

Sudden Transition in Anatomy Education: Assessing the Perception of Anatomy Course Delivery among Medical Students during COVID-19 Pandemic

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Abstract

Coronavirus disease 2019 (COVID-19) pandemic has undoubtedly impacted anatomy education. This has led to a vast shift from a face to face (F2F) session to a complete online session and practical demonstration. Nonetheless, this pandemic provides an opportunity for anatomy educationists to embark on an alternative delivery of anatomy education via an online platform. The aim of this study was to evaluate the students' perception of the online teaching and learning in anatomy course delivery among the first-year medical students in Universiti Sains Islam Malaysia (USIM). A total

Manuscript Received Date: 31/12/20

Manuscript Acceptance Date: 30/06/21

Manuscript Published Date: 15/08/21

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doi: 10.33102/uij.vol33no3.360



Universiti Sains Islam Malaysia
<https://uijournal.usim.edu.my>

of 90 first-year medical students partook in an online questionnaire-based survey after semester completion of online anatomy course delivery. Synchronous online lectures conferred positive responses from the students with 73.0% of the students perceived effective communication with lecturers through the online platform. Out of these, 71.6% inclined towards online lectures as it allows them the flexibility to record the lecture and revisit it. Gross anatomy practical sessions were executed asynchronously via pre-recorded video with an additional supplementary quiz on USIM's Global Open Access Learning system (GOALS) while histology practical was executed synchronously via virtual slide demonstration. A total of 80.1% students felt convenient with histology practical, however, only 48.3% students responded positively to the gross practical. Overall, 76.4% students favoured the conventional practical compared to the online sessions. Meanwhile, an online examination had disputable responses between the different exam formats whereby 71.9% students perceived that Multiple Choice Questions (MCQ) were conducted conveniently contradictory to the Modified Essay Questions (MEQ) in which only 34.9% students responded positively. In addition, 57.3% students disclosed multiple setbacks during the Objective Structures Practical Exam (OSPE). The extensive and impromptu changes in the study technique have received multiple responses from the students. Overall, the students preferred an online platform for didactic sessions but a real live classroom for practical sessions.

Keywords: COVID-19, gross anatomy, online learning, anatomy education, histology

1. Introduction

The year 2020 witnessed an abrupt change in medical education resulting from the rampant spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that was initially identified in Wuhan, China. The Malaysian National Security Council issued a movement control order (MCO) that directed immediate cessation of all activities beginning March 2020 to contain the spread of the virus. These included immediate closure of higher institutions and direct cessation of all teaching and learning activities, which have affected most medical schools in Malaysia.

Anatomy education has been long regarded as the fundamental basis of medical sciences in which future physicians gain basic knowledge not only on the structure of the human body but also in psychosocial areas. This is a critical element to prepare them for their future clinical years and throughout their practising years (Rizzolo, 2002; Saverino, 2020; Jacob, 2013). Before the pandemic, the delivery of the anatomy curriculum has longed faced several challenges. The main challenges are the limitations in obtaining gross cadaver specimens that include cost, storage, viability, reduced number of specimens, ethical and religious issues as well as the number of academic staff (Cheng et al., 2020; Guimarães et al., 2017; Jacob, 2013). Therefore, determined to cater to these challenges, there has been a paradigm shift in the past decades with innovation and invention to aid anatomy teaching and learning. Advancement of technology and database has initiated the higher institution as well as the private bodies to develop a variety of virtual learning programs such as virtual lab (VL) (Štrkalj et al., 2020), virtual dissector (VD) (Darras et al., 2019), and augmented reality (AR) (Aebersold et al., 2018; Zilverschoon et al., 2017) that has been described to potentially aid in the traditional hands-on cadaver dissection practicals (Štrkalj et al., 2020). Moreover, various educational contents from anatomy experts worldwide that are readily available online also have contributed towards the shift in anatomy teaching and learning (Jain et al., 2017).

