

# The attitude of medical students towards the teaching of Anatomy

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## SUMMARY

The study of anatomy is essential in understanding basic and clinical medical sciences and it is taught by various methods. This study aimed to find out the attitude of medical students in Jordan towards the various methods of teaching anatomy and their opinion regarding the relevance of anatomy in their study. An online survey was sent to the third- to sixth-year medical students at the Hashemite University, Jordan. The survey asked about various aspect of teaching anatomy. The answers were analyzed using non-parametric methods.

The response rates ranged from 24% to 45% in the different groups. More than half the students believed that anatomy was interesting, but only a small percentage thought about becoming anatomists. In all the groups, plastic models were considered the most favored method of teaching and theoretical lectures were the least favored. The students preferred the number of lab session to be increased and lectures to be decreased. Textbooks were not considered as a main source of study. A very high percentage of students in all the groups considered digital media as a main source of study preferring it to be incorporated more in the curriculum. A greater percentage of students in the third and fourth years thought that too much information was given in their anatomy courses. The greater percentage of students in the fifth and sixth years did not. Almost all the students believed that anatomy was important in understanding basic and clinical medical sciences and in their future profes-

sion as doctors.

Modifications in the anatomy curriculum may be required. More practical sessions should be arranged, reading textbooks should be encouraged, and new technology and digital media need to be incorporated more.

**Key words:** Teaching anatomy – Anatomy curriculum – Medical students – Medical education – Digital media – Jordan

## INTRODUCTION

The study of normal human structure (anatomy) is essential in understanding its normal function (physiology) and its abnormal conditions (pathology). This provides a solid base for the interpretation and eventual treatment of clinical cases (Louw et al., 2009).

Human anatomy has been studied since antiquity. The 'Edwin Smith papyrus' from ancient Egypt, which was mainly concerned with the surgical treatment of some clinical conditions, contained the earliest recorded anatomical description of various structures of the human body (Serageldin, 2013). During the reign of Ptolemy I of Egypt, human anatomy was first taught in the medical school of Alexandria by the dissection of human bodies (von Staden, 1992; Strkalj and Chorn, 2008; Serageldin, 2013). Since then, anatomy has become an integral part of the curriculum of any school of medicine.

With the advances in medicine, however, and the addition of new disciplines that were incorporated into the curriculum, the time allocated to the teaching of anatomy was reduced (Tong, 2019). This took place in the USA (Drake et al., 2009), Austral-

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ia (Craig et al., 2010), and other countries (Fitzgerald et al., 2008). Moreover, a shift has occurred from an anatomy syllabus compacted with detailed anatomical knowledge to a syllabus that concentrated on anatomical information with more clinical relevance. This shift is clearly reflected in the guidelines issued by the General Medical Council of the UK since the early 1990s, which has emphasized the correlation between what a medical student learns and the clinical application of such knowledge (General Medical Council, 2015). With this transition, the integrated and problem-based learning systems became more popular.

Throughout the years, the methods of delivering the curriculum of anatomy to the students changed. The traditional method of teaching anatomy is through lectures and the dissection of cadavers (Older, 2004). Alternative/modern methods include the use of prosected cadavers and plastinated specimens (Estai and Bunt, 2016), as well as plastic models. Anatomical models are not exactly a modern method to study anatomy, as the ancient Babylonian priests used clay liver models to teach their students the anatomy of the liver and how to use this knowledge for the purpose of divination (Cavalcanti and Martins, 2013). Other methods, such as living anatomy, medical imaging, computer/mobile software, web-based material, and others have been incorporated more recently (McLachlan, 2004; Collins, 2008; Ganguly and Chan, 2008).

The study of human anatomy by the dissection of human cadavers has withstood the ultimate test, the test of time. However, in this age of rapidly developing science, the use of technology has become part of our lives, including education, because such technology is easy to acquire and easy to implement. So, the debate among those involved in teaching anatomy on which method is better is ongoing, with some arguing for the traditional method (Older, 2004; Ramsey-Stewart et al., 2010), and others supporting the newer methods (McLachlan, 2004; Collins, 2008).

What about the other end of the scale, the students? Many students consider anatomy to be boring (Tong, 2019) because they perceive it only as memorization of large amounts of information (Kemeir, 2012; Bergman et al., 2013). It has been shown, however, that students realized the importance of studying anatomy (Triepels et al. 2018), and that it was a key component in the understanding of clinical courses (Moxham and Plaisant, 2007). Students also differed in their opinions regarding which method of teaching anatomy was the best to help them comprehend the subject. Some preferred the traditional method of dissecting cadavers (Lempp, 2005; Ramsey-Stewart et al., 2010), while others believed that the modern methods were also helpful (Nieder and Nagy, 2002; Kerby et al., 2011).

