



# Study of nonsynchronous online teaching of regional anatomy for international students integrated with medical humanities and local culture during COVID-19 pandemic

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## Abstract

**Purpose** The COVID-19 pandemic imposed unexpected disruptions to anatomical educational practice, the teaching of regional anatomy for international students which has changed to an online format and faces various challenges. The challenges include creating online education homogeneous/equivalent to offline education, introducing local culture to international students, and educating students in medical humanities and ethics.

**Methods** To address these problems, the teaching staff integrated medical humanities and local culture into nonsynchronous online teaching of regional anatomy.

**Results** The nonsynchronous online teaching with interpreted videos of dissections does not significantly affect the experimental and total scores of regional anatomy courses for international students. Integrating medical humanities and local culture into this teaching model is appreciated by them and also has a good teaching effect.

**Conclusion** Students not only gained professional knowledge but also obtained enhanced exposure to local culture and professional spirit from this regional anatomy education.

**Keywords** Regional anatomy · International students · Online teaching · Chinese culture · Medical humanities and ethics

## Introduction

Regional anatomy is a core course of basic medicine and a bridge discipline between basic medicine and clinical medicine. Regional anatomy is taught to the first- and second-year medical students through didactic lectures and corpse

dissection. The COVID-19 pandemic imposed unexpected disruptions to anatomical educational practice, where face-to-face (F2F) teaching in universities was not possible during the pandemic and anatomy education was shifted to the online teaching mode [3]. E-learning platforms are online teaching tools used successfully in teaching practices in

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medical education that use multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and remote communication [9, 11]. Because most international students were stuck in their own country, the teaching method for international students was online using e-learning platforms. However, online teaching of regional anatomy using e-learning platforms encountered various challenges. First, practical dissection is important for medical students to learn regional anatomy [12], but online teaching of anatomy cannot provide international students with experimental teaching for practical dissection. Teachers should try their best to make online education homogeneous equivalent to offline education. Second, students were unable to return to China due to the COVID-19 pandemic. Most of them have fewer chances to learn about and experience local culture. Teachers must introduce Chinese culture while teaching professional subjects. International students' understanding of Chinese culture helps them to integrate and explore culture from different perspectives and improves their interest in learning complementary and alternative medicine (CAM), including Traditional Chinese Medicine. In recent years, because of the change in medical models and in menu of human diseases, CAM is getting popular in Western countries and is gradually accepted by mainstream medicine. Third, medical students will become a doctor in the near future. It is important to make students understand more about the associated responsibilities and medical humanities [7, 14, 15].

To address the aforementioned issues, we designed and carried out the nonsynchronous online teaching of regional anatomy for international students, meanwhile, we introduced medical humanities and ethics and Chinese culture. After that, we used the questionnaire to investigate the teaching effect. The details of the survey are discussed in this article.

## Methods

The research object of this study was the international students of 2019 and 2020 majoring in clinical medicine at Guangzhou Medical University (Xinzhao, Panyu District, Guangzhou, China), and international students studying offline in 2017 and 2018 as controls. Due to the time difference between the location of international students and China, and the different Internet conditions, the teaching staff chose to use nonsynchronous online teaching of regional anatomy. The nonsynchronous online teaching of regional anatomy for international students includes four parts: theoretical teaching, experimental teaching, medical humanistic education, Chinese cultural context, and after-class activities.

## Preparation of network platform and teaching materials

To begin with, we used the semi-structured questionnaire to investigate the characteristics of the participants before the regional anatomy online teaching. Using the online teaching platform (the network platform of the Super Star), we uploaded electronic textbooks, slides for teaching, videos for theoretical and experimental teaching, etc. International students could download these materials from the platform. Before each chapter, teachers released the course schedule and key points. Students checked in through the learning link of the network platform when class began.

## Theoretical teaching of regional anatomy for international students

In regional anatomy, we introduced layers and relationships of different regions, such as the neck, upper limb, lower limb, thorax, abdomen, perineum, and back. Teachers made videos of theory chapters for online teaching. To make the videos easier to understand, each chapter was divided into 10 segments and about 9 min per segment. At the end of each video, a quiz was attached to help students revise what they had been taught. During the process, a clinical application was taught related closely to the purpose of practical use. For example, when we talked about the anatomical structures of the ventral anterolateral wall, we referred to the layers to reach the appendix from superficial to deep when doing the surgery of appendectomy. By introducing the clinical practice into the regional anatomy, students can be engaged in the study of the subject.