Although the use of these technologies is being applied in several medical schools over the years, however, it does not completely replace conventional anatomy teaching. During MCO, the traditional didactic face to face (F2F) lectures and practical sessions are no longer feasible. Anatomy educationists were forced to conduct comprehensive online teaching and this has presented as an opportunity to make use of the recent technological innovations and various online platforms. Nonetheless, the traditional curriculum still precedes its credibility (Green et al., 2018). Hence, it is important to assess the student’s perception that partakes in this process in order to understand the effectiveness of the online anatomy course delivery.

2. Methodology

Demographic population

A total of 90 first-year medical students in their second semester of the preclinical course in Universiti Sains Islam Malaysia (USIM) participated in this study. All students enrolled in the anatomy course were included in this study. No exclusion criteria were considered as the course is mandatory.

Delivery of online anatomy course

Prior to the implementation of MCO, USIM’s academic staff were forced to work from home and students were forced to head back to their hometown during the first half of their second semester. During the first few months, academic staff were trained to prepare teaching and learning delivery via an online platform. Meanwhile, students were exposed to a variety of online teaching and learning platforms provided by the university. The use of the Global Open Access Learning System (GOALS) was coherently emphasised by the university. GOALS is the official USIM’s e-learning platform that enables interactive online engagements between students and lecturers. This platform enables various functions such as quizzes, assignments, forums, discussions, online video streams, and others. After several months, online teaching and learning were implemented and teaching and learning activities resumed for the rest of the semester via an online platform. Anatomists from USIM decided to conduct a synchronous lecture delivery via the Microsoft teams (MS Teams) platform. Team based learning (TBL) was delivered asynchronously using GOALS developed by USIM. Meanwhile, practical sessions for histology were conducted using an online slide bank through synchronous demonstration. Gross practical sessions, on the other hand, were conducted asynchronously via pre-recorded demonstration video by USIM anatomists and supported with a supplementary enhancement quiz on GOALS. Students were assessed through end semester examinations that are fully conducted online through the GOALS platform supervised by anatomist lecturers and technical staff. Their examination was prepared via standardised learning outcome-oriented and stratified according to Bloom’s Taxonomy blueprints. The exam questions were vetted at the unit and faculty level as per standard. Their answer scripts were marked and revised accordingly to the standard setting.

Study Design

The objectives of this study were explained to each student via official students’ group. An online questionnaire was designed and shared with the students. The students’ perception was assessed after more than 3 months of online anatomy teaching and learning process. The answers were

completely anonymous. Data were collected and analysed using SPSS 20.0 (SPSS Inc. Chicago, IL, USA). The demographic data were analysed using a descriptive statistical analysis whereas paired sample t-test was used to assess the relationship between the demographic data and the students' perception of their online teaching and learning experience.

3. Results

Demographic characteristics of the participants

All 90 first-year medical students completed the online questionnaire. Students that enrolled in this course have a mean age between ≥ 19 to < 21 years old. The demographic data as shown in Figure 1 indicated that the first-year medical students who participated in this study were distributed throughout West and Peninsular Malaysia. Majority of the students (23.4%) are located in Malaysia's main capital of Selangor and Wilayah Persekutuan Kuala Lumpur. These numbers were then followed by Kelantan (18.9%), Terengganu (13.3%), Kedah (10.0%), and Perak (10.0%). Meanwhile, students residing in other states such as Johor, Melaka, Sabah, Negeri Sembilan, and Pahang are less than 10.0%. Based on their geographical variation, 13.0% declared that they have an excellent internet connection while the majority of the students (62.0%) indicated having good internet connection (Figure 2). Poor internet connection was experienced by 1% of the students' cohort.

