



Role of cadaveric dissections in modern medical curricula: a study on student perceptions

Lakal O. Dissabandara¹, Selvanayagam N. Nirthanan^{1,2}, Tien K. Khoo¹, Raymond Tedman¹

¹School of Medicine and ²School of Medical Science, Griffith University, Gold Coast, Australia

Abstract: The shift from traditional medical curricula to newer teaching and learning approaches such as problem-based learning has often resulted in omission or significant reduction of cadaveric dissections as a method of learning anatomy. The objective of this study was to evaluate students' perception of dissection in a graduate-entry, problem-based learning-based medical curriculum. At the end of the musculoskeletal dissection program in second year, a Likert-type questionnaire was used to explore medical student perceptions of the perceived advantages and challenges of cadaveric dissections in comparison with other anatomy teaching methods. Overall, a majority of students had a positive perception of dissections. Students who attended dissections regularly had significantly more positive perceptions about their experience and were in agreement with statements such as "dissections make learning more interesting" and "I would be disadvantaged if I did not attend dissection classes." Non-regular attendance was associated with statements about dissections such as "I do not like the smell," "time consuming" and "bored with the way it is carried-out." A follow-up study after completion of the medical program revealed a significant improvement of positive perception about dissection. Student perceptions appear to favour a role for cadaveric dissection in learning anatomy in modern medical curricula. However, optimal and effective integration of dissections is important, with consideration given to its structure and extent of content weighed against logistics and availability of resources; while addressing negative perceptions of dissection-based teaching.

Key words: Dissection, Anatomy, Cadaver, Medical, Perception

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Introduction

Anatomy is considered to be the language and the basis of clinical medicine [1]. The discipline of anatomy, while providing the fundamental knowledge of the structure of the human body, also underpins the study of physiology and pathology as well as a host of clinical specialties including clinical medicine, surgery and radiology. Thus, a thorough

knowledge of anatomy is imperative for crucial medical skills that include eliciting a clinical history and examination as well as clinical reasoning that would contribute to diagnostic acumen and patient management. The significance of anatomical sciences notwithstanding, the introduction of newer learning and teaching approaches such as problem-based learning (PBL), new streams such as communication skills, bioinformatics and abridged curricula that reflect graduate-entry medical programs have necessitated a drastic reduction in time and resources dedicated for anatomy teaching, for the most part the dissection, as has been traditionally taught in a typical five-year undergraduate medical program [2, 3].

Anatomy has been taught using different approaches including didactic lectures; practical sessions based on models, pro-sected materials, cadaveric dissection and

Corresponding author:

Lakal O. Dissabandara
Griffith School of Medicine, Griffith Health Centre (G40) 8.17, Southport, Gold Coast 4215, Australia
Tel: +61-420234356, Fax: +61-756780303, E-mail: l.dissabandara@griffith.edu.au

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living anatomy sessions, as well as newer methods such as 3D models and interactive computer based software, body painting, radiological images and holograms [4-7]. Traditionally, cadaveric dissection has been the mainstream of delivering an anatomy curriculum in medical schools. With reduced time available for anatomy teaching in systems-based, integrated PBL-based curricula, there has been a drastic reduction of dissection-based teaching, and sometimes, complete elimination of this teaching approach [8]. Some of the unique aspects of cadaveric dissection include the realistic nature of this teaching medium that allows students to grasp a clear visuo-spatial picture of the organization of human body, experience the texture of human tissues, witness and comprehend pathological conditions while learning the normal and compare the normal versus pathological. The former can also include anatomical variations that are not always effectively delivered through other means. Additionally the usefulness of anatomical dissections to reinforce the respectful and compassionate attitudes among medical students has been discussed in the literature [9]. Previous studies have revealed that students rated cadaveric dissection as an important method of learning anatomy [10, 11].

Critics cite high costs, time intensity, requirement for highly skilled teachers and the emotionally challenging nature of cadaveric dissection as its potential disadvantages [12]. Some studies have reported dissection as a cause of significant psychological distress among medical students; while others have not found evidence that this was a common finding [13, 14]. Although a number of studies have been published comparing different teaching modalities for anatomy, including dissection, generalization of results of these studies is difficult owing to the heterogeneity of study methodologies and the lack of use of standardized assessment of anatomy knowledge [15]. A review of anatomical dissection as a teaching method in medical schools reported that a number of studies supported dissection as a better method of learning when compared to non-dissection-based methods although some studies were of a contradictory opinion [15].

