

The teaching of anatomy during the Covid-19 pandemic

O ensino de anatomia durante a pandemia de Covid-19

Júlia Mendes Brandão¹ jumendesbrandao@gmail.com

Isabella Ally Vasconcelos Silva¹ isabellaally@gmail.com

Túlio Carmona Moura¹ tulio.99@hotmail.com

Daniel Martins Vieira Zimmermann¹ danielmvz93@gmail.com

Wagner José Favaro¹ favarowj@unicamp.br

Simone Appenzeller¹ appenzel@unicamp.br

ABSTRACT

Introduction: Human Anatomy is an essential subject for medical education. In addition to the theoretical content, practice is an irreplaceable way of learning. However, the COVID-19 pandemic brought up new challenges to the teaching of Anatomy. Therefore, new strategies were implemented aiming to adapt the medical curriculum.

Experience report: At UNICAMP, Anatomy was taught virtually, through synchronous and asynchronous activities. For practical sessions, teachers and teaching assistants recorded lessons using real anatomical structures. The students had tutoring sessions with content review and quizzes. The anatomy final exams were taken on Google Forms. At the end of each semester, questionnaires were applied so that the students could evaluate the teaching tools.

Discussion: The new method had both positive and negative aspects, but it was important to assure the maintenance of the teaching-learning process. All tools were approved by the students and the objectives of the course were achieved with no additional funding.

Conclusion: This experience demonstrated that a teaching team consisting of teachers and monitors is of great value in the learning process. Furthermore, it showed that low-cost technology tools are helpful in overcoming adversities. Nevertheless, this model does not replace face-to-face teaching.

Keywords: Anatomy; Online Teaching; Medical Education; COVID-19.

RESUMO

Introdução: A anatomia humana é uma disciplina indispensável para a formação médica. Além do conteúdo teórico, sabe-se que o aprendizado por meio da prática é insubstituível. Entretanto, a pandemia de Covid-19 impôs desafios ao ensino de anatomia. Por isso, novas estratégias de ensino foram desenvolvidas para adaptar o currículo médico.

Relato de experiência: Na Unicamp, o conteúdo de anatomia foi oferecido virtualmente por meio de atividades síncronas e assíncronas. Para as práticas, professores e monitores gravaram aulas com peças anatômicas verdadeiras. Os alunos também tiveram monitorias com revisão de conteúdo e quizzes. As provas finais foram feitas em formulários do Google Forms. Ao fim de cada semestre letivo, aplicaram-se questionários para que os estudantes avaliassem as novas ferramentas de ensino.

Discussão: O novo método teve pontos positivos e negativos, mas foi importante para garantir a manutenção do processo de ensino-aprendizagem. Todas as ferramentas foram aprovadas pelos alunos, e atingiram-se os objetivos do curso sem financiamento adicional.

Conclusão: Essa experiência demonstrou que a união entre professores e monitores é de grande valia para o processo de ensino-aprendizagem. Além disso, revelou que ferramentas tecnológicas de baixo custo podem ser úteis nesse contexto. Entretanto, esse modelo não substitui o ensino presencial.

Palavras-chave: Anatomia; Ensino On-line; Educação Médica; Covid-19.

¹Universidade de Campinas, Campinas, São Paulo, Brazil.

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INTRODUCTION

"Anatomy is the setting in which the events of life occur"¹. For this reason, Human Anatomy is an essential subject in medical education. In addition to the importance of the theoretical content, practice is an irreplaceable way of learning. During practical sessions, students get to learn from those who are considered to be their first patients: the cadavers.

However, the COVID-19 pandemic brought up new challenges to the teaching of Anatomy. Due to the closing of campuses and social distancing, new strategies were implemented aiming to adapt the medical curriculum to emergency remote teaching (ERT). Regarding the teaching of Anatomy, it was particularly difficult, once most of the study load is based on face-to-face activities in the classroom and at the laboratory.

International studies have already revealed the impact of COVID-19 in the teaching and learning of Anatomy²⁻⁵. The majority of scientific research about online teaching and learning was developed in high-income countries, with wide access to digital platforms⁵⁻⁸. This reality, however, is a distant one from that experienced in developing countries. The ERT implemented at UNICAMP faced several challenges. At first, we had to ensure that each student had access to a computer and the internet⁹. Moreover, no additional funding was available to support the transition to ERT, which had to be done within a short period of time (2-4 weeks).

