

Newer Technologies to Teach Basic Sciences

Sharadkumar Pralhad Sawant*, Shaheen Rizvi**

Abstract

Anatomy is the base of medical science in India and is taught practically to all disciplines of undergraduate health sciences in the first year. It is an acknowledged fact that a basic knowledge of Anatomy is a prerequisite to learn any other branch of medicine. All medical professionals must have a basic knowledge of Anatomy so as to ensure safe medical practice. Traditionally Anatomy teaching consists of didactic lectures as well as dissections or prosections as per the requirement of the course. Lecture is defined as an oral discourse on a given subject before an audience for purpose of instruction and leaning. In the traditional method lectures were taken via chalk & board, but nowadays power point presentations are increasingly being used. To make Anatomy learning both pleasant and motivating, new methods of teaching gross anatomy are being assessed as medical colleges endeavour to find time in their curricula for new content without fore-going fundamental anatomical knowledge. This paper examines the other teaching methodologies for teaching gross anatomy.

Keywords: Anatomy; Medical Science; Undergraduate Students; Medical Professionals; Medical Practice; Traditional Methods & New Methods of Teaching.

Introduction

It is an innate challenge teaching Anatomy. Firstly, Anatomy is a subject in which students have to learn many new concepts and complex terminologies making it difficult. As a result, they find it monotonous and painstaking and concentrate their efforts on "memorizing" the lists of new terminologies. Secondly, the recent changing face of medical education has lead to a reduction in the hours of teaching Anatomy. Thirdly, students are extremely diverse with respect to their grades, their scientific literacy levels, their abilities, their cultural backgrounds and professional fields. Hence it remains a challenge to find and assess methods to teach *all* students anatomy more effectively, in less time, and often with limited resources [1].

Author's Affiliation: *Professor and Head, **Assistant Lecturer, Department of Anatomy, K. J. Somaiya Medical College, Somaiya Ayurvihar, Eastern Express Highway, Sion, Mumbai-400 022.

Corresponding Author: Dr. Sharadkumar Pralhad Sawant, 25/2, Samrat Ashok Nagar Society, Shell Colony Road, Chembur, Mumbai - 400 071, Maharashtra, India.
E-mail: drspsawant@gmail.com

The fundamental approach to teaching Anatomy is the use of human cadavers. Cadavers are indispensable to the study of human Anatomy. With increasing awareness of voluntary body donations, there is no dearth of cadavers and students in India get ample opportunities for dissection.

Anatomy as a subject not only requires surface learning or memorisation but also requires deep learning through understanding and the ability to apply the information to solve clinical problems.

For effective learning of Anatomy, students need to be engaged and sustained in significant learning activities through interaction with other students. Having interested and zealous teachers is also crucial to sustaining a students' interest [2].

Discussion

Didactic Lectures have been a universal form of teaching and learning since ancient times, especially for large group teaching, when the number of students attending is much larger than the number of teachers available. Lecture is defined as an oral discourse on a given subject before an audience for purpose of instruction and leaning. During a lecture, both the

visual and auditory senses are used to absorb information. In the usual course of teaching, the most frequently used method of taking didactic lectures is the chalk and board method, while the use of transparencies with an overhead projector (TOHP) is also popular. Nowadays the use of PowerPoint (PPT) presentations is the most popular electronic presentation used. Some students prefer PPT presentations, mainly because they evade the issue of poor handwriting and dirty blackboards, but students develop into passive observers rather than active participants. Although use of PPT has some constructive effects, it reduces the interactive dialogue between teacher and students. On the other hand majority of students favour chalkboard teaching not only because of the improved student-teacher interaction but also lectures using chalkboard, contained natural breathers or breaks (eg, during writing or rubbing out the blackboard) allow students to follow the material and take down their notes. Hence, a chalkboard is said to be more student-centered while PPT is more teacher-centered [3]. This is also followed in all colleges as one of the traditional teaching method for anatomy. Anatomy teaching in medical schools has been traditionally based around the use of human cadaveric specimens, either taking the whole body specimens for complete dissection or as prosected specimens. Cadaveric dissection is central and indispensable to the study of human anatomy. The concrete foundation of medicine comes from a sufficient and very accurate knowledge of human anatomy and this can be achieved only from learning human dissection. Thus dissection training has remained an significant part of medical curriculum. In addition, cadaveric dissection allows students to not only grasp the three -dimensional anatomy and but also the concepts of biological variability. Through dissection, students are able to envision firsthand, the actual structures of the human body. The manual dexterity learnt in the dissection room are vital in almost every branch of medicine and thus dissection has remained a globally identifiable step in becoming a doctor [4]. Cadavers are embalmed with formaldehyde, a hazardous chemical, and carry the risk of accidental overexposure. Hence some medical schools in the West, began to explore alternative methods for teaching Anatomy. In some schools, dissection has been substituted by plastinated specimens. Plastination, a method invented by Gunther von Hagens, makes it possible for prosections or slices of cadavers to be conserved in a safe, strong, dry polymer medium that is odourless and inert. Plastinated specimens appear like a perfect choice, as the specimens allow students to see a high degree of

