Anatomy Education Environment among Pre-Clinical Medical Students in Universiti Putra Malaysia Using Anatomy Education Environment Measurement Inventory

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ABSTRACT

Anatomy is the foundation of medicine. Having adequate anatomy knowledge would improve medical students' comprehension of pathology and patient management. The evolving scenario in anatomy education has created a changing educational environment in medical schools. Since educational environment influence the students' motivation and ability to learn, it is pertinent to measure anatomy education environment as a feedback mechanism tool for further improvement in the curriculum. This study was performed to measure pre-clinical medical students' perception of the anatomy education environment in Universiti Putra Malaysia (UPM) by using a validated 25-item inventory, known as the Anatomy Education Environment Measurement Inventory (AEEMI). The inventory was distributed online to 171 first- and second-year medical students to measure their perception of anatomy teachers and instructors, anatomy knowledge, their intrinsic interest and efforts in learning anatomy, anatomy learning resources and histology practical facilities. The analysis revealed that most of the items show "positive area" indicated by score of more than four. The first-year medical students showed a significantly higher perception of the anatomy education environment compared to the second-year medical students ($p \leq 0.05$). However, both cohorts perceived an "area of improvement" for histology practical facilities (score of 3 to 3.99). In conclusion, the students were pleased with the anatomy education experience in UPM except for histology practical facilities that may require further

improvement. The use of virtual microscopy in histology teaching would be a good alternative to overcome the problem in histology teaching in UPM, especially during the COVID-19 pandemic.

Keywords: *Anatomy Education Environment Measurement Inventory, Medical students, Anatomy teaching, Anatomy teachers, Anatomy knowledge*

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INTRODUCTION

Anatomy is the study of human body that includes gross anatomy, histology, neuroanatomy and embryology (1). Having adequate anatomy knowledge would improve medical students' comprehension of pathology and patient management (2). Despite the importance of anatomy knowledge among medical students, anatomy input in medical curriculum has been in decline ever since the major medical curriculum revamp in the early 20th century (3). The content-driven nature of anatomy subject requires significant time in the schedule of traditional curriculum for lecture delivery and cadaveric dissection. However, it was impossible to accommodate these requirements in the modern medical curriculum as new medical subjects were introduced and teaching became more integrated (4–5).

A research conducted in the Netherlands compared medical students' anatomy skills to the expectation of stakeholders (6). They concluded that there was a substantial difference between the acquired anatomy knowledge and skills with the public expectation, which triggered significant concern on the provision of safe clinical practice (6). As a result, a few approaches in anatomy education have been proposed (3). Although conventional teaching methods are emphasised, anatomy education must be integrated with other medical subjects – vertically and horizontally – and adapts with the ever-changing waves of technology (7). Traditional and modern approaches should coexist to ensure the best possible anatomy education for

medical students, rather than competing for supremacy (7). Furthermore, with increasing awareness among anatomy educators on the importance of experiential and collaborative learning, anatomy instruction is also taught through several modalities that apply educational principles such as team-based learning and problem-based learning (8–9).

The evolving scenario in anatomy education has created a changing educational environment to the medical students. Educational environment is a multifactorial construct comprising of factors that influence the students' motivation and ability to learn (10). These factors include teachers' and instructors' competencies, instructional content, expected learning outcomes, teaching strategies, learning facilities, and peer and social support (11). An important element in anatomy education is the anatomy educators. It was reported that there are shortage of qualified anatomy educators and many of them are overburdened with high teaching, administrative and research loads, which could eventually influence the quality of teaching (12). Furthermore, medical students' perceive having difficulties in studying anatomy and retaining their knowledge for future practice, indicating potential shortcomings in anatomical education (7). These situations may influence students' motivation to learn anatomy and eventually affect their performance. In histology, conventional learning using optical microscopy has been a standard teaching method in medical schools despite having some drawbacks. Teaching using optical microscopy is

inefficient when there are not enough experienced teachers, and costly as damaged or under-stained histology slides need to be replaced and regularly re-stained, respectively.