In Jordan, there is a mix of both traditional and

modern methods of teaching anatomy, with a progressive decrease in the use of dissection and an increase in the application of alternative methods. This research aimed to find out the attitude of medical students towards the various methods of teaching anatomy and their opinion regarding the relevance of anatomy in their academic journey and future profession.

## MATERIALS AND METHODS

A survey was created by several specialists in anatomy at the Hashemite University, Faculty of Medicine in Jordan. An online version of the survey was then placed on Survey Monkey. The survey consisted of 9 questions divided into 5 categories (see the Appendix for details on the survey questions). In the first category, the students were asked if they considered anatomy to be interesting (the content being engaging or fascinating to learn), and if they considered becoming anatomist. The second category asked if the teaching methods used by the faculty were helpful in understanding anatomy and if they used digital media (which was not part of the faculty curriculum) in learning content. The third asked the students which was used most, the various sources provided from the class (lecture notes, audio records) or those found on their own (textbooks, digital media). The fourth construct focused on the anatomy curriculum. Finally, they were asked about the importance of anatomy in understanding the other branches of medicine. All the questions, except category 4 (being descriptive rank), used 5-category Likert-type questions ranging from strongly disagree to strongly agree.

A link to the survey and consent form were sent to four groups of students (N = 985): (1) third-year students that had just finished their third year of medical school and completed all of the basic medical sciences courses (including anatomy), (2) fourth-year students that had just finished their first year of clinical training, (3) fifth-year students that had finished their second year of clinical training, and (4) sixth-year students who had just graduated. The link was sent to the classes through private social network groups that only members of each class could access. Although no reward was promised for participation, the students were sent weekly reminders online to take the survey. The survey remained accessible to the students over a period of two months during the summer of 2019. The ethical criteria of this research were approved by the Institutional Review Board of the institution in which the study was carried out and in accordance with the Declaration of Helsinki. Only students that agreed to the consent form were allowed to access the survey.

All the students surveyed had completed their anatomy courses in previous terms. These included a general anatomy course, given to students in

their first year (2 hours for lectures and 1 hour for labs per week), and systemic anatomy that was provided during their second and third years while studying various body systems integrated modules, where anatomy accounted for 3 lecture hours and 1 lab hour per week in each module. The department of anatomy is formed of six members, all of which participated in teaching the students in the courses using theoretical lectures and practical lab sessions. During the practical sessions, the students were taught by a demonstrator using plastic models, plastinated specimens, and prosected cadavers. The students were encouraged to use digital media (computer software, web sites, and videos) if they had access elsewhere to supplement their course materials.

Data were collected and tabulated. Analysis was done using IBM SPSS v25. Graphs were created using Microsoft Excel. The data collected were considered ordinal and their distribution could not be ascertained; therefore, non-parametric tests were used (Kuzonetal, 1996; Jamieson, 2004; Harpe, 2015). To compare multiple groups and two groups, Kruskal-Wallis and Mann-Whitney U tests were used, respectively. Comparisons within the same group were done using Friedman test. Whenever multiple tests were simultaneously done, the p value was adjusted using the Bonferoni method. Using 254 valid responses and 18 items, Cronbach's Alpha was calculated to estimate the reliability of the survey instrument and the value was 0.681. While below the 0.8 threshold, the Cronbach's alpha calculated can be considered acceptable for the purposes of this study, as this has been reported by some research (Taber, 2018).

## RESULTS

The number of students that accessed the survey website was 311. Of those, 304 completed the survey with response rates ranging from about 24% to 45% for the different classes. Just over 50% of respondents were females (see Table 1). The number of questions answered differed among the students and the groups. For example, for the third year group, Q9 was answered by 84% of the students in that group; and only Q2 for the fifth year group was answered by all the respondents in that class. To make sure these variations in

question response did not impact the results, a one-way ANOVA was done. This yielded no significant difference between the groups,  $F(3, 290) = 0.403$ ,  $p = .751$ .

A chi-square test was used to determine if there was a difference between the participation of males and females in the different groups. No difference was found in the third (same value), fourth ( $X^2(1, n = 68) = 0.059$ ,  $p = .808$ ), fifth ( $X^2(1, n = 57) = 0.860$ ,  $p = .354$ ), and sixth ( $X^2(1, n = 66) = 2.182$ ,  $p = .140$ ) year groups. Some participants did not answer the question about gender (see Table 1), and were, therefore, excluded from these calculations.

