Recent Advances and Changing Face of Anatomy Teaching and Learning in Medical Education

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Abstract

Keywords
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Background A sound knowledge of human anatomy is a major requirement for being a good physician or a practicing surgeon. Despite digitalization and modernization of education sector, traditional cadaveric dissection still occupies the leadership of anatomy education. It is becoming an untold truth that no modern technologies such as virtual dissection or 3D model printing could replace cadaveric dissection in its way of teaching students.

Methods Recent research studies on modern anatomical teaching methods for medical and non-medical students and their influences are reviewed.

Results Despite new technologies, traditional cadaveric dissection helps students to acquire more practical knowledge and still occupies prior position on its way.

Introduction

As per current perspective, main aim of anatomy education in medical and paramedical schools is to provide students an in-depth understanding of morphology, their position, and spatial relations, for example, connectivity and innervation. Students should be able to locate anatomical structures, which are an essential prerequisite for surgical interventions. They should also be aware of variability of morphology and location, for example, of branching patterns of nerves, lymphatics, and vascular structures. Traditional methods for anatomy education involve lectures, demonstrations, use of textbooks and atlases as well as cadaver dissections. Cadaver dissection has played an essential role for many reasons, for example, training of manual dexterity and communication skills.

In addition to above basic requirements, students should be trained in such a way as to correlate anatomic basis of diseases, that is, anatomical explanation of signs and symptoms for a particular disease condition. This is lacking in many medical schools in spite of curriculum which demands the same. It may be due to various reasons such as time limitation, demonstration scarcity, shortage of proper training of faculty in clinical specialties, and even lack of interest of teaching faculty.

Despite immense medical knowledge, doctors from Indian subcontinent often receive negative comments due to lack of or due to improper communication skills. Thus, while preparing a curriculum for medical schools, special training in developing communication skills in addition to medical training should be made mandatory.

An Overview of Technologies Used for Anatomy Education in Terms of Medical History

Using technology contributes learning and teaching in a better and effective way. Using technology creates interest and also increases motivation of student. Thereby, learning outcomes become more permanent. Moreover, using model, plastic model, and computer-assisted simulator technologies instead of traditional methods is preferred as a part of respect to privacy in medical ethics. Benefits of simulation technique are that it supports one of the basic principles of bioethics “first do no harm” by providing students equal opportunities and to repeat many times as they wish. The key aspect is that modern technologies doesn’t replace the traditional way of education rather provides much support for the same.
In this modern technological era, style or mode of education also has to be revisited/updated as per student requirements. Cadaveric teaching is essential because it provides the opportunity of knowing three-dimensional (3D) structure and diversity of the body. But recent and technologically developed methods allow us to decrease both the required time for training and the cost of education. It provides better hygiene and more better standard for laboratories. Even if modern artificial cadaveric laboratories and simulation laboratories decrease the risk of formalin-induced diseases, they may not create a suitable environment to monitor anatomic variations of human body and possible pathological structures. Consequently, although it seems to have some negative aspects to be dealt with, it is still considered appropriate, resulting in the continued use of cadavers in education.

**Anatomy Education for YouTube Generation**

YouTube generation is specifically defined not by age group but by an attitude and mindset. This group is a core audience for YouTube and 80% Millennials constitute this generation. Furthermore, about more than three-fourth of this population has an online social media profile and update it daily. Almost every undergraduate student owns three or more electronic devices (i.e., smart phones and iPods) and 90% own a laptop or a computer.

The below are the results of the survey conducted in Ireland. When asked to select the method used to solve a difficulty encountered in their anatomy learning, the majority of the students surveyed (70%) had employed web-based platforms to source information, either by using Internet search engines (62%) and/or social media websites (10%). However, 29% students also selected recommended anatomy textbooks, while 5% indicated they would contact an instructor.

In agreement with previous studies, majority (78%) of students selected YouTube as their source of anatomy video clips, while medical websites (8%), Facebook, and other social media (22%) mentioned that the usefulness depends on the particular topic.

This survey analysis suggests that social media and in particular YouTube are becoming increasingly prevalent as student learning aids in anatomy education. It is suggested here that a change in anatomy instructors’ perceptions may be needed regarding the use of social media, given that a significant portion of students consult online resources such as YouTube or Facebook rather than asking the educator to answer a question.

**Problem-Based Learning: An Overview of the Process and Its Impact on Learning**

Problem-based learning (PBL) has been widely adopted in diverse fields and educational contexts to promote critical thinking and problem-solving in authentic learning situations. Its close affiliation with workplace collaboration and interdisciplinary learning contributed to its spread beyond the traditional realm of clinical education to applied disciplines such as health sciences, business studies, and engineering. With this growing practice and popularity of PBL in various educational and organizational settings, there has been an increasing number of studies examining its effectiveness on the quality of student learning and the extent to which its promise of developing self-directed learning habits, problem-solving skills, and deep disciplinary knowledge achieves its intended result. In atypical PBL setting, learning is triggered by a problem which needs resolution.

PBL is a pedagogical approach that enables students to learn while engaging actively with meaningful problems. Students are given the opportunities to solve problem in a collaborative setting, create mental models for learning, and form self-directed learning habits through practice and reflection. Hence, the underpinning philosophy of PBL is that learning can be considered a “constructive, self-directed, collaborative and contextual” activity. Longer term knowledge retention is in favor of PBL.

**Modern Methods Used in the Study of Human Anatomy**

Anatomy study should not be completed in 2nd year of medical school, instead student, by means of a harmonized curriculum, shall continue the process of understanding the anatomy in the 3rd, 4th, and 5th year by means of optional and facultative subjects such as clinical anatomy, imaging anatomy, and joint biomechanics.