There are several studies that measure students' feedback on the factors of anatomy education environment. A survey on medical students' knowledge about clinical importance and effective teaching methods of anatomy reported a major difference in students' perception of the most effective way to teach anatomy (13). Students in the pre-clinical phase rated lectures as the most useful method to teach anatomy, while students in the clinical phase rated clinical integrated instruction as the most useful teaching method. The research also discovered that pre-clinical students were more examination-oriented and were only interested to score well in their anatomy examinations; on the other hand, the clinical-year students learned anatomy to improve their clinical skills. Another study done at the Pakistan's Kust Institute of Medical Sciences in Kohat reported that majority of the pre-clinical year students were pleased with the anatomy content in the medical curriculum, the internal assessment process and instructor performance (8).

The importance of evaluating the students' perception of particular areas in the anatomy education environment was reported as part of the feedback process mechanism (7). Understanding how the medical students feel about these factors would provide information on the quality and efficiency of the teaching system, and thus provide a platform for further improvement. Their perception may provide valuable information about possible shortcomings in anatomy education, as well as mitigate discrepancies between existing and desired understandings or performances. As a result, the Anatomy Education Environment Measurement Inventory (AEEMI) was created by Universiti Sains Malaysia (USM) as a valid and reliable inventory to precisely measure the quality of the

anatomy education environment (13). As compared to Dundee Ready Education Measure (DREEM), AEEMI is specific to anatomy education; hence, it measures students' perception of specific domains in anatomy education (e.g., histology facilities). Furthermore, AEEMI was validated in Malaysia, and thus could be suitably applied in the local context. Furthermore, AEEMI has only 25 items, and therefore, rating errors imposed lengthy questionnaire could be minimised (13).

The AEEMI is a 25-item inventory that assesses medical students' attitude towards six factors of anatomy education: anatomy teachers, the importance of anatomy knowledge, anatomy subject, anatomy learning resources, students' effort to learn anatomy and the quality of histology learning facilities. The Delphi method was used to create the factors and items of AEEMI, which included nine anatomists and five medical educators (9). The inventory underwent a thorough validation process, and was found to have good content validity, response process validity and internal structure validity (14). The survey uses a 5-point Likert scale with the following options: strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, and strongly agree = 5. The mean score for each factor is divided into three categories: "area of concern" (score 1 to 2.99), "area for improvement" (score 3 to 3.99), and "positive area" (score 4 to 5). The outcome will be a representation of the standard of anatomy education environment in each institution, providing useful input for quality assurance and management (10).

This study aimed to measure medical students' perception of the anatomy education environment in Universiti Putra Malaysia (UPM) by using the AEEMI. Since the new intake of the first-year UPM medical student underwent a revised anatomy curriculum – a shift from four-semester to a compact three-semester curriculum with integration of the heavy musculoskeletal module in the first-semester, we compared the mean scores'

differences of the six factors in AEEMI between the first- and second-year medical students.

METHODS

A cross-sectional study took place at the Faculty of Medicine and Health Sciences, UPM between August 2020 and September 2020. All the first- and second-year UPM medical students, who were in the pre-clinical phase of their studies were included in the study. For subject recruitment, stratified random sampling was used, which included gathering a full list of student's names and stratification of the gender and year of study.

The approximate sample size was determined using a documented formula with consideration of adjustment of 10% non-response rate (11). This gave 171 respondents as a minimum sample size from first- to second-year medical students. About 177 medical students consented for this study. This study excluded medical students who were illiterate in English and had a weak internet connection.

The AEEMI was used in this study to assess students' perceptions of their anatomy education environment since March 2020, which was the beginning of the movement controlled order in Malaysia. Using the Google Forms, the inventory was distributed to all consenting students via official students' email. The first section of the inventory collected personal information of respondents (year of study), while the second section evaluates their perception of the anatomy education environment in the faculty, namely on anatomy teachers and instructors, anatomy knowledge, students' intrinsic interest in learning anatomy, anatomy learning resources, students' efforts on learning anatomy and histology practical facilities.