## Results by Class

### Third Year Group

Of this group, 62% agreed or strongly agreed that the subject of anatomy was interesting and only 18% disagreed or strongly disagreed. However, when asked if they considered becoming anatomists in the future, just more than one fourth (27%) answered positively while 44% answered negatively (Table 2). As for digital media, 89% of the third year students agreed/strongly agreed that digital media was very helpful in understanding anatomy, and 87% agreed or strongly agreed that it should be an integral part of the curriculum. On the other hand, 76% of these students felt that the information given in the courses of anatomy was 'too much', and no one thought that the information was 'not enough'. Of these students, 81% believed that the number of anatomy lectures should be decreased or remain the same and 83% of the students wanted the number of anatomy lab sessions to be increased or remain the same (see Table 3). As for the importance of anatomy, 88% of these students agreed/strongly agreed that anatomy was important in understanding basic medical sciences, 82% thought that it was important in understanding clinical courses, and 72% believed that anatomy was important for their future profession as doctors. See Table 2.

By using Friedman's test, this group was found to prefer plastic models as the method of teaching that helped them understand anatomy more (Table 4), with pairwise analysis showing a difference only between theoretical lectures and the use of plastic models in lab sessions ( $p = .013$ ). In addition,

**Table 1.** Groups characteristics

Group	Accessed website	Participated in the survey	Response Rate	Male/Total <sup>a</sup> (%)	Female/Total <sup>a</sup> (%)
Third year	110	105	105/234 = 44.87%	50/100 (50%)	50/100 (50%)
Fourth year	74	73	73/228 = 32.01%	33/68 (48.53%)	35/68 (51.47%)
Fifth year	58	57	57/238 = 23.94%	32/57 (56.14%)	25/57 (43.86%)
Sixth year	69	69	69/285 = 24.21%	27/66 (40.91%)	39/66 (59.09%)
Total	311	304	304/985 = 30.86%	142/291 (48.80%)	149/291 (51.20%)

<sup>a</sup> Total refers to the number of participants who responded to the question about gender.

**Table 2.** Survey results as percentage for question 2-6 and question 9

Group	Questions															
	2	3	4a	4b	4c	4d	5a	5b	6a	6b	6c	6d	9a	9b	9c	
Third	n*	100	100	90	90	89	89	91	91	91	91	91	90	88	88	88
	SD	9	22	17.78	4.44	8.99	1.12	3.30	5.49	4.40	19.78	26.37	4.44	2.27	1.14	6.82
	D	9	22	15.56	4.44	10.11	3.37	1.10	1.10	4.40	20.88	26.37	3.33	4.55	1.14	4.55
	Ne	20	29	22.22	24.44	31.46	39.33	6.59	6.59	14.29	32.97	17.58	12.22	5.68	15.91	17.05
	A	37	21	35.56	45.56	32.58	38.20	32.97	31.87	40.66	24.18	19.78	30.00	30.68	44.32	35.23
	SA	25	6	8.89	21.11	16.85	17.98	56.04	54.95	36.26	2.20	9.89	50.00	56.82	37.50	36.36
Fourth	n*	69	69	63	63	63	63	63	63	63	63	63	63	63	63	63
	SD	13.04	23.19	15.87	6.35	6.35	4.76	3.17	3.17	11.11	11.11	30.16	0.00	1.59	0.00	6.35
	D	14.49	28.99	30.16	7.94	14.29	6.35	0.00	1.59	4.76	23.81	34.92	1.59	3.17	0.00	11.11
	Ne	18.84	34.78	26.98	20.63	33.33	31.75	1.59	1.59	22.22	26.98	14.29	3.17	11.11	9.52	15.87
	A	33.33	8.70	25.40	49.21	33.33	44.44	33.33	31.75	41.27	28.57	14.29	42.86	36.51	49.21	42.86
	SA	20.29	4.35	1.59	15.87	12.70	12.70	61.90	61.90	20.63	9.52	6.35	52.38	47.62	41.27	23.81
Fifth	n*	57	56	54	54	53	53	53	54	53	52	52	54	54	54	54
	SD	3.51	14.29	11.11	3.70	1.89	1.89	0.00	0.00	9.43	11.54	21.15	1.85	3.70	3.70	3.70
	D	5.26	33.93	18.52	7.41	11.32	13.21	0.00	0.00	3.77	15.38	23.08	0.00	0.00	0.00	1.85
	Ne	15.79	30.36	38.89	16.67	30.19	18.87	3.77	1.85	11.32	17.31	23.08	7.41	5.56	5.56	7.41
	A	42.11	14.29	22.22	50.00	43.40	47.17	37.74	37.04	45.28	36.54	19.23	46.30	29.63	29.63	38.89
	SA	33.33	7.14	9.26	22.22	13.21	18.87	58.49	61.11	30.19	19.23	13.46	44.44	61.11	61.11	48.15
Sixth	n*	67	66	60	60	61	61	62	61	61	61	60	61	61	61	61
	SD	1.49	21.21	10.00	0.00	0.00	1.64	1.61	1.64	0.00	4.92	5.00	0.00	0.00	0.00	0.00
	D	5.97	43.94	15.00	5.00	18.03	3.28	0.00	1.64	3.28	24.59	25.00	3.28	1.64	0.00	0.00
	Ne	28.36	21.21	23.33	11.67	13.11	21.31	6.45	3.28	8.20	16.39	18.33	9.84	0.00	0.00	8.20
	A	34.33	12.12	41.67	58.33	44.26	45.90	43.55	39.34	59.02	42.62	28.33	31.15	37.70	31.15	32.79
	SA	29.85	1.52	10.00	25.00	24.59	27.87	48.39	54.10	29.51	11.48	23.33	55.74	60.66	68.85	59.02

