

Usefulness of Animal Simulator Software in teaching Amphibian Physiology Practical for 1st Prof MBBS Students

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Background & Objectives:

Amphibian experiments in Physiology Practical classes are at present taught by using simple lecture-demonstrations as killing of animals for laboratory use has become controversial especially after the intervention of animal rights activists. Animal Simulation method could be used as an alternative to it. The present study tried to see the knowledge gained by the 1st Prof MBBS students by using Animal Simulation model in Amphibian Physiology Practical classes as compared to conventional Lecture-Demonstration method. It also tried to find out that the difference in knowledge gain by Poor performing students as compared to Good Performers. The student's Perception on this simulation based T-L Methodology was also surveyed.

Material & Methods:

This interventional, prospective study was done in the department of Physiology, B. S. Medical College, Bankura, after obtaining proper written approval from the institutional ethics committee. Pre-test was conducted by a validated Questionnaire consisting 25 MCQs. Then the class of 150 1st Year medical students was divided into two groups of 75 students each by Systematic Random Sampling. Group 1 or Case attended Animal Simulation ((Reed Elsevier India Pvt. Ltd, product@animalsimulator.com) Method while other batch of students (Group 2, Control) attended Lecture-demonstration. After 15 days both the groups were tested with the same questionnaire (Post Test). Pre-Test & Post-Test scores were analyzed using SPSS statistical software. Group 1 student's perception to the simulation based teaching was surveyed by a questionnaire. Cross over was done after completion of the study.

Result:

The new method of Simulation based teaching of nerve-muscle Physiology of 1st Prof MBBS students was found more effective than the Traditional Lecture- Demonstration method. This new method is particularly helpful for slow learners. Students also found it interesting, student centric and useful.

Conclusion: Simulation based teaching of Amphibian Physiology is a better method that needs to be implemented on a wider scale in 1st Prof MBBS Physiology curriculum.

Key Words: Animal Simulator Software, Amphibian Physiology Practical, Undergraduate MBBS students

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I. Introduction:

In physiology courses, practical classes using animals or animal tissues form a major component of the curriculum. Physiology courses continue to rely on laboratory observations to provide students with practical information to correlate with their developing base of conceptual knowledge. There is a belief that just as medicine cannot be taught or learnt without exposure to wards and clinics, physiology cannot be taught without experimentation in animals. However, it has become increasingly difficult to do animal experiments, because of issues related to the procurement of animals, their cost, and regulations controlling their use, and changes in ethical attitudes toward animal experimentation in general. Moreover, with changing trends in teaching methods and practices, it is increasingly felt that animals should not be sacrificed just to acquire skills and techniques of experimentation. For some students, particularly those intending to pursue a career in research, skills developed during these sessions (both generic laboratory skills and those specific to a particular practical) are essential. For many others, these skills are not essential. In addition to that these experiments are expensive, time consuming and tedious. [1, 2] As per notification of Medical Council of India on 18th March, 2014 (No. MCI-34(41)/2013-Med./64022) clause 1.9 states that "For teaching Physiology and Pharmacology in UG curriculum, the required knowledge and skills

