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Perception of Online Anatomy Education by Medical and Dental Students at a Malaysian University: Post-COVID-19 Impact

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Abstract

Introduction The COVID-19 pandemic precipitated an unprecedented shift in medical education, particularly in anatomy instruction where traditional hands-on learning was suddenly replaced by virtual methods. As educational institutions transition into the post-acute phase of the pandemic, understanding students' experiences and preferences regarding online anatomy education becomes crucial for developing effective teaching strategies. This study investigated medical and dental students' perceptions of anatomy education in the post-pandemic context, with particular emphasis on the continued utilization of online learning methodologies. **Methodology:** A cross-sectional study was conducted through an online questionnaire distributed to medical and dental students. The study sample comprised 128 participants, and data collection occurred between February and July 2022. The survey employed a 5-point Likert scale to evaluate various aspects of anatomy education, including the effectiveness of online teaching methods, virtual tools, and student engagement. The questionnaire assessed students' experiences with online anatomy classes, communication effectiveness, utility of virtual anatomy tools, and preferences for learning modalities. **Results**: The study revealed mixed perceptions regarding online anatomy education. Only 5.6% of participants strongly endorsed the enjoyability of online anatomy classes, while 29.7% expressed dissatisfaction. Communication effectiveness in online settings showed moderate acceptance, with 27.3% of students agreeing it was effective, contrasted by 19.5% who disagreed. Virtual anatomy tools received more favorable responses, with 42.4% finding cyber anatomy beneficial and 51.2% appreciating histology applications. However, concentration difficulties during online sessions were reported by 68.8% of students. A significant majority (71.2%) advocated for supplementing online classes with face-to-face practical sessions. **Conclusion:** The findings highlight ongoing challenges in online anatomy education despite institutional adaptations to post-acute pandemic conditions. While virtual tools demonstrate some utility in anatomy education, significant barriers to student engagement persist in online environments. The strong student preference for supplementary face-to-face sessions suggests the necessity of hybrid educational models. These results indicate that future anatomy education should integrate both digital and traditional teaching methods, leveraging the advantages of virtual tools while maintaining crucial hands-on learning experiences. This study's findings can guide educational institutions in developing more effective and student-centered anatomy education programs in the post-pandemic era.

Key Words: COVID-19, Anatomy, Medical Education, Education

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Introduction

Anatomy education is essential in medical and dental curricula, providing students with critical knowledge of human structure for clinical practice [1]. Traditional anatomy education includes lectures,

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cadaver dissections, and practical laboratory sessions, focusing on hands-on learning and direct interaction between students and educators [2].

The integration of technology in anatomy education has been evolving, with virtual anatomy tools and 3D modeling software increasingly adopted even before the COVID-19 pandemic [3,4]. These digital resources have offered new ways to visualize and interact with anatomical structures, complementing traditional teaching methods [5].

The COVID-19 pandemic precipitated an unprecedented shift to online learning modalities in medical and dental education worldwide [6]. This rapid transition posed unique challenges for anatomy education, which traditionally relies heavily on hands-on experiences. Longhurst et al. [6] reported that while online anatomy education offered increased flexibility, students often struggled with the lack of hands-on experience. Similarly, Pather et al. [7] highlighted the difficulties in replicating the tactile aspects of anatomy learning in a virtual setting.

In the context of South Korea, Kim et al. [8] noted mixed responses from medical students regarding online anatomy education, with concerns about the depth of learning achieved through virtual methods. This aligns with broader trends observed in Asian medical schools, where the culture of hands-on learning and direct mentor-student interaction is deeply ingrained [9].

As we transition into the post-acute phase of the pandemic, it is crucial to assess the lasting impacts of these changes on anatomy education [9]. The challenge lies in determining how to effectively integrate online learning components with traditional hands-on methods to ensure comprehensive and engaging anatomy education for medical and dental students [10,11].