This article intends to describe the strategies applied to teach Human Anatomy to first-year students in a Brazilian public university during the COVID-19 pandemic. We also describe formative and summative assessment methods, and the students' perception about the quality and effectiveness of the teaching methods.

EXPERIENCE REPORT

The teaching of Anatomy before the COVID-19 pandemic

At UNICAMP, human morphophysiology is taught during the first three semesters of the medical course and it is structured according to human body systems. There is a subject for each system: Locomotor, Cardiovascular, Respiratory, Digestive, Endocrine, Urogenital and Neurological. For each of these subjects, students have classes on Anatomy, Radiology, Histology, Embryology, Physiology and Biochemistry, which enable an integrated learning.

The teaching of Anatomy relies on face-to-face activities, with lectures and practical sessions at the laboratory. During practice, the students have the teachers' support. They are also allowed to study in groups to identify structures in previously dissected anatomical specimens. The exams take place at the same laboratory, where students are asked questions about Anatomy, Histology and Radiology.

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Theoretical lessons: The anatomical theory was taught virtually, using synchronous and asynchronous activities. For the asynchronous lessons, professors recorded presentations and uploaded them to the Google Classroom Platform (Google, Inc. Mountain View, CA, United States). Textbooks, atlas and study guides were available on the same platform. After accessing the asynchronous lessons, the students had the opportunity to discuss questions with a teacher in synchronous meetings through Google Meet (Google, Inc. Mountain View, CA, United States) (Figure 1).

Practical lessons: Due to social distancing, teachers and teaching assistants recorded asynchronous lessons with real anatomical structures at the laboratory. The lessons were shared on YouTube (YouTube, LLC. San Bruno, CA, United States) in a public channel called "Anatomia UNICAMP"¹⁰. After watching the videos, the students could discuss their questions with a teacher in synchronous meetings through Google Meet.

Peer tutoring: The students had tutoring sessions every week or every other week. The tutoring was provided by medical students who had already had Anatomy classes in previous years. These students are part of the Teaching Support Program (*Programa de Apoio Didático - PAD*) at UNICAMP¹¹. The tutoring sessions were carried out synchronously by Google Meet. The tutors presented brief reviews of the anatomical theory, in addition to clinical correlations and curiosities. The tutoring sessions were also a space for students to elucidate their doubts. Social media was also an important tool. Students kept in touch with their tutors through WhatsApp (WhatsApp, Inc. Menlo Park, CA, United States) to ask questions. In addition, tutors started a profile on Instagram (Instagram, LLC. Menlo Park, CA, United States) to share clinical cases. Each case presentation was followed by a series of questions, so that students could interact and practice what they had learned (Figure 1).

Formative assessment: Activities, like quizzes, were carried out synchronously during tutoring sessions using the Kahoot! application (Kahoot! ASA. Oslo, Norway). The students themselves played an important role in this part of the teaching-learning method. Both the first-year students and the tutors had an active participation in these activities, which demonstrates their formative goal (Figure 1).

Summative assessment: The exams were carried out separately for each subject (e.g.: Anatomy, Histology, Physiology). Anatomy exams were uploaded on Google Forms (Google, Inc. Mountain View, CA, United States) and remained open for one week. The students had to answer questions and identify structures pointed out in images of anatomical specimens (Figure 1).

Students' perspective

At the end of each academic semester, questionnaires were applied for students to evaluate the new teaching methods. Questionnaires were available on Google Forms. The analysis of the responses was authorized by the Research Ethics Committee of UNICAMP (CAAE: 44321221.0.0000.5404).

There were 110/137 (80.3%) respondents in the first semester and 93/130 (71.5%) in the second semester of 2020. The students' mean age was 21 years (range 18 to 25) and the female/male gender distribution ratio was 6:5 in the first semester. The distribution was similar in the second semester.

The students informed which tools they used and rated their usefulness according to data shown in Table 1.