anatomical specificity, even though they are dry, odourless, and non-toxic. Although the expenditure of acquiring the collection of plastinated specimens is significant, the specimens have a life span of twenty years or longer. There are no recurring costs such as those of cadaver acquisition and embalming associated with a dissection laboratory [5]. But dissection is considered to be a far superior tool to achieve anatomical knowledge. According to Professor Harold Ellis, of London: "Dissection teaches the basic language of medicine and some manual dexterity. It introduces an understanding of three-dimensional anatomy and the concept of biological variation. It acclimatizes students to the reality of death and teaches respect for the body." [6].

Medical imaging technologies, such as Radiographs, CT, MRI and ultrasound disclose both normal and pathological anatomy. Teaching radiographic anatomy to pre-clinical medical students is essential, as it correlates anatomical studies to clinical medicine and simultaneously prepares them for the radiology they will come upon in their clinical years. The most extensively used medical imaging modality in anatomy teaching is radiographs. It is a vital part of all anatomy teaching programs. Plain radiographs allow students to study primarily skeletal anatomy. The study of soft tissue anatomy using radiographs rely on the use of contrast, in studies such as barium meal, barium enema, intravenous urogram, hysterosalpingogram, etc. Radiographs and Ultrasound are non-invasive methods of morphological study to supplement the teaching of gross human anatomy. They allow students to visualize 'living anatomy' through correlations with cadaveric dissection. Students can use radiographs and ultrasound to learn normal anatomy of the thorax, abdomen, pelvis, and extremities [7]. CT and MRI images initiate the study of sectional anatomy, and transform the three dimensional structures and relationships into two-dimensional representations and help the students to understand the concepts better. Students will have the opportunity to correlate these sectional images side by side with the dissected or prosected specimens. They facilitate a better understanding of the anatomy of the spine as well as the study of neuroanatomy. Integrating these medical imaging modalities in the study of anatomy is fitting, not only because they recommend ways of visualizing the anatomy of living subjects, but also because they are the very same diagnostic resources which the students will use in their clinical years and in their practice [8]. Students get encouraged when they see the application of what they are doing and are likely to retain the information, because they are learning it in context. Problem based

learning was developed on these grounds. A given 'problem' often a clinically related one, is given to the students and from this problem, students are left to explore different topics and learn the different facets of the problem. e.g. – An elderly lady falls and fractures her leg may be the problem. From this, the students will learn the anatomy of the lower limb, pathophysiology of bone healing, pharmacology of pain relief, the risks of immobilisation in the elderly and the consequences of disability. This type of approach is being progressively adopted by many medical colleges. It also helps the pre-clinical students to improve their clinico- pathological skills early in the profession. At the end of the day, it is the problem-solving skills rather than memory based learning which are crucial for treating patients [9]. Evidence is available to show that knowledge retrieval is facilitated when knowledge is acquired in a situation resembling those in which it will be applied. By heading in the direction of integrated learning, anatomical details may be reduced but the ability to apply knowledge increases [10]. Students secure what they learn by looking at the surface anatomy relevant to the area on themselves, or on each other. Surface anatomy is the study done on the surface of the subject by inspection, palpation and manipulation, in relation to the anatomy under the skin. It brings forth students' interest in gross anatomy, showing them what they learned from books, lectures, and dissection are actually present in living persons. Although the facts are apparent and should need no convincing, the students still show astonishment and elation, when they first 'discover' what lies under the skin. This informs us that surface anatomy is an invaluable method of instruction. Living Anatomy forms the obvious connection between basic gross anatomy and clinical practice, because it is the basis of physical examination [11].

In spite of all the above methods, a number of students still find Anatomy difficult to comprehend. For such students various methods can be employed to facilitate their learning:-

1. For students who are mainly visual learners or artists – Such students are encouraged to draw anatomical drawings or what they visualise during dissection, on a board or on paper. This is a valuable learning tool for them and allows them to recapitulate and combine concepts and facts to make them easier to learn. These visual cues also assist with long-term retention of information [12].
2. For students who are mainly tactile learners – Such students are given models to study or they

themselves are encouraged to prepare models using moulding clay. This approach is enjoyable and reinforces learning, while developing a real 3-D image of structures and their relationships.

