Lei *et al. Zoonoses* (2022) 2:1
DOI 10.15212/ZOONOSES-2021-0012

SHORT COMMUNICATION

Online Education in Human Parasitology during the COVID-19 Pandemic in Wuhan: Our Experiences, Challenges, and Perspectives

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Abstract

Traditional face-to-face teaching in medical schools has been suspended during the global COVID-19 pandemic, and remote online learning has consequently been implemented as an emergency measure. This study aims to share our experiences in exploring online teaching of human parasitology and to discuss the possible advantages, challenges and perspectives that we observed during Wuhan's lockdown due to the pandemic. The application of online education is likely to be an indispensable component of post-COVID-19 interactive online parasitology courses. Our experience might provide an example for the future development of interactive online medical courses.

Key words: online education, human parasitology, COVID, Wuhan

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Received: September 3 2021
Revised: October 30 2021
Accepted: December 22 2021
Published Online: January 6 2022

INTRODUCTION

Due to the SARS-CoV-2 outbreak,Wuhan implemented a total blockade on February 23rd, 2020; the city was locked down for 76 days. As part of an effort to minimize viral transmission, all educational institutions were closed, and all face-to-face teaching activities were suspended until the end of the summer semester. Complete online learning has become a new emergency teaching approach to maintain the continuity of medical education during the pandemic [1].

Our medical curriculum at Tongji Medical College, Huazhong University of Science and Technology (HUST), consists of preclinical and clinical phases.The initial 3 years involve preclinical training focusing on basic science subjects, such as microbiology and parasitology. The preclinical curriculum is the core foundation and an integral component of the subsequent clinical education [2]. In-depth mastery of preclinical knowledge is indispensable to prepare clinically competent doctors with scientific knowledge [3].

Our human parasitology course is a national "Excellent Resource Sharing Course," taught by a team with extensive medical teaching experience. For more than 10 years, we have adopted disciplinary-based and problem-oriented approaches to teaching this subject [4]. Blended learning practices, involving face-to-face and online instruction, have been used in our routine teaching. The introduction of these new strategies enabled us to provide adaptable distance teaching during the COVID-19 pandemic.

COVID-19 was declared a pandemic disease by the WHO on March 11th, 2020 [5]. Web-enabled teaching was immediately

embraced to facilitate the educational process, by allowing students and teachers to continue communication and engagement during the unprecedented COVID-19 pandemic. This report aims to share our experiences in distance teaching of human parasitology and to discuss opportunities and challenges in online teaching during Wuhan's COVID-19 lockdown. Our experience might provide an alternative teaching paradigm to develop interactive online medical courses in the future.

PRIOR EXPERIENCE IN PARASITOLOGY TEACHING AND LEARNING

The Department of Parasitology at Tongji Medical College was founded in 1948 by Professor Yao Yongzheng, a well-respected parasitologist in China. Human parasitology teaching involves theoretical lectures and laboratory-based practical training. The didactic lecture is a weekly course with a duration of 2 academic hours (90 min) per week (total of 24 academic hours). Thematically, this instruction focuses on the life cycle, pathogenesis, epidemiology, and prevention. The laboratory-based class occurs during 3 academic hours per week (total of 30 academic hours) and focuses on teaching the morphology of parasites and hands-on techniques to identify parasites of different species. The average teaching period lasts 13 weeks.

Traditionally, the entire teaching content has been arranged according to the biological classification of parasites. To relate the instruction more closely to later clinical teaching, our team rearranged the course content according to the affected organ systems. Various learning theories for parasitology education, including case-based learning, problem-based learning (PBL), sandwich teaching method, flipped class and online collaborative learning, have been used [4]. The introduction of these new teaching strategies makes student learning more engaged and creative [6]. This course, a traditionally excellent discipline at Tongji Medical College, was designated a national "Excellent Resource Sharing Course" in 2013 [7]. In 2014, we created and operated a public media account called "I Love Parasitology" on WeChat. Blended learning practices (face-to-face and online) were included in our regular teaching, particularly in the lecture portion. Based on the above teaching platforms, we divided 24 academic hours of lectures into 16 academic hours of in-person teaching and 8 academic hours of online learning from 2017. Students gained basic knowledge of parasites online with a virtual learning community, and this teaching was supplemented by related sandwich and PBL cases to complete the integration and application of knowledge. Our new related course, "Parasitic Disease and Food Safety," was launched as a national MOOC in 2018 [8]. Multiple technologies and multimedia were used to deliver the teaching content, promote collaboration and peer-to-peer learning among students, and evaluate the progress and effectiveness of student learning. These blended learning practices have been demonstrated to be effective participatory tools for parasitology teaching and learning [9]. However, the experimental portion is a practically oriented course requiring laboratory-based hands-on training. Therefore, face-to-face teaching makes up most of the entire teaching process, and social presence and teacher-student interactions are key components of the learning environment.