This study explores medical and dental students' perceptions of online anatomy education at Manipal University College Malaysia in the post-COVID-19 phase. It aims to provide insights into the future of anatomy education by examining students' perceptions, challenges, and preferences [12].

Methodology
A cross-sectional study using a questionnaire-based survey approach was conducted to capture students' perceptions of anatomy education during the COVID-19 pandemic. The study involved 2nd to 5th-year medical students and 2nd to 4th-year dental students who had experience with online anatomy education during the pandemic. The study used convenience sampling and invited eligible students via email after obtaining informed consent. The study protocol was approved by the Institutional Review Board of MUCM, ensuring participant anonymity throughout the process. The IRB Reference number: FOM/Research Ethics Committee – 3/2022.

Sample Size Calculation:
The sample size calculation was conducted to ensure adequately powered to detect a meaningful effect. The sample size was calculated using the following formula.The total population of medical and dental students was 400.
Formula: $n = [N * z^2 * p * (1-p)] / [d^2 * (N-1) + z^2 * p * (1-p)]$
Total population size (N) = 400
The sample size was calculated to be 197 at a 95% confidence interval and a 5% error rate. The minimum target was set at 30%, which represented 59 students. This study collected data from 128 medical and dental students, which exceeded the minimum target.

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2. Data Collection

A structured questionnaire was developed based on a comprehensive review of the literature on online anatomy education in studies conducted during and after the COVID-19 pandemic [8].

The content and validity were reviewed by a panel of experts, and face validity was assessed through cognitive interviews. A pilot study was conducted with 30 MBBS and BDS students who were not part of the final study sample. Internal consistency reliability was assessed using Cronbach's alpha. The Cronbach's Alpha Calculation: $\alpha = 0.827$

The questionnaire consisted of 15 Likert-scale items:
1) Strongly Disagree (1)
2) Disagree (2)
3) Neutral (3)
4) Agree (4)
5) Strongly Agree (5)
6) Future preferences (6)

The questionnaire covered six main dimensions:
1) Engagement and Enjoyment
2) Communication Effectiveness
3) Technical Aspects of Online Learning
4) Social Interaction
5) Challenges

The validated questionnaire was digitized and distributed via Google Forms. Data collection occurred over six months from February to July 2022. Informed consent was obtained from all participants at the beginning of the survey. The study protocol, including the final questionnaire, was approved by the Institutional Review Board of Manipal University College Malaysia.

Data Analysis

Descriptive statistics were used to analyze the data. Frequencies and percentages were calculated for each Likert-scale item. An inferential statistical analysis was conducted using Chi-square tests to compare responses between medical and dental students. A significant difference was found in the preference for face-to-face practical sessions ($\chi^2(4) = 9.87$, $p = 0.043$), with dental students showing a stronger preference.

Results

The data analysis revealed students' responses as percentages using a Likert scale from strongly agree to strongly disagree. There are 128 responses, grouped to clarify trends in student feedback

Perceptions of Online Anatomy Lectures:
1. Enjoyment and Engagement:
This study found that 15.6% and 14.8% of students expressed their opinion as strongly agreeing and agreed, respectively, that online anatomy classes are enjoyable whereas 29.7% disagreed with online anatomy classes (Fig. 1).
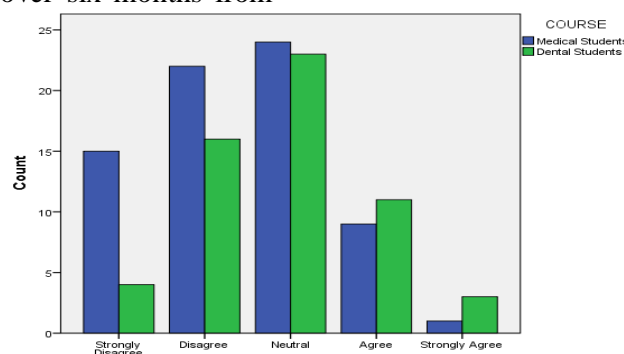