3. For students who prefer learning by 'doing' – Such students can be taught Anatomy by performing body movements with weights or by performing movements of the various joints of the body. This 'doing' assists in long term retention of information for many students [13].

Recommendations

Anatomists should include recommended teaching strategies in their teaching methodologies. They should apply evidence based practice, in their choice of teaching strategies, for subject content. The use of peer and student evaluation of teaching strategies should be increased, as a means to improving the use of learner centered teaching strategies as well as to identify best practices. Educators should assess and understand their own teaching styles, so that they can adapt them to meet the learning styles of the students. A user friendly tool to assess the learning styles of students, should be designed, piloted and implemented. This is important in anatomy education; so as to assist lecturers in choosing teaching methods to match the learning styles of students. Benchmarking can be carried out with the department of Anatomy of other colleges to identify best practices and implement them.

Conclusion

Proper utilization of newer technologies along with the traditional teaching methods will certainly lead to enhanced understanding of gross anatomy and will ultimately improve students' performance. The advanced teaching methodologies will help in learning anatomy in a better and an easier way. If these new- view points on teaching methodologies are employed, the environment for learning Anatomy will not only be appealing and interesting but also exciting and enjoyable, leading to deeper learning. Students will accomplish the desired learning outcomes, and will gradually become positive and self-directed learners.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

SPS drafted the manuscript, performed the literature review & SR assisted with writing the paper.

Acknowledgement

Authors are thankful to Dean Dr. Geeta Niyogi Madam for her support and encouragement. Authors are also thankful to Mr. M. Murugan for his help. Authors also acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

References

- Ramsden P. Learning to Teach in Higher Education. 2nd edn. London: Routledge Falmer; 2003. Approaches to learning (Chapter 4) pp. 39–61. ISBN 0-415-30345-1.
- Professor Claudia Diaz, James Cook University, For stimulating multidisciplinary first year students to learn Anatomy for life via innovative, pro-active approaches to improve engagement and learning outcomes, 2011 Citations for Outstanding Contributions to Student Learning.
- Vikas Seth, Prerna Upadhyaya, Mushtaq Ahmad, and Vijay Moghe, PowerPoint or chalk and talk: Perceptions of medical students versus dental students in a medical college in India- Adv Med Educ Pract. 2010; 1: 11–16.
- Horst-Werner Korf, Helmut Wicht, Robert L. Snipes, Jean-Pierre Timmermans, Friedrich Paulsen, Gabriele Rune, Eveline Baumgart-Vogt,-The dissection course – necessary and indispensable for teaching anatomy to medical students, Ann Anat 190 (2008) 16–22.
- Fruhstorfer BH, Palmer J, Brydges S, Abrahams PH. The use of plastinated prosections for teaching anatomy: the view of medical students on the value of this learning resource. Clin Anat 2011;24:246.
- Harold Ellis: a surgeon's contribution to anatomy education. Anat Cell Biol. 2012 Mar; 45(1): 70–71. Published online 2012 Mar 31.
- McNulty JA, Sonntag B, Sinacore JM. Evaluation of computer-aided instruction in a gross anatomy course: a six-year study. Anat Sci Educ 2009; 2:2-8.
- De Barros N, Rodrigues CJ, Rodrigues AJ Jr, De Negri Germano MA, Cerri GG. The value of teaching sectional anatomy to improve CT scan interpretation. Clin Anat 2001;14:36-41.
- Katinka J A H Prince¹, Henk Van Mameren², Nelien Hylkema¹ Jan Drukker², Albert J J A herpbier³ and Cees P M Van Der Vleuten⁴ Does problem-based learning lead to deficiencies in basic science knowledge? An empirical case on anatomy, Medical Education Volume 37, Issue 1, pages 15–21, January 2003.
- Karpicke JD, Roediger HL. The critical importance of retrieval for learning. Science 2008;319:966-8.
- Pallab K Ganguly¹, Lap Ki Chan², Living anatomy in the 21st century: how far can we go? South East Asian Journal of Medical Education Vol. 2 no 2, 2008.
- Edgell: Multiple Approaches to Teaching Anatomy, Teaching Innovation Projects, Vol. 1 [2011], Iss. 1, Art. 3.
- P. Benly, Teaching Methodologies on Anatomy- A Review, J. Pharm. Sci. & Res. Vol. 6(6), 2014, 242-243.