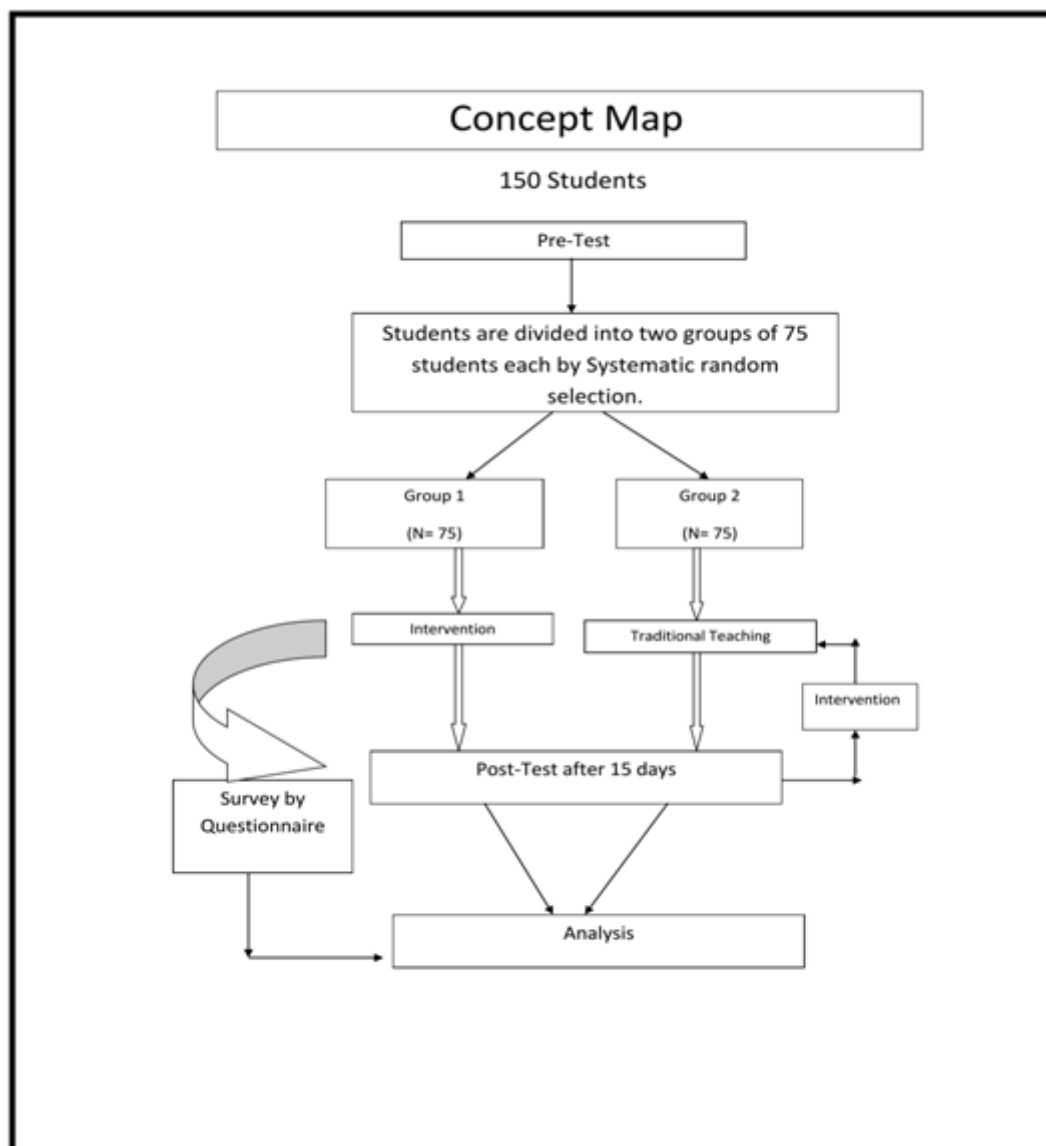
should be imparted by using Computer Assisted modules.” Ministry of Environment and Forest, Government of India, passed an order on January, 2012 where it was clearly mentioned that ‘it is necessary to ensure that animals are not subject to unnecessary pain or suffering, during or after the performance of experiments on animals. Now- a-days effective alternatives in the form of CD's, computer simulations,-. manikin models , in-vitro methods, etc. are available and they are not only , effective and absolute replacements to the use of animals in teaching Anatomy/Physiology but they are also superior pedagogic tools in the teaching of Pharmacy or Life Sciences. The use of these alternatives in teaching may avoid the unnecessary suffering or pain of animals.’[3]

A computer model, a computer simulation or a computational model is a computer program, or network of computers, that attempts to simulate an abstract model of a particular system. Computer simulations are now widely available at relatively low cost and can provide a dry lab experience. Few previous studies on this issue have shown that Computer Assisted Learning (CAL) programs can actively involve students even in large classes and are designed to cover the major objectives of the NM physiology experiments. CAL programs appear to provide an effective alternative to animal demonstrations in teaching experimental neuromuscular physiology, better in some aspects and not in others. [2, 4] But how these learning modules are helpful to gain in knowledge of Amphibian Physiology in 1st Prof MBBS students relative to the conventional T-L methodology were not clearly elucidated in those studies. Moreover, whether this Simulation based teaching methodology is also helpful for slow learner or not and student’s perception on this method of teaching Practical Physiology was also unknown. Hence in the present endeavour we intended

- To study the knowledge gained by the 1st Prof MBBS students by using Animal Simulation model in Amphibian Physiology Practical classes as compared to conventional Lecture-Demonstration method.
- To see the difference in knowledge gain by Poor performers (pre-test score <50%) and Good Performers (pre-test score ≥ 50%) and whether the Animal Simulation Model is helpful for poor performers
- We also tried to assess Student’s Perception on this simulation based T-L Methodology. We used few open ended questions to know the student’s opinion about the merits and de-merits of Simulation based teaching.

