Effectiveness of Asynchronous VS Synchronous Online Histology Learning in Covid-19 Era Among Dental Students

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Abstract

Social distancing is the most effective preventive strategy in COVID-19 management. However, this has prevented students from receiving face to face lectures and tutorials. This research evaluated the effectiveness of synchronous vs asynchronous online learning as teaching modality among the first-year undergraduate dental students of Universiti Kebangsaan Malaysia (UKM).

Data were obtained from 40 first year dental students by comparing their result in Test 1 for synchronous and Test 2 for asynchronous teaching. Both tests were conducted after a live online lecture (synchronous) and online histology video (asynchronous) respectively. A questionnaire was distributed after the tests ended. Results showed a statistically significant difference between asynchronous and synchronous learning method scores whereby 77.5% of students score more than 5.0 marks in Test 2 compared to 50% of students that score more than 5.0 marks in Test 1.

In conclusion, most of the students preferred asynchronous methods for histology learning.

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Introduction

In response to COVID-19, universities around the world including dental faculty have been directly and indirectly affected causing the face-to-face learning needs to be replaced by online learning in order to ensure education continuity. Both students and lecturers were greatly hit by this unprecedented changes as a result of this COVID-19 pandemic [1]. Small-group formats convene online in virtual team settings, and clinical skills sessions as well as examinations have also transitioned to online platforms. Updating content material may be a benefit of the online format and virtual activities seem functional, but outcomes of these changes will require subsequent evaluation. The transition from the workplace or medical school setting to home results in isolation, an increased use of email, and struggles with establishing boundaries between work and home, which could affect the faculty, students, and support staff. [2]

Malaysia has initiated the Movement Control Order (MCO) to help counter with the COVID-19 pandemic, effective on 18 March 2020, in order to increase social distancing and reduce the transmission rate of the virus. This MCO order was extended multiple times and has at times been switched to either the Conditional Movement Control Order (CMCO) or the Recovery Movement Control Order to flatten the curve of the spread of virus. In conjunction with this, the Ministry of Higher Education has announced that all universities in Malaysia need to conduct teaching and learning activities through online platforms (Ministry of Higher Education, 2020). In the Faculty of Dentistry, The National University of Malaysia (UKM), Microsoft Teams are mainly used to deliver educational materials along with the use of UKMFolio.

In addition to today's expansion of the Internet and IT, online learning is getting more and more popular. Online learning or e-learning is a medium to gain knowledge and enhance performance by the use of internet technologies.

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E-learning helps in delivery and learning enhancement. Learning delivery becomes more effective as it leads to increased accessibility to information, ease in updating and standardizing the content, personalized instruction, ease of distribution and accountability. Learning enhancement permits greater learner interactivity as well as motivates them to be more engaged to the content[3]. Some findings show that students' readiness towards online learning is not optimal, requiring support and assistance from universities and lecturers, internet accessibility, timely feedback on assessments and constant academic engagement[4].

Two basic types of e-learning are commonly compared, asynchronous and synchronous. The word "asynchronous" means not keeping time together, which refers to the students' ability to access information, demonstrate what they have learned, and communicate with classmates and instructors on their own time. Until recently, e-learning initiatives mainly relied on asynchronous means for teaching and learning as an adjunct to traditional face-to-face learning methods. However, recent improvements in technology and increasing in bandwidth capabilities have led to the growing popularity of synchronous e-learning.[5]

In recent years, major revisions within the medical teaching curriculum of many institutions have placed severe constraints upon the time allocated to the teaching of traditional histology courses in anatomy[6]. Traditionally, light microscopes are used in studying anatomy histology. However, students have always expressed their difficulty and frustration in learning histopathology subjects using light microscopes. This has caused poor comprehension of the students in histopathology class. In order to overcome this limitation, heutagogy in histology learning has been applied in many institutions. A creative approach by using online learning for histology gives better understanding to students as they are able to do revision and discussion outside of the histology laboratory. Most of the researchers only assessed student perception when using virtual microscope compared to light microscope by using questionnaires to evaluate the result. Most studies done have only measured students' perception and did not take into account the influence of virtual microscope on academic performance[7]. Thus, the rationale of our research is to compare the student's performance in identifying histological structures through live online learning and pre-recorded online videos.