In addition, we introduced Chinese culture while teaching the regional anatomy. For example, when explaining the anatomy of the diaphragm, we compared it to the postures of Chinese Taijiquan, which combines human physiology, anatomy, gymnastics, and Chinese traditional culture including martial arts, aiming at strengthening the body, fighting, confrontation, and other functions. Taijiquan not only vividly made students understand the relationship between diaphragm contraction and breathing, but also let them know more about Chinese culture. For another example, when teaching the anatomy of the lung, we introduced how COVID-19 infected the lung. Chinese medical staff took many measures to contain the spread of COVID-19, including the invention of a vaccine. In this way, we shortened the distance between international students and China and continue their professional development, although they were stuck in their own countries during the pandemic period.

## Experimental teaching of regional anatomy for international students

Experimental teaching was a very important part of the regional anatomy course. Before COVID-19, students were required to dissect the body and observe anatomical structures. However, during COVID-19, most students could not return to China and could not attend in person and dissect the body by themselves. To make students understand the dissection procedure better, we selected and interpreted videos of dissections. Each video was about 8–10 min and highly consistent with the contents in theoretical teaching. At the beginning of each video, key points were focused on so that students were clear about the content. For example, when teaching the branches of the common hepatic artery, teachers explained how to accurately identify the gallbladder artery and avoid the wrong ligation. When talking about the anatomical structure of the thyroid, we emphasized how to avoid injuring the superior laryngeal nerve and recurrent laryngeal nerve when ligation of the superior and inferior thyroid arteries. At the end of each chapter, several comprehensive topics related to clinical cases were put forward for students to discuss in groups. The students were required to discuss, summarize and present their findings in a group. Before the beginning of the course, international students were divided into groups and designated or recommended as group leaders. After the beginning of the course, international students were required to ask questions in the discussion area within the specified time. The group leader collected the comments of the students in the group in the discussion area, summarizes them and share common opinions of own group. Finally, the teacher explained in the discussion area. Through the group discussion, students learned how to work in a team and as a team.

### Ceremony to show gratitude to donors

When studying regional anatomy, students need to dissect corpses and observe the formation and relationships of anatomical structures. Corpse gave their bodies to educate medical students. The donors did not say anything in class, but they teach the student a lot. We call them “silent teachers”. At the beginning of offline local anatomy teaching, teacher and student held a silent ceremony to express their gratitude to “silent teachers”. Guangzhou Medical University had built a Thanksgiving square in memory of these corpse donors. Because international students could not attend the ceremony and visit the square during COVID-19 pandemic, we made a video to show the ceremony and square. Also, we explained how the concept of Chinese people’s donating remains changed in recent years. In Chinese traditional culture, it is believed that “The body is given by parents and children should treasure it, which is filial piety to their

parents”. Few people were willing to donate their bodies after death in the preceding decades. However, “silent teachers” donated their bodies to cultivate generations of medical students. Inspired by their deeds and spirits, more and more people have donated their bodies to medical universities. We are very grateful for their contributions. In this way, international students can feel the humanities and ethics, although they could not attend the ceremony during the COVID-19 period.

### After-class activities

We held a series of medical specimen exhibitions and science popularization lectures for citizens. Students at Guangzhou Medical University always participated as commentators. Also, students were involved in the maintenance of specimens in the exhibition hall. In addition, we also held a drawing competition of anatomical structures. Through the competition, medical students become more familiar with the anatomical structure. Considering that international students could only receive online teaching, we made a short video to introduce these activities. Furthermore, international students were invited to attend the drawing competition of anatomical structures. Through these activities, international students got a deeper understanding of the campus culture of China Medical University while enjoying the beauty of anatomy.

### Statistical analysis

All data were summarized as mean  $\pm$  SEM. To compare multiple groups on a continuous response variable, we used one-way ANOVA followed by Bonferroni post assay to compare the selected two groups. Normality and homoscedasticity were tested to ensure that parametric testing was appropriate.  $P \leq 0.05$  was considered statistically significant. Graph-Pad Prism 5 software was used to carry out all statistical analysis.