II. Methods & Materials:

- **Type of Study:** Interventional, Prospective
- **Study Area:** Department of Physiology, B. S. Medical College, Bankura, West Bengal
- **Study Population:** 1st Prof. MBBS students. Inclusion Criteria: All 1st Prof MBBS students who are not previously exposed to Animal Simulation technique.
- **Study Tool:** Animal Simulator (Reed Elsevier India Pvt. Ltd, product@animalsimulator.com, available at department of Physiology, BSMC, Bankura) + Pre & Post Test Question Paper containing 25 MCQs + Validated Questionnaire containing 10 questions
- **Ethical consideration:** This study was conducted only after obtaining proper written approval from the institutional ethics committee.
- **Study Design:**
 1. Pre-test was conducted using validated Questionnaire consisting 25 MCQs on all 150 1st Prof. MBBS students. Questions were designed to reinforce basic physiological principles and their integration in response to each intervention. Some MCQs were based on Data manipulation, calculation and interpretation.
 2. The class of 150, 1st Year medical students were divided into two groups of 75 students each by Systematic Random Sampling.
 3. One batch (Group 1, Case) of the student attended Animal Simulation Method while other batch of students (Group 2, Control) attended Lecture-demonstration.
 4. Both practical sessions were designed to illustrate the following experiments:
 - Recording a Simple Muscle Twitch
 - Determination of conduction Velocity of Sciatic nerve
 5. Each experiment took one full practical class of 2 hours duration.
 6. After 15 days both the groups were tested with the same questionnaire (Post Test)
 7. Pre-test and post-test scores of both the groups were recorded
 8. Group 1 student’s attitude to the simulation based teaching was surveyed by a questionnaire consisting of 8 close ended and 2 open ended questions (Total 10 Questions). Question 9 and 10 were open ended questions asking for the comment on the pedagogical approach followed.
 9. Two practical sessions on same topic based on Simulation model were taught to Group 2 students (Control group) who were undergone traditional teaching methods initially



Data Analysis: Data were entered in Microsoft Excel & checked for accuracy. Comparison of marks obtained in the test by the two groups were analysed by paired t test through SPSS version 17. Result of feedback questionnaire will also be assessed statistically. P value less than 0.05 was taken as significant.

III. Result:

Table 1 shows the Pre-test and Post-test score of both Intervention Group (Group I) and Traditional Teaching Group (Group II).

There is significant gain in Post-Test score of both Intervention Group/ Group I (**Table 2**) and Traditional Teaching Group/ Group II (**Table 3**).

But score gain is significantly high in Intervention group/Group I as compared to Traditional Teaching Group/ Group II (**Table 4**).

Table 5 shows that students with <50% of Pre-Test Score is grouped as Poor Performer whereas students with \geq 50% Pre-Test Score are denoted as Good Performer.

After Traditional Teaching (Group II) Post-Test scores of Poor Performers are significantly low than that of the Good Performers. (**Table 6**)

After Simulation based teaching or in Group I there is no significant difference between the Post-Test Score of Poor Performers and Good Performers i.e. Poor Performers have done equally well as Good Performers. (**Table 7**)

Figure 1 depicts student's perception on the simulation based Teaching- Learning Methodology

Students were asked **two open ended questions** 1. **Merits** of Simulation based teaching methods 2. **Disadvantages** of Simulation based teaching methods.

Regarding merits of simulation based teaching method most of the students have said it gives better visualization and understanding of the subject. One of the students said this Audio-Visual method is ‘more appealing and interesting’ whereas Traditional Lecture – Demonstration is ‘monotonous’. According to one of the students ‘Teacher-Student interaction’ is better in simulation based teaching method and ‘topics can be repeated several times according to the need of the students’.