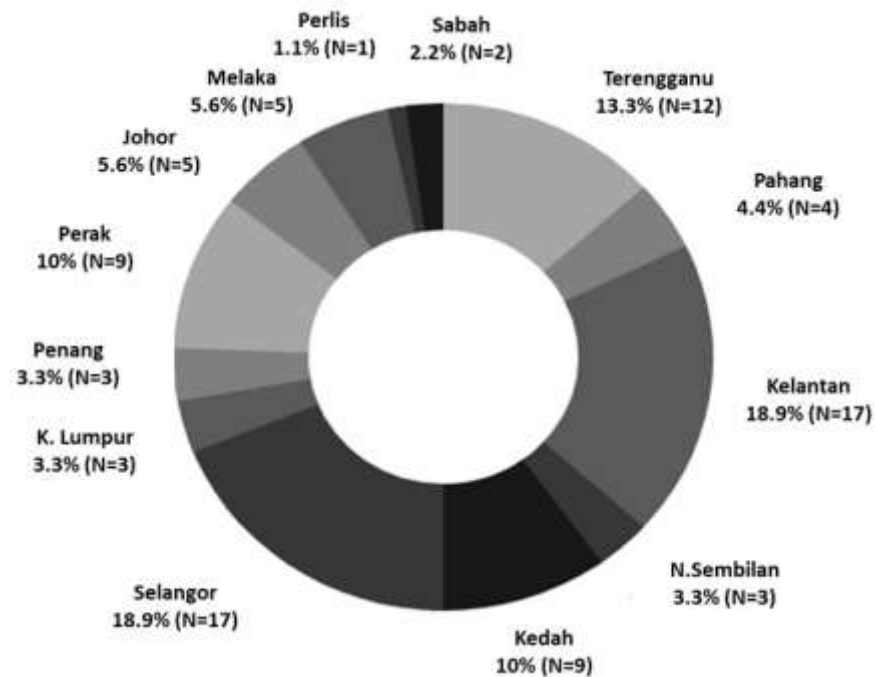


Figure 1: Distribution of hometown among USIM first-year medical students (N=90)

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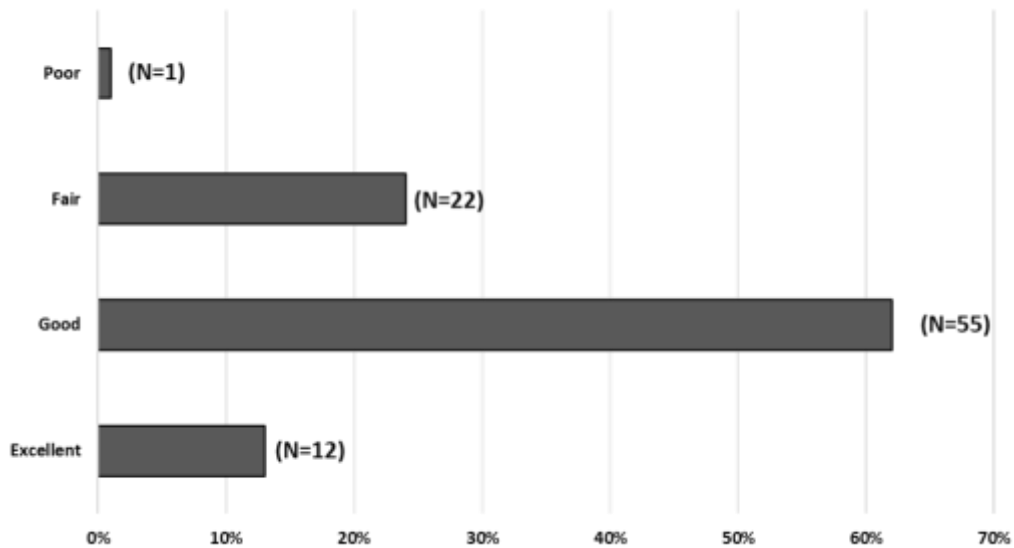


Figure 2: Strength of internet connection among USIM first-year medical students (N=90)

Overall online teaching and learning delivery

The data showed that there is a significant association ($P < 0.001$) between USIM's first-year medical students' perception of online delivery of anatomy courses and the level of their internet connection (Table 1). Figure 3 summarises USIM's first-year medical students' perception of the delivery of online anatomy course teaching and learning.

Synchronous online lectures received positive feedbacks from the students whereby 73.0% of the students perceived effective communication with lecturers through online platforms. However, out of these, a total of 47.7% students indicated a neutral reaction when asked about their understanding of lectures during online delivery compared to the physical class. They also have a neutral reaction (49.4%) when asked about their opinion on the understanding of the topic during physical class compared to the online session. Surprisingly, 71.6% prefer online lectures as it allows them to record the lecture and to revisit the recording in the future. In regard to the online practical session, a total of 80.1% students felt convenient with histology practical, however, only 48.3% students reacted positively while 31.5% had a neutral reaction on their understanding using online gross practical delivery. Overall, 76.4% students preferred F2F practical compared to the online sessions and only 2.2% disagreed with this statement.