Figure 1: Students' experience in engaging with online anatomy classes

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2. Effectiveness of Communication:
In this study, 27.3% of students agreed and 3.1% of students strongly agreed on the presence of effective communication,

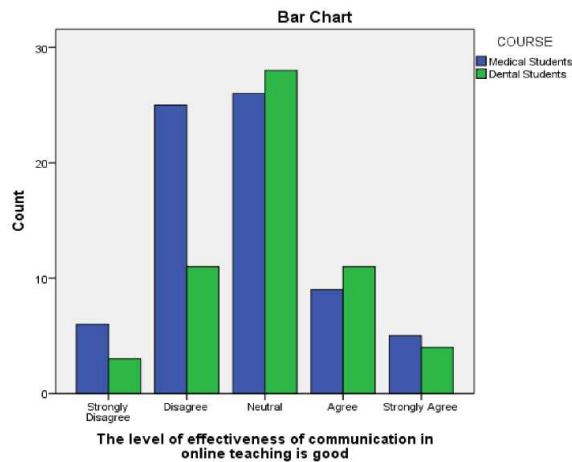whereas 19.5% and 6.3% of students agreed and strongly disagreed, respectively (Fig. 2).

Figure 2: Students' experience with the effectiveness of communication in online teaching

3. Technical Aspects of Online Learning:

a. **Accessibility:**
 In the survey, 42.2% of students agreed and 15.6% strongly agreed that using

Microsoft Teams made accessing classes and lectures easier. Conversely, 8.6% disagreed and 3.9% strongly disagreed. 29.7% had a neutral opinion on the accessibility of teaching materials.
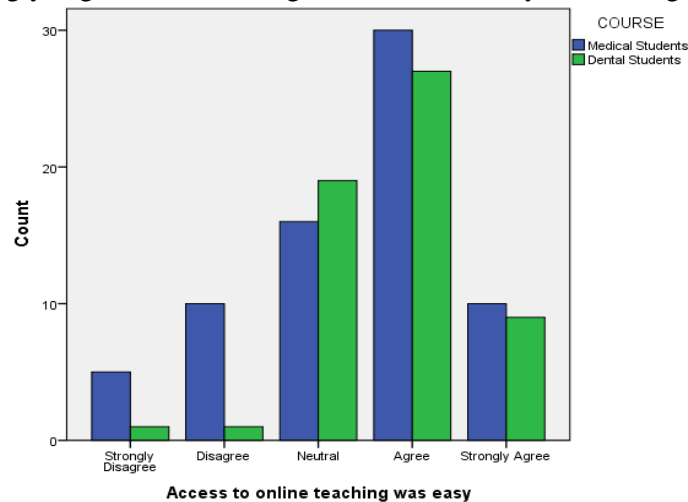

Figure 3: Student response on the overall access to online teaching

b. **The Teaching Material was Clear and Understandable:**
 34.4% of students agreed, and 6.3% strongly agreed that the teaching material

was understandable in online teaching. In contrast, 22.7% of students disagreed, and 3.9% strongly disagreed (Figure 4).
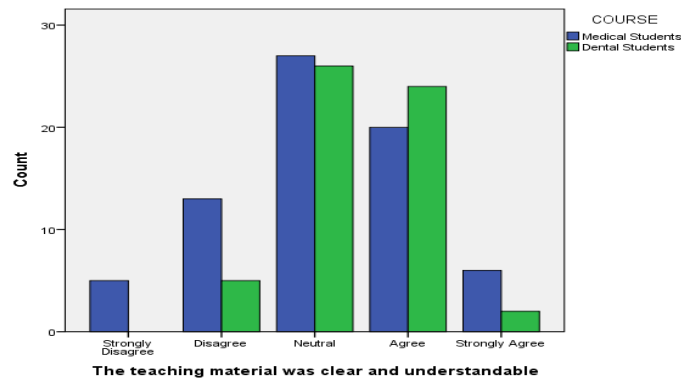
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Figure 4: Students' response to the quality of teaching material used in online teaching

c. Effectiveness of Virtual Tools:

21.9% of students agree and 9.4% of students strongly agree that the usage of virtual tools makes the learning of gross anatomy much easier, whereas 19.3% of students disagree and 12.5% strongly disagree (Figure 5).
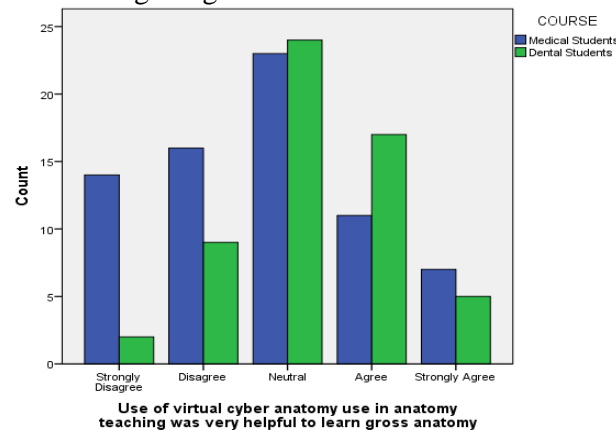

Figure 5: Students' response on the usefulness of the virtual cyber anatomy tool

d. Histology Applications:

46.9% of students agreed, and 9.4% strongly agreed, that using the histology app broadened their understanding of structures in online teaching, while only 8.6% of students disagreed, and 7.0% strongly disagreed with it (Figure 6).
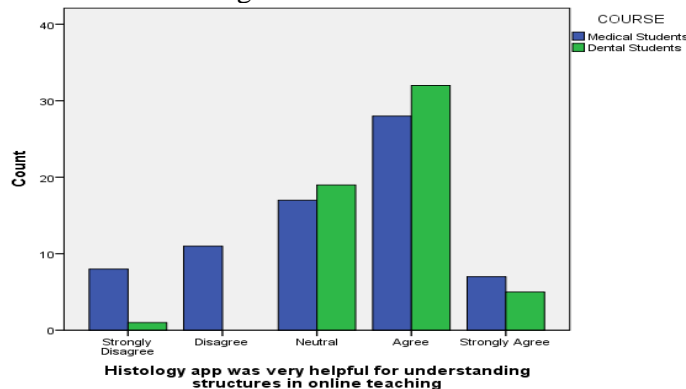
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Figure 6: Student's response on the usefulness of the Histology App

4. Social Interaction:

50% of the students couldn't meet and interact with friends, while only 3.9% indicated their inability to do so (Figure 7).
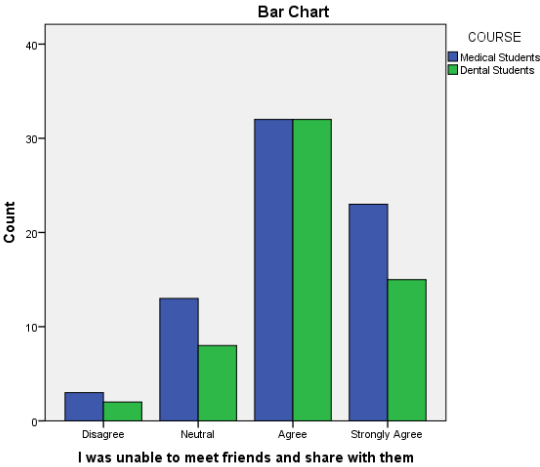