The collected data was analysed using SPSS version 25. The independent t-test assumption was tested before running the statistical test, and the level of significance (α) was set at 0.05 with a confidence interval of 95%. The Mann-Whitney test was used to measure the mean score differences of the six variables between the subgroups because the data was not normally distributed.

The UPM's Research Ethics Committee involving human subjects granted ethical approval for the report (JKEUPM 2020-236).

RESULTS

A total of 177 consenting respondents completed the inventory, thus giving a response rate of 100%. Statistical comparisons were made to investigate the differences of the scores between the first- and second-year respondents. Even though most of the items show "positive area" (score > 4), first-year medical students showed a significantly higher perception of the anatomy education environment in UPM as compared to second-year medical students ($p \leq 0.05$). However, both academic years perceived an "area of improvement" for histology practical facilities (score > 3 to 3.99). The results are illustrated in Figure 1.

DISCUSSION

This research examines how UPM's pre-clinical students perceived the anatomy education environment in the university. All factors of the anatomy education environment in UPM were positively viewed by the respondents, except the histology practical facilities, which may need further improvement, as shown by the analyses. Nevertheless, significant differences were observed between the first- and second- pre-clinical year respondents in five out of six factors of anatomy education environment.

In a study that assessed the learning atmosphere among first-year Malaysian medical students at Universiti Kebangsaan Malaysia, the majority of students had
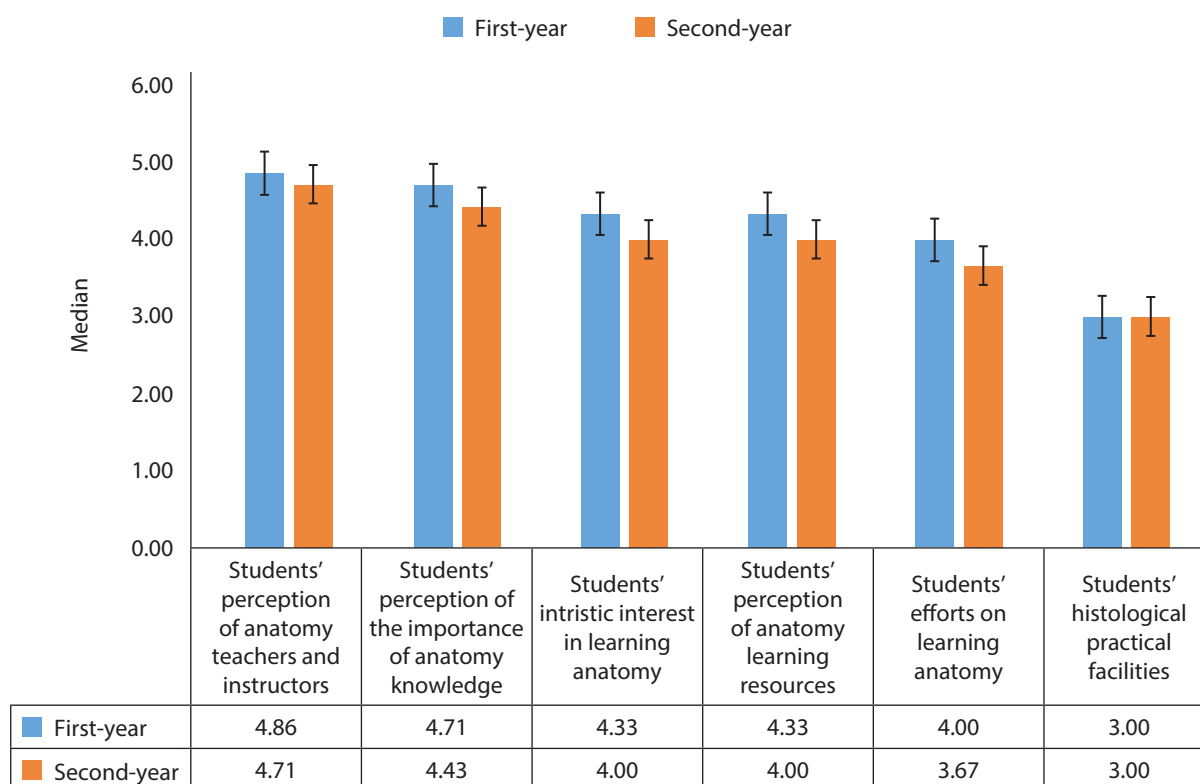
Figure 1: Comparison between pre-clinical medical students on their perception of anatomy education environment.

