ANIMAL LABORATORY, INTERACTIVE AND COMPUTER BASED LEARNING, IN ENHANCING BASIC CONCEPTS IN PHYSIOLOGY: AN OUTLOOK OF 481 UNDERGRADUATE MEDICAL STUDENTS

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Background: Laboratory exercises are intended to illustrate concepts and add an active learning component to courses. Since 1980s, there has been a decline in animal laboratories in medical physiology courses. Other cost-effective non-animal alternatives are being sought. The present study was designed to find out the students’ opinion regarding the animal versus computer lab and whether innovative teaching methodologies helped students achieve their goals. Methods: Opinions of 481 female medical students of 2nd and 3rd year MBBS were included in the study. A questionnaire based on animal/computer based experiments and new teaching methodologies in physiology was voluntarily filled in by the students. Results: Majority of students immensely benefited from both the animal lab and other teaching methodologies. Conclusion: Although computer based learning is considered effective in helping students acquire basic concepts, there is evidence that some students acquire a more thorough understanding of the material through more advanced and challenging experience of an animal laboratory. The fact that such labs as well various teaching methods offer distinct educational advantages should be taken into account when courses are designed. Keywords: Animal Lab, animation, Learning technique, Physiology learning, Teaching methods

INTRODUCTION
The animal laboratory experiments in undergraduate medical course curriculum are designed to aid comprehension and consolidate basic concepts in physiology. Medical students benefit more with a hands-on training. Experts agree that dissection provides the learner with ‘real material’ and ‘real experience’. They add that when dissection is not a part of the curriculum, students may miss the opportunity to prepare for vocations and become valuable contributors in medicine and other health related professions. However, there is a global trend in reduction of animal experiments with replacement with non-animal alternatives.

In our country, most of the medical schools, both in government and private sector, are not using the animal laboratory (lab) for undergraduate physiology. Well-designed practical work has the potential to motivate students and support deeper learning of concepts, manipulative competence and cooperative approaches to learning. Fatima Jinnah Medical College (FJMC) affiliated with the University of Punjab, is unique in the sense that in addition to being an only all-female government institute, there is an animal as well as a computer lab used side-by-side for physiology experiments. There are a number of amphibian experiments on frog skeletal muscle and heart in the practical syllabus prescribed for 1st and 2nd year medical students. The physiology lab is also equipped with the PowerLab®, a data acquisition system comprising of hardware and software designed for use in life science research and teaching applications.

Experts agree that teaching should be multisensory and filled with variety. Hence in accordance with modern teaching trends in medical education, students in this institute, are exposed to various interactive modes such as Problem Based Learning (PBL), Small Group Discussions (SGD) and clinical scenarios with reference to basic physiology. The objectives of this study were to find out the students’ opinion regarding animal laboratory and computer-based learning in physiology practical classes; and whether various teaching methodologies helped consolidate core concepts in physiology.

MATERIAL AND METHODS
Four-hundred-eighty-one undergraduate medical students, 231 from 2nd year and 250 from 3rd year from Fatima Jinnah Medical College were included in this study conducted in February 2013. First year MBBS was not included because they had not taken any university examination yet.

Second year students had done animal plus computer based experiments while undergoing courses in cardiovascular and respiratory physiology. They then took the university First Professional MBBS Part-I written (multiple choice, short essay and clinical scenario based questions), viva voce, and practical examination.

Third year students after having passed Part-I, had done animal plus computer based experiments in nerve muscle, special senses, and central nervous system physiology. They then took the university Part-2 examination as above.
The study was conducted using a questionnaire, 11 questions in all, which was filled anonymously and voluntarily. Students were asked to choose between the 4 option: strongly agree, agree, neutral, and disagree on Likert scale. Data were analysed using SPSS-20. All variables were described in frequencies and percentage.

RESULTS

In response to the question whether the students felt that frog experiments were important, 54% from 2nd and 63% from 3rd year agreed, 33% and 23% disagreed, while 12% and 13% were neutral respectively.

In answering where they learned the facts better when the teacher used computer programs instead of demonstrating live experiments, 87% from 2nd and 72% from 3rd year disagreed.

The 3rd question asked whether animal experiments be completely replaced by computer simulations, 49% from 2nd and 58% from 3rd year disagreed, while few, 29% and 22% agreed respectively.

For LabTutor® techniques, 64% and 56% agreed, 13% and 15% were neutral, while 22% and 28% disagreed respectively.

Table 1: Students’ views towards the use of animal laboratory, computer-based learning and modern teaching approaches in Physiology

