

ORIGINAL ARTICLE

Distance Learning: Perceived Constraints Towards the New Norms in Learning Anatomy During COVID-19 Pandemic

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ABSTRACT

Introduction: The unprecedented COVID-19 pandemic has led to unavoidable new norms, including increasing demands for online learning. In view of the potential constraints to virtually learn anatomy among medical students, this study was conducted to identify the level of exposure towards online anatomy learning as well as the perceived constraints among medical students in a public university in Malaysia. **Methods:** A cross sectional study utilizing online survey was conducted during the movement control order (MCO) enforcement in Malaysia between March and October 2020 among all consented medical students at a public university in the Klang Valley area. The data was collected using a validated self-administered questionnaire which was distributed using Google Form application. **Results:** A total of 281 medical students consented and completed the online survey, with 94.3% students had low level of exposure towards online anatomy learning. Year of study and accessibility towards computing facilities and internet connection were significantly associated with online anatomy learning, with the non-clinical students are 19.9 (aOR= 19.888, B=2.990, 95%CI: 2.484-159.220) times more likely to have higher exposure towards online anatomy learning respectively. **Conclusion:** A very high proportion of medical students having low exposure towards online anatomy learning was observed in this study, which was predicted among the clinical students. Strengthening the utilization of online learning should be seriously considered in parallel with the new norms and the many uncertainties with COVID-19 pandemic, to ensure continuity of effective and quality learning.

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INTRODUCTION

Anatomy is commonly perceived as strenuous and exhausting subject in medical programme (1), but at the same time an important groundwork subject in medical education (2), in order to build a firm foundation in clinical years as well as for future professional practice (1). Knowledge on anatomy is needed for the students to better understand clinical presentations of certain illnesses and strengthened their future professional practices. Traditionally, anatomy teaching and learning involves gross dissections and individual memorization, which recently undergoing transformation into the utilization of three-dimensional (3D) stereoscopic virtual models (3).

The pressure in teaching anatomy during the COVID-19 pandemic does not only related to the new teaching and assessment approaches, limited contact hours compared to the massive scopes to cover, as well as limited resources, but also to ensure the continuity and quality of distant teaching and learning during the Movement Control Order (MCO). It requires anatomist to explore multimodal approach and implement innovative, but at the same time engaging and stimulating learning for students (4).

Numerous new strategies in teaching and learning anatomy have emerged over the last decade, particularly of technology-based, such as online teaching and learning that still maintaining interactive and student-centred learning, as well as more appealing to the general student body (5). Online learning refers to either the use of electronic technology or media to deliver, support, and enhance both learning and teaching (6), as well as employing distance self-learning, which is an

important aspect of adult education (7).

Innovative teaching through the employment of recent technology has led to a shift in the approach of learning and teaching from teacher-centred to a student-centred, which are more innovative but still interactive and effective (8). Apart from the commonly used computer-assisted learning and videos, other methods such as simulations, online interactive 3D images, group-based learning, case-based learning (CBL), flipped lectures and peer teaching have also been employed in teaching and learning to ensure not only active, engaging and deep learning process, but also effective retention and application of knowledge (9) among medical students.

Online teaching and learning have been utilized quite extensively in many developed countries, with nearly all medical schools in the USA and Canada employ online course materials in learning anatomy, physiology, pathology, and pharmacology in the recent years (10). Compared to the developed countries which may have widely exposed to online teaching and learning, the traditional teaching and learning approach is still dominant in many developing countries due to various challenges and constraints. However, with the recent unprecedented COVID-19 pandemic, increasing demands towards online teaching and learning have been observed, including in the medical education despite the major unpreparedness towards its utilization. In Malaysia, anatomy teaching and learning has been conducted mostly using the conventional method, involving lectures, dissections and tutorials.

However, urgent needs towards the implementation of online learning are not without challenges, with many barriers particularly in the developing countries have been reported, especially those residing in the rural localities with poor access, lack of information and communication technology (ICT) knowledge development (11) as well as lack of resources to purchase appropriate devices were very common. The potential barriers must be overcome appropriately to ensure the successful and effective implementation of online learning in these regions. This study aimed to determine the level of exposure and perceived constraints associated with online anatomy learning among medical students in a public university in Malaysia.