Materials and methods

Subject Recruitment

This is a cross sectional study that involved 40 first year undergraduate dental students from the Faculty of Dentistry, Universiti Kebangsaan Malaysia (UKM). Ethical approval was obtained from the Research Ethics Committee Universiti Kebangsaan Malaysia (RECUKM); UKM PPI/111/8/JEP-2018-663. The inclusion criteria for the study was that all first-year dental students who had undergone the anatomy syllabus in histology of the basic tissue. The exclusion criteria for the study was any students who are color blind.

Synchronous Online Learning

Several learning sessions in the form of lecture, directed self-study and seminar on basic histology of human tissue were provided to the students as part of anatomy course in the first year undergraduate programme. All first-year dental students were briefed on the type of epithelium in an introduction lecture of epithelium and glands. Afterwards, the students attended a live online lecture (synchronous) on histology specimens of 5 types of epithelium through Microsoft Teams. After the learning session completed, they were assessed in Test 1 using 5 objective structured practical examination (OSPE) type of questions through Google Docs.

Asynchronous Online Learning

After the first session is completed, the students attended the second session and underwent a self-directed e-learning session by using online video (asynchronous) of other histology specimens from another 5 types of epithelium through UKM Folio. Then, they were assessed again in Test 2 which also has 5 OSPE type of questions through Google Docs. All histology specimens used in this study were digitized and manipulated using CaseViewer, 3DHISTECH Ltd. software. Their answers were collected and marked by lecturers who have sound knowledge in basic tissue histology. Two lecturers were assigned to mark the answers in both tests, and they were blinded from the type of learning method received by students from each test.

Questionnaire

Upon completion of Test 2, questionnaires were distributed to assess students' perception on asynchronous e-learning methods. The questionnaire was adapted from Yazid et al. 2019. These questionnaires consist of 4 parts as stated in table 2, where (P1) is about student's personal details, (P2) assessing student's perception, (P3) is questions on the sufficient image quality while (P4) is questions on student's experience throughout this study. All statistical analyses were computed using Microsoft Excel and SPSS (version 20 for Windows) using paired T-test.

Results

In the synchronous learning method, Test 1 was conducted to assess the students' performance after going through a live online lecture on histology specimens of 5 types of epithelium via Microsoft Teams. The average marks for Test 1 are 5.56 with a minimum mark of the test is 0.5 and the highest mark is 10.0. Meanwhile, to assess students' performance in the asynchronous learning method, test 2 was conducted after students underwent a self-directed e-learning session by using online video of other histology specimens from another 5 types of epithelium through UKM Folio. The average marks for test 2 are 6.67 with a minimum mark of the test is 1.5 and the highest mark is 9.5. Both test's results can be referred from table 1.

Descriptive Statistic

		Test1	Test2
N	Valid	40	40
	Missing	0	0
Mean		5.563	6.675
Median		5.250	6.750
Std. Deviation		2.5374	1.9300
Minimum		.5	1.5
Maximum		10.0	9.5

Table 1. descriptive statistic of test 1 (synchronous) and test 2 (asynchronous).

Question	Agree (%)	Neutral (%)	Disagree (%)
P2 Student's perception			
Q1: Preferred online class learning	45	40	15
Q2: Preferred online histology video learning	40	47.5	12.5
P3 Sufficient image quality			
Q4: The manoeuvrable images studied with the e-histology were of sufficient resolution to allow identification of the required organs, tissues and cells	60	32.5	7.5
Q5: The e-histology had sufficient magnification potential to allow me to examine the tissues and cells in great detail	70	20	10
Q6: The medium used for the e-histology (UKM Folio) was effective with the purpose of this course	77.5	17.5	5
P4 Attractive teaching experience			
Q3: Using e-histology enhanced my learning of the material	67.5	32.5	0
Q7: Using e-histology was more fun than using the light microscope	25	60	15
Q8: The e-histology allowed for greater collaboration with another student	20	50	30

Table 2. result for each question in the questionnaires which percentage represent number of students.