<table>
<thead>
<tr>
<th>Items</th>
<th>Class 1</th>
<th>Students’ views [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In physiology, are experiments on frog important at undergraduate level?</td>
<td>2nd</td>
<td>Strongly Agree: 29 (12.6), Disagree: 77 (33.3)</td>
</tr>
<tr>
<td>2. Facts are learnt better, when the teacher uses computer programs instead of demonstrating live experiments.</td>
<td>3rd</td>
<td>Strongly Agree: 99 (42.4), Disagree: 77 (33.3)</td>
</tr>
<tr>
<td>3. Animal experiments should completely be replaced by computer simulations.</td>
<td>3rd</td>
<td>Strongly Agree: 126 (50.4), Disagree: 59 (23.6)</td>
</tr>
<tr>
<td>4. Introduction to techniques like EEG, ECG, pulse oxymeter and blood pressure on the LabTutor® helped improve comprehension and ability to relate physiology to clinical problems.</td>
<td>3rd</td>
<td>Strongly Agree: 112 (46.8), Disagree: 146 (58.4)</td>
</tr>
<tr>
<td>5. Were you aware that practical skill helped secure marks during examination?</td>
<td>3rd</td>
<td>Strongly Agree: 79 (32.4), Disagree: 122 (50.0)</td>
</tr>
<tr>
<td>6. Demonstrations regarding examination checklists enabled better understanding of clinical scenario based questions.</td>
<td>3rd</td>
<td>Strongly Agree: 134 (56.9), Disagree: 14 (5.6)</td>
</tr>
<tr>
<td>7. Prior preparation of specific practical skill related questions helped answering viva voce in examinations.</td>
<td>3rd</td>
<td>Strongly Agree: 132 (52.8), Disagree: 16 (6.4)</td>
</tr>
<tr>
<td>8. Simultaneous integration of practical and theory classes helped in better understanding of the subject matter.</td>
<td>3rd</td>
<td>Strongly Agree: 102 (40.8), Disagree: 9 (3.9)</td>
</tr>
<tr>
<td>9. Do you agree that small group discussions during demonstrations helped improve your practical skill?</td>
<td>3rd</td>
<td>Strongly Agree: 122 (48.8), Disagree: 7 (2.8)</td>
</tr>
<tr>
<td>10. Meticulous Practical Journal corrections helped improve your performance during examination.</td>
<td>3rd</td>
<td>Strongly Agree: 105 (42.0), Disagree: 6 (2.4)</td>
</tr>
<tr>
<td>11. Horizontal teaching integration enabled better understanding of core concepts in physiology.</td>
<td>3rd</td>
<td>Strongly Agree: 105 (42.0), Disagree: 6 (2.4)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Practical sessions in physiology occupy a key role in consolidation of topics taught in lectures. They create an opportunity for discussion in a laboratory environment with smaller groups, provide students with time to acquire skills and create chances for analytical thought process. In favour of the animal lab, our study is in accordance with a number of other studies. Live animal demonstrations are pedagogically superior to any teaching modality. Harel Weinstein states that the direct experience, insight and learning achievable from an animal based lab has not yet been replaced entirely by other teaching modalities. While replacing the traditional ‘wet’ lab work with computer assisted learning modules has educational and practical merits, there is general agreement among scientists that there can be no substitute for real wet laboratory experiments in physiology. Computer simulations does not replace, although it does compliment and enrich experimental awareness that practical skill helped secure marks at the university level, the majority, 78% from 2nd and 72% from 3rd year were fully aware of it.

Regarding the clinical examination checklists that enabled better understanding of clinical scenarios, 78% from 2nd and 86% from 3rd year agreed.

The painstaking routine taken by our staff members in preparing students for answering specific practical related questions resulted in agreement by 92% from 2nd and 3rd year students.

Simultaneous integration of practical and theory classes helped 97% of 2nd and 93% of 3rd year students. Ninety-two percent from 2nd and 93% from 3rd year agreed that small group discussions during demonstrations helped improve their performance in practical. Seventy-eight percent from 2nd and 71% from 3rd years realised importance of practical journals.

Maintaining horizontal teaching integration is a difficult job and requires good communication between the concerned departments. This achievement was appreciated by 99% from 2nd and 97% from 3rd years.

2nd Year (n=231), 3rd Year (n=250)

methods. Laboratory classes offer an opportunity for enforcing learning and complementing the teaching modalities such as lecture and PBL. While PBL and lectures focus on the big picture, laboratory classes facilitate learning about details and hands-on experience.

Certain studies, however, represent a different view from ours. In one of such, a majority of students felt that animal experiments involved needless pain and suffering to animals, and that computer simulations should be used as an alternative. Others think that a CD-ROM consisting of the software for computer simulations of all the amphibian experiments, is an alternative for conventional animal experiments.

Physiology occupies a prime position in undergraduate medical teaching. This has given curriculum planners an opportunity to be more innovative by attempting different modes of teaching. Our department has been successful in adopting multiple teaching strategies to enable students’ better understanding of the subject. This is in accordance with a number of other studies.

Our horizontal integration had the highest degree of agreement rating in both second and third year. This is in accordance with Hooi SC et al who stated that integration of physiology benefits not only horizontally across basic subjects but also vertically into the clinical years.

Since admissions in government medical colleges are strictly merit based, students in our institute come from a very diverse socioeconomic and educational background. Hence by emphasising on practical skill, clinical examination and small group tutoring, students with poor prior knowledge are able to overcome the disadvantage of their limited science exposure and achieve similar learning outcomes to those students with good science background.

CONCLUSION

The present out that both the 2nd and 3rd year medical students of FJMC although supportive of computer based learning, understand the importance of the animal laboratory for acquiring a more thorough understanding of Physiology. Our innovative teaching methodologies indeed did consolidate their concepts in the subjects and helped them through examinations. The medical curricula should focus on learning approaches that enhance students’ self-directed learning.

REFERENCES


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