\* n, the number of respondents to that question. SD, strongly disagree. D, disagree. Ne, neutral. A, agree. SA, strongly agree.

Mann-Whitney U test showed that females preferred plastinated specimens as a teaching method more than males ( $U = 742.50, p = .044$ ) with mean ranks of 49.63 for females and 39.38 for males. Using Friedman test again showed that this group preferred digital media as the main source to study anatomy (Table 5). Post hoc analysis showed that differences were between textbook and lectures, textbook and digital media, audio record and lectures, and audio records and digital media (all differences with  $p < .001$ ).

**Fourth Year Group**

Only 54% of the students in this group agreed or strongly agreed that anatomy was interesting (Table 2). Fewer considered becoming professional anatomists (13%), while the majority did not (52%). One response that had a very positive reaction was on digital media: 95% of the fourth year

students agreed/strongly agreed that digital media were useful in understanding anatomy, with 94% preferring it to be incorporated into the curriculum. Only 2% of this group thought that the information given during the courses of anatomy was 'not enough', while almost two-thirds (65%) believed it was 'too much' (Table 3). More than three-quarters (78%) of the students preferred the number of lectures to remain the same or be decreased, and 94% preferred the number of lab session to be increased or remain the same (see Table 3). Moreover, 84% of fourth year students felt that anatomy was important in understanding other basic medical sciences, and 90% thought that it was important in understanding clinical courses, however only 67% indicated that anatomy was important in their profession as medical doctors.

This group also chose plastic models as their

**Table 3.** Survey results as percentage for question 7 and 8

Question		Third Year	Fourth Year	Fifth Year	Sixth Year
7	n*	90	63	54	61
	Too much	75.56	65.08	33.33	40.98
	Just OK	24.44	33.33	61.11	57.38
	Not enough	0.00	1.59	5.56	1.64
8a	n*	90	63	54	60
	Should be increased	18.89	22.22	12.96	3.33
	Should remain the same	41.11	42.86	57.41	61.67
	Should be decreased	40.00	34.92	29.63	35.00
8b	n*	89	63	54	61
	Should be increased	40.45	63.49	81.48	86.89
	Should remain the same	42.70	30.16	12.96	11.48
	Should be decreased	16.85	6.35	5.56	1.64

\* n, the number of respondents to that question.

favorite method of teaching (Table 4). Differences were found between theoretical lectures and prosected cadavers ( $p = .18$ ), plastinated specimens ( $p < .001$ ), and plastic models ( $p < .001$ ). Digital media was their most favored source of study (Table 5). Significant differences were found between audio records and lectures, audio records and digital media, textbooks and digital media, and lectures and digital media (all differences with  $p < .001$ ).