The most frequently used tools were theoretical video lessons, practical video lessons on YouTube, textbooks, Anatomy atlas, study guides and tutoring. Theoretical and practical video lessons were considered more useful than textbooks and Anatomy atlas. When considering tutoring, the content review, clinical cases on Instagram and formative assessments were well evaluated. On the other hand, for the purpose of answering questions, WhatsApp was better rated than tutoring sessions. The 3D Anatomy Atlas showed low student adherence when compared to other instruments.

Among the positive aspects of remote Anatomy teaching, the possibility of reviewing recorded lessons more

than once was considered the main advantage by 97 (88.2%) students, followed by timetable flexibility [92 (83.6%)]. Regarding the negative aspects, the absence of face-to-face activities [105 (95.5%)], the impossibility of studying in groups at the laboratory [97 (88.2%)] and the emotional distancing from classmates [85 (77.3%)] were also mentioned. The percentages were statistically similar in the second semester ($p > 0.05$).

Considering the students' difficulties regarding online education, 83 (75.5%) students in the first semester stated that dealing with emotional factors, such as anxiety, stress and depression was a major problem, associated with difficulties in concentrating [83 (75.5%)] and activity overload [79 (71.8%)].

Teachers and tutors perceived a reduction in student's engagement in the second semester. Students attributed the reduced commitment to physical and mental fatigue, content overload and discouragement due to lack of practical activities on campus.

Seventy-six (69.1%) students in the first semester said that the content offered by the university was sufficient to achieve the main goals of Anatomy class. However, 100 (90.9%) students considered that on-campus practical sessions are essential for learning and were looking forward to attending these activities. The percentages were statistically similar in the second semester ($p > 0.05$).