Table 1: The association between the strength of internet connection and USIM's first-year medical students (N=90) perception in anatomy teaching and learning delivery

N=90	Students Perception	Mean	Standard deviation (SD)	P value
Strength of internet connection	<i>Lecture</i>	-2.22222	.95726	<0.001
	<i>Gross Practical</i>	-1.15556	1.44495	<0.001
	<i>Histology Practical</i>	-1.56667	1.28998	<0.001
	<i>TBL</i>	-1.51111	1.19215	<0.001
	<i>End semester examination</i>	-2.27778	.93650	<0.001

Majority of the students (70.8%), found that the use of the USIM GOALS platform is an effective platform to conduct TBL sessions. About 62.9% students felt that asynchronous delivery of TBL does not disrupt their understanding. However, a significant number of students (29.2%) still have mixed feelings about the method of TBL delivery.

Examination to assess students' performance was carried out online for the first time. Students' perception was assessed with regards to a different examination format. A total of 71.9% students felt that MCQ was conducted conveniently and encountered no problem during the examination. Majority of the students (78.7%) agreed that they have no problem understanding the questions and the examination format. However, 6.8% of the students experienced setbacks from the MCQ examination. These results were contradictory to the MEQ in which only 34.9% students react positively to the exam convenience. Even though they felt that MEQ is not conveniently conducted online, majority of the students (78.7%) have no problem understanding the exam questions and format. Meanwhile, 57.3% students reported multiple setbacks during the OSPE. Overall, more than 80.0% of the students felt that they have no problem accessing the examination paper on GOALS and to be punctual to sit for the examination as scheduled. Lastly, majority (89.9%) of the students reported no difficulties in accessing materials such as lecture notes, TBL questions, and activities in GOALS. A group of 74.1% students expressed their hope that more material could be provided to them during the period of online teaching and learning.

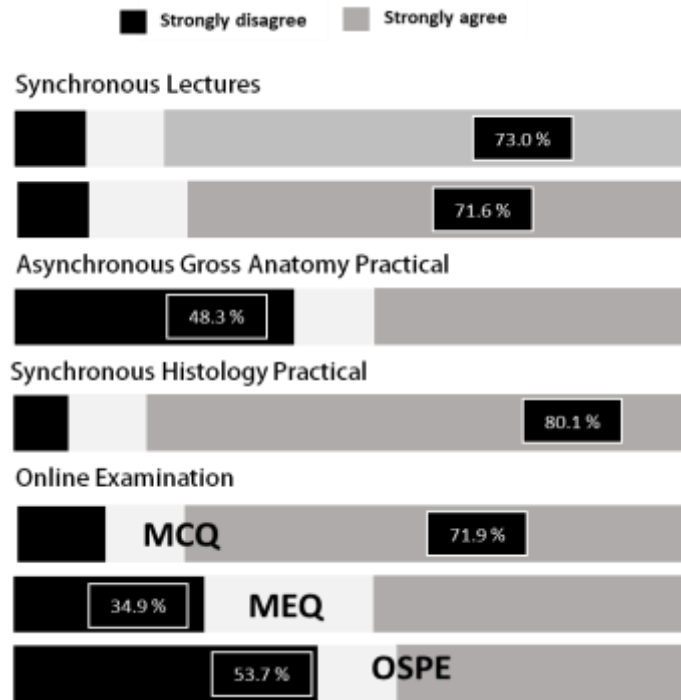


Figure 3: Summary of USIM's first-year medical students' perception on the delivery of online anatomy course teaching and learning

Study environment among the USIM's first-year medical students during MCO

Table 2 shows the students' perceptions of their study environment during MCO. A total of 65.9% students agreed that the MCO period gave them more time to study whereas 23.6% students stated that MCO affected them emotionally and mentally. 25.8% students indicated that they did not have a conducive environment to study at home during MCO. Students have contemplating responses when it came to their ability to study at home during the MCO period. An open-ended question was asked at the end of the questionnaire on their general feedback towards their learning experience throughout the MCO period. Students had a positive experience in terms of “saving time from travelling” to the faculty daily. This has resulted in what they perceived as having “more study time”. However, there are students who experienced negative outcomes throughout their online learning experience. Some of them had a “poor learning environment at home” along with “poor internet connection” and “having a lot of distractions from their family members”. In addition, others have mentioned “needing to be more focused and disciplined during online classes” as they felt distracted while learning from home.

