DIGITAL VISUALIZER FOR TEACHING - LEARNING IN ANATOMY

Surajit Ghatak1, Pushpa Potaliya2, Ranbir Pal3

1 Professor and HOD, Department of Anatomy, AIIMS, Jodhpur, Rajasthan.
2 Senior Resident, Department of Anatomy, AIIMS, Jodhpur, Rajasthan.
3 Professor and HOD, Department of Community Medicine and Family Medicine, ANIIMS, Andaman.

ABSTRACT

BACKGROUND

Innovative medical education technologies are used as alternate mode of teaching-learning of Anatomy to undergraduate students in Indian tertiary care teaching institutes. As knowledge of anatomy helps students a long way in their clinical acumen, effective innovative teaching-learning tools need to be explored to build up their competency in anatomy.

The aim of this study was to find out outcome of application of Digital visualizer in systematic teaching-learning of Anatomy to undergraduate medical students.

MATERIALS AND METHODS

A qualitative and quantitative analysis was undertaken among First Professional MBBS students studying at All India Institute of Medical Sciences, Jodhpur Rajasthan, India divided in two groups. The groups were subjected to conventional and aid-assisted teaching using digital visualizer in a cross-over design on separate topics with comparable level of difficulty. Both groups were assessed by pre and post-test followed by feedback from them in reference to use of digital visualizer as aid in regular teaching-learning.

RESULTS

Both the conventional and aid-assisted teaching showed significant changes in knowledge of participants, though mean post-test score was higher with the use of digital visualizer. In the feedback analysis, it was noted that majority of the students considered digital visualizer as an average aid for teaching-learning.

CONCLUSION

The facilitators of this newly established institution conveyed the intricacy of topics well with both the methods and the use of newer medical educational technologies can assist as a comprehensive tool in regular teaching-learning sessions.

KEYWORDS


BACKGROUND

Globally information technology is dramatically changing the way learners, faculty and staff learn and work. Innovative aids as Internet-ready phones, handheld computers, digital cameras and MP3 players are revolutionising the teaching-learning process. With the advancement of technology, educational institutions are improving learning experiences for the students in classrooms, laboratories, libraries and all the student services. The main motive of medical education is not only to make a learner literate, but inculcate rationale thinking, reasoning and understanding the subject in-depth. For a true progress in a field, the foremost criteria is to have a willingness and determination to change and cope with innovations. This makes not only the understanding of given subject better, but also benefits both learners and educators. Digital visualizer or document camera provides high resolution magnified real time sharper images. These are used to display close up details of smaller objects to a larger audience in normal lighted room. Using computer or laptop with this digital visualizer, lecture and demonstration is possible in outreach sites also.[1-2]

In India, in the first year, anatomy is taught to medical undergraduate students as pre-clinical subject for their foundation of medicine when they are not directly exposed to patient care. As this knowledge helps them a long way in their clinical acumen, effective innovative teaching-learning tools need to be explored to build up their competency in anatomy.[3]

Ideally, 6 - 8 students should be taken in small teaching-learning groups. But due to paucity of faculty, we usually have to take a bigger number of students in the tutorials groups. So for eagerness of hand-on training, the students do pushing and shoving to gain a better view of demonstrated objects. This problem has compelled department to look for some advanced innovative technological aids for better viewing and interpretation of demonstrated object to the larger groups simultaneously. For this Digital visualizer was introduced in the teaching-learning with students between 25 and 50.

The purpose of the present study was to analyse the scope of application of Digital visualizer in the teaching-learning of Anatomy to undergraduate medical students and to evaluate the merits of its use in a general manner.
MATERIALS AND METHODS
A qualitative and quantitative study was conducted on First Professional MBBS students at the Department of Anatomy at the All India Institute of Medical Sciences, Jodhpur, by a crossover design using conventional and aid-assisted (Digital visualizer) teaching-learning methods followed by the student feedback.

Two topics of osteology on cranial cavity were selected for teaching-learning sessions for the study of comparable difficulty level. For data collection, two anonymous pretested structured questionnaires (Assessment of learning) for two topics was prepared for administration before and after teaching sessions for assessment of knowledge of the participants. A predesigned anonymous feedback questionnaire assessed by Likert scale was also prepared for opinion of participants regarding use of digital visualizer in the small group teaching sessions on Anatomy. The questions varied from relevance, scope, in-depth analysis and interaction etc. to the overall rating of the two teaching-learning experiences. The topics and these questionnaires were endorsed by the researchers, faculty members and experts on the medical education by intensive discussion at the Institute followed by the pilot study.