MATERIALS AND METHODS

A cross sectional study was conducted using an online survey, distributed via whatsapp and email among the medical students at a public university in Malaysia, located in the Klang Valley area. The study was conducted during the 1st implementation of Movement Control Order (MCO) in March 2020 until October 2020. The medical program at the selected public university involves integrating the anatomy subjects in each systemic module such as the reproductive

module, and anatomy of pelvis, with male and female gross anatomy will be taught. A total of eight systemic modules and one general anatomy module are being conducted throughout the preclinical years (Year 1 and Year 2) with subsequent continuous assessment will be conducted at the end of each module. During the MCO, all anatomy lectures are delivered virtually. Teaching materials were provided either synchronous or asynchronously depends on the students' and teachers' suitability. Discussions on the topics were conducted at the end of the lectures or through email. Meanwhile, the anatomy practical sessions were modified as semi-virtually. The lecturers were also allowed to record their live anatomy dissection demonstration and the video will be played virtually to the students. The use of pre-recording video was also conducted for the histology practical.

Universal sampling was employed with all medical students with current or past experience of learning anatomy at the selected institution were invited to participate. However, from a total of 505 medical students enrolled in the medical programme, 281 consented and completed the online survey, which were dominated by the non-clinical year students. Data was collected using a validated online self-administered questionnaire which was developed in English, consisted of 3 sections namely, a) Socio-demographic characteristics, b) Exposure towards online anatomy learning and c) The perceived barriers (access towards computing facilities and internet connection, inadequate practical learning, learning environment, time constraints). The questions on exposure towards online anatomy learning was adapted from a study by Clayton et al. (12), which was later categorized into low (< 5 hours) and high (\geq 5 hours). Meanwhile all components under the perceived barriers were measured with 5-point likert scale and further divided based on the median values.

Two panel experts were involved for content validity and face validity was conducted among 10 medical students from other institution, with no changes made to the proposed items in the questionnaire. Data analysis was performed by using SPSS Version 26. Variables were transformed into binary categorical data based on the mean or median values. Descriptive analysis was undertaken using frequencies and percentages. Chi-square test and multivariable logistic regression were conducted to measure the associations between dependent and independent variables. Level of significance was set at 0.05. Approval from the Ethic Committee for Research involving Human Subject of the Universiti Putra Malaysia and individual consent were obtained prior to data collection (ref. no: JKEUPM-2020-210).

RESULTS

Table I is showing the background characteristics of the

Table I: Characteristics of the respondents (N=281)

Factors	n (%)
Gender	
Male	83 (29.5)
Female	198 (70.5)
Ethnicity	
Malay	172 (61.2)
Chinese	52 (18.5)
Indian	48 (17.1)
Others	9 (3.2)
Year of study	
1	62 (22.1)
2	68 (24.2)
3	61 (21.7)
4	60 (21.4)
5	30(10.7)
Level of exposure towards virtual-based anatomy learning	
Low (< 5 hours)	265 (94.3)
High (≥ 5 hours)	16 (5.7)
Access towards computing facilities and internet connection [Median:8, IQR:3]	
Good (<8)	80 (28.5)
Poor (≥8)	201 (71.5)
Inadequate practical learning [Median:14, IQR:3]	
No (<14)	130 (46.1)
Yes (≥14)	151 (53.9)
Learning environment [Median:7, IQR:3]	
Conductive (<7)	143 (50.9)
Non-conductive (≥7)	138 (49.1)
Time constraint [Median:11, IQR:2]	
No (<11)	124 (44.1)
Yes (≥11)	157 (55.9)

medical students participated in this study. Majority of the respondents had low level of exposure toward online anatomy learning (94.3%), female (70.5%), Malay ethnic (61.2%), had poor access towards computing facilities and internet connection (71.5%), inadequate practical learning (53.9%) and time constraints (55.9%) were potential barriers towards online anatomy learning.

Meanwhile, the findings of the bivariate analysis are shown in Table II, with year of study ($p<0.001$) as well as the access towards computing facilities and internet connection ($p=0.049$) were the only two factors identified to significantly associated with online anatomy learning. Among the non-clinical medical students, 88.5% (115) were having low exposure towards virtual-based anatomy teaching and learning, compared to 99.3% (150) clinical students respectively. Meanwhile, among those with good access to computing facilities and internet connection, only 10% (8) students were reported having high virtual-based anatomy teaching and learning. In general, all medical students (pre-clinical and clinical years) had low exposure towards online anatomy learning.