The graduate-entry medical program at Griffith University is a four-year PBL-based program leading to the award of the Doctor of Medicine degree. Most of the basic sciences including anatomy are covered during the first two years, and further emphasized through case-based learning in years 3 and 4 when the learning and teaching is almost entirely undertaken during clinical placements in hospitals and general practice.

Anatomy is a major component of the Griffith medical curriculum during the first two years starting with an introduction to the general anatomy of systems followed by a more detailed systems-based clinical anatomy program. The musculoskeletal anatomy program runs in the second year. A typical week of this program includes a 2-hour clinical anatomy lecture and a pro-sected material-based practical session followed by dissection sessions. There are 12 dissection sessions of 3 hours duration per session. Students carry out the dissections in their PBL groups. A group consists of about 8-9 students. Each group is provided with a formaline fixed cadaver. All the sessions are supervised by a group of tutors. A tutor is responsible for the supervision of 2 dissection groups. A dissection protocol tailored to the curriculum is provided to the students before the dissection session. The dissection sessions are not compulsory, however the attendance are recorded. The anatomy knowledge is assessed using a combination of multiple choice questions, short answer questions and a practical exam that involves direct identification as well as objective structured practical questions which span over 40 stations.

The objective of the current study was to investigate student perception of dissection in a PBL-based curriculum in an Australian Graduate Entry Medical Program (GEMP), namely, Griffith Medical School.

Materials and Methods

Methodology

This study was done as part of routine anatomy program evaluation following completion of ten weeks of musculoskeletal dissection in 2011, 2012 and 2013, by second year students in the Griffith University GEMP. An anonymous, self-administered, Likert-style survey instrument, comprising of 23 questions, was used for evaluation of the dissection program. The survey instrument was adapted from questions utilized in a previously published study [10]. The questions addressed three broad categories with nine questions evaluating positive experiences, seven questions evaluating negative experiences and seven questions comparing dissection with other forms of learning. In addition, students were asked to indicate whether they regularly attended the dissection or not, based on the participation of 50% or more of the scheduled sessions. The instrument was administered on a voluntary basis during the revision practical session after completion of the dissection

program. The attendance was recorded for the dissection sessions. Furthermore, an additional follow-up evaluation of the cohort that undertook dissection in second year in 2011 was carried out in 2013 after the cohort graduated from the medical program.

Data analysis

The IBM SPSS statistics version 21 (IBM Co., Armonk, NY, USA) [16] was used for analysis of data. The average scores for each item were calculated and compared between regular vs non-regular attendees at dissections using Mann-Whitney’s U test. A logistic regressions analysis was carried out to identify the factors that influenced the participation status in dissection sessions. The nature of participation (regular or non-regular) was used as the predictor variable and the positive and negative items that were found to be significantly different among the two groups, according to Mann-Whitney U test, were separately entered as predictor variables. The alpha value was set at 0.05 for all analyses.

The study received ethical approval from the local Human Research Ethics Committee.

Results

A total of 133 students completed the 23-question survey instrument. This corresponds to 28.9% of the total number

of students enrolled in the 2011, 2012, and 2013 Year-2 cohorts. Of this, 106 students indicated that they attended the dissection sessions regularly while 27 students indicated they had not attended regularly (attendance at less than 50% of sessions).

The majority of students (>75%) agreed or strongly agreed with survey instrument items that reflected positive perceptions of cadaveric dissections (Fig. 1A):

- Overall I am satisfied with the dissection program
- Enhances my respect for the human body
- Deepens my understanding of anatomy
- Provides three-dimensional perspective of anatomical structures
- Makes learning of anatomy more interesting

Less than half (40%) of the participants also agree with the item: “provides better understanding of the effects of trauma.” Nonetheless, a significant number of respondents related to items that reflected a negative perception of cadaveric dissection including “being time consuming,” (59.3%) “difficult to identify structures” (48.4%), and “do not like the smell (of preservatives)” (45.1%) (Fig. 1B). However, only a minority of the students indicated that the experience of cadaveric dissection as having been stressful (15.8%).