Necessary permission was obtained from the Institutional Ethics Committee. Initially, each participant was well briefed individually about the purpose and module of study. The participants were explained in detail that there was no identified risk in participating in this research. Still, they were given option to participate or not, followed by obtaining the informed consent before they took part in this study.

All the First Professional MBBS students were taken as census population and were divided into two Groups A and B as per their serial numbers. Group A and B were both administered with the first ‘Assessment of Learning’ on the first osteology topic (pretest). Then parallel sessions of small group teaching session was initiated on the first topic - for Group A conventional method with the facilitator holding the object on hand and showing parts thereon; for Group B the digital visualizer was used to get high resolution magnified real time sharper images on screen. After completion of sessions, both the Groups were administered again post-test with the same (First) ‘Assessment of Learning’. In the crossover design, same population was evaluated on the second topic of comparable difficulty level by second ‘Assessment of Learning’ (Pre-test). For the second topic, Group B received conventional and Group A digital visualizer aided teaching-learning method. Again, after completion of these parallel sessions, both the Groups experienced their post-test with the same second ‘Assessment of Learning.’

Student Feedback on Participation in Medical Education Research
On the second day of the study, the participants were administered the feedback questionnaire in Likert scale about their understanding on the use of Digital visualizer in relation to other educational technologies used in regular teaching-learning. Similar responses were grouped and percentage was calculated for each group.

Further, the students informally expressed their views on this teaching aid candidly along with role of facilitators and intricate details of their learning experience even after formal feedbacks.

RESULTS
Undergraduate MBBS First Professional students indicated varied outcomes regarding use of Digital visualizer. In the first topic, both the groups showed significantly improved performance in post-test; mean scores were comparatively better in Group B, where mean difference in Pre- and post-test (5.20) compared to Group A for the first topic (8.50). For second topic, a significant increase of knowledge was also observed in both methods in post-test performances. Yet, trivial improvement was observed with aid-assisted teaching by using digital visualizer (16.52 ± 2.37) with the difference of 2.25 mean score from conventional teaching (14.27 ± 2.52).

Later, we have added data of both phases of conventional and aid-assisted teaching-learning sessions. Analysis of the cumulative data showed improved pursuance of knowledge in both groups, though scores were slightly lower in post-test data of conventional group (14.27 ± 2.52) when compared to aid-assisted method (16.52 ± 2.37) [Table 1].

In the feedback response from the participants on the use of digital visualizer as an aid to understand osteology, half of total participants were in agreement (50% and more in Group B, i.e. 55.6%). In both the groups, there was difference in opinion regarding its use as an individual tool (69.6% in Group B and 21.7% in Group A). Most of them disagreed for its use as understanding minor details in demonstrations (64% in total) and considered it not at part to study with actual object (Bones) at hand (84%). Still half were in favour of continuing its use in the small group teachings, whereas 92.6 percent were interested in its use in revision only. The participants in the Group B (51.9%) found the knowledge gained through aid got improved and enhanced their confidence on subject as well; yet one-fifths was clueless about it [Table 2].

Regarding the point of view of the participants on the suitability of digital visualizer for regular teaching-learning in Anatomy, a five-point Likert Scale of (1 = useless, 2 = not useful, 3 = average, 4 = good, 5 = very good) was used to rate their subjective assessment; among them a 32 percent rated this aid to be just average (i.e. = 3) [Table 3].

In the informal discussions on corridor talk, the participants were in agreement on the use of novel innovative medical educational technologies along with clinical relevance in the real life scenarios in this newly established Institute of National Interest. They wished to get best of both worlds to be in pace with advancing technologies globally, yet emphasised the age old conventional face-to-face ‘sitting around teacher’ method as equally important for augmentation of knowledge. The motivation of researchers also facilitated the participants to disclose their opinion during the interactions and after the sessions.
The present study was conducted for assessing the role of digital visualizer for conduction of tutorials in Anatomy amongst first year undergraduate students and to evaluate the digital visualizer as an alternate mode of innovative medical education technology in teaching-learning as compared to conventional methods.