The results of the multivariate analysis are shown in Table III, which was conducted to identify the determinants of online anatomy learning. Year of study ($p<0.001$) was

Table II: Challenges associated with virtual-based anatomy teaching and learning (N=281)

Factors	Virtual-based anatomy teaching & learning		X ² (df)	P
	Low n (%)	High n (%)		
Gender				
Male	80 (96.4)	3 (3.6)	0.949 (1)	0.330
Female	185 (93.4)	13 (6.6)		
Ethnicity				
Malay	159 (92.4)	13 (7.6)	2.870 (1)	0.090
Non-Malay	106 (97.2)	3 (2.8)		
Year of study				
Non-clinical	115 (88.5)	15 (11.5)	15.389 (1)	<0.001*
Clinical	150 (99.3)	1 (0.7)		
Accessibility (computing facilities & internet connection)				
Good	72 (90.0)	8 (10.0)	3.862 (1)	0.049*
Poor	193 (96.0)	8 (4.0)		
Lack of practical learning				
No	124 (96.1)	5 (3.9)	1.468 (1)	0.226
Yes	141 (92.8)	11 (7.2)		
Learning environment				
Conductive	82 (91.1)	8 (8.9)	2.517 (1)	0.113
Non-conductive	183 (95.8)	8 (4.2)		
Time constraint				
No	116 (94.3)	7 (5.7)	0.000 (1)	0.999
Yes	149 (94.3)	9 (5.7)		

*Significant at $p<0.05$

the only significant predicting factor determining online-based anatomy learning, with ethnicity ($p=0.052$) was almost significantly predict online anatomy learning among the medical students. Those in the pre-clinical year predicted to have 19.9 (aOR= 19.89, 95%CI: 2.48-159.22) odds of having high exposure towards online-based anatomy learning compared to the clinical year medical students.

DISCUSSION

The findings of this study indicate a low level of exposure towards online anatomy learning among the medical students participated in this study, with higher exposure is predicted among pre-clinical year medical students. Although, the results may have been influenced by the demographic distribution of the respondents, which were dominated by female and Malay ethnic medical students, previous studies reported controversial effect of gender (13) and ethnicity (14) on online learning outcomes. Compared to males, female students had stronger self-regulation, which contribute significantly more towards a positive or better online learning engagement than males (15). Nevertheless, the effect was only limited to engagement but not on learning outcomes (16). In contrast, a study conducted among university students in the United States revealed lack of satisfaction towards online education among the minority ethnic (14).

Online learning is considerably an important and demanding learning approach in the new norms and is unavoidable during the enforcement of MCO, requiring

Table III: Predicting factors for exposure towards virtual-based anatomy teaching and learning

Factors	B	SE	Wald	p	aOR	95% CI (B)	
						Lower	Upper
Constant	-6.841	1.357	25.408	.000	.001		
Access towards computing facilities & internet connection [Good] vs Poor	1.041	.568	3.356	.067	2.832	.930	8.627
Lack of practical learning [No] vs Yes	-.968	.613	2.492	.114	.380	.114	1.263
Learning environment [Conductive] vs Non-conductive	-1.001	.615	2.655	.103	2.722	.816	9.076
Time constraint [No] vs Yes	-0.478	.604	.625	.429	1.613	.493	5.272
Ethnicity [Malay] vs Non-Malay	-1.366	.702	3.785	.052	3.919	.990	15.518
Year of study [Non-clinical] vs Clinical	-2.990	1.061	7.938	.005*	19.888	2.484	159.220

*significant at $p < 0.05$, [] = ref. category, Cox & Snell $R^2 = .098$, Hosmer & Lemeshow Goodness of fit: $\chi^2 = 1.940$, $df = 8$, p -value = 0.983, Nagelkerke $R^2 = .277$

exclusive adoption of online teaching and learning to enable students to continue to learn remotely. Hence, its utilization together with online teaching should be strengthened with the many uncertainties associated with COVID-19 pandemic. The substantial impact of COVID-19 on medical education has caused an unparalleled challenge to deliver quality online education to students (17).

Many studies have been focusing on the extensive use of online teaching rather than learning before the COVID-19 era, which was reported highly effective to improve medical students' knowledge (18). Among others, increasing utilization of virtual 3D models (19) and the use of virtual reality (VR) in anatomy teaching and resident surgical training were observed (18). According to Dost et al. (20), online teaching has allowed approximately 19.6% international medical students in the UK, many of whom have returned home to access teaching regardless of location. However, a survey conducted among the medical students in the UK on their perception on online teaching demonstrated higher preference towards face-to-face teaching (20).