The role of knowledge construction by students themselves in learning is really significant, reflected in the formation of critical and reflexive individuals and qualified professionals. Using the methods of cognitive behavioral training, we may obtain a positive response from students, who declared being more interested; objectively, student participation in classes can be improved if flip class rooms, small group teachings, quiz programs, etc. are incorporated in teaching schedule and with proper time management.

Anatomy is one of the very few disciplines of medicine where no changes occur, as structure of human body remains the same. Yet, every teacher struggles permanently to improve their course. All the time they have tried to strike a balance between the number of concepts presented and the iconography quality, type of analyzer used in reception, and understanding by student. We ask ourselves, since teachers were compared with actors and actors play in plays and then films came into being, would not it be better in future to use 3D images with anatomy teacher. Thus, better and better courses could be obtained, and the teacher will sit at his/her chair in the classroom and interact within amphitheater. There will still be questions from students about the understanding of certain structures.

Thus, teacher will be able on the one hand to explain these unknown subjects to students, access pictures, or demonstrations to clarify the concepts and upgrade their course based on the redundancy and importance of questions.

Any educational process ends with students’ assessment. There were and there are still various controversies on this
subject. The earliest methods of examination involved practical and theoretical tests. The classic practical exam involves the recognition of certain anatomical structures on dissection preparations or sections of the different topographic regions.

To these we can add the recognition of anatomical formation on paraclinical investigation images: X-rays, computed tomography with or without contrast dye, nuclear magnetic resonance.

Teaching Anatomy in the 21st Century: New Aspects and Pitfalls

By learning gross anatomy, medical students get a first “impression” about the structure of the human body that is the basis for understanding pathologic and clinical problems. Although the importance of teaching anatomy to both undergraduate and postgraduate students remains undisputed, there is currently a relevant debate concerning methods of anatomy teaching. Recently, the time allocated for anatomy teaching has been dramatically reduced to such an extent that some suggest that it has fallen below an adequate standard.

Anatomy as a discipline is disappearing and few new anatomists are being trained properly. Worldwide curricula reforms, which have resulted in a reduction both in gross anatomy teaching hours and its context, lead to a serious review of the way in which anatomy is taught. Furthermore, the abolition of anatomy demonstrator positions has deprived surgical trainees of valuable exposure to clinical anatomy and a new generation of surgeons is subsequently taking up operative responsibilities despite their poor knowledge of anatomy.

The question is, why students do not seem to have enough anatomical knowledge to practice safely. The answers are various: ranging from reduced teaching hours to recently developed teaching methods not including compulsory dissecting and light microscopy sessions.

It is strongly suggested that anatomy to be integrated vertically into medical education so that students are exposed to anatomy teaching throughout undergraduate (preclinical and clinical), postgraduate, and later in professional training. Modern digitalized methods of teaching anatomy are undoubtedly useful. However, body donation can still significantly benefit new medical students, and the dissection procedures should be reintegrated into medical training.

Computer-assisted learning, PBL, and newly developed techniques such as plastination should be used to enhance and support anatomical teaching and learning in medical education.

Learning gross anatomy by dissection cannot be undermined in a modern medical curriculum, since it gives a 3D experience in real life that cannot be attained by the most advanced digital anatomy programs available.

Blended Learning in Anatomy Teaching for Nonmedical Students: An Innovative Approach to the Health Professions Education

Study contributed to literature by introducing an innovative courseware that is exclusively oriented for nonmedical students and exploring attitude and blended learning experience from students’ perspective. As per the results obtained, majority of students had an acceptance of the method of blended learning, but the researchers could not establish any of its effect on learning. The view could also be explained by the mainstream students who learned anatomy in the form of pure memorization instead of strategic learning felt that the amount to learn was daunting and stressful. A gamified element (games, quiz, animations) in health profession education has gained wide attention as an active learning strategy.

The Virtual Dissecting Room: Creating Highly Detailed Anatomy Models for Educational Purposes

The world is making a push toward a digital environment. The use of multimedia in the 21st century has become commonplace worldwide and 3D presentations of information are being increasingly used in medical education and healthcare. Therefore, modern anatomy teaching may include the use of multimedia presentations and radiological images next to more traditional procedures such as cadaver dissection and depicting surface anatomy. Computer-based (3D) interactive models of human anatomy have evolved over the last decade with advances in computer technology and web-based education curricula (such as online education). Such models can be used outside the classical teaching environment in a blended learning approach, or—in the case of the absence of dissecting facilities—as a tool to replace dissecting practical.

3D Digital Anatomy Modelling - Practical or Pretty?

With current technological advances and a constantly changing learning environment, a growing number of digital applications are being implemented into undergraduate and postgraduate medical teaching curricula. Even though the value of cadaveric dissection is irreplaceable, digital technology without a doubt can greatly facilitate anatomy learning. Interactive 3D digital models improve understanding of complex anatomical structures, their special relationship and help improve manual skills and hand–eye coordination. Also, digital mobile technology is an appealing mode of learning anatomy as it is logistically convenient, more engaging, and less intimidating to the contemporary student.

Drawing classes, once restricted to arts majors and painters, seem to be gaining traction in medical education. Drawing as a teaching method could also benefit the lecturers as the students’ drawings could reveal common knowledge gaps. A variety of media are being explored including collage and wire modelling in the hope of effectively relating structure to function.

Conflict of Interest

None.
References