Table 2: Student learning environment during MCO period among the USIM'S first-year medical students

	(N=90) %
MCO did not affect my study ability	31.4%
MCO gave me more time to study	65.9%
MCO has affected me emotionally	43.8%
I had a conducive environment at home during MCO to continue with my study	39.4%

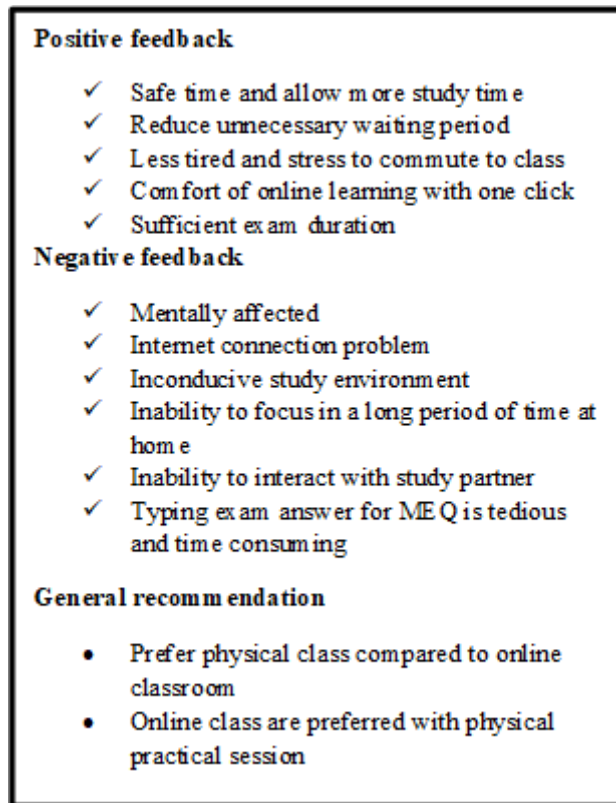


Figure 4: Summary of additional predisposing factors that affected online learning during the MCO period among the USIMs first-year medical students

Following that, there are a number of students who mentioned how this pandemic and MCO have affected their mental health. One student mentioned "feeling missing out that triggered anxiety" and some others expressed that they are "missing their friends to learn together". Overall, majority of the students felt they were able to adapt to the online lectures. A summary of the students' feedback is shown in Figure 4.

4. Discussion

During the first few months of MCO, academic staff are extensively trained and educated to cater to a full verse of online teaching. Various online platforms such as MS Teams, Zoom, and Google Meet were introduced for the purpose of teaching delivery. Additionally, USIM's main online blended learning platform, GOALS was used as the main medium to share lecture notes and to conduct asynchronous teaching activities. The students' feedback is a powerful tool to assess their opinion concerning the content and the delivery of the online anatomy classes. This study aims to attain student's perception regarding the delivery of online anatomical education and to gather the various problems during this learning process.

