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Research Article

Make a Personal Anatomical Atlas in Your Mind with Mental Imagery and Improve Your Active Learning of Human Anatomy

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Abstract

Objective: Human anatomy can be hard to learn and even harder to recall. The students often say that the subject is forgotten quickly. In this study, “mental imagery” or “mental modeling”, as an active learning technique, was applied to teach anatomy to medical students.

Methods: An amusing interactive model of teaching anatomy as mental imagery was introduced. The students of the anatomy class were asked to watch an anatomical figure and then start imagery of the figure in their minds with closed eyes. At the first step, imagery of each organ and its characteristics was modeled in mind. At the second step, imagery of some organs and their relations was reconstructed in mind. The model’s instruction effectiveness was assessed through a quasi-experimental study. Then, the students were asked to write their learning experiences in their portfolios, and their views were evaluated by a questionnaire.

Results: The results of portfolio evaluation revealed that the students believed that this method led to profound learning and better understanding of anatomical subjects. Also, evaluation of the questionnaire regarding the students’ views showed that more than 88% of the students found that anatomical concepts were easy to learn, easy to recall, less boring, attractive, less time-consuming, and useful with mental modeling.

Conclusion: Imagery of the anatomy figures in mind, as an interactive learning technique, is an effective method for learning and recalling anatomy.

Keywords: Anatomy; Education; Mental imagery

Introduction

“There are two kinds of visual memory: one when you skillfully recreate an image in the laboratory of your mind, with your eyes open (and then I see Annabel in such general terms as: “honey-colored skin,” “thin arms,” “brown bobbed hair,” “long lashes,” “big bright mouth”); and the other when you instantly evoke, with shut eyes, on the dark inner side of your eyelids, the objective, absolutely optical replica of a beloved face, a little ghost in natural colors (and this is how I see Lolita).” Vladimir Nabokov.

Anatomy is a basic course in the curriculum of medical and paramedical students. Human anatomy can be hard to learn and even harder to recall. Students often say that the subject is forgotten quickly. The present study describes a method for helping students to learn and recall anatomy by carefully watching anatomy images in class or later. The method includes doing mental imagery and reconstructing a mental anatomical model. This technique can be considered as an active learning method in class to overcome the boring lecture-based classes. The lecture-based method is a passive experience in which, the class becomes boring after a while. Besides, the students are involved in hearing and taking notes [1-3]. Anatomy is a descriptive science understanding of which requires studying anatomical atlases, models, and dissections. In addition to lecture-based teaching, many learning and teaching approaches have been described to improve students’ understanding of anatomy. Using anatomical figures has been used as a method for medical education from the Medieval Age [4]. Many famous painters, including Leonardo da Vinci, Michelangelo, and Rembrandt, studied anatomy, attended dissections, and published drawings [5]. The new methods include computer multimedia, mobile phone, videos, and using illustrations [6,7]. All the media-based methods aim at improving the understanding of anatomy [6,7]. Although presently we are able to create a new “virtual reality” of anatomy via computerized simulations, they are still need to be understood, settled down, and stored in the brain. However, we are trying here to convert the understanding to a model in mind and deep the concepts learning. Deep learning of anatomy has been shown to be superior to the surface learning approach [8,9]. Interactive techniques in anatomy education in theory classes have received more attention, but a stronger disposition toward classic teaching techniques often exists among teachers [8,9]. Our methods rely on visual memory. Visual memory explains the association between perceptual processing and encoding, storage, and recalling of the resulting neural images. The experience of visual memory is also defined as the mind’s eye. This condition is a process through which we can recall from our memory a mental image of original things [10]. In the present explanation, visual mental image or

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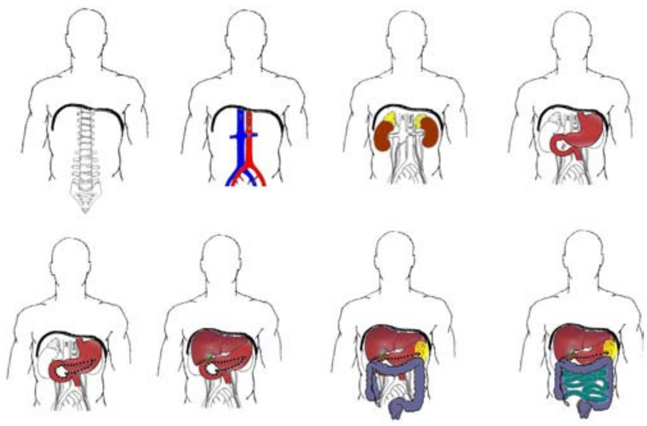

