

Teaching gross anatomy: Anatomage table as an innovative line of attack

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Background: In medical education, with the emerging technology-assisted equipment, anatomage had developed as one of innovative approach for medical education teaching and learning tool for better understanding of basic sciences. The aim of this study was to explore the practicality of the virtual body dissection table and inclusive gratification among medical students in the teaching and learning of gross human anatomy.

Methods: A cross-sectional survey was conducted during 2019 academic calendar among second-year medical students at the University of Gondar, Ethiopia. Questionnaires modified to the local context designed to explore the practicality of the virtual body dissection table and inclusive gratification among medical students in the teaching and learning of gross human anatomy. Eighty nine study participants (51 males and 38 females) were participated.

Results: The majority, 80.89% of medical students study participants were satisfied that the anatomage had a helpful starring role and it was a supplementary tool for their learning and learning human anatomy and also gives well-known numerous benefits of using the anatomage table in the medical teaching and learning activities.

Conclusion: As a major basic medical science, learning human anatomy could be expressively wedged with real visual anatomy. Therefore, the use of virtual body dissection technology gives the impression to have an auspicious role in upcoming educational training programs.

Key Words: Anatomage table; Anatomy education; Dissection; Medical students

Abbreviation: LCD: Liquid Crystal Display; 3-D; 3- Dimension; MRI: Magnetic Resonance Imaging; CT: Computerized Tomography; X-ray: X-Radiation

INTRODUCTION

Anatomy is one of the furthermost imperative basis life sciences and keynotes in medical education. The label of knowledge in anatomy makes students for forthcoming in clinical practice [1]. Now days, medical undergraduate and human anatomy post graduate students could study the human body parts by using diverse approaches based on current innovative technology. The blast of new technologies in the period of the latter few decades has fetched anatomical education into a new domain [2,3]. The progression and the advances use of interactive modern technology in medical education is repetitively developing and growing. Currently, students are strengthened inversely from the students of previous cohorts that use electronic access like table, smart phone for educational purpose. Companies with virtual anatomy products offer detailed, interactive anatomical images to complement textbooks and traditional cadaveric studies. Medical education curriculum for human anatomy teaching and learning process could focus on the virtual anatomy products to raise the standard of medical education by supplying novel and groundbreaking tool for sightseeing the human body parts. The table can be a supplement to any human anatomy teaching methods [4,5].

Anatomage table is a visualization of computerized system for anatomy education which is being implemented by many medical schools and institutions globally with highly advanced technology product that draws attention from visitors, students as well as faculty members. The product will quickly become the technological flagship at institutions that set apart from other institutes [4]. This table merges stereoscopic image of the whole body with software in order to build a 3-D refurbishment of the different human body parts that are primarily taken from cadavers that allow for virtual dissection and rebuilding. Anatomage is a computerized body-size

table with 2.13 x 0.67 meter screen that chains the technology of CT scan, X-Ray, ultrasound and MRI to renovate the human body [6].

It is a fully segmented real human 3-D anatomy system with unique aspects of accuracy of the real anatomy for normal and pathological conditions. The product bids extraordinary technology for medical education. Medical and anatomy postgraduate students were inspired and could simply understand 3-D forms of human anatomy which makes the table very effective for anatomy education. Even though more research is needed for the better understanding of the efficacy of using this technology in the classroom, the use of virtual dissection technology seems to have a promising role in future educational training. In this regard, a study conducted by scholars concluded that students appreciate learning with this technology and believe that it is a beneficial and effective tool in preparing them to meet a standard health care professional level [4].

Anatomage table assisted education has been proven to be effective as it is showed by numerous publications, more efficient classroom, lab sessions, and student acceptance. The accurate details and annoying content draw students' interest and attention, leading to more effective educational outcomes [7]. The incorporation of cadaver CT scans and life-size virtual dissection tables significantly improved the performance of medical students [8,9].