The answers from both tests were obtained from forty students and the scores of their answers are categorized into 3 categories. Scores less than 5 marks are categorized as fail, scores in between 5 to 7.5 are categorized as pass satisfactorily and scores in between 8 to 10 are categorized as pass with excellent marks.

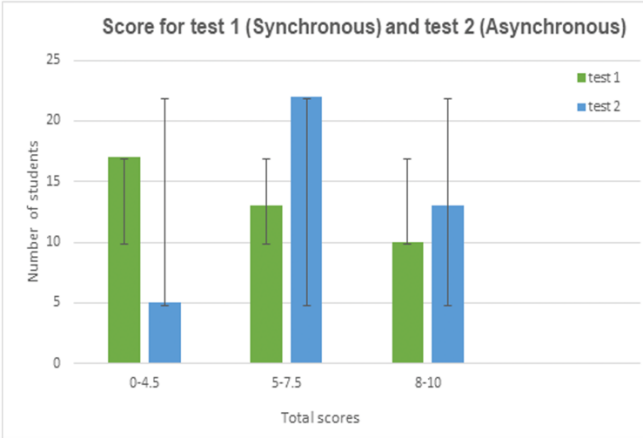

Figure 1. Bar chart illustrating number of students and range of scores obtained in Test 1 (synchronous) and Test 2 (asynchronous).

As illustrated in Figure 1, the percentage of students that failed in Test 2 is lesser than Test 1, with 5 students (12.5%) and 17 students (42.5%) that get below 5.0 marks in Test 2 and Test 1, respectively. Moreover, Test 2 also demonstrates a higher number of students who pass satisfactorily, as well as pass with excellent marks. Nonetheless, there are 2 students (5%) that score full marks in Test 1, while none of the students manage to score full marks in Test 2.

Higher average marks in Test 2 in comparison to Test 1 suggests that generally, students show better achievement when learning histological specimens through asynchronous learning than synchronous learning. This finding is consistent with the significant difference between asynchronous learning method and synchronous learning method scores ($p < 0.05$).

Part 1 questionnaires comprises students' personal details whereas for part 2 of the questionnaires, is on student's perception on asynchronous vs synchronous learning method which shows that 45% of students preferred synchronous learning method while 40% of students preferred asynchronous learning method. However, most students choose neutral for both synchronous and asynchronous learning methods.

Part 3 of the questionnaires comprises question 4, question 5, and question 6. These questions evaluate a student's perception on the sufficient image quality for both learning methods. For asynchronous learning methods, 70% of students agree that online histology videos (asynchronous) had sufficient magnification potential to allow them to examine the tissues and cells in great detail while only 10% of students disagree with this statement.

77.5% of students agree with question 6's statement which is "the medium used for the online histology video (UKM Folio) was effective with the purpose of this course" while only 5% of students disagree with this statement.

Part 4 of the questionnaires assess the attractive teaching experience for both asynchronous and synchronous learning method. 67.5% of the students agree with question 3's statement which is "using histology video learning method enhanced my learning of the material" and none of the students disagree with this statement while 32.5% of the students choose neutral for this statement. Most of the students, 60% of them choose neutral for question 7's statement which is "using online histology video learning method was more fun than using live online class learning method" while only 25% of them agree with this statement. Apart from that, for question 8, only 20% students agreed with the statement "online histology video learning method allowed for greater collaboration with other students" and 30% of the students disagreed with this statement while the majority chose neutral over this statement.

Discussion

The outbreak of Covid-19 has been a great challenge to dental students in Malaysia as in the beginning of the outbreak, teaching and learning activities are only allowed through online platforms. As a result, most of practical and clinical sessions that are fundamental in dental training and generally need to be conducted as face to face sessions have to be postponed.