## Results

### Investigation of international students before the online teaching of regional anatomy

Guangzhou Medical University enrolled 61 international students majoring in clinical medicine in 2019. Due to the pandemic, the enrollment scale in 2020 was reduced, and 28 international students majoring in clinical medicine were enrolled. A total of 89 international students participated in the questionnaire survey, including 54 males (60.7%) and 35 females (39.3%), ranging in age from 18 to 21, and 89 questionnaires were collected. During the pandemic,

**Table 1** Baseline characteristics

Characteristics	<i>n</i>	%
Male	54 (89)	60.7%
Female	35 (89)	39.3%
Country of residence		
India	59	66.29%
Pakistan	7	7.87%
Tanzania	6	6.74%
Bangladesh	14	15.73%
Other	3	3.37%

59 international students (66.29%) were from India with a Time Difference with China (TDC) of 2.5 h; 14 students (15.7%) were from Bangladesh (TDC = 2 h); six students (6.74%) were from Tanzania (TDC = 5 h); seven students (7.87%) were from Pakistan (TDC = 3 h); one student was from Zambia (TDC = 6 h); one person was from Angola (TDC = 7 h); one student was from Ghana (TDC = 8 h), as shown in Table 1. Forty-four students (49.4%) reported that the local network was in good condition whereas 35 students (39.3%) reported that the local network was not working well with buffering and delays. Ten students (11.2%) reported that networks were not available and they used the mobile data which incurred greater costs. However, all international students ensured that they completed the online courses on time.

## Effect and feedback of online teaching of regional anatomy for international students

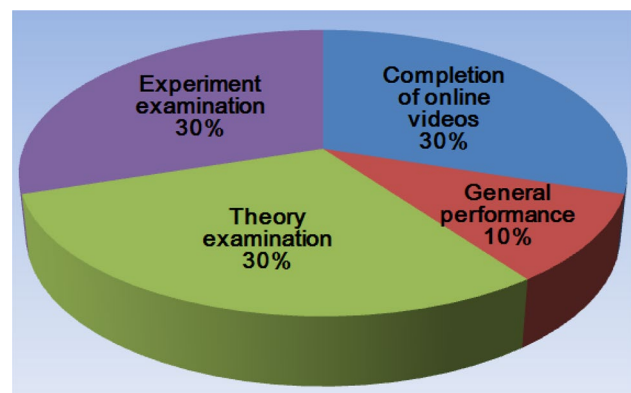
### Course achievement

We used formative assessment to evaluate the effects of online teaching of regional anatomy. The formative assessment was composed of four parts. The first part is the completion of online videos, which is scored according to the progress of watching the course video, accounting for 30% of the total score. The second part is the evaluation of general performance (including three items): signature, online quiz, and participation in discussion. Those who have completed three items will get 100 points, those who have completed two items will get 80 points, those who have completed one item will get 60 points, and those who have not completed any items will not get any points. This part accounts for 10% of the total score. The third part is the score of the experiment examination. Using lecture examination scores to predict experimental performance was a feasible way to identify students who may have difficulty in learning practical dissection [2]. In this exam, students were required to find 20 structures on the pictures specified, with 5 marks for each structure. This part accounted for 30% of

the total score. The fourth part is the theoretical examination at the end of the semester, accounting for 30% of the total score (Fig. 1). As Fig. 2A shows there is no significant difference between the score of the experimental examination of nonsynchronous online teaching of regional anatomy for international students in 2019 or 2020 and that of offline teaching in 2017 or 2018. Although the theoretical examination of nonsynchronous online teaching of regional anatomy for international students in 2020 decreased significantly, the total score did not decrease but was higher than that in 2019 and 2017 or 2018. The total scores in 2020 were: 19 students (21%) got 85 points or more, 70 students (79%) got 60–80 points, and 100% of students passed the exam (Fig. 2). The above results showed that students have mastered the relevant knowledge structures and key points through the implementation of nonsynchronous online teaching of a regional anatomy course.

