



Learning styles and strategies preferences of Iranian medical students in gross anatomy courses and their correlations with gender

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Abstract: The learning approaches can help anatomy teachers design a suitable curriculum in harmony with their students' learning styles. The research objective is to evaluate gross anatomy learning styles and strategies preferences of Iranian medical students at Kashan University of Medical Sciences (KAUMS). This cross-sectional questionnaire-based study was carried out on 237 Iranian medical students. The students answered questions on approaches to learning anatomy and expressed opinions about learning anatomy in medical curriculum. The data were analyzed to disclose statistically significant differences between male and female students. Iranian male and female students were interested in learning anatomy using notes, plastic models, pictures and diagrams, clinical context, dissection and prosection of cadavers; however, they rarely used cross-sectional images and web-based resources. Both groups of medical students used region and system in learning anatomy. However, there existed some striking differences, particularly in having difficulty in studying anatomy using cadaveric specimens, using books alone, and learning it in small groups. Male students were less interested in learning with cadavers than female counterparts. However, female students were more interested in learning anatomy in small groups. This study suggests that instructors should design gross anatomy curriculum based on limitations of using dissection of cadaver in Iranian universities, emphasis on the applied anatomy, and learning of gross anatomy in small groups.

Key words: Anatomy, Education, Culture, Learning, Students

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Introduction

Gross anatomy is taught in medical schools as a cornerstone of medical education. In recent years, the way in which anatomy is taught has encountered a lot of changes. At present, many medical institutions use different learning

approaches in teaching gross anatomy such as lecture-based learning, problem-based learning, and small teaching groups [1, 2]. Currently, the main modalities in gross anatomy course curriculum are dissection, prosection, interactive multimedia, procedural anatomy, surface and clinical anatomy, and imaging [2]. While many medical schools use dissection as an essential component of their teaching of gross anatomy [1, 3], there are certain gross anatomy programs that do not use cadavers, but rather prefer to use plastinated specimens, atlases, plastic models, and multimedia learning tools [4]. Medical students show diversity in age, experience, culture, ethnicity, and level of readiness as well as learning styles. Learning styles and strategies are a key part of learner-centered approach and

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refer to cognitive differences that are relatively permanent but can change over time [5]. Likewise, learning styles and strategies provide insight into the ways learners perceive, process, store, recall and interact with and respond to their instruction conditions and aimed at achieving optimum learning [6]. Students improve their learning using different learning styles and strategies [7]. Adapting teaching approaches to learning styles and strategies preferences improve student's motivation and performance as well as their experience in learning style preferences which leads to the development of the most effective teaching approaches [8]. Medical students select different learning styles in learning gross anatomy with regard to their different ethnic backgrounds. A number of reports which investigate medical students with different culture background show the role of culture in learning anatomy [7, 9, 10]. These reports have indicated that cultural factors have significant effects in anatomy learning of medical students. Students from a given culture adopt different learning styles for gross anatomy than those from other cultures.

Apart from learners' cultures, the preference of learning styles can also relate to gender. Results from earlier reports have revealed a possible effect of gender on learning styles [11, 12]. Regarding the influence of society and culture on learning styles of males and females [8], in present study, the learning styles and strategies preferences of Iranian male and female medical students in gross anatomy at Kashan University of Medical Sciences (KAUMS) are designed and evaluated. We investigated the similarities and differences in selection of anatomy learning styles and strategies among male and female medical students resulting from culture-related factors. We tested the hypothesis that males and females have different learning styles and strategies and preferences in gross anatomy study. The results of this study pave the way for Iranian institutions in designing anatomy curriculum.

Materials and Methods

Method of the teaching

The present study is a cross sectional evaluation and has employed quantitative methods of data collection and statistical analysis. Teaching of the gross anatomy at KAUMS is traditional with dissection laboratory exercises. Medical schools in KAUMS have 7-year curriculum with the gross anatomy teaching in the first and second years. The gross anatomy courses have organized in a regional order (upper and lower limbs, thorax, abdomen and pelvis, head and neck)

and neuroanatomy course has been presented in a systemic order. The theoretical classes are taught in 90-minute sessions that contain more than 50 male and female students together using PowerPoint presentations method. Practical classes are taught in 1-hour sessions that contain 15 students male or female in separate groups. Anatomy instructors teach gross anatomy using cadavers, dissections, prosections, multimedia, and radiological images.