The majority of students did not like the proposition that the dissection program should be eliminated (84.9%) and most of them were satisfied (68.7%) with the time allocated

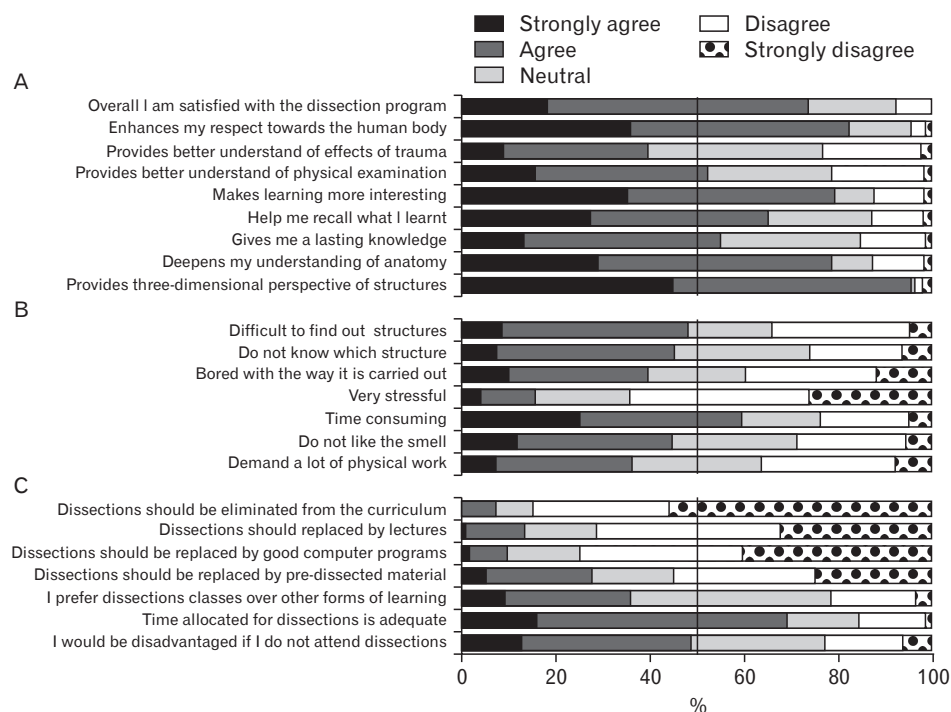


Fig. 1. (A–C) Student perception about dissection.

for dissection. Comparing cadaveric dissection with other forms of learning anatomy, students indicated that they did not prefer an option of substituting dissections with lectures (71.2%), good computer programs (74.4%) or pre-dissected material (54.6%) (Fig. 1C). Interestingly, while, only about 35.8% of students preferred dissection over other forms of learning anatomy, 48.9% of the respondents viewed non-participation at dissection sessions to be disadvantageous for their learning.

It was also noted that student responses to most of the

items in the survey instrument were significantly different between those considered regular or non-regular attendees at dissections, except for the items “provides understanding of the effects of trauma,” “time allocated for dissection is adequate,” “demands a lot of physical work” and “difficult to identify structures” (Table 1).

The results of the logistic regression analyses are shown in Tables 2 and 3. It can be seen in Table 2 that items “dissections makes learning more interesting” and the opinion that “I would be disadvantaged if I did not attend dissection classes”

Table 1. Comparison of perception about dissection between regular and non-regular attendees

	Mean±SD		P-value
	RA	NRA	
Positive experiences			
Deepens understanding of anatomy	3.22±0.97	4.14±0.86	<0.001
Provides three-dimensional perspective of structures	4.11±0.58	4.43±0.74	0.004
Gives me a lasting knowledge.	3.22±0.93	3.62±0.9	0.064
Helps me recall what I learnt	3.04±0.81	3.99±0.97	<0.001
Makes learning more interesting	3.11±1.12	4.25±0.79	<0.001
Helps better understand physical examination	3±0.92	3.58±1	0.007
Helps better understand the effects of trauma	2.96±0.81	3.32±0.96	0.058
Enhances my respect towards the human body	3.85±0.91	4.22±0.78	0.052
Overall I am satisfied with dissection program	3.56±0.88	3.91±0.79	0.208
Negative experience			
Demands a lot of physical work	2.67±1.14	3.09±1.06	0.092
Do not like the smell	3.89±0.93	3.07±1.08	<0.001
Time consuming	4.15±0.95	3.42±1.2	0.004
Very stressful	2.96±1.29	2.13±0.98	0.002
Bored with the way it is carried out	3.74±0.94	2.79±1.19	<0.001
Do not know which structure	3.63±0.97	3.1±1.04	0.027
Difficult to identify structures	3.54±0.88	3.11±1.12	0.084
Comparisons			
I would be disadvantaged if I do not attend dissection classes	2.41±0.93	3.56±1.01	<0.001
Time allocated for dissection is adequate	3.41±1.08	3.75±0.91	0.097
I prefer dissection classes over other forms of learning	2.52±0.75	3.2±0.97	0.001
Dissection should be replaced by pre-dissected materials	3.35±1.02	2.34±1.21	<0.001
Dissection should be replaced by lectures	3±1.02	1.89±0.91	<0.001
Dissection should be replaced by good computer programs	2.59±1.19	1.8±0.91	0.001
Dissection should be eliminated from the curriculum	2.81±1	1.67±0.91	<0.001

RA, regular attendee (n=106); NRA, non-regular attendee (n=27).