Figure 7: Students' response to social interaction

5. Language Barrier:

Our survey indicated that 14.8% of students faced challenges of a language barrier during online classes, whereas 32% of students disagreed and did not find a language barrier (Figure 8).
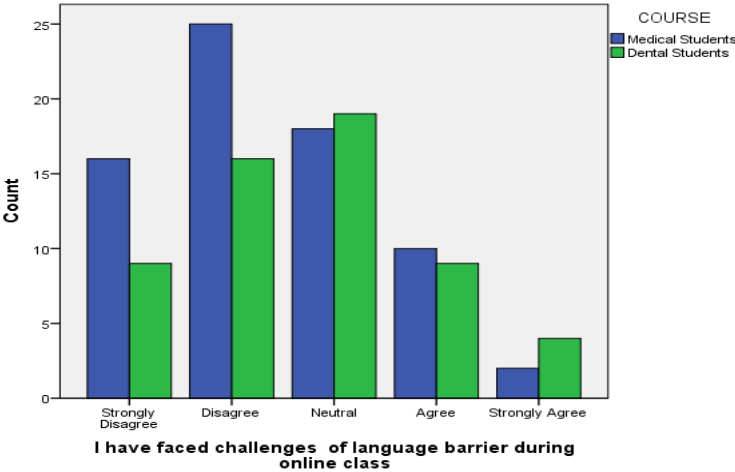

Figure 8: Students' response to the challenges related to the use of language during online engagement

6. Challenges in Online Learning:

27.3% of students agree and 34.4% strongly agree that it was difficult to concentrate during online lectures and practicals, while 6.3% agree and 4.7% strongly disagree (Figure 9).
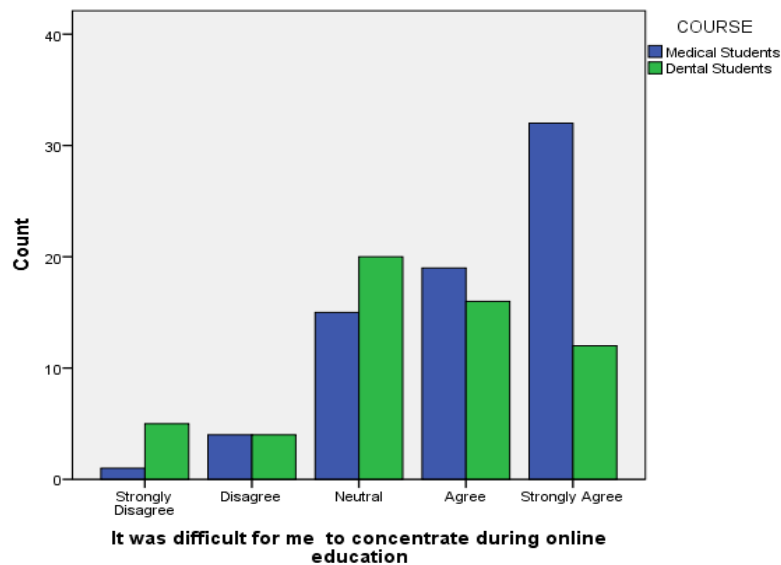
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Figure 9: Students' response to challenges in engagement during the online session

7. Future Preference for Online Classes:

Data analysis shows that 10.1% of medical students, 8 % of dental students agree, 69.6% disagree with medical students and 82% of dental students and 20.3% of medical students and 10% of dental students are neutral about attending more online anatomy classes in the future (Figure 10).
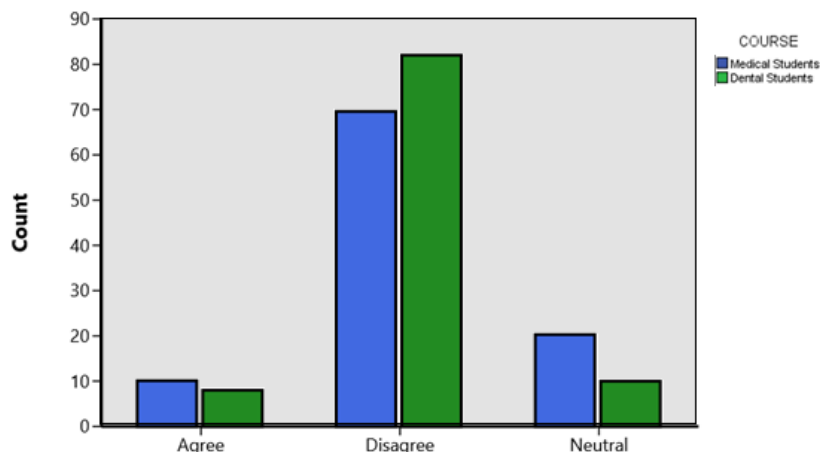