Administration of the questionnaire

This survey is comprised of 237 second and third-year medical students (77 male and 160 female). The questionnaire was included with the class packet for medical students; 237 of 295 students (80.3%) returned the completed questionnaire and were included in the study. The questions were focused on methods the students used to study anatomy. The questionnaire was based on a study by Mitchell et al. [7], with some modifications. The modifications were included to add the questions in learning anatomy by all regions using cadaveric specimens, and omitting of some questions that were not related to gross anatomy curriculum at KAUMS. A Persian version of the questionnaire was made available and the students answered the questions regarding commonly recognized learning styles/strategies and their opinions of using them in their anatomy learning in order of preference in a ranking system and were graded on Likert scale. Ethical approval of the study was taken from the Research Committee of Medical Faculty of KAUMS. The questionnaire had three sections. Section 1 contained general information such as gender, city, and current study level of student. Section 2 had 16 questions on approaches to learning anatomy, with 4-item-scale, where 1 was never, 2 was sometimes, 3 was often, and 4 was always. Section 3 contained 15 questions on opinions about learning anatomy in medical studies, with 5-item-scale, where 1 was strongly disagree, 2 was moderately disagree, 3 was moderately agree, 4 was strongly agree, and 5 was not applicable.

Statistics

The answers to each question were reported as percentages of students. The answers "never and sometimes," from section 2 of the questionnaire, and "strongly disagree and moderately disagree," from section 3 of the questionnaire, are considered as a negative attitude. The answers "often and always," from section 2 of the questionnaire, and "moderately agree and strongly agree," from section 3 of the questionnaire, are con-

sidered as a positive attitude. Responses with “not applicable” were not included in the statistical analysis. The differences between the male and female responses for each question were assessed using a chi-square test. *P*-values less than 0.05 were considered statistically significant.

Results

The survey is comprised of 237 students, 160 females and 77 males. The results highlight the similar styles and strategies regarding the anatomy learning methods among Iranian male and female students. However, there were also striking differences, particularly in having difficulty in studying anatomy with cadaveric specimens, learning anatomy from book alone, and learning it in small groups.

Female students were significantly more interested in learning of gross anatomy with cadaveric specimens (male, 41.7%; female, 49.2%; *P*<0.01). Male students found learning of thorax anatomy using cadavers more difficult than female students (male, 24.7%; female, 9.4%; *P*<0.001), while differences in learning head and neck (male, 50.6%; female, 50%; *P*<0.5), limbs (male, 26 %; female, 19.4%; *P*<0.3), abdomen (male, 23.4%; female, 17.5%; *P*<0.2), pelvis (male, 55.8%; fe-

male, 51.9%; *P*<0.8), and brain (male, 46.8%; female, 44.4%; *P*<0.9) were not statistically significant.

Table 1 shows comparison between the percentages of male and female students who preferred the styles and strategies in learning of gross anatomy. There were no significant differences (*P*≥0.05) between male and female students' responses. More than half of male and female students used the approach of “tackle whole area first then... to easier and smaller pieces”. Most students preferred to make and use notes, plastic models, bones, pictures and diagrams (male, 77.9%; female, 74.2%). Female group used study aids such as plastic models, images, bones and diagrams more than male group, but it was not statistically significant (*P*<0.08). Some students raised questions in class (male, 27.3%; female, 19.4%) and after class (male, 28.6%; female, 24.4%). They found it easier to understand (male, 61%; female, 60.6%) and remember anatomy (male, 62.3%; female, 57.5%) in a clinical context. Some male and female students' learning was driven by the format of assessments (male, 27.3%; female, 23.1%). They used an “image in mind” while they study anatomy (male, 62.3%; female, 64.4%). For both groups the moderately easiest way to learn is based on body regions and different systems (male, 49.4%; female, 55.6%). Some students learn by reciting definitions

Table 1. The comparative data of male and female students with positive attitude regarding the different styles and strategies of anatomy learning