#### Fifth Year Group

Most of these students (75%) felt that anatomy was interesting yet similar to other classes; almost half (48%) expressed no interest in becoming anatomists (see Table 2). Digital media were high-

ly valued, with 96% agreeing/strongly agreeing that it was helpful in understanding anatomy, and 98% believed that digital media should be incorporated in teaching anatomy. But when asked about the information given to them during the courses, 33% thought it was 'too much', 61% thought it was 'just ok', and 6% thought it was 'not enough'. Furthermore, a clear majority (87%) preferred the number of anatomy lectures to remain the same or be decreased. 94% percent of the class preferred the number of lab sessions to remain the same or be increased (Table 3). The percentage of fifth year students that agreed/strongly agreed that anatomy was important in understanding basic medical sciences, clinical courses, and their future profession as doctors was 91%, 91%, and 87%

**Table 4.** Mean ranks and comparison of students' preferences for the formats used in teaching anatomy using Friedman test

Group	Mean Rank				Friedman test ( df =3 ) <sup>a</sup>		
	Lectures	Plastic models	Prosected cadavers	Plastinated specimens	X <sup>2</sup>	n	p
Third	2.19	2.78	2.41	2.62	14.63	88	.002
Fourth	1.83	2.88	2.52	2.77	37.39	63	< .001
Fifth	1.93	2.84	2.51	2.72	21.70	53	< .001
Sixth	1.99	2.83	2.52	2.67	20.21	60	< .001

<sup>a</sup> df, degrees of freedom.

**Table 5.** Mean ranks and comparison of the various sources used in studying anatomy among the different groups using Friedman's test

Group	Mean Rank				Friedman test ( df =3 ) <sup>a</sup>		
	Lectures	Textbooks	Audio records	Digital media	X <sup>2</sup>	n	p
Third	3.07	1.86	1.92	3.15	96.14	90	< .001
Fourth	2.67	2.18	1.67	3.47	80.15	63	< .001
Fifth	2.78	2.27	1.82	3.13	40.96	52	< .001
Sixth	2.78	2.00	2.11	3.12	39.83	60	< .001

<sup>a</sup> df, degrees of freedom.

respectively.

Friedman's test, again, showed that the students preferred plastic models over other methods, with differences found between lectures and plastinated specimens ( $p = .011$ ) and plastic models ( $p = .002$ ). Females preferred plastinated models more than males ( $U = 190.50$ ,  $p = .003$ ), with a mean rank of 33.56 for females and 21.57 for males. For this group also, the main source of study was digital media with differences between audio records and lectures ( $p = .001$ ), audio records and digital media ( $p < .001$ ), and textbooks and digital media ( $p = .004$ ). Females also preferred lectures as a main source of study more than males ( $U = 244.00$ ,  $p = .047$ ), with a mean rank of 31.33 for females and 23.41 for males.

#### *Sixth Year Group*

In this group, 64% of the students indicated that anatomy was interesting, whereas, only 7% disagreed/strongly disagreed to that question (Table 2). Just 14% agreed/strongly agreed to becoming an anatomist, while the majority (65%) disagreed/strongly disagreed. The use of digital media was again very favorable, as 92% of students agreed or strongly agreed that digital media was helpful in understanding anatomy, and 93% preferred it to be part of the teaching process. Some students (41%) believed that 'too much' information was given during the anatomy classes (Table 3). However, most of the recent graduates (97%) believed that the number of anatomy lectures should be decreased or remain the same, and 98% wanted the number of labs to increase or remain the same. In addition, almost all (98%) of the students believed that anatomy was important in understanding other basic medical sciences and 100% agreed/strongly agreed that anatomy was important in understanding clinical courses. Moreover, the recent graduates indicated that anatomy was important in their future profession as medical doctors (94%). See Table 2.

As with the other groups, plastic models were mostly favored as a teaching method (Table 4). Statistically significant differences were found between lectures and plastinated specimens ( $p = .025$ ), and plastic models ( $p = .002$ ). Digital media was mostly favored as a source of study (Table 5) with significant differences found between textbooks and lectures ( $p = .006$ ), textbooks and digital media ( $p < .001$ ), audio record and lectures ( $p = .028$ ), and audio record and digital media ( $p < .001$ ). In addition, digital media was preferred by males more than females ( $U = 311.00$ ,  $p = .032$ ), with mean ranks of 26.89 for females and 35.56 for males.

#### **Comparison between groups**

Further differences between the classes were explored using the Kruskal-Wallis test. The  $p$ -value was adjusted using the Bonferroni method. This

identified nine points of difference between the four groups based on mean ranks (see Fig. 1).

A significant difference was found only between the fourth and fifth year students ( $p = .031$ ) with regard to the question of anatomy being an interesting subject. The fourth year group found it less interesting than the fifth year group.