Anatomage gifts some striking advantages over the use of cadavers such as no contact with embalming chemicals, no need of special place for the anatomical table; there are no restrictions and permits to use it. The anatomical accuracy in the reconstruction of the human body is very high since it is based on real human bodies. It is also possible to cut and make sections of the body in any direction. The anatomage table offers a high quality lab experience without any chemicals. There are no possibilities of leaks, no environmental

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concerns, and the product provides headache free lab sessions. Unlike cadavers, the anatomage table does not require ventilation infrastructure, embalming equipment, personnel, and storage. The contents are reusable, so there are no recurring acquisition costs. The product will save significant costs over the long term [10]. Despite its costly, anatomage can be used frequently and for a long period of time. Stereotypically, its most usual application is dissection replacement. With a fully interactive touch screen, it is possible to dissect the body, moving through layers of tissues and offers cutting tools, by using digits we can rotate the body and cut in any direction. After the cut off, the cross section shows the details of the internal structure. Laboratory assistant or anatomist can scroll through the plane of the last cut or cut again to further explore the anatomy. Unlike a real body, a cut can be undoing to restore the body immediately. This innovative dissection method enables to practice dissections over and over again to be effective anatomy learning tool than any other techniques [11,12].

Anatomage table also offers the option to combine scanning planes to get a better understanding of the location and relationships of the different human body inner structures. It is possible to combine the view at one level with the view of structures in sagittal, parasagittal, coronal and transverse planes, and to move up and down to check the structures at different levels of cross section. This allows the user to watch a complete and perfect 3-D view of the size, position and relationships of organs, vessels, nerves, muscles and spaces. It is not only for anatomical education but also it can be used for radiology, surgery case review, patient consultation, and research purposes [13-16].

METHODS

This study was conducted on second year medical students in a real practical lesson setting and under actual learning conditions of the anatomy department who have undergone the process of anatomage table as a part of anatomy course in their second year of medical education of the college of medicine and health sciences, University of Gondar, Gondar, Ethiopia.

The data was collection through a 10-item questionnaire. The study was done in the period of July 2019 to August 2019. Total 304 respondents completed the questionnaire. They were asked the questions pertaining to five major issues. At the end of each laboratory practical session, the lecturer, as a facilitator undergoes a discussion session with the students. It enables students to increasing their knowledge and success on the human anatomy study process (Figure 1).

RESULT

A total of 89 medical students were included in this study. Of these, 51 (55.83%) were males; 74 (83.14%) were Christians. The mean age of male and female medical students was 19.9 ± 0.6 , 18.9 ± 0.7 years (Table 1).

Gross anatomy practical laboratory session is a main skill laboratory session that leads to know the human body parts easily within short period of time. Anatomage table is a three dimensional presentation of human body parts into different layers, which was essentially supportive for medical students. All structures were labeled and the students could effortlessly understand the relationship of all neighboring structures. The students can dissect human body parts from healthy organs to pathologic ones. The majority of the students found that gross anatomy practical session through anatomage was



Figure 1) Photograph of anatomage during usage at anatomy laboratory, department of human anatomy, University of Gondar, Ethiopia.

TABLE 1

Socio-demographic characteristics of the respondents, Gondar, Ethiopia, 2019.

Variable		Frequency	Percentage
Age (Years)	≤ 18	4	4.49
	18-20	63	70.78
	> 20	22	24.71
Sex	Male	51	57.3
	Female	38	42.7
Religion	Christian	74	83.14
	Muslim	12	13.48
	protestant	3	3.37

an interesting and effective learning tool to enhance the independent and collaborative learning, also develop students' knowledge and skills (Table 2).

The students who spent more time on the table had more positive perception as an excellent learning aid as compared to other teaching aids for teaching and learning of human anatomy. This is due to the fact that the table offered some advantage of answering the relationship among structures. Moreover, anatomage gives special preferences to increase the possibilities to imagine the rotation and positions of anatomical structures in different planes in different perspectives and it contribute to improve learning and understanding of students' verbal and visual knowledge. At the end of practical session, majority of students can easily understand the topographical relationships between neighboring structures with a very simple view and description of all structures. One of the ways to increase students' learning is changing the method of teaching and allows students to take active participation.