Style and strategy of anatomy study	Male	Female	<i>P</i> -value
To learn whole area first then to smaller pieces	43 (55.8)	90 (56.3)	0.9
To use notes, plastic models, bones, pictures and diagrams	60 (77.9)	118 (74.2)	0.8
To raise questions in class	21 (27.3)	31 (19.4)	0.1
To raise questions after class	22 (28.6)	39 (24.4)	0.4
To find it easier to understand anatomy in a clinical context	47 (61)	97 (60.6)	0.9
To find it easier to remember anatomy in a clinical context	48 (62.3)	92 (57.5)	0.4
The students' learning is often driven by format of assessments	21 (27.3)	37 (23.1)	0.4
To use an “image in mind” whilst studying anatomy	48 (62.3)	103 (64.4)	0.7
To find it easiest to learn according to body regions	38 (49.4)	89 (55.6)	0.3
To find it easiest to learn according to different systems	33 (42.9)	71 (44.4)	0.8
To prefer using cadavers dissection	44 (57.1)	97 (60.6)	0.6
To prefer using prosection	29 (37.7)	65 (40.6)	0.6
To prefer having lab demonstrator	56 (72.7)	117 (73.1)	0.9
To prefer to learn by memorizing facts	23 (29.9)	41 (25.6)	0.4
To find learning from cross-sectional images easy	23 (29.9)	36 (22.9)	0.2
To use web-based resources	9 (11.7)	17 (10.6)	0.8
To enjoy learning anatomy	43 (55.8)	93 (58.1)	0.6
The probability of forgetting anatomical knowledge after exams	42 (54.5)	97 (60.6)	0.5
Sufficient time is given in the curriculum	30 (39)	72 (45)	0.3
To find hands-on dissection very useful	49 (63.6)	105 (66.6)	0.5
Not necessary of the dissection for to learn anatomy	12 (15.6)	15 (9.4)	0.07
Learning of anatomy from book alone	26 (33.7)	28 (17.5)	0.03
Learning of anatomy from lecture alone	16 (20.8)	16 (10)	0.07
Learning of anatomy on my own	18 (23.4)	42 (26.3)	0.2
Learning of anatomy in small groups	31 (40.3)	96 (60)	0.01

Values are presented as number (%).

and memorizing facts (male, 16.9%; female, 16.9%). Both groups preferred to use cadavers dissection (male, 57.1%; female, 60.6%) and sometimes prosection (male, 37.7%; female, 40.6%) but most of them preferred to have a demonstrator carrying out dissection in laboratory sessions (male, 72.75%; female, 73.1%). Some students found it easy to learn from cross-sectional images (male, 29.9%; female, 22.9%) and used web-based resources (male, 11.7%; female, 10.6%) as a learning strategy. No significant difference was found in male and female students' opinion about whether their way of learning is suited for anatomy study. Female students enjoyed learning anatomy more than their male counterparts but this difference was not significant. There was no significant difference between male and female students in the likelihood of forgetting anatomical knowledge after exams. They did not believe that sufficient time is given in the curriculum. There is no significant difference between male and female students to find hands-on dissection very useful, and to hold the view that learning anatomy takes up more time than other subjects. Female students believed dissection sessions are necessary for anatomy learning more than their male counterparts but this difference was not significant ($P < 0.07$). Male and female students agreed that they cannot learn anatomy from books and lectures alone (77% and 86% respectively), but their differences in case of using books were statistically significant ($P < 0.03$), although regarding lectures, they were not significant ($P < 0.07$). Female students were significantly more interested in learning in small groups ($P < 0.01$) but there was no difference between students of both sexes in their preference for learning individually ($P < 0.2$) (Table 1).

Discussion

This study was carried out on medical students at KAUMS in Iran for exploration and assessment of their learning style preferences and the possible gender-based differences. The current study demonstrated some similarities and differences in learning styles and strategies in studying between male and female students in Iranian medical schools. Gender difference in anatomy education is important regarding the development of new teaching methods and the increasing proportions of female students in medical schools worldwide [13]. At KAUMS, the number of female medical students is approximately twice their male counterparts. Results of different studies showed statistically significant differences in learners' perceptions in different countries [7, 9, 10, 14, 15]. Iranian

students like Chinese [7] and Jordanian [9] students seem to be involved in tackling a whole area of anatomy for first approach. This is indicated by their preference in earning a general image about an anatomical region in their minds and low interest in studying cross-sectional images and web-based resources to learn an anatomical structure. According to Gestalt psychology, in this holistic approach of learning, students acquire an overview about the anatomical region which is considered to enable them in understanding the relationship between different anatomical parts [7].

The present study revealed that both male and female students did not like to learn anatomy by reciting definitions and memorizing facts but were interested to understand anatomy in a clinical context. Anatomy learning in both groups is not exam-oriented and not driven by the format of assessment. This preference may explain why both student groups did not claim to forget anatomical knowledge soon after exams. It is reported that retention of anatomical sciences is significantly less than other basic medical sciences [16]. Using new modalities in anatomy learning and an approach of exam that examines the applied anatomy can improve deep learning of anatomy among medical students [17]. Iranian medical students, such as Chinese [7], Jordanian and Malaysian students [9] are not interested in asking questions during and after class. It can be related to the authority of the teachers and their official interaction with their students [7, 9]. Most Iranian students preferred to study gross anatomy according to body regions and in a clinical context. It seems that studying regional anatomy is easier than systemic anatomy [18].