According to most of them the major Disadvantage of Simulation Based teaching is that Laboratory Skill cannot be acquired by this method. One of them also told that ‘as frequent Power Cut is a major problem of this rural medical college Simulation Based teaching may sometimes be difficult to foster in future.

Table 1: Comparison Of Pre-Test & Post-Test Score Of Group I (Intervention Group) And Group II (Traditional Teaching Group)

	N	PRE-TEST SCORE (Full Marks =30) MEAN±SD	POST-TEST SCORE (Full Marks =30) MEAN±SD
GROUP I	75	11.98±2.61	26±1.9
GROUP II	75	14.21±3.9	22.77±2.23

Table 2: SCORE GAINED BY GROUP I (INTERVENTION GROUP)

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Group I	Pre-Test Score - Post-Test Score	-14.014	3.237	.376	-37.239	73	0.000

Table 3: SCORE GAINED BY GROUP II (TRADITIONAL TEACHING GROUP)

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Group II	Pre-Test Score - Post-Test Score	-8.554	3.413	.397	-21.561	73	.000

Table 4: Comparison Of Score Gained By Group I (Intervention Group) And Group II (Traditional Teaching Group)

		Intervention	N	Mean	Std. Deviation	Std. Error Mean	‘t’ test		
							t	df	Sig (2 tailed)
Score gain	Traditional method		75	8.55	3.413	.397	-9.984	146	.000
	New method		75	14.01	3.237	.376			

Table 5: GROUPING OF STUDENTS ACCORDING TO THEIR PRE-TEST SCORE

	SIMULATION METHOD (n)	CONVENTIONAL METHOD (n)
POOR PERFORMERS (<50%)	45	42
GOOD PERFORMANCE (≥ 50%)	30	33
TOTAL	75	75

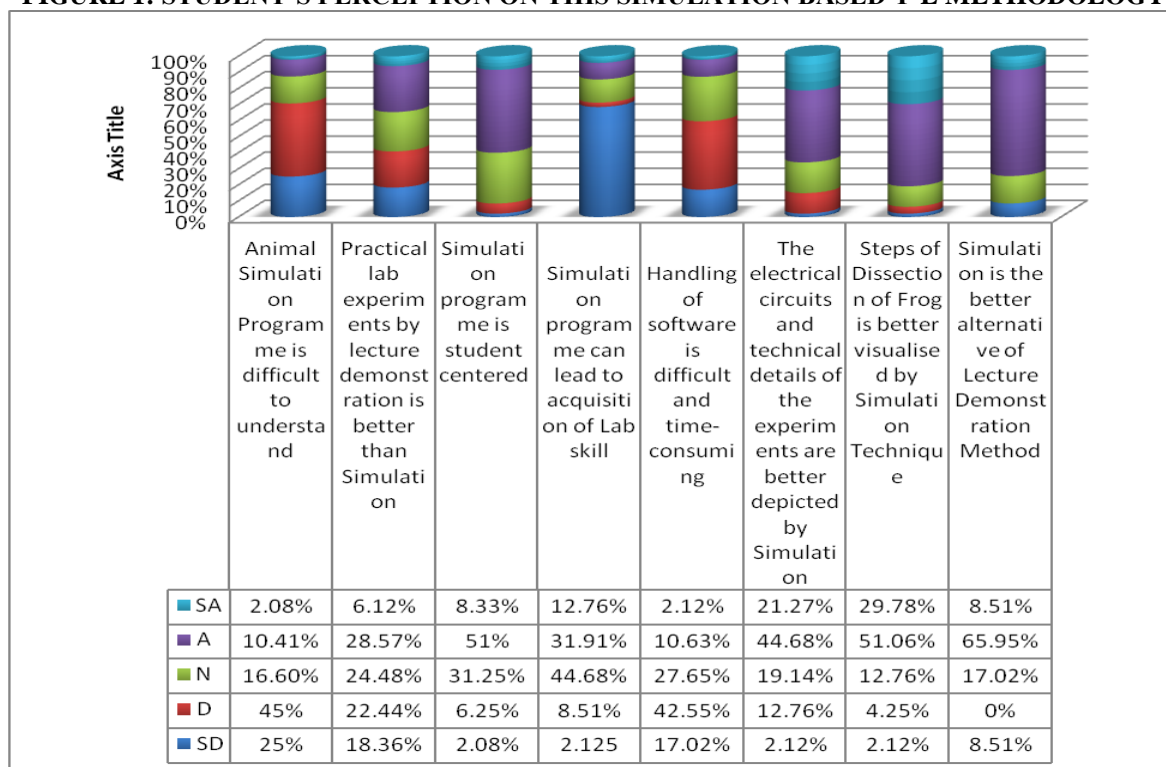
Table 6: DIFFERENCES IN POST TEST SCORE OF POOR PERFORMERS AND GOOD PERFORMANCE AFTER CONVENTIONAL TEACHING

		Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)
		F	Sig.			
Post-Test Score	Equal variances assumed	.151	.698	3.551	72	.001

Table 7: Differences In Post Test Score Of Poor Performers And Good Performance After Simulation Based Teaching

		Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)
		F	Sig.			
Post-Test Score	Equal variances assumed	1.396	.241	-.309	72	.758

FIGURE 1: STUDENT'S PERCEPTION ON THIS SIMULATION BASED T-L METHODOLOGY



SA- Strongly agree, A- Agree, N-Neutral, D- disagree, SD- Strongly Disagree

IV. Discussion

In the present study the new method of Simulation based teaching of Amphibian Physiology Practical of 1st Prof MBBS students was found more effective than the Traditional Lecture- Demonstration method. This new method is particularly helpful for slow learners as after this method of teaching poor performers did as good as the good performers. Students also found it interesting, student centric and useful.

This finding is in agreement with that of Richa Ghay Thaman [4] who showed that Computer Assisted Learning (CAL) programs can actively involve students even in large classes and are designed to cover the major objectives of the NM physiology experiments. In her study she also showed CAL programs appear to provide an effective alternative to animal demonstrations in teaching experimental neuromuscular physiology, better in some aspects and not in others. In another study done by D. G. Dewhurst et al [5] it was found that although knowledge gain in Computer Assisted Method and Traditional teaching-learning method is almost same but the students had a positive attitude toward using CAL and the cost of the conventional laboratory based approach was five times greater than that of CAL.

Balcome in 2000 summarised 20 studies presenting other applications of alternatives in experimental learning. In a number of studies carried on earlier, measurable student performance was equivalent between the compared learning methods.[6,7] In a few other studies students performed better using alternatives.[8,9] In one study CAL study was found to provide inferior learning to dissection.[10,11] The design of that study was deemed too rudimentary for a college-level class by Balcome in his letter to the editor.[12] A conclusion based on these studies is that CAL or alternative methods are pedagogically equivalent to animal dissections.

The present study put forward one interesting finding that the students who performed poorly in the pre-test after Simulation Based Teaching their score was as good as the students who already did well. In traditional method the poor performers showed improvement but that was not as good as the students who

performed well in pre-test. This shows that Simulation based teaching provides good understanding of the subject to the slow learners as well.

In the Feedback Questionnaire most of the students found simulation based teaching as student-friendly and better alternative of Traditional Lecture-Demonstration Method.

Study by Nosek *et al* revealed that CAL offers self-paced learning that puts students in control of their learning resources. [13] In the present study also students stated that in simulation based teaching method ‘topics can be repeated several times according to the need of the students’. Majority of students felt that Simulation Based Teaching cannot provide acquisition of lab skills, but they clearly stated that it can replace animal demonstrations on live tissues. Although few pointed out some practical problems like Power cut etc. as the probable hindrances against simulation based teaching but they agreed on the point that this new method provided better understanding, quicker grasping and it was less time consuming.

LIMITATION:

This is a single institution based study. Further studies using multiple centres with a large sample size on the current topic are therefore recommended.

V. Conclusion:

Lecture/demonstrations and Simulation Based learning programs both can fill the need for understanding of fundamental concepts of N-M physiology experiments and are regarded as highly effective teaching tools. But the Simulation Based program is highly interactive and is designed to cover the major objectives of the N-M physiology practical. The students easily gain learning objectives and achieve better scores. Even the slow learners can perform as good as the other students.

VI. Recommendation

The curriculum of N-M physiology experiments on frog can be modified and updated. It seems sooner than later, we all need to use computer simulation models for animal experiments.

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