Figure 10: Students' response to future Preference for Online Classes

Discussion

This study provides valuable insights into the perceptions, challenges, and preferences of medical and dental students regarding online anatomy education during the post-acute phase of the COVID-19 pandemic.

The low level of student engagement aligns with similar studies [13], indicating a need for more interactive online teaching in anatomy education. Engagement is also influenced by learning styles, motivation, and access to technology [14], requiring a

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holistic approach to address this challenge.

Despite challenges, most students had positive experiences with technology in online anatomy classes. However, there were mixed responses about communication effectiveness, highlighting the complexities of online interaction in anatomy education.

While the positive reception of virtual anatomy tools and histology apps is encouraging [14], interpreting moderate satisfaction levels solely as a call for "more advanced technologies like augmented reality" risks oversimplification. Could factors beyond technological complexity be at play? For example, do these tools fully address diverse learning styles, integrate seamlessly into existing curricula, or receive adequate support from educators? A nuanced investigation into the reasons behind moderate satisfaction, rather than assuming technological solutions alone, will yield more insightful directions for improvement [15].

Our findings underline the multifaceted nature of student engagement and learning in an online anatomy context, where factors such as individual learning preferences, course design, and the quality of instructional delivery play crucial roles in student perceptions and experiences [16]. The high percentage of students reporting concentration difficulties is a significant concern, echoing findings by other researchers who identified maintaining focus as a major challenge in online medical education [17]. The reported lack of social interaction highlights the limitations of purely online education in medicine and dentistry, supporting the argument that the social aspects of medical education are crucial and challenging to replicate online [18].

The strong preference for supplementing online classes with face-to-face practical sessions aligns with the global trend toward hybrid learning models in medical education [19]. This preference is consistent with findings by other researchers who reported that medical students valued the combination of online theoretical learning with in-person practical sessions [20].

The differences observed between medical and dental students, particularly in their satisfaction with online practical demonstrations, highlight the need for program-specific approaches. This aligns with the findings of other studies, noting that dental students often require more hands-on practical experience compared to medical students [21]. The acknowledgment of distinct learning requirements suggests that curriculum designers should tailor educational strategies to enhance learning experiences for both disciplines, ensuring that each group receives appropriate support to develop the necessary competencies essential for their professional practice [22].

While the analysis of this study highlights a clear preference for supplementing online anatomy education with face-to-face practical sessions—reflecting a broader trend toward hybrid learning models in medical education [23]—it is recommended that a hybrid model for the anatomy curriculum include a mix of online modules, video tutorials, live lab reviews, and in-person sessions led by the anatomy instructor to help students visualize specimens. This approach allows students to interact with facilitators, experience 3D anatomy, and receive more feedback and interaction from peers [24]. The online

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hybrid anatomy curriculum is considered the most effective, as it combines the advantages of synchronous and asynchronous learning components [25].

Conclusion:

In conclusion, this study provides valuable insight into the perception of medical and dental students regarding online anatomy education in the post-acute phase of the COVID-19 pandemic. This study's findings suggest that medical and dental students appreciated the flexibility innovations associated with online learning, but significant challenges persist, particularly in maintaining concentration, engagement, and quality of hands-on learning experiences. The irrefutable need for hybrid learning models underscores the need to integrate face-to-face practical sessions with online educational tools to optimize anatomy education. Future research should explore the implementation and effectiveness of hybrid models in a longitudinal study to track changes in student perception and performance over time to provide deeper insights into the long-term impact on learning.

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