Figure 1: Mental modeling of the abdomen. The students were asked to assume that their abdominal cavity was devoid of any structure. Then, they were asked to place the structures in their mental images. The steps of placing the vertebra, aorta, inferior vena cava, kidneys, suprarenal gland, esophagus, stomach, duodenum, pancreas, spleen, large intestine, and small intestine are shown.

mental modeling means reconstruction of anatomical subjects in a person's mind. It is widely believed that imagery functions as mental representations, playing an important role in memory and thinking [11,12]. Mental images, including mental visualization, can occur while a student reads his/her book. Calling up an image in our minds can bedone easier. It has been stated that people often have learning processes that emphasize visual, auditory, and kinesthetic systems of experience [13]. The present study aims to describea method named mental anatomical imagery or mental anatomical modeling, an active teaching method to help students towards better learning and recalling. In this study, mental imagery is described and the results of an evaluation aimed at exploring the students' views regarding this teaching approach are reported.

Materials and Methods

We reconstructed an interactive model of teaching anatomy as mental imagery. To evaluate the effectiveness of the model, we conducted a quasi experimental study. The study population consisted of all first-and second-year medical students at Shiraz University of Medical Sciences in 2014 (n=76). Undergraduate medical education in Iranian medical education curriculum takes 7 years. During the first five semesters of education, students take their basic science courses which include gross anatomy. The study was conducted at the courses of trunk, head, and neck anatomy of the basic science medical curriculum organized by Shiraz University of Medical Sciences, Shiraz, Iran to evaluate the efficacy of mental imagery in teaching and learning anatomy. In doing so, six anatomy instructors attended the class and the lectures were presented in 100 h. Mental imagery of anatomical subjects was presented in 20 h. In the remaining hours, the lectures were presented by other colleague in forms of lecturing and power point presentations. A total of 76 students attended the course. The subjects were presented through slide show. Then, the students were asked to observe the figure carefully. When the slide show was over, they were asked to reconstruct the details of the figure with closed eyes. Afterwards, some questions were asked regarding the image details to make the students more eager towards imagery. This method could help the student make a correct mental model of the subjects rather than a non-real imagination. Our method included two steps of imagery. At the first step, the students were asked to watch gross anatomy of an individual organ, such as liver, and begin the imagery. The second step of imagery was performed at the end of the class or course when teaching of anatomy of some abdominal organs was completed. For example, the students were asked to make their more complete mental models of the abdomen Figure 1. At the beginning of this step, the student observed some slides of the abdominal anatomy. Then, they were asked to assume that their abdominal cavity was devoid of any structure. Afterwards, they were asked to place the following structures in their mental model step by step:

- Place the aorta and inferior vena cava in front of the vertebra in your mental model.

- Place the kidneys and suprarenal gland in their positions.

- Place esophagus, stomach, and duodenum in the correct position of your mental model.

- Place the pancreas.

- Place the spleen.

- Place the large intestine as a frame.

- Place the small intestine as a picture in the frame.

Finally, some students were chosen randomly to explain their mental models. Other students were also asked to correct any mistakes. An example of modeling of abdominal cavity anatomy has been presented in Figure 1.

At the end of the classes, the students were asked to write their learning experiences in their portfolios which had a flexible, learner-centered format [14,15]. The students' views regarding the mental image and modeling sessions were evaluated by means of a questionnaire that included questions about their interest in each session and their opinions about the usefulness of each session in learning anatomy. The validity of the questionnaire was confirmed by a panel of experts and its reliability was determined after a pilot study (r=0.87). After collecting the study data, the results of the questionnaires were evaluated using statistical software. In addition, the results of portfolio evaluation were analyzed by reading them and interpretation of the important emerging themes by qualitative content analysis. Qualitative content analysis with a conventional approach was used to analyze the data. In content analysis at the first, semantic units should be specified, and then the related codes should be extracted and categorized based on the similarity. Finally, in the case of having a high degree of abstraction, the themes can be determined. Content analysis method is used to verify the existence of certain words and concepts in the text for giving structure and discipline to the data [16,17].