Figure 1. Teaching and assessment tools used during anatomy classes

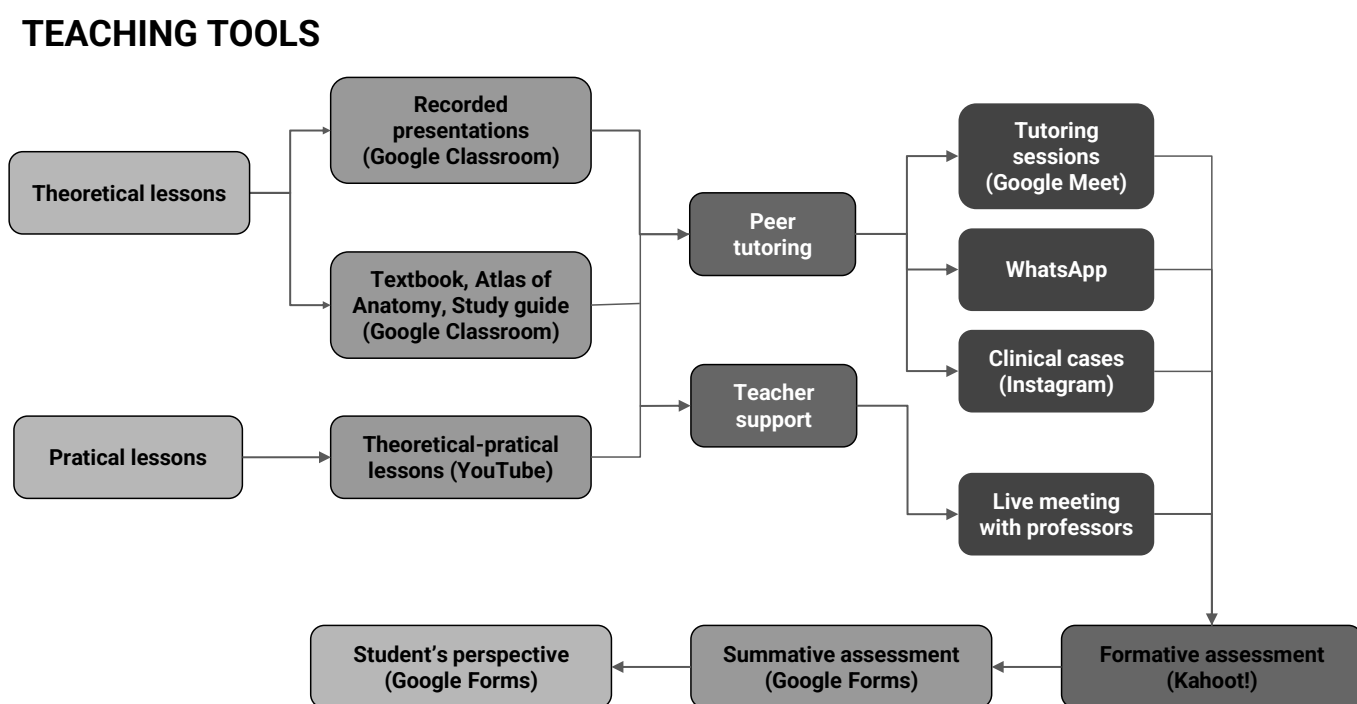


Table 1. Frequency and usefulness of ERT tools used in Anatomy

Teaching tools	Students who used it (n)	Evaluation of the tool			
		"It was very useful" % (n)	"It was useful" % (n)	"It was not useful" % (n)	"It impaired learning" % (n)
Theoretical lessons	110	95.5% (105)	4.5% (5)	0	0
Practical lessons	110	90% (99)	10% (11)	0	0
Textbook	102	59.8% (61)	36.3% (37)	3.9% (4)	0
Atlas of Anatomy (physical book)	99	84.8% (84)	15.2% (15)	0	0
Atlas of Anatomy (3D e-book)	61	62.3% (38)	36.1% (22)	1.6% (1)	0
Study guides	100	63% (63)	35% (35)	2% (2)	0
Tutoring sessions for content review	90	82.2% (74)	17.8% (16)	0	0
Tutoring sessions to elucidate doubts	73	76.7% (56)	21.9% (16)	1.4% (1)	0
Formative assessment (Kahoot!)	85	80% (68)	17.6% (15)	0	2.4% (2)
Clinical cases (Instagram)	66	68.2% (45)	30.3% (20)	1.5% (1)	0
WhatsApp	68	83.8% (57)	16.2% (11)	0	0

DISCUSSION

With the challenges imposed by COVID-19, several universities have adapted their curriculum in order to keep qualifying their students¹²⁻¹⁴. At UNICAMP, the ERT was important to ensure the maintenance of the Human Anatomy teaching-learning process.

The objectives of the course were reached with different technology and interplay between faculty and peer tutoring. The students' perception on Anatomy teaching tools was positive in both semesters. None of the tools were considered useless or inefficient. Therefore, implementing technologies in ERT has been a great alternative to overcome adversities. Before the pandemic, teaching took place on campus only and no technology was available. Some of these technologies could be incorporated into a future hybrid teaching model to improve learning¹⁵.

Regarding costs, it is worth noting that the teaching methods implemented at UNICAMP were developed with no additional funding. A low-cost system was implemented, unlike universities in developed countries⁵⁻⁸. However, the university did have concerns regarding equity of access to the educational content and supportive strategies were available when needed⁹.

Students stated that the video lessons uploaded on YouTube allowed good comprehension of anatomical topography as previously reported¹⁶. This assertion is also related to the concept of the "YouTube generation", which is not specifically defined by age group, but by attitude and mindset¹⁷, actively interacting with social media and integrating it into their education experience¹⁸.

The literature about social media shows that it enhances students' interaction outside the scheduled contact hours¹⁸ and creates a supportive environment for sharing doubts and concerns¹⁹. This potential was verified in the present study, particularly regarding the use of WhatsApp for contact between students and tutors. The preference for WhatsApp over tutoring sessions was probably due to the possibility of talking in private with a tutor through the app. During tutoring sessions, however, doubts were shared with the group, which could cause embarrassment for some students.

Therefore, social media is becoming increasingly prevalent as a student learning aid in Anatomy education^{18,20}. However, the current generation of students can be fickle when it comes to social media¹⁹. In this context, the teaching team must remain alert and updated, considering that some platforms can become "old-fashioned" and lose the students' interest.

In addition to the tools, it is important to recognize the role of peer-tutoring in Anatomy education. Since tutors had already had the subject in previous years, they acquired enough experience to help with video lessons, tutoring sessions, clinical cases and quizzes. Peer tutoring can be an effective tool in educational settings where poor staff-to-student ratios limit delivery of interactive workshops²¹, which is the reality of most public universities in developing countries.