IMPLEMENTATION OF FULLY ONLINE TEACHING

Existing teaching and learning practices have been challenged by the COVID-19 pandemic worldwide [10]. All teaching activities were forced to convert rapidly from face-to-face or blended learning to entirely distance learning. Our department has made good progress in reforming parasitology teaching. Our prior experience made teachers and students more adaptable and efficient in full-time distance online learning during the COVID-19 pandemic.

Platform support for online teaching and learning

Although the gates of the campus were closed, all education activities needed to continue. Our university developed a learning platform and course-management system in the context of the COVID-19 pandemic [11]. An online teaching app called XUEXITONG was authorized by our university as the study platform. The system can be used in preparation for class opening (creation of student learning communities, and delivery and editing of educational content and resources), classroom interaction (sign-in and in-class quizzes), assessment of homework, and analysis of course operation and student learning. The WeChat public account "I Love Parasitology" and our MOOC called "Parasitic Disease and Food Safety" provided all students with multiple resources for parasite teaching and research. To enable direct interaction with students, we used another app called "Microteaching" (Wuhan Daily Interactive Technology Co. Ltd, China) [12] as well as Tencent Meeting (Tencent Inc., China) to track student performance at different stages of the course. Both software programs allowed slides to be shared through audio or video media, or even through synchronous live streaming. For the experimental portion, the Dream Road Medical Virtual Simulation Experiment Teaching Cloud Platform [13] was chosen by the Department of Higher Education of the Ministry of Education to serve as our medical experimental platform. The innovative digital platform provided various pictures of parasites and videos of hands-on training to support online teaching during the pandemic. On the platform, students could practice parasite identification, perform experimental simulations, and take examinations whenever they were ready. With a focus on student education and teaching, all these platforms were used to create a virtual teaching environment and an open practical learning environment allowing students to learn at their pace.

Distance online teaching and learning

All our teaching materials, including audio and video media, were uploaded to the course-management system of our university. One week before the practical class, we outlined all components of the class, providing links to external online available resources. This timely material delivery provided students with opportunities for self-directed, independent learning. We created different virtual learning communities based on classes and topics, which allowed for a social and teaching presence in the online learning. Students were able to take advantage of these platforms to meet their learning needs.

Because conferring rudimentary knowledge of morphology and life cycles based on biological classifications would make online learning more acceptable, we divided the traditional didactic lecture into four modules: introduction to human parasitology, medical helminthology, medical protozoology and medical arthropodology. We held weekly flipped classroom sessions involving student self-learning (30 min), live question and answer (Q&A, 30 min), and a teacher summary of the target content and questions (30 min). Our aim was to provide students with opportunities to engage in social and teaching presence during the distance learning [14]. Each teaching module included a quiz (30 min) to gauge students' knowledge and understanding, and the results were used to modify the teaching direction if required. For parasitology practical classes, the Dream Road Medical Virtual Simulation Experiment Teaching Cloud Platform [13] provided various pictures of parasites and videos of hands-on training to support the online teaching. Each week, we held a 3-hour class including teacher instruction based on the related teaching materials (30 min), student self-study (90 min), live Q&A (30 min) and an in-class quiz (30 min). In addition, all teachers' lectures and Q&A sections were screen-recorded and uploaded to the relevant platforms for student learning. For assessment, we changed the paper-based assessment used in traditional classes to an open-book examination with strict time limits. The open-book examination comprised a combination of single-choice, multiple-choice and short-answer questions. Various asynchronous and synchronous teaching approaches have been used to promote student engagement, and interactions between students and teachers, and to encourage deep learning [15].