Results

A total of seventy six students completed the questionnaires. The details regarding the students' responses have been presented in Table 1. According to the results, more than 88% of the students agreed or completely agreed that leaning anatomy concepts were easier with this method. They preferred to attend such anatomy classes and found that the class was active and less boring. Also, more

Table 1: Evaluation of sketching simultaneously with professor for learning anatomy in 76 respondents, Shiraz University of Medical Sciences, Iran, 2014.

	Strongly agree	Agree	No idea	Disagree	Completely disagree
Leaning anatomical concepts is easier by imagery method	90	5	5		
I prefer to attend the anatomy classes presented with this method	89	6	6		
Attending the classes presented with mental imagery is less boring	88	5	7		
I prefer to make the mental model of the figures with the professor simultaneously	90	6	4		
Mental imagery helps me remember the anatomical concepts later	89	5	6		
Mental imagery helps me learn the anatomical concepts in the class	88	4	8		
Mental imagery makes anatomy more attractive	89	5	6		
Mental imagery helps me learn anatomical concepts in anatomy laboratory	83	3	10	4	
Mental imagery reduces the time for learning anatomy	86	6	4	4	
Overall, I found mental imagery a good method for learning anatomy	90	5	5		

Table 2: Themes and categories of content analysis of portfolio.

Themes	Subthemes	Source codes
1- Cultural Traumatic Factors	1- Factors related to motivation	1- Attractive class 2- Good feeling 3- Personal growth
	2- Factors related to the learning environment.	1- Reduce stress 2- Reduce the gap between teacher and learner 3- Respect for the learner
2- Cognitive Traumatic Factors	1- Awareness	1- Awareness of mind and memory 2- Mindfulness 3- Self-awareness
	2- Training	1- Good model 2- Effective teaching 3- Formation of positive interactions
	3- Deep learning	1- Being knowledgeable 2- Development of intellectual and professional competencies

than 90% of the students reported that remembering the anatomical concepts was easier. These students also found that mental modeling was a good method for learning anatomy.

Furthermore, most of the students agreed or completely agreed with simultaneous mental imagery of the anatomical figures with the professor. They also believed that this method made anatomy more attractive and reduced the time required for learning anatomy. Recalling of the anatomical concepts in anatomy laboratory was also easier for most of the students. Evaluation of the students' writings in their portfolios resulted in identification of several themes about deep learning and attractive class, including feelings of a good teaching culture and attractive educational environment Table 2.

Discussion

The results of this study revealed that the students were more satisfied with mental anatomical imagery sessions compared to traditional lecture-based methods. The results were confirmed by other studies in this field [18,19]. This method involves the visual areas and results in profound learning. The neuroanatomical basis of this process involves many brain areas. The primary visual areas of the occipital lobes of the brain are the first receptive area of the visual stimuli. In addition, there are some areas specialized for visual object recognition called the "ventral stream". These areas have a more inferior location in the temporal cortex and have also been called the "what area". In addition, there are the areas which are specialized for visual-spatial location of objects in the dorsal stream. These areas have a more superior location in the posterior parietal cortex and are also called the "where area". While ordinary observation of something, we can only hold in mind a minor fraction of what we see in the visual scene. These mental representations are put in storage in visual short-term memory [20-22]. The information suggests that the posterior parietal cortex is a key neural locus of our limited mental representation of the visual world [20]. Therefore, during the lecture-based slide showing, the posterior parietal cortex might function as a capacity-limited store for representation of the visual image. Reports have indicated thata small amount of the visual information is held in mind in an active, readily available state for a short period of time (usually not more than 30 seconds). In addition, limitation of the visual short-term memory storage is determined both by the number and complexity of objects [20]. Learning of human gross anatomy involves many complex objects. Therefore, spending time on mental imagery might help restoration of the data in the long-term memory area of the brain. Recalling of the patterns from long-term visual memory is associated with increase of regional cerebral blood flow in different areas of the prefrontal cortex, fusiform area, and the anterior cingulate cortex [20]. Researchers have demonstrated that these cortices might be necessary for consolidation and/or maintenance of this information. One of the limitations of the study is that this study used a sample of students from a single university, so issues of generalizability are acknowledged. In addition there are strengths and weaknesses to any methodology. Future iterations of this study might be served by random sampling into the two arms with possible cross-over between groups for decrease threat of validity.