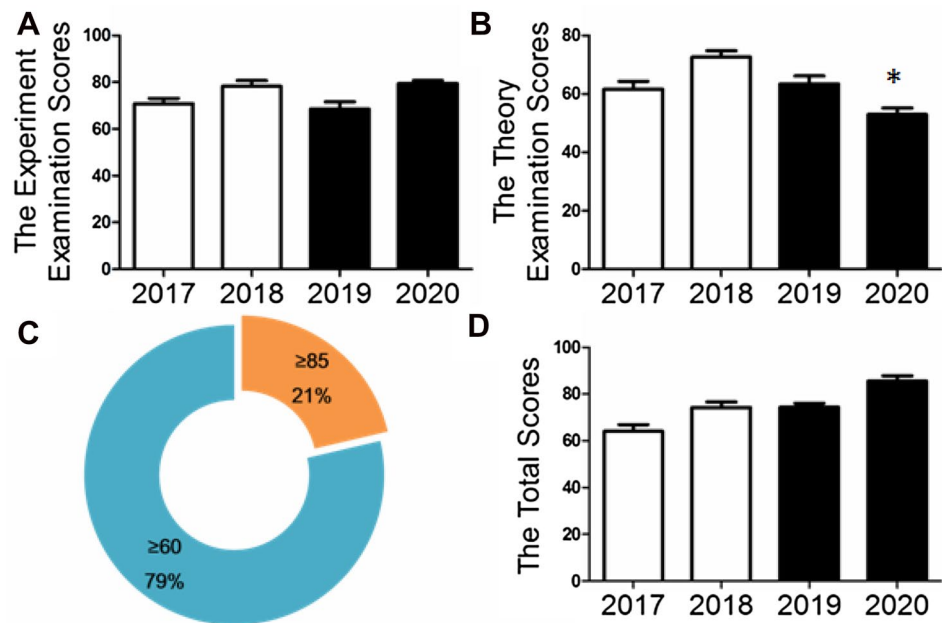
### Feedback from students

We also used a questionnaire to investigate the responses from students. The statements in the questionnaire were: (1) Do you agree that introducing the clinical cases in teaching regional anatomy promoted the understanding of the learning content and enhanced the learning effect? (2) Do you agree those clinical cases retain your attention in class and promote you to pay more attention to your professional spirit? (3) Do you agree that the introduction of Chinese culture in the teaching of regional anatomy enhanced your knowledge more about China? (4) Do you agree that drawing pictures related to regional anatomy attracts you to learn regional anatomy? (5) Do you expect to come back to China earlier? (6) Please list the names of the Traditional Chinese Festival. (7) Please list names of Solar terms in the traditional Chinese calendar. (8) Please list examples of Chinese scientist contribution to world medical science. (9)

**Fig. 1** Formative assessment of the total score

**Fig. 2** Student achievement.

**A** The scores of experimental exams in different groups. **B** The scores of theoretical examinations in different groups. \* $P \leq 0.05$ . **C** Score distribution of the total scores in 2020. **D**. The total scores in different groups



Please write down measures for combating the COVID-19 pandemic in China.

Seventy-three students (82.0%) agreed that introducing the clinical cases in teaching regional anatomy promoted the understanding of the learning content and enhanced the learning effect. Eighty students (89.9%) strongly agreed that those cases retained their attention in class and promoted them to pay more attention to professional spirit. Eighty-two students (92.1%) reported that the introduction of Chinese culture in the teaching of regional anatomy enhanced their cognition of China to a large extent. Eighty-nine students (100%) reported that the involvement in drawing pictures attracted them to learn regional anatomy. All international students hope that the COVID-19 pandemic can be controlled as soon as possible and that they could travel to China for offline learning earlier.

Fifty international students (56.2%) were able to list 4–5 Chinese traditional festivals, 29 (32.6%) could list 2–3, and 10 (11.2%) knew less than or equal to one. Fifty-three international students (59.6%) listed 4–5 Chinese seasonal solar terms, 28 students (31.5%) listed 2–3, and eight students (0.09%) could list only one. Forty-two students (47.2%) write down 4–5 examples of contributions to medical progress in China. For example, Zhong Nanshan was known for the SARS virus; Chen Wei is a Chinese epidemiologist and virologist specializing in biodefense. Tu Youyou contributed a lot to the malaria treatment. Thirty-six (40.4%) could list 2–3, and 11 (12.4%) could list only one. Among these examples, 56 (62.9%) international students mentioned traditional Chinese medicine, 48 (53.9%) mentioned acupuncture and 75 (84.3%) mentioned China's COVID-19 vaccine. For anti-pandemic measures, 60 (67.4%) international students could

list 4–5, 20 (22.5%) could list 2–3, and 9 (10.1%) could list one or less. 100% of students hope to come to China to carry out in-person education courses.

Taking together, adding medical humanities and local culture into this nonsynchronous online teaching of regional anatomy is appreciated by international students, and achieved good teaching results.

## Discussion

During these 2 years, the nonsynchronous online teaching combined with medical humanities and local culture was used to teach regional anatomy to international students. The students not only gained professional knowledge but also obtained enhanced exposure to local culture and professional spirit. The nonsynchronous online teaching with interpreted videos of dissections does not significantly affect students' experimental achievement in international students. Integrating medical humanities and local culture into this teaching model is appreciated by them, and achieved good teaching results.

Regional anatomy has always been taught to the first and second-year medical students through didactic lectures and corpse dissection (approximately 100 medical students for lectures and 30 students per group for corpse dissection). Because of the pandemic, the teaching mode has to be shifted to online teaching [9, 11]. Although Zoom video conference platform (a video conferencing tool) is a very good synchronous learning tool, due to the time difference of foreign students in different countries, we used the non-synchronous online teaching other than Zoom for regional

anatomy teaching, that is, uploading learning materials (such as electronic textbooks, videos for theoretical and experimental teaching and/or recording of narrated lecture slides using PowerPoint presentation) to the e-learning platforms, reminding students regularly, checking the progress of learning, supervising the completion of learning tasks, answering students' questions and correcting homework from time to time.