Formative assessment, such as quizzes on Kahoot!, helped students to focus on relevant topics and to reinforce learning, which agrees with the current literature²². Thus, the implementation of formative assessments, combined with summative assessments, can be an effective method to help with knowledge consolidation³.

Regarding remote learning itself, some peculiarities must be noted. The main strengths of this model are flexibility and content availability 24 hours a day, which guarantees students' autonomy and favors the active learning process²⁴. Likewise, there is the possibility of reviewing theory as often as necessary. Remote teaching also brought benefits to the university, especially with regard to video lessons. Once recorded, they can be used or reviewed by future students, not only from UNICAMP, but also from other institutions that offer Anatomy courses in Portuguese. This topic can be focused on future studies, aiming to evaluate the impact this tool may have on Anatomy teaching once the pandemic is over.

However, some negative aspects deserve attention. This study showed that social and emotional distancing were among the main shortcomings of the pandemic. Psychological issues are something to be concerned about during social isolation. It is known that the quarantine, as a measure of complete isolation in order to contain a disease, has effects on emotional suffering and mental health, being associated with depression, generalized anxiety, insomnia and post-traumatic stress²⁵. Problems related to emotional factors, such as anxiety and depression, were reported by most students, denoting another irreplaceable factor in face-to-face teaching: human contact. It is not surprising that several studies have been carried out in the context of mental health related to the pandemic²⁶⁻²⁹.

In addition to the impact of remote education on students' mental health, and despite the predominantly positive evaluations, it was possible to observe fatigue and students' exhaustion throughout the year. Fatigue is already known to be prevalent among students and it is related to a heavy course load, extracurricular and social activities, work obligations and even drug use³⁰. Moreover, it seems that the pandemic scenario had a negative impact on mental health of medical students³¹, which may contribute to fatigue among undergraduates. In this study, fatigue became evident by the "difficulty in concentrating

on studies", the "lack of motivation" and the "general content overload" reported in the questionnaires.

Another aspect that should be highlighted is the role of students in the teaching-learning process. It is known that active learning methods have stood out in higher education, with significant importance²⁴. In the present study, the result was no different. The active participation in tutoring sessions, Instagram clinical case presentation and formative activities, as well as the autonomy while studying, denote that it is important for students to be involved in the learning process.

However, the teachers' participation is also essential. Different studies point out the need for the teachers' involvement in the pedagogical process, from planning to the identification of the most appropriate digital platforms to be used for teaching^{32,33}. The Anatomy teaching team played a very important role. By recording lectures and conducting virtual meetings, it was possible to maintain the teaching process and to offer support to the students. Furthermore, the attempt to simulate practical activities through video lessons proved to be a success.

Despite the success of remote learning methods, it is well-known that the practical content of Anatomy is irreplaceable. The possibility of studying with real anatomical specimens is a unique opportunity to understand the complexity of the human body, not always properly expressed in textbooks. However, it can be questioned whether anatomical dissection is still the best way of learning, and whether a single tool would be sufficient for the appropriate study of Human Anatomy³⁴.

Finally, considering the students' main opinion that practical sessions are essential for learning, the replacement of face-to-face activities is being planned. Practical sessions in the laboratory will be resumed once students get fully vaccinated.

Limitations

This article is a cross-sectional study based on data from a one-year period. To verify whether the new teaching method provided greater knowledge in comparison with the traditional way of teaching, and also to evaluate if the blended learning contributes to better training, it is necessary to follow the students in the long term, during the medical course.

CONCLUSION

The experience demonstrated that a teaching team consisting of teachers and tutors has great value in the learning process. Different low-cost technology tools are helpful in overcoming adversities and can be implemented for remote learning in other public universities with limited resources. Nevertheless, this model does not substitute the experience provided by face-to-face teaching. The replacement of practical activities must be considered in the future.

AUTHORS' CONTRIBUTION

Júlia Brandão, Isabella Silva and Túlio Moura participated in study conception and design, data collection and analyses and manuscript writing. Daniel Zimmermann participated in study design and data collection. Wagner Favaro participated in critical review of the manuscript for intellectual content. Simone Appenzeller participated in study conception and design, data collection and analyses, manuscript writing and critical review.

CONFLICTS OF INTEREST

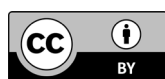
The authors declare no conflicts of interest.

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