Table 2. Advantages of dissection predicting participation status

	β (SE)	95% CI for odds ratio		
		Lower	Odds ratio	Upper
Provides three-dimensional perspective of structures	-0.54 (0.47)	0.24	0.58	1.45
Deepens understanding of anatomy	0.41 (0.38)	0.29	1.51	3.16
Helps me recall what I learnt	0.41 (0.38)	0.28	1.51	3.19
Makes learning more interesting	0.68 (0.31)*	0.03	1.97	3.61
Provides better understanding of physical examination	0.01 (0.32)	0.98	1.01	1.89
I would be disadvantaged if I do not attend dissections	0.70 (0.29)*	0.01	2.02	3.52
I prefer dissection classes over other forms of learning	0.04 (0.38)	0.92	1.04	2.18

$r^2=0.41$ (Nagelkerke). Model $X^2(1)=40.17$, * $P<0.05$. SE, standard error; CI, confidence interval.

have significant positive influences on participation in dissection classes (odds ratios of 1.97 and 2.02, respectively).

In contrast, the “smell,” “time consuming” nature and feeling that the way the dissection sessions are carried out was “boring” have relatively minor negative impacts on regularly attending the sessions (odds ratios of 0.53, 0.58, and 0.57, respectively).

The results of the follow-up study done after completion of graduate medical program by the Year-2 cohort which participated in the first survey in 2011, indicate that the

majority of students either agreed or strongly agreed with all the positive perceptions of the anatomy dissection program (Fig. 2). As shown in Fig. 3, the percentage of students strongly agreeing with the positive aspects of dissection at the completion of medical program has markedly increased compared to the cohort responses in their second year in 2011. This was greatest for the items “I would be disadvantaged if I do not attend dissection classes,” Dissection gave a better and lasting knowledge,” and “Dissection deepens my understanding of anatomy.”

Table 3. Disadvantages of dissection predicting participation status

	β (SE)	95% CI for odds ratio		
		Lower	Odds ratio	Upper
Do not like smell	-0.64 (0.26)*	0.31	0.53	0.88
Time consuming	-0.54 (0.27)*	0.34	0.58	0.98
Very stressful	-0.44 (0.23)	0.41	0.64	1.01
Bored with the way it is carried out	-0.56 (0.26)*	0.34	0.57	0.95
Do not know which structure	-0.03 (0.29)	0.55	0.98	1.72

$r^2=0.34$ (Nagelkerke). Model $\chi^2(1)=32.23$, * $P<0.05$. SE, standard error; CI, confidence interval.

Discussion

The current study revealed important findings about student perceptions with regard to positive and negative aspects of anatomical dissection in a PBL-based, graduate-entry medical program. Overall, the majority of respondents held positive perceptions about the usefulness of cadaveric dissections as an effective approach to studying anatomy. Furthermore, the study also identified the main reasons

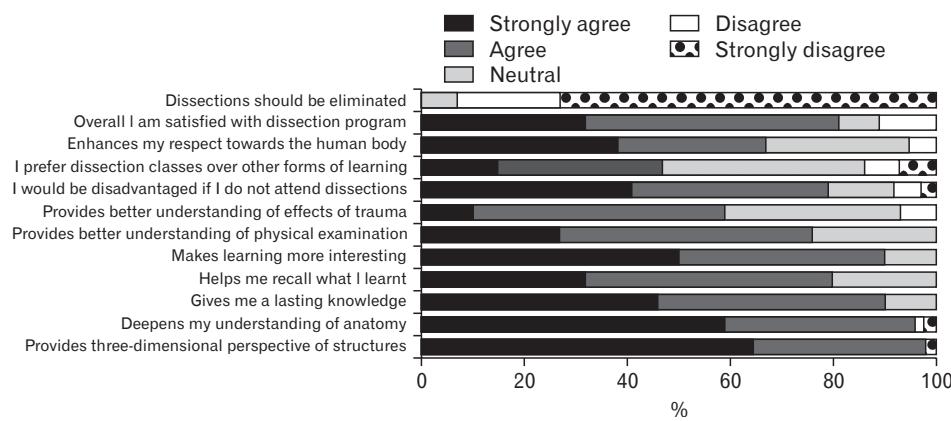


Fig. 2. Student perception about dissection after the completion of medical course.

