Introduction of Computer Simulation Models in Experimental Physiology in 1ST M.B.B.S

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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>
<thead>
<tr>
<th>Table-1: shown pre and post evaluation test</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>Conventional teaching group (PreTest Score)</td>
</tr>
<tr>
<td>Computer simulation model teaching group (PreTest Score)</td>
</tr>
</tbody>
</table>

*Unpaired ‘t’ test

<table>
<thead>
<tr>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>‘p’ Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional teaching group (PostTest Score)</td>
<td>114</td>
<td>61.30</td>
<td>17.11</td>
</tr>
<tr>
<td>Conventional teaching group (PreTest Score)</td>
<td>114</td>
<td>33.51</td>
<td>17.04</td>
</tr>
</tbody>
</table>

*Paired ‘t’ test

<table>
<thead>
<tr>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>‘p’ Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer simulation model teaching group (PostTest Score)</td>
<td>113</td>
<td>67.89</td>
<td>18.03</td>
</tr>
</tbody>
</table>

*Paired ‘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

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

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 opinion 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. Balcombe [6] summarized twenty studies presenting other application of alternatives in experimental learning. In a number of studies carried on earlier, measureable 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 Balcombe [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 Neuromuscular 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

Available online at http://saspublisher.com/sjams/