Although higher exposure is expected and predicted among the pre-clinical year medical students due to the nature of the teaching and learning using face to face lectures in classrooms, via a teacher-centred model (21), compared to the clinical years, which involve more practical sessions, the findings highlight the potentially lack and uncommon practice of online teaching and learning culture in general among medical students participated in this study during the earlier phase of the pandemic. Culture resistant particularly among staff was found to be a crucial barrier towards technology-based education (22), rather than students' engagement. There has been established evidence on the effectiveness of online teaching using blended learning during pre-clinical years, including in anatomical teaching and learning (23), more evidence is needed on the exclusive

and prolong use during the pandemic particularly among the clinical year medical students. A very wide range of 95% CI for year of study observed in this study, due to the imbalance proportion between those having low and high levels of exposure towards online anatomy learning, may have contributed towards the predicting role of year of study. The precision of data may have been affected by the tools used to measure the variables and the distributions of the respondents, particularly in relation to ethnic groups.

Numerous challenges and barriers associated with online teaching and learning in medical education have been reported, which include limited time, poor competency or technical skills, inadequate infrastructure to effectively conduct online teaching and learning, absence of institutional strategies and support as well as the negative attitudes (21,24,25) towards the new norms. In a related study conducted in Jordan concluded that, distant learning in medical education during the COVID-19 pandemic was mainly limited by inadequate technical and infrastructural resources (26), since distance learning was not considered as an educational modality at any Jordanian universities prior to the pandemic (24). Technical challenges, confidentiality and assessment issues, as well as reduced student engagement were among the reported weaknesses of online teaching causing its previously limited utilization (27). Some students possess the ability to work independently and coping well with online learning, while others who find comfort with easy access to professors and their fellow students may experience a sense of isolation. This can be very challenging in learning anatomy where dissection in human anatomy traditionally requires group work commitment. Furthermore, online learning exposes students to a frightening amount of time in front of screens, which can lead to all sorts of physical ailments like poor posture or headaches, as well as personal issue to students who struggle with learning from or focusing on screens. Additionally, the use of

pre-recorded materials is common in distant learning which known to reduce learning success (28) due to the limited opportunities to interact with lecturers (28).

Despite the reported challenges and barriers, online teaching and learning bring together many advantages. It is time and money saving to students from the lack of travelling, as well as enabling students to learn at their own pace (20). Online teaching and learning are more encouraging to certain students, due to the less intimidating environment online (29). Additionally, online class in general is more convenient particularly in reducing the burden related to lengthy commuting, has greater flexibility in choosing the best time to study, centre around the tremendous amount of savings for the learning institution, foster more interaction via a live, private chat with the instructor or lecturer, and unlock more learning opportunities caused by different time zone all over the world.

In view of the reported benefits, and the unavoidable needs to adopt online teaching exclusively during the pandemic, as well as the future demand towards virtual teaching and learning, addressing the potential barriers and weaknesses are crucial particularly in the low- and middle-income countries. The skills and competency of the staffs involved as well as institutional policy and support system should be improved through proper and periodic training on the various approaches of online teaching methods, and staffs' acknowledgement and incentives or award for the effort to develop and delivery of online content should also be considered to instil positive attitude, and indirectly overcome to key barriers to online teaching and learning (21).

According to Das and Al Mushaiqri (30), even in a non-pandemic setting and in the absence of cadavers, the utilization of online atlases is an excellent resource to learn gross anatomy. Additionally, the use of integrated multimodal and system-based approaches anatomy curriculum may limit cadaver usage, as well as induce better learning exposure for medical students (30). Although some of the tools used and the related infrastructure needed to assist online learning and teaching in medicine can be very costly, the long-term benefits are undoubtful, especially when dealing with unprecedented future lockdown situations. This study did have some limitations, such as the use of cross-sectional study design which limit the temporal effect and only slightly more than half of the medical students in the institution consented and participated in the survey.

CONCLUSION

The low exposure towards online learning among medical students in this study, despite its tremendous needs during the pandemic should be addressed seriously to ensure continuity of quality learning. The

low exposure may be due to the lack of readiness and its unprecedented longer utilization than expected during the pandemic. Year of study was the only significant factor predicting the exposure, with the non-clinical students had higher likelihood towards higher exposure as expected. To ensure a robust evidence-based on online learning in medical education, students, lecturers, and university perspectives on online teaching and learning should be accounted accordingly.

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