Forced online teaching and learning presented as an opportunity for anatomist

Anatomy education aims are to provide future doctors with basic knowledge and skills to prepare them for the actual patient-doctor situation. Overall, the abrupt shift in the anatomy course delivery is becoming a predisposing issue to deliver a quality anatomy education to medical students. However, these setbacks also presented as an opportunity for the anatomist to incorporate recent innovations that have longed aid in the delivery of anatomy education worldwide. Integrated anatomy learning by utilising virtual reality (VR) technology through interactive visualisation, model manipulation and information has been shown to fulfil similar learning objectives and outcomes (McMenamin et al., 2018). A study on VR anatomy resources developed at the University of Dundee reported overall positive feedback on the use of VR technology for anatomy learning. Participants that participated in the study reported a better understanding of the anatomical structure. Moreover, the ability to manipulate the anatomical orientation of VR specimens also aided in their learning (Falah et al., 2014). Apart from computed VR technology, an interactive augmented reality (AR) system that behaves as a mirror image allowing in-situ visualisation of anatomy on the user's body. Study has demonstrated high anatomy precision ratio of the AR overlays on the user's body (Erolin et al., 2019; Ma et al., 2016). Presently, there are several universities in other parts of the world that have fully utilised this technology replacing the conventional cadaver (Green et al., 2018).

Despite its promising potential, analysis of technology assisted anatomy learning have indicated that the aftermath of learning anatomy with technology visualisation did not always allow a significant improvement of actual anatomical knowledge and appreciation of anatomical structure (Henssen et al., 2020). This input was coherent with an earlier study that reported technology-based learning methods are not always superior compared to the classic teaching methods (Yamine & Violato, 2015). Other approaches such as using virtual human (VH) dissector were said to offer more flexibility than the cadaver in the dissection hall. The use of a 3D printed anatomy model and body painting was also one of the popular methods to deliver anatomy education (Johnson et al., 2012; Aka et al., 2018). Nevertheless, not all methods are applicable to be used in online teaching.

These technologies and methods are highly beneficial to the students and anatomists as an add-on educational tool. During this period, it is crucial for the anatomist to take this opportunity and apply these tools in their teaching pedagogy.

Association between internet connection and students' perceptions in anatomy teaching and learning delivery

Prior to implementing the delivery of a fully online course, USIM has conducted an extensive survey pertaining to the students' accessibility to the online teaching and learning pedagogy. The main identified issues were mainly regarding students' internet connection that includes speed, stability, and internet quota. This study shows that there was a significant association between the strength of internet connection among the first-year medical students and their perception of the online anatomy teaching and learning delivery. The speed of the internet connection does not only limit the students' ability to attend online classes but also can limit their access to the learning materials and class activities and eventually disrupt their understanding of a particular topic.

Majority of the students that were not associated with internet problems perceived positively to the online anatomy lectures, practicals, TBL, and examinations. They also agreed that effective two-way communication between the lecturers and students were achieved similar to what they had in a physical class. Interestingly, majority of the students favours online lectures as it allowed them to revisit the lectures from time to time to increase their understanding of the topic. Repetitive audio and visualisation help to increase their understanding during study (Jones, 2019). As an effort from the Malaysian government to support the education system and ease students in their online learning, students were given free one gigabyte (GB) internet quota data per day. Moreover, several universities in Malaysia took an initiative to provide their students with financial aids to help them acquire access to the internet (Vaughan, 2014). Despite all the efforts, the issues did not entirely resolve as there are still a minority of the students who mainly experience this difficulty due to their remote location.

Anatomy topics require extensive understanding in order to properly relate the structure and function of the human body with its clinical correlation (Jacob, 2013). Continuous and prolonged disappointment due to instability of the internet connection may emotionally affect the student's interest in the anatomy course. This is more pronounced in students with other predisposing factors (Bernama, August 2020).

Favouritism and underlying benefits of traditional gross anatomy hands-on practical session versus online practical.

The closure of medical schools and state borders limit the anatomist and medical students' access to a cadaver and anatomy specimens. Hence, the traditional hands-on cadaveric practicum was not an option during the pandemic. USIM anatomists utilised pre-recorded cadaveric demonstration videos to conduct an asynchronous online practical throughout the rest of the semester during the MCO period. To ensure students understanding, supplementary questions and case studies were given to the students.