	Students' perception of anatomy teachers and instructors	Students' perception of the importance of anatomy knowledge	Students' intristic interest in learning anatomy	Students' perception of anatomy learning resources	Students' efforts on learning anatomy	Students' histological practical facilities
First-year	4.86	4.71	4.33	4.33	4.00	3.00
Second-year	4.71	4.43	4.00	4.00	3.67	3.00

positive perception of their educators, giving high scores to the DREEM items "teachers are competent" and "teachers are well-prepared for their teaching sessions" (12). However, another study found that second-year medical students were in disagreement with faculty members about the criteria of an excellent teacher, whereby the students perceived that teachers who provide comprehensive notes to the students were excellent teachers (15). Additionally, in the same study, faculty members believed that active learning sessions were more effective for learning. In contrary the second-year students' perceived passive learning methods such as lectures and self-study were more effective than active learning. Hence, it is evident from these two studies that there was a significant variation of how the first- and second-year medical students perceived their educators, as what was found in this present study. The students in both years have positive perceptions of their educators, however, the significant difference is most probably because the second-year

medical students are well-adapted to the learning environment of medical school, and therefore, they were less dependent on lecturers compared to the first-year medical students.

Students in both first- and second-year in this study acknowledged the importance of anatomy in their medical study. This is in line with a previous study that reported the medical students viewed anatomy as an integral part of their medical education before starting the course in their first year, after completing the course in their second year and even in their final year of medical school (13). The significant difference, however, may be due to how the students viewed the subject after more than one year of medical study. Furthermore, there was a less positive, albeit still positive, attitude of Cardiff student's post-completion of the anatomy course (13). According to the researchers, this could be because of the students gained a greater grasp and respect of the subject and did not regard it as

unrealistically as they had before the course began. Likewise, the same postulation could be applied in this study. The first-year medical students find the anatomy subject interesting as they are new to it, while the second-year medical students might not look at it as favourably because they have been introduced to other medical subjects such as pathology and clinical medicines. This, however, does not eliminate the fact that both years understand the importance of the subject itself.

Intrinsic interest is when people indulge themselves in an activity because they find it interesting and achieve satisfaction to learn and develop from the activity itself. A study assessed the relationship between academic motivation, grade expectations and academic performance over a two-year cycle in their research (16). Students with high grades who studied for long hours were extrinsically motivated and did better academically. Self-determination theory (SDT) is a theory that examines the relationship between extrinsic and intrinsic motivation in humans. The central principle of SDT is that if one's "world enables one to experience feelings of competence, autonomy, and relatedness, one's motivation toward a particular task will be optimal" (17). To sustain learning satisfaction, a combination of extrinsic and intrinsic motivation is needed, and it is a critical determinant of academic success. Motivation have been reported to be declining over time; the decline could be one of the factors for a significant difference in interest areas between the students. Students are more enthusiastic and have more desire and motivation to succeed during the early time; the desire and motivation might slowly decline as there are a lot of external factors that will influence them. Thus, it is important to implement teaching and learning strategies that prevent students from feeling demotivated. Students need to maintain their motivation as the medical study requires them to focus on study and do clinical workloads at the same time.