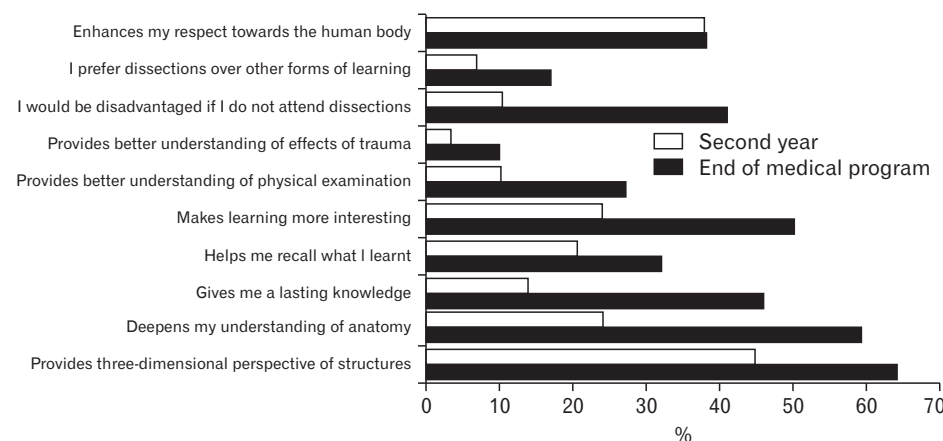


Fig. 3. Comparison of perception about dissection just after the dissection program and at the end of Bachelor of Medicine, Bachelor of Surgery program.

associated with regular and non-regular attendance at dissection sessions.

Taken together, the participants recognized dissection made learning of anatomy more interesting whilst providing a three-dimensional and deeper understanding of human anatomy. Such positive aspects of dissection have been reported previously [10]. However, only about 36% of respondents agreed that dissection classes were preferred over other forms of learning anatomy. As reviewed by Winkelmann [15] previous studies comparing different forms of anatomy teaching methods have provided mixed results. The methods used in these studies to assess and compare different approaches of anatomy teaching were not uniform and they may not comprehensively assess the strengths and weaknesses of different methods; and the effectiveness of a particular mode of learning could vary across the curriculum, hence limiting the reliability of direct comparisons. A recent study has shown that students exposed to PowerPoint-based small group sessions performed better in written type of exams than the oral exams and those who took part in cadaveric dissection performed well in both written and oral exams [17]. The authors argued that PowerPoint-based teaching may have improved the theoretical understanding of anatomy than the ability to explain something orally during a viva-voce where students are examined on a wide range of anatomical knowledge. Viva-voce has been considered an effective mode of testing knowledge essential for solving clinical problems as well as means of testing rational and well-articulated answers and the students ability to defend answers plausibly [18, 19]. Anatomy models including 3D computer graphic programs can be a useful tool for beginners to understand basic anatomy as well as to understand complex anatomical relationships and cross-sectional anatomy [20]. Conversely, large group resource sessions such as lectures provide a means of introducing topics ahead of practical sessions as well as facilitate learning and understanding difficult concepts as well as clinical relevance. New strategies such as body painting no doubt would help understand and consolidate knowledge of surface anatomy which is essential to improve clinical skills. Likewise, anatomical dissection, despite being subjected to debate over its utility in modern medical curricula, is likely to provide a significant opportunity to study the exact nature of human tissues, and their clinically relevant relationships. This practical activity also facilitates active learning at an individual and group level, thus fostering a deeper learning experience [15, 21].

A majority of the participants perceived this experience of human cadaveric dissections as a means of enhancing respect towards the human body. This observation supports Weeks et al's [9] consideration that benefits of a dissection program may include the opportunity to develop a relationship between student and cadaver donor which has been coined to be a model of clinician-patient relationship at the very early stages of a developing medical student. We suggest that it is imperative that medical students are exposed to opportunities that nurture professional attributes essential for medical practice such as respect, dignity and compassion; thus, dissection provides our students with an invaluable opportunity for them to learn to be appreciative of the act of donation, behave respectfully and develop a sense of compassion and empathy towards suffering.