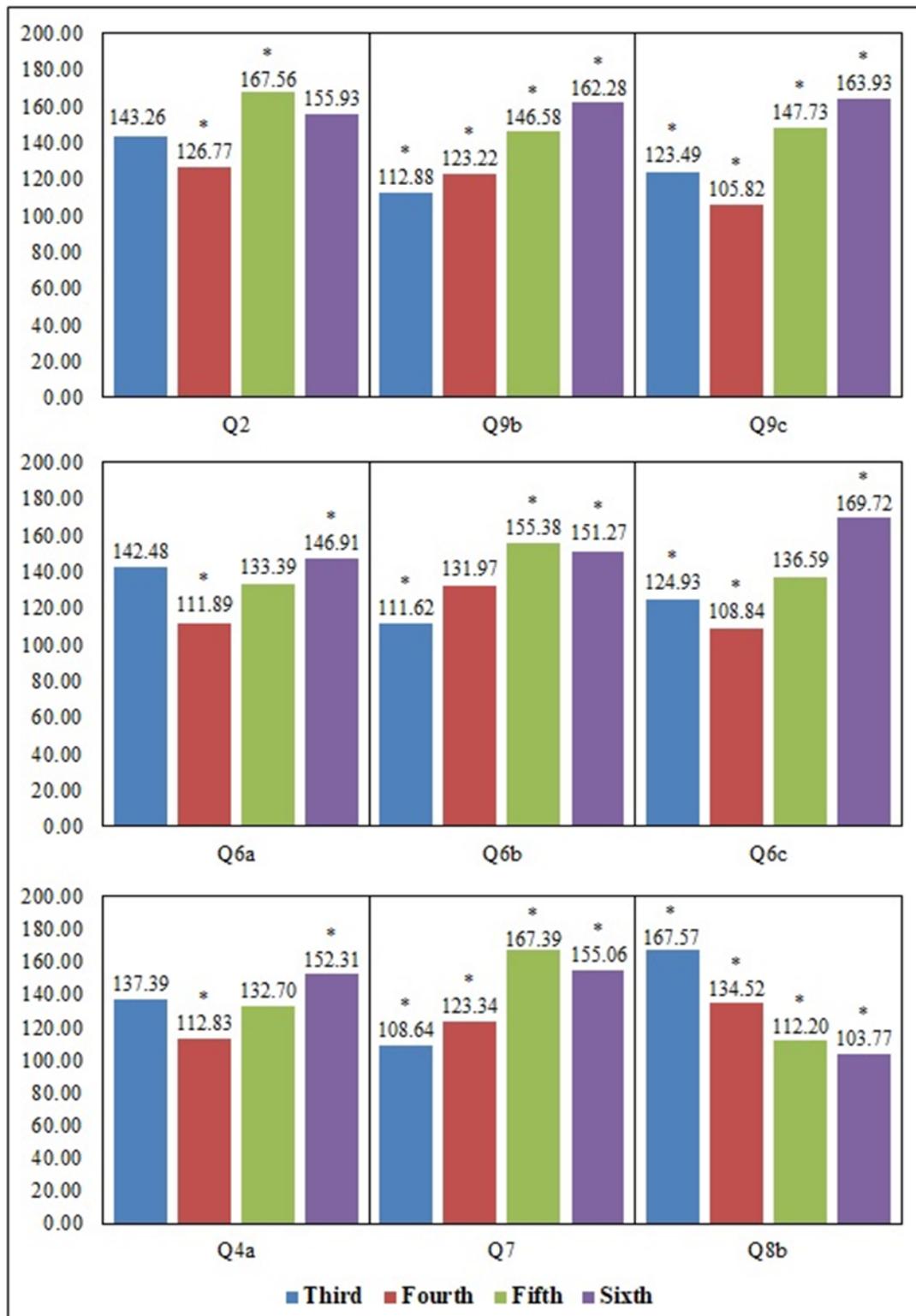
The students in the groups also differed in their opinion regarding the importance of anatomy in understanding clinical courses ( $p < .001$ ) and in their future professions as doctors ( $p < .001$ ). As for understanding clinical courses, a significant difference was found between the third and fifth ( $p = .029$ ), third and sixth ( $p < .001$ ), and fourth and sixth ( $p = .010$ ) years. For the importance of anatomy in their future professions as doctors, differences were found between the third and sixth ( $p = .005$ ), fourth and fifth ( $p = .010$ ), and fourth and sixth ( $p < .001$ ) year students. Analyzing the preferences of students for the main source of study between the groups showed a significant difference with regard to lectures ( $p = .029$ ), textbooks ( $p = .001$ ), and audio records of lectures ( $p < .001$ ), see Fig. 1. As for lectures, a difference was found only between the fourth and the sixth year groups ( $p = .043$ ). Regarding textbooks, differences were found between the third and fifth years ( $p = .005$ ), and the third and sixth years ( $p = .008$ ). For audio records, differences were found between the third and sixth years ( $p = .002$ ), and the fourth and sixth years ( $p < .001$ ).