E-learning, defined as learning and teaching online through network technologies, is inarguably one of the most powerful responses to the growing need for education. It is increasingly utilized since the Covid-19 outbreak and still remains as an important learning platform until the entrance of endemic phase, recently. Until today, home quarantine is still mandatory for any individual with confirmed Covid-19. Home quarantine among students will hinder them from participating face to face learning session can lead to frustration and emotional disturbance. [8] Interruption of training due to short-term quarantine or relatively long locking can trigger anxiety and worry among dental students due to the fact of dental education depends largely on practical and clinical sessions that are often require students to present at dental institution. [9] Practical that can also be performed through online method is an initiative that will facilitate students to keep pace with their peers on dental training and will help to reduce stress and anxiety among dental students.

Asynchronous and synchronous learning methods are two basic types of e-learning that are commonly compared. To cope with the current situation that deemed e-learning as the main learning method, asynchronous learning method has started to be widely practiced among educators. In asynchronous learning, instructors usually set up a learning path such as pre-

recorded online video which students can engage with at their own pace [5].

Prerecorded video provides necessary visuals, allowing students to experience each other as actual humans rather than text on a screen, thereby increasing social presence. This form of presence, aided by video, is "a psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways" [10]. In this research, pre-recorded online video was prepared, and students were given ample time to understand the topic discussed before being assessed in a test. Asynchronous learning methods can increase a person's ability to process information, this is due to students having more time to comprehend a message because immediate answers are not expected.

Meanwhile, online video discussions develop group cohesion and affiliation, helping students to be active in the group, thereby increasing engagement and participation [11]. Canning & Callan, 2010 reported on three higher education institutions in the UK that have practice e-learning methods, show that this learning method helps students to gain more control over learning as well as comprehend and help them to apply what they have learned in practical situations [12]. Students are able to learn and revise at their own pace is one of the foremost advantages of this learning method, it is found that being able to revise multiple times gives students more understanding in learning.

Synchronous learning methods can provide a real time interaction [13] such as a lecture with question-and-answer session that can make the session more interactive using webcams and class discussion features. From this study, 45% of the students respond positively to the synchronous learning method. This can be explained by the fact that the inflexible nature of the teaching via pre-recorded video and the few and poor-quality interactions increase the transactional distance and the gaps in communication and create a psychological void. Students felt that asynchronous communication was "more like talking" compared to synchronous communication, they felt more motivated since this type of learning resembles face to face learning method.

Based on the conducted analysis in this study, comparisons of two different e-learning methods (synchronous and asynchronous) in histology showed that there was a significant difference between e-learning method and academic performance of students. From this study, students' performance was assessed and the result shows that asynchronous learning method has a low percentage of failure compared to synchronous learning method. Decrease in failure rate in test 2 shows better understanding and comprehension through asynchronous learning method. This is due to students having ample time to learn at their own pace through pre-recorded online video. In addition, learning becomes more flexible and the students are able to work on e-learning at their own pace as the teaching material is accessible anytime and anywhere.

As per data analytics, the majority of the students agreed that e-histology provided either through synchronous or asynchronous methods has a sufficient resolution for them to identify each of the tissues and cells with a sufficient magnification through an effective medium used for the course. In spite of the majority of the students (67.5%) admitted that histology learning through asynchronous method enabled them to enhance their learning of the material, most of them (60%) responded neutral on the statement that using online histology video learning method was more fun than using live online class learning method. Thus, although online histology video learning helps students to engage better with the learning material and an effective way for them to retain the new knowledge, the teaching of histology through asynchronous method still can be explored further for more interactive content that can create excitement and increase student's motivation in studying histology asynchronously.

Conclusions

This study was to determine the effectiveness of asynchronous and synchronous learning methods to help increase student's understanding and performance in learning. The findings from the study indicate that asynchronous learning method is a more effective medium than synchronous learning method in histology of anatomy subject. In contrast findings from the questionnaires indicate that the students prefer learning via synchronous learning rather than by asynchronous learning.

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Declaration of Interest

The authors report no conflict of interest.

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