In this new millennium, students experience a divergent domain of learning by visual, auditory, reading/writing, kinesthetic modes. All of these modes of learning should be kept in the mind-set of the facilitators in imparting the medium for teaching-learning.[4,5,6] Audio-Visual aids have been used for years in different parts of our countries by the facilitators who are concerned about the learning of students, even using medical education technologies in different combinations.[7,8,9] However, assessment is needed on the optimum use of these aids for reaping benefits in undergraduate pre-clinical medical education.[10]

The traditional or innovative methods of teaching are critically examined, evaluated and some modifications in the delivery of knowledge are suggested. As such, the strengths and weaknesses of each teaching methodology are identified and probable modifications that can be included in traditional methods are suggested.[11]

In the era prior to learner oriented education, the educator was the centre or the focal point of the topic to be taught was the information and the learner was merely the receiver of the information. In terms of the delivery medium, the educator can deliver the message via the "chalk-and-talk" method and Overhead Projector (OHP) transparencies. This directed instruction model has its foundations embedded in the behavioural learning perspective. It is a popular technique, which has been used for decades as an educational strategy in all institutions of learning.[12] Also, it is reported in literature that use of traditional methods are best for teaching-learning in biomedicine and medicine courses.[13,14]

Basically, in the undergraduate medical education in our country, the educator controls the process of instruction. The matter of subject is delivered to the whole class and the educator tends to stress more on the knowledge based on the behavio

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A</th>
<th>Group B</th>
<th>Cannot Say (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Digital Visualizer in Osteology</td>
<td>26.1</td>
<td>69.5</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td>33.3</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Aid as Support Mechanism for a.</td>
<td>39.1</td>
<td>56.5</td>
<td>51.9</td>
</tr>
<tr>
<td>Face-to-Face Learning</td>
<td>48.1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>b. As an Individual Tool</td>
<td>21.7</td>
<td>51.9</td>
<td>69.6</td>
</tr>
<tr>
<td></td>
<td>44.4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Usefulness in Terms of Perception of</td>
<td>30.43</td>
<td>65.21</td>
<td>29.62</td>
</tr>
<tr>
<td>Minor Details</td>
<td>62.96</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Ability to Interact and Clear Doubt</td>
<td>78.3</td>
<td>17.4</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td>33.33</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Comparison of Aid with Real Thing</td>
<td>4.3</td>
<td>91.3</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>77.77</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Whether to Continue for Demonstration</td>
<td>26.1</td>
<td>65.2</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Role in Enhancing Confidence in Subject and Improving Knowledge</td>
<td>21.7</td>
<td>60.8</td>
<td>51.9</td>
</tr>
<tr>
<td>Better to be used for a. Basic Study</td>
<td>13.0</td>
<td>73.9</td>
<td>40.7</td>
</tr>
<tr>
<td>Revision</td>
<td>40.7</td>
<td>51.9</td>
<td>1</td>
</tr>
<tr>
<td>Both</td>
<td>13.0</td>
<td>60.9</td>
<td>37.0</td>
</tr>
<tr>
<td></td>
<td>44.44</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

### DISCUSSION

The traditional or innovative methods of teaching are critically examined, evaluated and some modifications in the delivery of knowledge are suggested. As such, the strengths and weaknesses of each teaching methodology are identified and probable modifications that can be included in traditional methods are suggested.[11]

In the era prior to learner oriented education, the educator was the centre or the focal point of the topic to be taught was the information and the learner was merely the receiver of the information. In terms of the delivery medium, the educator can deliver the message via the "chalk-and-talk" method and Overhead Projector (OHP) transparencies. This directed instruction model has its foundations embedded in the behavioural learning perspective. It is a popular technique, which has been used for decades as an educational strategy in all institutions of learning.[12] Also, it is reported in literature that use of traditional methods are best for teaching-learning in biomedicine and medicine courses.[13,14]

Basically, in the undergraduate medical education in our country, the educator controls the process of instruction. The matter of subject is delivered to the whole class and the educator tends to stress more on the knowledge based on facts. It is same as the instructor delivers the lecture content and the audience learners listen to the lecture. This as a result makes the learning mode to be passive and the learners play a very compliant role in their learning process.[15]

The widespread use of computers, projectors and popular presentation software programs in meeting rooms meant that overhead projectors became less frequently used. Digital visualizer continues to provide a convenient and flexible way of allowing documents, books or slides to be spontaneously displayed during presentations as required. Digital visualizer was developed to meet an increased demand for the ability to project and present original documents, plans, drawings and
objects directly, rather than necessitating the prior preparation that would be required for their use as part of an overhead projector based presentation.\textsuperscript{[1,2]} Among published literature regarding studies on various teaching-learning aids in medical education, the authors are yet to find one on digital visualizer in Indian context.