Regarding the teaching tools, the only difference was found in the option of theoretical lectures ( $p = .031$ ), with post hoc analysis showing a difference between the fourth and sixth year groups ( $p = .021$ ). The fourth year students found lectures to be less effective than the sixth. Varying percentages of the students in the different groups thought that the material covered in the courses was too much. Kruskal-Wallis test indicated that there was a statistically significant difference between the groups regarding the information given ( $p < .001$ ), specifically between the third and fifth ( $p < .001$ ), third and sixth ( $p < .001$ ), and fourth and fifth years ( $p = .002$ ). Although no difference was found between the groups regarding the number of anatomy lectures ( $p = .572$ ), a significant difference was found regarding the number of anatomy lab sessions ( $p < .001$ ). Specifically, the difference was between third and fourth ( $p = .012$ ), third and fifth ( $p < .001$ ), and third and sixth years ( $p < .001$ ).

#### **DISCUSSION**

Response rates ranged from 24% to 45%. Even though the rates were less than 50%, this is consistent with research on online survey participation (Nulty, 2008; Cunningham et al., 2015; Saleh and Bista, 2017).

Although more than half the students in each of the four groups thought that anatomy was an inter-



**Fig 1.** The mean ranks of the questions that were significantly different between the groups. The asterisks indicate which groups were different.

esting subject, there was a lack of interest in becoming anatomists, and this increased as the students progressed through the years. The courses of anatomy might not have provided a good environment in which the students could build their professional identity. On the other hand, such an environment might have been found in clinical courses in which the students had direct patient

contact, worked in teams, and had greater responsibility, all of which assist in establishing professional identity (Pawlina, 2019).

The students in all the groups agreed that plastic anatomical models were the best tools for understanding anatomy, followed closely by plastinated specimens. This might be expected since a good comprehension of anatomy requires the apprecia-

tion of the spatial orientation of organs and body parts in three-dimensional (3D) space (Vorstenbosch et al., 2013). This could be achieved by using plastic models, which are easily carried, rotated, and flipped in space. Small plastinated specimens of organs are also useful in this respect (Garg et al., 2001). This indicates that the students thought that learning anatomy practically was more helpful than learning it theoretically. This preference was reported for cadaver dissection (Flack and Nicholson, 2018), for prosected cadavers and anatomical models (Davis et al., 2014), and for various methods of practical anatomy teaching (Moxham and Moxham, 2007).

Theoretical lectures, on the other hand, was the least favored tool to understand anatomy. Lectures provide mere images that do not help in spatial orientation. However, these lectures were considered an important source of anatomical knowledge as they are short, concise, and adequate enough for the students to pass the exams (Sunba et al., 2017). In contrast, textbooks were regarded very lowly by the students. Third year students favored textbooks the least, as compared to the other groups, especially the fifth and sixth year students. It seemed that the dislike of textbooks started from the early basic training years of the students, but was less with the more mature students in the clinical training years. Still, this was not enough to make the students choose textbooks as a main source of study.

The majority of the students in all the groups thought that digital media were especially beneficial in understanding anatomy, and preferred it to be incorporated more in the teaching of this subject. This runs congruent with some studies on the use and benefit of digital media (Rosario et al., 2019; Triepels et al., 2020), but in opposition to others in which students preferred the traditional gross anatomy lab over digital media (Davis et al., 2014; Mathiowetz et al., 2016). Still, in others, students believed that online media was a helpful addition to the traditional course (Nieder and Nagy, 2002; Chan et al., 2019). New digital technology can provide 3D representations of the various body parts (interactive 3D images, holographic models, virtual models, and others) that are easily manipulated by the students. One must also remember that these students belong to a digital generation (Erstad, 2010) for whom digital learning is just part of life that can be easily accessed anywhere and anytime. It was not surprising, therefore, to see that students in all the groups chose digital media as the main source of studying anatomy, as it helped them understand anatomy greatly.