The main disadvantages as perceived by students of the current study are the 'time consuming nature of dissection,' 'difficulty in finding correct structures,' and the 'smell of the embalmed cadavers.' By nature of its attributes, dissection is time consuming compared to other forms of learning anatomy; however, this slow but sequential nature of dissections may be beneficial to study and understand complex anatomical regions such as limbs which can be challenging for a beginner due to the content, complexity and the terminology involved. Understandably, this may be a concern for students in an integrated PBL-based curriculum owing to time limitations, workload and perceived career aspirations for the future.

Many students indicated that they struggle to explore structures and had problems identifying structures. Anatomical dissection being an active, student-centred and exploratory way of learning can be considered harmonious with current trends in medical education. The struggle to find and learn relevant information is characteristic of this approach to learning. This inherent challenge of dissection is likely to facilitate critical thinking and further development of both, physical and mental skills to help overcome obstacles and solving problems. Such issues can be alleviated by preparing students adequately before the dissection sessions by using other modes of learning such as introductory lectures, projection and model-based sessions prior to the dissection activities and by providing adequate guidance during the sessions.

Significant differences in perception about the dissection were noted between regular and non-regular attendees at dissection sessions. The non-regular attendees related to

items in the survey that reflected negative perceptions of dissections. Specifically, this group preferred other types of learning approaches to anatomy such as lectures, prosected materials and computer programs over the relatively labour- and time-intensive dissection process. Clearly therefore, the non-regular attendees were of the view that they would not be disadvantaged by not attending dissection sessions and stated that they were comfortable with a medical curriculum without dissections. It is difficult to draw conclusions from this study as to why some students prefer dissection while others do not. Based on the logistic regression analyses, the two factors associated with regular participation at dissections were “dissection makes learning anatomy more interesting” and “I would be disadvantaged if I did not attend dissection classes;” while the “time consuming nature”, the “smell” of cadavers and “bored with the way it was carried out” were the main factors to abstain from regularly attending the sessions.

Previous studies have shown that significant emotional stress in the form of anxiety was associated with cadaveric dissection [12]. Interestingly, only a minority of students in our study perceived anatomical dissection as stressful. While there was a statistically significant difference in the number of students who mentioned dissection as being very stressful between regular and non-regular attendees at dissection, the perceived stress was not found to be a significant predictor for not regularly attending dissections. One reason for this may be that the cohort comprised of graduate students, many of whom may have had previous encounters with cadaveric material during their first degree.

The first group of students who participated in this study, as second year students in 2011, also completed a follow-up survey at the completion of their medical program. This second survey revealed that the benefits of cadaveric dissections tended to enhance the learning experience during clinical rotations in the senior years. Obviously, this subgroup of students was better placed for giving feedback about the utility of the knowledge gained via the dissection during their clinical clerkships. There was a notable increase in the number of students who, as recent graduates, strongly agreed on the most positive aspects of dissection when compared to their responses as second year students. This was particularly evident with regard to the items “dissections deepens my understanding of anatomy,” “dissection gave me a better and lasting knowledge,” “provides better understanding of effects of trauma and physical examination,” and “deepens my understanding of anatomy.” These results may reflect the

more thorough, enduring and contextual learning experience provided by cadaveric dissections which are better appreciated in clinical workplaces where the knowledge could be applied to clinical situations.

The findings of the current study, in agreement with a number of previous studies, support a definitive role of cadaveric dissection in the delivery of an anatomy curriculum in a graduate-entry medical program. While most of the students identify the importance of having cadaveric dissection to learn anatomy, many did not seem to prefer dissection as the sole method of delivery of the anatomy curriculum. Hence, the inclusion of alternative methods such as lectures, prosected materials, models, animations and body painting is recommended. Inclusion of such diverse methods would facilitate the learning experience and cater for the diversity of students who often have different learning styles and expectations based on their prospective careers. The impact of student attitudes and learning styles on student achievement [22] and the importance of considering these aspects in planning curricular activities in general and its relevance to the anatomy practical sessions has been recognized [23].

Considering the significant time limitations and strong emphasis placed on clinical applicability of basic sciences such as anatomy from the outset of modern medical curricula, it is important to identify the specific components that can be delivered using dissection and devise dissection protocols that facilitates engagement of students in an active learning experience (e.g. dissection session based scenarios and clinical procedures).

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