DISCUSSION

Medical education had been intensely affected by the developing passion in technologies over the past few years. Also, teaching human anatomy had substantially fluctuated during the former decades. Even if there was continuous progression of computer-based technologies, there is much argument about the appropriate teaching methods to bring essential basic sciences knowledge. The anatomage table is an exclusive technology with software that leads anatomy viewing and modeling tools, materials with virtual body parts for anatomical education. Numerous research studies conducted showed that the anatomage table is an efficient method of active learning method [17].

The anatomage table brings anatomical images to life can let students to dissect the body and move through layers of tissue. The current study findings also showed that the potentials of the anatomage table offer students to view and manipulate full body over the cadavers. In practical laboratory sessions students can rotate and manipulate structures from various views to identify anatomical structures and relationships between them. As it is a touch screen, students can expand the size of a body students can expand the size of a body section to study its details and turn that body part in different direction and allows to undo any mistake [18,19].

The anatomage table does not replace the cadaver involvement, but rather broadens and deepens the information. Any innovation in technology must be integrated with innovation in pedagogy [20]. The use of technology to enhance medical education, but hope to see technology used not as a replacement for other learning tools, but actually as an additional tool to improve the educational process. Students can explore the detailed structures of the body that are difficult to view using other tools. The table uses LCDs and displays in the practical rooms, all students can view the image at the same time. Full body volume data of virtual anatomy can serve as a supplement to the existing cadaver based practical sessions of anatomy course.

Different scholars' studies indicated that 3D anatomy has several shortcomings as compared to outdated teaching methods [21]. Even when computerized based education has established a new approach and offering medical students to simplify their tactic to structures, the advantage of direct

TABLE 2

Distribution of the response of each student for use of anatomage table as teaching methods, Gondar, Ethiopia, 2019.

Item	Male					Female				
	SA	A	N	DA	SDA	SA	A	N	DA	SDA
Over all satisfactions of students to anatomage table as methods	37	7	5	2	0	21	6	4	6	0
Use of Anatomage table has helped me to understand the topic better	11	40	0	0	0	8	30	0	0	0
I developed deeper understanding of the topic with use of Anatomage along with dissection	16	35	0	0	0	13	25	0	0	0
Anatomage helped me to understand different parts of body	20	31	0	0	0	20	18	0	0	0
Anatomage helped me to visualize better the relative sizes of different parts	17	27	0	3	4	6	28	3	1	0
Anatomage helped me to understand relationship between different parts of the body	8	36	0	4	3	20	14	0	4	0
I enjoyed the whole process of using Anatomage	14	37	0	0	0	8	24	0	6	0
Use of Anatomage enhanced my learning experience and interest in studies	24	27	0	0	0	12	26	0	0	0
Learning with Anatomage take less time than traditional learning with Dissection	16	28	2	5	0	9	20	8	1	0
Anatomage table should be included in routine teaching learning process	29	22	0		0	16	22	0	0	0

contact with human body parts could not yet be substituted. This study pronounced the learning and pleasure of students as to the anatomage table at university of Gondar. The anatomage table is becoming an additional component of teaching aid for medical students that offered a unique digital plate-form for anatomy. This technology based teaching method will not only support medical students to learn anatomical particulars, but also afford the gratitude of 3D structure. The anatomage table advances understanding of complicated body parts and their distinct relationship.

CONCLUSION

Learning human anatomy could be expressively wedged with real visual anatomy. Therefore, the use of virtual body dissection technology gives the impression to have an auspicious role in upcoming educational training programs in collaboration with other methods.

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AUTHOR CONTRIBUTIONS

BT, soley Author, who developed the study design, conducted the interviews and analysis, ensured trustworthiness, and drafted the manuscript. The author read and approved the final manuscript.

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AVAILABILITY OF DATA AND MATERIALS

The datasets were freely obtainable from the corresponding author on reasonable request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Ethics Committee of, School of Medicine, University of Gondar. The participants were justified about the research aim and interviews. Informed consent for conducting and recording the interview was obtained. The confidentiality of the participants' information was maintained throughout the study.