Conclusion

Imagery of the anatomical figures in mind, as an interactive learning technique, is an effective method for learning and recalling anatomy. Motivation and active participation with mental imagery was the cost-effective strategy for supporting academic success and enhancing goal accomplishment.

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References

1. Halasz NA. We create and can remove the roadblocks to good basic science education. Acad Med. 1999; 74: 6-7.
2. Grammaticos PC, Diamantis A. Useful known and unknown views of the father of modern medicine, Hippocrates and his teacher Democritus. Hell J Nucl Med. 2008; 11: 2-4.
3. Handfield-Jones R, Nasmith L, Steinert Y, Lawn N. Creativity in medical education: the use of innovative techniques in clinical teaching. Med Teach. 1993; 15: 3-10.
4. Vessal K, Noorafshan A, Faridi P, Zargaran A, Mohagheghzadeh A. Using colors in anatomical figures: a novel method for medical education in Medieval Age. Int J Cardiol. 2014; 175: 183-184.
5. Cappabianca P, Magro F. The lesson of anatomy. Surg Neurol. 2009; 71: 597-598.
6. Trelease RB. Diffusion of innovations: smartphones and wireless anatomy learning resources. Anat Sci Educ. 2008; 1: 233-239.
7. Mayfield CH, Ohara PT, O'Sullivan PS. Perceptions of a mobile technology on learning strategies in the anatomy laboratory. Anat Sci Educ. 2013; 6: 81-89.
8. Pandey P, Zimitat C. Medical students' learning of anatomy: memorisation, understanding and visualisation. Med Educ. 2007; 41: 7-14.
9. Smith CF, Mathias HS. Medical students' approaches to learning anatomy: students' experiences and relations to the learning environment. Clin Anat. 2010; 23: 106-114.
10. Courtney SM, Petit L, Haxby JV, Ungerleider LG. The role of prefrontal cortex in working memory: examining the contents of consciousness. Philosophical Transactions of the Royal Society of London Series B: Biological Sciences. 1998; 353: 1819-1828.
11. Vogel EK, Machizawa MG. Neural activity predicts individual differences in visual working memory capacity. Nature. 2004; 428: 748-751.
12. Oh SH, Kim MS. The role of spatial working memory in visual search efficiency. Psychon Bull Rev. 2004; 11: 275-281.
13. Dumbauld J, Black M, Depp CA, Daly R, Curran MA, Winegarden B, et al. Association of learning styles with research self-efficacy: study of short-term research training program for medical students. Clinical and translational science. 2014; 7: 489-492.
14. Gadbury-Amyot CC, McCracken MS, Woldt JL, Brennan RL. Validity and reliability of portfolio assessment of student competence in two dental school populations: a four-year study. J Dent Educ. 2014; 78: 657-667.
15. Azzi AJ, Ramnanan CJ, Smith J, Dionne É, Jalali A. To quiz or not to quiz: Formative tests help detect students at risk of failing the clinical anatomy course. Anat Sci Educ. 2015; 8: 413-420.
16. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005; 15: 1277-1288.
17. Vaismoradi M, Turunen H, Bondas T. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. Nurs Health Sci. 2013; 15: 398-405.
18. Noorafshan A, Hoseini L, Amini M, Dehghani M-R, Kojuri J, Bazrafkan L. Simultaneous anatomical sketching as learning by doing method of teaching human anatomy. Journal of Education and Health Promotion. 2014; 3: 50.
19. Burke A, Shanahan C, Herlambang E. An Exploratory Study Comparing Goal-Oriented Mental Imagery with Daily To-Do Lists: Supporting College Student Success. Current Psychology. 2014; 33: 20-34.
20. Todd JJ, Marois R. Capacity limit of visual short-term memory in human posterior parietal cortex. Nature. 2004; 428: 751-754.
21. Kool W, Conway AR, Turk-Browne NB. Sequential dynamics in visual short-term memory. Atten Percept Psychophys. 2014; 76: 1885-1901.
22. Oakes LM, Baumgartner HA, Barrett FS, Messenger IM, Luck SJ. Developmental changes in visual short-term memory in infancy: evidence from eye-tracking. Front Psychol. 2013; 4: 697.

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