The present study revealed that 59.5% of students preferred using dissection and 39.7% preferred prosection of cadavers. Limitations of using dissection of cadaver in Iranian universities are related to their religious beliefs [19]. Previous authors reported similar problems such as touching and looking at dead bodies in Asian countries students [20, 21]. The majority of male (61.1%) and female (68%) students, however, did not find learning anatomy using cadavers difficult. In female students, difficulty in learning the anatomy of all regions using cadavers is less difficult than that of male students. Dissection-room experiences promote the learning of three-dimensional (3D) anatomical structures and develop both psychosocial and professional skills [2, 22-24]. Iranian students relatively prefer to apply cadaveric dissection in learning of gross anatomy. The male students find greater difficulty in learning the anatomy of all regions using cadavers, with a significantly proportion in thorax. These results may

represent that female students are more interested than male students in dissection-room experiences. Sandor et al. [24] reported that female students significantly stated that dissection experiences were a source of stress for them. Our data shows the dissection-room experiences do not provoke negative reactions in majority of the female medical students.

Learning of anatomy by web-based computer-aided instruction causes an absence of the emotional experience obtained in learning from dissections and prosections of cadaver [9]. In the other hand, the improvement of anatomy learning by using computer and Internet has been confirmed by many reports [9, 25, 26]. However, Iranian students expressed low interest in using web-based resources. One likely explanation for such strategy is the different cultural background of the Iranian students with their counterparts in other countries. The anatomy lecture classes and learning from the book occupy a considerable time of the course in medical curriculum of Iranian universities, but in our study, it is proved that this fails to improve anatomy learning for both male and female students alone. The students in this study mostly preferred to learn gross anatomy in small groups. In small groups, students participate directly in the instruction process and in their own learning and develop their interpersonal and communication skills [27, 28]. In our study, female students preferred to participate in small groups more than their male counterparts. Gender differences in their preferences about learning in small groups, can be related to interest of female students to learn in a collaborative environment and their more social interaction with other students as higher than males [6]. Present study showed that learning styles preferences of the majority of Iranian medical students are not of a single mode. The study about learning styles preferences of medical students have showed that the learning style preference of students is through four modalities of visual, auditory, reading/writing and kinesthetic [6, 11, 29]. The majority of Iranian medical students preferred using multi-modal learning style [30]. Current study was accomplished only at a single university in Iran and the number of participants in this may not depict total population of Iranian medical students. It can be main limitation of this study. More considerations with multiple participants at many institutes are necessitated for assessment of learning styles and strategies preferences of Iranian medical students.

The present study described the learning styles and strategies preferred by Iranian medical students in learning gross anatomy. Moreover, it showed significant differences in anat-

omy learning styles and strategies related to gender differences between male and female students. The most prominent distinctions were the difficulty of studying anatomy with cadaveric specimens, learning of anatomy from book alone, and learning of anatomy in small groups. Knowing these learning styles and strategies enables instructors to provide a variety of teaching materials and resources and design suitable curriculum in order to achieve educational plans that supply educational goals of medical students. In respect of increasing the proportion of female medical students in Iranian Medical Sciences Universities and their more interest for dissection-room experiences and learning in small groups, it is necessary for the instructors to improve the gross anatomy curricula. This study suggests an increase in proportion of dissection-room experiences and learning in small groups in curriculum of female students' programs.

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References

1. Azer SA, Eizenberg N. Do we need dissection in an integrated problem-based learning medical course? Perceptions of first- and second-year students. *Surg Radiol Anat* 2007;29:173-80.
2. Sugand K, Abrahams P, Khurana A. The anatomy of anatomy: a review for its modernization. *Anat Sci Educ* 2010;3:83-93.
3. Ghosh SK. Human cadaveric dissection: a historical account from ancient Greece to the modern era. *Anat Cell Biol* 2015;48:153-69.
4. McLachlan JC, Bligh J, Bradley P, Searle J. Teaching anatomy without cadavers. *Med Educ* 2004;38:418-24.
5. Pashler H, McDaniel M, Rohrer D, Bjork R. Learning styles: concepts and evidence. *Psychol Sci Public Interest* 2008;9:105-19.
6. Wehrwein EA, Lujan HL, DiCarlo SE. Gender differences in learning style preferences among undergraduate physiology students. *Adv Physiol Educ* 2007;31:153-7.
7. Mitchell BS, Xu Q, Jin L, Patten D, Gouldsborough I. A cross-cultural comparison of anatomy learning: learning styles and strategies. *Anat Sci Educ* 2009;2:49-60.
8. Abdallah AR, Al-zalabani A, Alqabshawi R. Preferred learning styles among prospective research methodology course students at Taibah University, Saudi Arabia. *J Egypt Public Health Assoc* 2013;88:3-7.