CONSENT FOR PUBLICATION

Participants gave printed informed consent for the use of passages for publication.

COMPETING INTERESTS

The author declares that no any competing interests.

REFERENCES

- Ang ET, Sugand K, Hartman M, et al. Singapore's anatomical future: quo vadis. *Anat Sci Educ*. 2012;5:234-40.
- Fruhstorfer BH, Palmer J, Brydges S, et al. The use of plastinated prosections for teaching anatomy-The view of medical students of the value of this learning resource. *Clin Anat*. 2011;24:246-52.
- Sugand K, Abrahams PH, Khurana A. The Anatomy of Anatomy: A Review for Its Modernization. *Anat Sci Educ*. 2010;3:83-93.
- Custer T, Michael K. The Utilization of the Anatomage Virtual Dissection Table in the Education of Imaging Science Students. *J Tomogr Simul*. 2015;1:1-5.
- Trelease RB. From chalkboard, slides, and paper to e-learning: How computing technologies have transformed anatomical sciences education. *Anat Sci Educ*. 2016;9:583-602.
- Martin GE, Zekter AS. Two-Dimensional NMR Methods for Establishing Molecular Connectivity: A Chemist's Guide to Experiment Selection, Performance, and Interpretation. Wiley Online Library. 1988;528.
- Paech D, Giesel FL, Unterhinninghofen R, et al. Cadaver-specific CT scans visualized at the dissection table combined with virtual dissection tables improve learning performance in general gross anatomy. *Eur Radiol*. 2017;27:2153-60.
- Duparc F. 3D-Virtual Dissection Table: We did not imagine how much it will be useful for teaching anatomy and clinical anatomy. *Rev Arg Anat Clin*. 2017;9:9-10.
- Fredieu JR, Kerbo J, Herron M, et al. Anatomical Models: a Digital Revolution. *Med Sci Educ*. 2015;25:183-94.
- Fyfe G, Fyfe S, Dye D, et al. Use of Anatomage tables in a large first year core unit. In Carter H, Gosper M and Hedberg J (Eds.), *Proceedings of the Electric Dreams 30th Conference*. 2013:298-302.
- Winkelman A. Anatomical dissection as a teaching method in medical school: a review of the evidence. *Med Educ*. 2007;41:15-22.
- Rohen JW, Yokochi C, Lutjen-Drecoll E. *Color atlas of anatomy* (7th Edn.). Wolters Kluwer Health, USA. 2015.
- Standring S. *Gray's Anatomy Gray's anatomy: the anatomical basis of clinical practice*. (40th Edn.). London: Churchill Livingstone, UK. 2008.
- Eason, Martin P. Anatomical dissection as a teaching method in medical

- school: a review of the evidence. The use of simulation in teaching the basic sciences. *Curr Opin Anesthes*. 2013;26:721-5.
15. Ruiz V. The Anatomage table – Visualizing Life Size Anatomy. *Street Anat*. 2013.
16. Ghosh, Sanjib K. Human cadaveric dissection: a historical account from ancient Greece to the modern era. *Anat Cell Biol*. 2015;48:153-69.
17. Fyfe G, Fyfe S, Dye D, et al. Use of anatomage tables in a large first year core unit. *Electric dreams, Proceeding ascilite, Sydney*. 2013;298-302.
18. Brown J, Stonelake S, Anderson W, et al. Medical student perception of anatomage-A 3D interactive anatomy dissection table. *Int J Surg*. 2015;23:17-8.
19. Gross M, Masters C. Virtual Dissection: Using Active Learning with the Anatomage Table to Enhance Student Learning. *FASEB J*. 2017; 31.
20. Chittaro L, Ranon R. Web 3D technologies in learning, education and training: Motivations, issues, opportunities. *Comput educ*. 2007;49:3-18.
21. Adamczyk C, Holzer M, Putz R, et al. Student learning preferences and the impact of a multimedia learning tool in the dissection course at the University of Munich. *Ann Anat*. 2009;191:339-48.