About three-quarters of the third year students and more than half the students of the fourth year group believed that the information given to them in anatomy courses was 'too much'. Anatomy as a burden was reported in other articles (Arráez-Aybar et al., 2010; Gupta et al., 2014). On the oth-

er hand, more than half of the fifth and sixth year students thought it was 'just ok'. It seemed that, as the students became more involved in clinical courses, they realized that anatomical information acquired during their basic training enabled them to understand these courses better. The majority of students in all the groups thought that the number of anatomy lectures should remain the same or be decreased. This should not be surprising in light of the answers the students gave about the information given in the courses of anatomy, and if one also considers that lectures were the least favorite method to help these students understand anatomy. But when asked about the number of lab sessions, the majority of students thought that they should be increased or remain the same. This was not surprising since these students considered practical teaching as the method that helped them understand anatomy most. The students in the clinical (fourth, fifth, and sixth) years preferred the number of lab sessions to be increased more than the students of the third year did. This may be another indication that the students in their clinical years had grasped the importance of anatomy in their study.

The majority of students in all the groups acknowledged the relevance of anatomy in understanding other basic medical sciences and clinical courses, and in their future profession as doctors. Similar views were expressed by students in India (Gupta et al., 2014), the UK and France (Moxham and Plaisant, 2007), and Spain (Arráez-Aybar et al., 2010). In contrast, some students believed that anatomy was irrelevant to their clinical studies (Kemeir, 2012). Regarding clinical courses and being a doctor, the two younger groups (third and fourth years) agreed with those points to a lesser extent than the fifth and sixth year students. The students of the sixth year group unanimously agreed/strongly agreed that anatomy was important in understanding clinical courses. So, the full appreciation of the relevance of anatomy was best demonstrated by the responses of the students in the sixth year group who had finished all of their medical studies and were about to embark on their practical lives.

### **Conclusion and recommendations**

The students surveyed preferred practical rather than theoretical learning to understand anatomy, and preferred digital media as a main source of study. Students have left textbooks aside and became more dependent on the instructors' lectures. The students appreciated the importance of anatomy in understanding basic medical sciences and clinical courses. As they matured, this perception became more apparent.

A more detailed survey with a higher response rate may be required to better understand the students' opinions. But the results of this study suggest that a change in the anatomy curriculum may

be required. More practical sessions should be arranged for the students and new technology and digital media should be incorporated more in the curriculum. The shelving of textbooks has to be addressed appropriately. The clinical aspects of anatomy must be emphasized in the lectures and labs. Anatomists must ensure that anatomical information that is more relevant to the future career of the students as doctors must be delivered to them aptly (Sinclair, 1975).

## APPENDIX

**Survey Questions:** (Possible answers are given in parentheses with their corresponding numerical values. These values used for analysis only and not shown to the students).

### Part i: General:

- Q1) What is your gender? (1 male, 2 female)  
(for questions Q2-Q6, 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, 5 strongly agree)  
Q2) Anatomy was an interesting subject to study.  
Q3) You consider a career as a professional anatomist.

### Part ii: Methods of teaching anatomy:

- Q4) The method of teaching that helped you understand anatomy more was:  
a) Theoretical lectures.  
b) Practical sessions with plastic models.  
c) Practical sessions with prosected cadavers.  
d) Practical sessions with plastinated specimens.  
Q5) Digital media:  
a) The use of digital media (web sites and computer / mobile software) is very helpful in understanding anatomy.  
b) Digital media should be incorporated in teaching anatomy courses.

### Part iii: Source of study:

- Q6) Your main source of study is:  
a) Lectures and labs given by the professors / teachers.  
b) Anatomy textbooks.  
c) Audio records of the lectures.  
d) Digital media (web sites, computer / mobile software, and online lectures).

### Part iv: Anatomy curriculum and delivery:

- Q7) The information given in your anatomy courses was: (1 too much, 2 just ok, 3 not enough)  
Q8) The number of the following: (1 should be increased, 2 should remain the same, 3 should be decreased):  
a) Anatomy lectures  
b) Anatomy lab sessions

### Part v: Anatomy and the other branches of medicine:

- (for Q9, 1 strongly disagree, 2 disagree, 3 neu-

tral, 4 agree, 5 strongly agree)

Q9) Anatomy is important in:

- a) Understanding other basic medical sciences (physiology, pathology, ....).  
b) Understanding clinical courses (medicine, surgery, ....).  
c) Your future profession as a medical doctor.

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