9. Mustafa AG, Allouh MZ, Mustafa IG, Hoja IM. Anatomy learning styles and strategies among Jordanian and Malaysian medical students: the impact of culture on learning anatomy. *Surg Radiol Anat* 2013;35:435-41.
10. Zurada A, Gielecki JS, Osman N, Tubbs RS, Loukas M, Zurada-Zielińska A, Bedi N, Nowak D. The study techniques of Asian, American, and European medical students during gross anatomy and neuroanatomy courses in Poland. *Surg Radiol Anat* 2011;33:161-9.
11. Nuzhat A, Salem RO, Al Hamdan N, Ashour N. Gender differences in learning styles and academic performance of medical students in Saudi Arabia. *Med Teach* 2013;35 Suppl 1:S78-82.
12. Slater JA, Lujan HL, DiCarlo SE. Does gender influence learning style preferences of first-year medical students? *Adv Physiol Educ* 2007;31:336-42.
13. Bleakley A. Gender matters in medical education. *Med Educ* 2013;47:59-70.
14. Cortazzi M, Jin L, Wall D, Cavendish S. Sharing learning through narrative communication. *Int J Lang Commun Disord* 2001;36 Suppl:252-7.
15. Jin L, Hill H. Students' expectations of learning key skills and knowledge. *Int J Lang Commun Disord* 2001;36 Suppl:333-8.
16. D'Eon MF. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. *BMC Med Educ* 2006;6:5.
17. Rowland S, Ahmed K, Davies DC, Ashrafian H, Patel V, Darzi A, Paraskeva PA, Athanasiou T. Assessment of anatomical knowledge for clinical practice: perceptions of clinicians and students. *Surg Radiol Anat* 2011;33:263-9.
18. McKeown PP, Heylings DJ, Stevenson M, McKelvey KJ, Nixon JR, McCluskey DR. The impact of curricular change on medical students' knowledge of anatomy. *Med Educ* 2003;37:954-61.
19. Abbasi Asl J, Nikzad H, Taherian A, Atlasi MA, Naderian H, Mousavi G, Kashani MM, Omid A. Cultural acceptability and personal willingness of Iranian students toward cadaveric donation. *Anat Sci Educ* 2017;10:120-6.
20. Bataineh ZM, Hijazi TA, Hijleh MF. Attitudes and reactions of Jordanian medical students to the dissecting room. *Surg Radiol Anat* 2006;28:416-21.
21. LaFleur WR. From agape to organs: religious difference between Japan and America in judging the ethics of transplant. *Zygon* 2002;37:623-42.
22. Dissabandara LO, Nirthanan SN, Khoo TK, Tedman R. Role of cadaveric dissections in modern medical curricula: a study on student perceptions. *Anat Cell Biol* 2015;48:205-12.
23. Romero-Reverón R. Venezuelan surgeons view concerning teaching human anatomical dissection. *Anat Cell Biol* 2017;50:12-6.
24. Sándor I, Birkás E, Györfy Z. The effects of dissection-room experiences and related coping strategies among Hungarian medical students. *BMC Med Educ* 2015;15:73.
25. 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.
26. Petersson H, Sinkvist D, Wang C, Smedby O. Web-based interactive 3D visualization as a tool for improved anatomy learning. *Anat Sci Educ* 2009;2:61-8.
27. Chan LK, Ganguly PK. Evaluation of small-group teaching in human gross anatomy in a Caribbean medical school. *Anat Sci Educ* 2008;1:19-22.
28. Dolmans DH, Schmidt HG. What do we know about cognitive and motivational effects of small group tutorials in problem-based learning? *Adv Health Sci Educ Theory Pract* 2006;11:321-36.
29. Lujan HL, DiCarlo SE. First-year medical students prefer multiple learning styles. *Adv Physiol Educ* 2006;30:13-6.
30. Sarabi-Asiabar A, Jafari M, Sadeghifar J, Tofighi S, Zaboli R, Peyman H, Salimi M, Shams L. The relationship between learning style preferences and gender, educational major and status in first year medical students: a survey study from Iran. *Iran Red Crescent Med J* 2015;17:e18250.