Effectiveness in learning should guarantee functionalism. One of the main elements, which will ensure efficiency in learning is the use of materials.\textsuperscript{[36]} Medical education can be largely benefited by considering student feedback on various modes of teaching-learning.\textsuperscript{[17]}

In first year professional MBBS course, pre-clinical subjects such as Anatomy, Physiology and Biochemistry are taught to students. Studies depicted that innovative aids are required for better illustrations and understanding not only in Anatomy,\textsuperscript{[16]} but even in other subjects of this and subsequent semesters like Pharmacology,\textsuperscript{[8,18,19]} Physiology,\textsuperscript{[20,21,22]} Biochemistry,\textsuperscript{[23,24]} Community medicine,\textsuperscript{[25]} Gynaecology and obstetrics,\textsuperscript{[26]} etc.

A study in India reported that combination of teaching aids is the best method of teaching and learning methodology.\textsuperscript{[7,27]}

In another study, it has been shown that the best teaching and learning methods are Liquid Crystal Display slides (54.83\%) followed by chalk and talk (37\%).\textsuperscript{[28]} Many workers found PowerPoint as most preferred aid in India\textsuperscript{[29]} for teaching-learning as well as in neighbouring countries like Pakistan, Nepal, Sri Lanka, China, Bangladesh,\textsuperscript{[31]} etc. This is in contrast to others who clearly disliked it and considered this lower attention span.\textsuperscript{[32]}

Apart from using aids in teaching-learning, various innovative methods of teaching are also employed by facilitators with changing times and need of students.\textsuperscript{[33]}

**Feed Back from the Students**

Students’ feedback is the primary element to evaluate diverse teaching-learning methodologies and intensify the pros and cons of various methods.\textsuperscript{[34,35,36,37]}

Initial briefing of this study through an activity made students excited and was an ice-breaker from routine tutorials. It helped them to interact more with the educators for their queries not only on subject, but mode of teaching as well. Participation of students for providing their opinions regarding teaching-learning methods, created a sense of responsibility and community among them.

Outcome of informal interaction through focal group discussion will certainly lead facilitators to impart ways in improving medical education in future. It provided a novel modernistic approach for the Anatomy tutorials and permitted students to probe their own perception regarding better outcome of a particular method. Also it helped the participants to resolve their pre-occupied notions regarding use of aid and made them more adaptable with use of technology.\textsuperscript{[38,39]}

Any system can never be considered immaculate in its execution; therefore, it should be constantly modified to the requisites of students.\textsuperscript{[40]} Their candid opinion regarding use of teaching aids in regular teaching-learning was well accepted by the researchers and faculty members of the Department of Anatomy at AIIMS, Jodhpur.

**CONCLUSION**

In this study both conventional and aid-assisted teaching showed significant changes in knowledge of participants, though mean post-test score was higher with the use of digital visualizer. The progression of understanding a topic under dialogue engrosses the dexterity and propensity to integrate and reminisce the ideas, comprehension and data provided by the facilitator along with the aid used.

**Strengths of the Study**

All India Institute of Medical Sciences, Jodhpur, has been recently established in 2012 under Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) by Government of India. We have introduced newer medical education technologies for better understanding of teaching-learning. Apart from interactive teaching in small groups, we have recently introduced Digital visualizer. This study helped us understand the use of this teaching aid for students in enhancing their confidence and improving knowledge on the subject.

**Limitations of the Study**

In the absence of any statistician recruited till date we validated the questionnaire by repeated pilot study, but we did not validate by Cronbach’s (alpha).

**Future Directions of the Study**

We will continue this study every year and on more topics excluding osteology, as found beneficial to demonstrate during dissection, etc.

**REFERENCES**