In the experimental and the total scores of regional anatomy, 100% of students passed the exam. Compared with offline teaching, the experimental results and overall evaluation results of regional anatomy of international students have not decreased significantly, which proves that the non-synchronous online teaching can partially replace offline teaching, consistent with previous studies [2, 8]. Nonsynchronous online teaching has its advantages, including promoting self-directed learning and providing flexible learning opportunities that would offer continuous (24 h, 7 days a week) availability for learners, especially for international students with time differences in different countries. Some medical students worried the lack of practical teaching about corpse dissection can adversely impact training and lead to losses for students, due to the learning environment being less than ideal [5]. Conversely, while many teachers recognize corpse dissection as a critical method for teaching and learning anatomy in medical education, the number of hours dedicated to corpse dissection has substantially declined over the years, and it has been completely removed from curricula in some cases [13, 17]. Srinivasan reported that effective and successful online learning was implemented using the Zoom video conferencing platform [16].

The addition of videos of dissections can help students to understand even if lack of practical teaching with corpse dissection [10, 17]. Our result showed that nonsynchronous online teaching with interpreted videos of dissections does not significantly affect the experimental achievement of international students or the acquisition of anatomical knowledge by medical students, but the impact on medical students' professional quality needs to be observed for a longer time (such as 10 or 20 years). With the application of new teaching methods, such as web-based interactive images, scanned three-dimensional (3D) models, and specimen displays on the internet, etc., it has been widely accepted by teachers and students to gradually reduce the contact time of autopsy and increase the integration of anatomy and other courses in the future anatomy teaching [4]. We must ensure we continue to provide students with learning experiences beyond anatomical knowledge that is crucial to their development as a medical practitioner.

Interestingly, we found that in asynchronous online teaching in 2020, the scores of theory examinations in the regional anatomy decreased significantly. One of the reasons may be that international students do not pay attention to

preparation before the exam. Unlike offline learning, teachers will emphasize reviewing before the exam in class. The second reason may be that during the preparation period of nonsynchronous online teaching, teachers upload all learning materials to the e-learning platforms, so many international students maybe finish all learning materials in the middle of the course but forget it at the end of term, so they cannot get high scores. The improvement method is to upload learning materials step by step according to the learning progress, instead of uploading them all at once in the early stage of nonsynchronous online teaching, and students shall be advised to review them many times before the exam.

In order to cultivate a humanistic, moral, and professional quality of international students, the current teaching methods are gradually changing from the traditional "teacher-centered" teaching model to a "student-centered" multi-element fusion teaching mode. Each medical university is constantly exploring its teaching mode according to its aim [1, 6]. International students cannot come to China because of COVID-19, most of them have fewer chances to learn about and experience the local culture. In addition to our professional knowledge, we also introduce Chinese traditional culture, traditional Chinese medicine, and the current pandemic situation, which can improve the understanding of international students about China. At the same time, we play some videos that increase humanistic quality during offline teaching, and actively invite international students to participate in after-class activities, to improve their professional quality. These measures enrich the knowledge of international students other than anatomy, which is appreciated by them, and also had a good teaching effect.

## Limitations of this study

This study has only been observed for 2 years, and the effect of this regional anatomical teaching method needs to be observed for a longer time. There are a few methods and strategies to cultivate humanistic professional quality, which cannot guarantee that every student can enjoy and benefit from it. Further studies should be carried out to assess the effectiveness of various e-learning strategies for conducting tutorials, which could open a new prospect for regional anatomy education.

## Conclusion

Integrating medical humanities and local culture into non-synchronous online teaching of regional anatomy with interpreted videos of dissections not only effectively promotes students learning of professional knowledge, but also makes them know Chinese traditional culture and professional

spirit better. This regional anatomy education model should continue to implement even post-COVID-19 pandemic as a supplement because teachers' efforts to put forward innovative teaching methods will always be appreciated by students. At the same time, the progressive implementation of computer-based learning methods has brought out new challenges and opportunities for anatomical sciences educators.

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**Author contributions** YH: project development, data collection, drafting of the manuscript. HD, QL, and AI: data collection. XW and YW: data analysis. ML: drafting of the manuscript. SL: project development, data analysis or interpretation, critical revision of the manuscript.

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**Data Availability** All data generated and analysed during the current study are available from the corresponding author upon reasonable request.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** The authors alone are responsible for the content and writing of this article.

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