simulation software that performs experiments without harming live animals. Computer simulation model teaching has grown in number over the years and so has the studies examining the efficacy of these studies in experimental settings. A number of studies have compared traditional animal dissection with various alternatives. Balcome [6] summarized twenty studies presenting other application of alternatives in experimental learning. In a number of studies carried on earlier, measurable student performance was equivalent between the compared learning methods [1,7] In one study computer simulation teaching was found to provide inferior learning to dissection [8]. The design of this study was deemed too rudimentary for a college level class by Balcome [9] in his letter to the editor. A conclusion based on these studies is that computer simulation teaching is pedagogically equivalent to animal dissection [2]. The analysis of the feedback response showed that majority agree or strongly agree that the computer simulation model teaching supplemented the knowledge acquired in theoretical class, promoted development of analytical thinking and motivated them to put in effort to find more about the topic. All students felt that Computer simulation session was helpful in creating interest in the topic, improved perception towards muscle and nerve Physiology and are necessary in medical education from 1st MBBS. Similar response for student feedback was observed by Richa *et al.* who found that ease of use of

computer simulation teaching and level of interaction was very positive.

CONCLUSIONS

We conclude that computer simulation models better achieves the desired outcome of understanding the fundamental concepts of Neuro-Muscular physiology experiments as compared to conventional method and are regarded as highly effective learning tool. A blending of conventional and computer simulation teaching session (hybrid method) could have been adopted to give more effective learning.

REFERENCES

1. Samsel RW, Schmidt GA, Hall JB, Wood LD, Shroff SG, Schumacker PT. Cardiovascular physiology teaching: computer simulations vs. animal demonstrations. *American Journal of Physiology*. 1994 Jun 1; 266:S36-.
2. Thaman RG, Sagar S, Kaur H, Dhillon S, Gupta S, Kaur P, Arora D. Neuro-muscular physiology experiments: computer assisted learning versus traditional lecture demonstrations. *Pak J Physiol*. 2012; 8(2):28-32.
3. Nageswari K, Syamala D. Simulation of physiology experiments—an alternative to animal use. *Indian J Physiol Pharmacol*. 2007 Oct 15; 51(4):354-60.
4. Barnard ND, Stolz J, Baron L. Use of and alternatives to animals in laboratory courses at US medical schools. *Academic Medicine*. 1988 Sep 1; 63(9):720-2.
5. Hansen LA, Boss GR. Use of live animals in the curricula of US medical schools: survey results from 2001. *Academic Medicine*. 2002 Nov 1; 77(11):1147-9.
6. Balcombe J. Student/teacher conflict regarding animal dissection. *The American Biology Teacher*. 1997 Jan 1:22-5.
7. Henman MC, Leach GD. An alternative method for pharmacology laboratory class instruction using biovideograph videotape recordings. *British Journal of Pharmacology*. 1983; 80:591.
8. Cross TR, Cross VE. Scalpel or mouse? A statistical comparison of real & virtual frog dissections. *The American Biology Teacher*. 2004; 66(6):409-11.
9. Balcombe JP. Animal dissections. *SCIENTIST*. 1998 May 25; 12(11):8.