It has been reported that the most ideal anatomy delivery is by applying factual contents and enhancing it with hands on dissection or prosection practical (Cheng et al., 2020). Despite the positive reaction by majority of the students on the online gross anatomy practical delivery, most students preferred to have a traditional dissection practical for gross anatomy. However, the results indicated that the students have accepted to remain with the online synchronous lecture delivery. During the pandemic, restricted access to the anatomy facilities leaves the USIM anatomists in a difficult position to help enhance students' hands-on knowledge. However, throughout the online learning period, supplementary practical demonstration videos that are very similar to what they would have experienced in a live physical demonstration were given. A study by Lackey-Cornelison indicated that these virtual demonstrations are adequate to replace the actual physical classes (Hamza et al., 2020). These are also supported by a study that reported that online anatomy practical allows similar understanding of the anatomical structure compared to a physical practical (Štrkalj et al., 2020). Finally, the use of additional educational tools has enabled an easier integration of anatomical knowledge via online practical (Falah et al., 2014). Nevertheless, modern online anatomy practical is still perceived as not being able to replace the traditional practical session (Lackey-Cornelison et al, 2020). Hence, the best way to teach modern anatomy is by combining multiple pedagogical resources to complement one another (Joseph & Singh, 2019).

Online examination as permanent assessment tools in anatomy

This study stipulated that the students perceived the use of GOALS as a platform to conduct the online exam as convenient and easily accessible. However, due to different course outline measured, different format of examination was implemented in order to best assess the students' knowledge and skills. Anatomy examination employed MCQ and written MEQ examination to assess the students' knowledge. Meanwhile, the OSPE examination was utilised to assess the student's comprehension knowledge of the actual anatomical structure. Before the pandemic, OSPE was commonly conducted in the dissection hall using a cadaver specimen. The use of OSPE has long proclaimed as an effective assessment tool in anatomy education (Estai et a., 2016).

Implementing different examination format online pose various challenges to the anatomist particularly in executing OSPE examination. This study indicated that majority of the students felt that MCQ was conveniently conducted online and reported no setback during the MCQ examination. Meanwhile, fewer students favour the online MEQ examination. Although students do not perceive online MEQ as a major setback, however, the process of typing the answers can be tedious and bothersome compared to an actual written physical exam. Lastly, the results indicated that majority of the students do not favour the online OSPE examination. This is due to the student's inability to appreciate and orientate the actual specimen in the online OSPE examination.

Overall, MCQ was presumed as the most convenient exam format to be conducted online and possibly can be retained as an online examination in the future. Meanwhile, the execution of the online MEQ examination for the long term will require more prerequisite planning. Most importantly, the online OSPE examination appeared as merely temporary and should be reverted to its original hands-on format. The use of OSPE in assessing students' competence, knowledge, and their application in anatomy is best to be conducted using an actual specimen (Roy et al., 2020).

Predisposing factors that dictate the students' learning environment

In this study, we also evaluated the students' perception of MCO implementation and their learning environment. Almost more than half of the students agreed that learning during the MCO period allowed them to have more time to study. Students also mentioned that they were able to save more time on getting ready and commute daily to the class. These eventually helped them to channel their excess energy to focus on their study. Despite the positive perception of MCO implementation, some students indicated that they do not have a conducive study environment at home. Some of them also perceived that studying at home during the MCO period affected them mentally and emotionally. A study has shown that various factors dictate students' learning abilities at their homes, which included family members, home chores, inadequate personal space at home, and family pressure that eventually may trigger unhealthy mental state (Bhat & Pushpalatha Muruges, 2020). Prolonged isolation and being trapped at home also posed a negative mental effect (Hamza et al., 2020). Therefore, all of these factors need to be considered and the methods of course delivery need to be tailored accordingly should online teachings were to be extended.

5. Conclusion

Anatomists in USIM have learnt a great lesson resulting from the impromptu transformation of F2F teachings to a full online assisted technology teaching pedagogy in anatomy course delivery. In general, students are very keen on the online teaching process and perceived an overall positive response. Nonetheless, due to the complexity of the components in the anatomy course, some aspects of the course delivery is worth to be improved. This pandemic creates a timely opportunity for both academics and students to begin familiarising themselves with the recent technology-driven teaching tools. Additional planning, training in executing the online delivery of anatomy courses are crucial in designing the best teaching and learning methods to achieve the general learning outcome of the course.

6. Acknowledgement

The authors would like to express their gratitude to all USIM anatomy lecturers and staff who were involved in the delivery of anatomy teaching and learning.

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