Nowadays, the method of learning anatomy has changed exponentially over the years as students have unlimited access to e-textbooks, lecture notes, anatomy software and apps that can be accessed from the internet. It should be recognised that no single method (i.e., lectures, dissection/prosected specimens, templates, technology, or living anatomy) can meet all of the teaching objectives, so a multimodal approach is recommended (14). For the first-year students, their curriculum has been designed differently and entirely new from the previous batch of students. As a result, the new students will be more appreciative, proactive and will extract every ounce of benefit from the various approaches in anatomy learning resources. Their approach on anatomy subjects is more comprehensive and detailed, hence they make full use of every anatomy learning resources available. The new curriculum requires them to have stronger memorisation, in-depth understanding and better comprehension to master the anatomy knowledge.

In addition, there was a significant difference in students' effort in learning anatomy. First-year students seem likely to put more effort than the second-year students in studying, particularly the anatomy subject. A study found that the significance of learning anatomy seemed to be detached among the junior students, who needed assessment as a motivation to study (18). Assessment as a learning motivator is well-known. Senior students expressed an interesting viewpoint, arguing that while tougher grading may have inspired them to study harder, it does not inherently result in improvement of knowledge retention. As for the second-year students, their effort in studying anatomy may have deteriorated as they do not appreciate anatomy as applied knowledge. Therefore, they might have failed to apply anatomy in other subjects like pathology and clinical medicines (18). It was postulated that the students had limited exposure to clinical applied

anatomy, and thus were motivated by exam factor. This postulation was based on the classification by Beatty and Feldman (19), who divided students into two categories: learning-oriented students who see the classroom as a place where they can discover ideas and knowledge that are important to them, and grade-oriented students who see the classroom as a place where they will be evaluated and assessed to obtain a certificate.

Furthermore, starting from March 2021, only online classes were permitted due to the COVID-19 pandemic. The student could not experience the actual learning environment in the laboratory, especially the histology laboratory adequately. In our study, most of the students answered "not sure" for item 8, which is "poor quality of histology slides". The ambiguous reason was most likely due to a lack of actual practical lessons. A study was conducted regarding students' perception of existing histology teaching methods (20). In this study, they found that 5.15% of the students reported of not being able to achieve better scores due to poor slide quality. Fortunately, second-year students were able to experience histology laboratory sessions adequately during their first year of study. However, some of them realised that there was a shortcoming during their histology sessions, such as poor histology slides resulting in them choosing "not sure" for the same item in the AEEMI. Hence, it is noteworthy to highlight the importance of virtual microscopy in histology teaching to overcome the problem of poor quality of histology slides especially during this COVID-19 pandemic. It was reported that the use of virtual microscopy as a learning tool have positively influenced students' perceived competence in learning histology (21).

The applicability of these results is restricted to the UPM education environment and cannot be extrapolated to other institutions. Since AEEMI is a validated inventory, the findings can be used to compare the anatomy education experience at different institutions if the same method is used (22).

LIMITATIONS

The present study is subject to several limitations. This study was a cross-sectional survey that measured the pre-clinical year students' perceptions of the anatomical education environment in UPM. Therefore, the results obtained from this study represent a snapshot of students' experience or perception at a given point in time. In addition, the result could be affected by recall bias as the students were required to provide ratings based on their past experience. Furthermore, the study was conducted during the COVID-19 pandemic whereby students have limited recent exposure to face-to-face anatomy session. Therefore, the input gained from this study may not be fully reflecting the actual learning environment as the students were learning through the online platform. To address these limitations, future measurement of anatomy education environment should be conducted in a longitudinal manner involving both clinical and pre-clinical year students. This effort would allow researchers and educators to obtain insightful data on the change of the anatomy education environment.

CONCLUSION

This study found that there was significant difference between UPM's pre-clinical medical students' (first- and second-year students) perception of their anatomy education environment. Overall, the students were pleased with the anatomy education environment in UPM, as almost all factors of the anatomy education environment were rated positively. The students' feedback indicates that the histology practical facilities at UPM require further improvement, as it is the only factor that has been designated as an "area for improvement".

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