Advantages and challenges of online teaching

Our teaching team has been committed to reforming online and offline blended teaching in parasitology in recent years [4,16]. The outbreak of COVID-19 forced educators to apply digital technologies to teach parasitology. Although a variety of learning theories have been integrated into medical education, because of the characteristics of the subject, no complete teaching theory is available to be applied in complete online teaching of parasitology. From the student perspective, implementing fully online education has advantages, disadvantages and challenges (Table 1). Our approach uses both asynchronous and synchronous online-learning methods. The former allows for autonomous learning online or offline, and the latter involves real-time teaching and learning encounters. A previous report has indicated that students clearly prefer asynchronous to synchronous concepts, because asynchronous concepts are an effective and functional form of distance education during a pandemic [17]. However, most of our students believed that synchronous learning, including real-time feedback and commentary, is more effective than asynchronous learning for students in academic settings (Table 1). One possible explanation for this finding may be that the transition from on-campus medical school settings to home environments may result in isolation, stress, and a lack of concentration [10], which could be alleviated by interactions with peers during synchronous learning. We emphasize that teachers act as facilitators rather than instructors in creating a social and metacognitive atmosphere for deeper student engagement in online active learning sessions [18].

TABLE 1 | Advantages, disadvantages and challenges reported by the participating students in the fully online education (n = 266).

		Number of students (%)
Advantages	Accessible to studying materials	186 (69.9%)
	Deeper understanding of basic knowledge	173 (65.0%)
	Flexibility of learning time	172 (64.7%)
	Real-time feedback and commentary	160 (60.2%)
	Synchronous learning	135 (50.8%)
	Asynchronous learning	37 (13.9%)
	No benefits	10 (3.8%)
Disadvantages	Poor interaction with classmates	165 (62.0%)
	Poor interaction with instructors	152 (57.1)
	No drawbacks	45 (16.9)
Challenges	Poor quality of internet service	189 (71.1%)
	Lack of suitable devices	59 (22.2%)
	Variation in learning platforms	101 (37.9%)
	No challenges	20 (7.5%)

Distance learning has emerged as a new method of teaching to maintain the continuity of parasitology instruction during the COVID-19 pandemic. Based on questionnaire responses from the participating students, the first advantage of online learning is that many learning materials and software programs are available to all students (Table 1). Some students cannot access the materials because of a lack of time or advanced equipment on campus. Digital approaches can transform medical education to achieve higher levels of knowledge and skills through competency-based education [19]. Second, remote learning encourages students to gain a deeper understanding of basic knowledge, because they can

learn as often as they desire (Table 1). Although this social isolation leads to poor interaction with classmates (62.0%) and teachers (57.1%), online learning enables students to attend the group laboratory sessions remotely, thus greatly decreasing the risk of COVID-19.

As shown in Table 1, the implementation of distance e-learning in medical education is challenging. The lack of infrastructure and internet access, particularly in low- to middle-income countries, is a major barrier affecting both learners and educators [20]. In this situation, institutional support is essential for the success of distance learning [21]. Our teaching administration not only designed strategies to facilitate the implementation of key skills and the adoption of methods, but also created a learning platform on the school website in a timely manner, thus allowing teachers and students to establish a learning community in various ways [22].

In an additional measure to address potential access issues among students, we provided all materials associated with each teaching section in advance to ensure that students had sufficient time to gain familiarity with the content. However, some students missed certain interactive aspects of learning due to poor internet quality.

RECOMMENDATIONS FOR FUTURE PRACTICE

This is the first open discussion of distance e-learning in human parasitology in Wuhan amid the COVID-19 pandemic. Both teachers and students recognize that distance e-learning can partially replace traditional methods of conferring theoretical knowledge. In terms of practical skills, face-to-face classes would be better for teaching hands-on techniques to isolate and diagnose parasites. Therefore, a blended approach (online and traditional) would be a suitable alternative for future medical education of parasitology. Online education is likely to be an indispensable component of post-COVID-19 interactive online parasitology courses [10].

The COVID-19 pandemic continues to affect the education system worldwide [1,23]. As of March 2021 (one year into the COVID-19 pandemic), according to UNESCO, nearly half of all students worldwide remained affected by partial or full school closures [24]. Effective and affordable educational strategies must be addressed to maintain and enhance student experiences and learning outcomes by assessing asynchronous and synchronous learning practices. In some subjects, a digital medical curriculum has been found to be more effective than the traditional approaches [3,6,25]. With the coming advances in artificial intelligence and virtual reality, we expect to have more opportunities to evaluate innovative learning practices. Further studies will be required to carefully assess short- and long-term effects of the COVID-19 pandemic on medical education.

ACKNOWLEDGEMENTS

We are grateful to the Education Administration Department of HUST for extensive support during the implementation of our online parasitology teaching.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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