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Teaching and learning anatomy online in South Africa during the COVID-19 pandemic

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Abstract

Due to the interactive nature of classic anatomy teaching and learning, great consideration and planning were necessary to deliver an effective online anatomy course. This paper describes the experiences of teaching and learning anatomy online in South Africa during the COVID-19 pandemic. An asynchronous approach was successful in delivering the course content; however, students expressed the desire to resume in-person, interactive cadaveric dissections. Anatomy course content was delivered using a variety of educational resources accounting for all learning styles and attempting to mimic a pre-pandemic setting. Although postgraduate student research timelines were disrupted, contact between research teams was maintained, allowing for projects to run through to completion. The challenges faced throughout the pandemic have shown that anatomical science is a constantly evolving discipline that requires a variety of resources.

Keywords: *Anatomy education; medical education; COVID-19; virtual; online learning; dissection.*

1. Introduction

The COVID-19 pandemic has disrupted higher education on a global scale, with universities forced to close and conduct teaching and learning via distance-based online learning, in an effort to curb the spread of the virus (Daniel et al., 2021; International Association of Universities, 2020). Social distancing and wearing of face masks became mandatory, with "lockdowns" enforced in some countries. In South Africa, a strict lockdown was implemented on the 26th March 2020, with only essential workers (such as emergency services, law enforcement, and health care providers) permitted to travel outside of their homes (Department of Higher Education and Training, 2020). In addition, national and provincial borders were closed. Although these restrictions were eased from the 1st May 2020, most higher education institutions had yet to resume in-person teaching for all or part of their teaching activities.

This article will describe the experiences of teaching anatomy online during the COVID-19 pandemic at a South African institution, situated in Cape Town. The authors comprise of two anatomy educators and two postgraduate (Master's) students, and therefore, can provide a range of perspectives. The authors' institution is classified as a "Historically Advantaged" institution, and as such, may be considered to be in a better position to deliver online education than some of the other institutions in the country. However, anatomy is a discipline that relies on cadaveric dissection as the gold standard for teaching and learning the three-dimensional (3D) structures and spatial relationships between structures within the human body (Ghosh, 2015).

2. Pre-pandemic teaching and learning

Prior to the COVID-19 pandemic, the delivery of anatomy to the Bachelor of Medicine and Bachelor of Surgery (MBChB), Allied Health Sciences, and Bachelor of Science (BSc) classes involved face-to-face didactic lectures and practical cadaveric dissection sessions. Cadaveric dissections took place in dissections halls in the Division of Clinical Anatomy (CA), with six to eight students dissecting one cadaver, for two to four-hour sessions. The Division of CA is also equipped with articulated skeletons, osteological material, and Lodox® (low-dose x-ray) scans accompany each cadaver. Assessment of practical anatomy knowledge was conducted face-to-face in dissection halls, using the "spot test" format. Postgraduate (PG) students from the Division of CA carried out all theoretical and practical coursework at the institution. The Honours programme involves coursework and research, while most of the Master's and Doctoral degrees are by research (dissertation) only. Furthermore, the PG CA courses aim to prepare students for the workplace, and thus the students were assigned a shared office space to work and assisted in near-peer tutoring of undergraduates.

2.1. Transition to online teaching and learning within a South African context

The shift to online teaching presented complications for institutions across South Africa. Few South African higher institutions had prior experience with fully online teaching and learning. After the commencement of lockdown on the 26th March 2020, all higher education institutions were mandated by the President of South Africa to close for early recess, with online teaching and learning resuming on the 20th April 2020 at the authors' institution (Department of Higher Education and Training, 2020). This period afforded educators the time to convert course content to a fully online delivery medium with the assistance of facilitated webinars held by the Centre for Health Professions Education.

South Africa experiences severe economic inequality, with parts of its population lacking electricity, internet access, and other resources essential for remote learning (Czerniewicz et al., 2020; Ojo & Onwuegbuzie, 2020). The authors' institution helped bridge this divide by providing staff and students with electronic devices and mobile network data, and zero-rated access to the university's online learning management platforms (du Plessis, 2020). Furthermore, the entire nation was affected by sporadic "load shedding" during which the electrical power supply is disconnected for extended periods, to meet the country's power supply demands, making it increasingly challenging for conducting online teaching and learning.

3. Clinical Anatomy in the pandemic setting

3.1. Undergraduate Courses in Anatomy

3.1.1. Course content resources and delivery

Due to the practical and interactive nature of classic anatomy teaching and learning, great consideration and planning were necessary to deliver an effective online anatomy course. All anatomy dissections were brought to an abrupt halt, and thus lecture slides needed to be adapted to provide an understanding of "real" anatomy. Lectures took the form of Microsoft PowerPoint presentations with voice recordings on each slide, mp3 recordings, or pdf documents. Asynchronous content delivery was recommended by the authors' institution to accommodate all students within the South African context. Thus, all lectures, supplementary resources, and assessments were made available on the university's learning management platform, SUNLearn. Where synchronous lectures were held on Microsoft Teams and Zoom, these were scheduled in consultation with the class, recorded, and subsequently posted on SUNLearn for those who were not able to attend. Email and discussion forums on SUNLearn were used for communication between the lecturers and students, although the engagement was generally poor. However, students mostly completed the compulsory quizzes by the deadline dates.

To mimic the frequency of pre-pandemic cadaveric interactions, students were encouraged to interact with the course content as frequently as possible using variable formats (Estai, 2016). Therefore, supplementary educational resources were made available, including question and answer sessions, quizzes, worksheets, and educational YouTube videos. In addition, some supplementary resources were compiled by lecturers in collaboration with the PG anatomy students, who provided insight into which aspects students may find challenging. Completion of and interaction with supplementary resources were made compulsory by some lecturers as it was believed that without deadlines, students would be reluctant to engage with the content. Other lecturers were concerned with increasing the cognitive load, known to be higher in online learning (Skulmowski & Xu, 2021), and thus rated resources according to their importance, with some being optional.

Primal Pictures (© Informa UK Ltd, 2022) and BlueLink – University of Michigan (Alsup & Fox, n.d.) were heavily incorporated into teaching anatomy. With an institutional subscription to Primal Pictures, students could access its full complement of features without incurring additional costs. These online resources enabled students to better visualise structures in 3D whilst conceptualising spatial and relational anatomy (Wilkinson, 2011). However, the absence of cadaveric dissections meant that students were limited in their exposure to anatomical variation as well as the haptic aspect of learning anatomy. Moreover, students were unable to fully experience the "hidden curriculum", which teaches the ethical considerations around sourcing of bodies, and facilitates the development of teamwork skills, respect, and empathy (Onigbinde et al. 2020). A virtual session was provided to account for this loss in the curriculum, within which the annual body donation thanksgiving ceremony was included.

3.1.2. Assessment

Assessments required redesigning for an online format, especially those assessing practical knowledge. Theoretical anatomy was assessed via multiple-choice questions for the larger classes, such as the MBChB cohort, and graded automatically on SUNLearn. In comparison, the smaller classes employed short- and long-answer assessment questions, graded manually by the lecturer. The practical component emulated the traditional anatomy "spot test" layout, displaying two-dimensional images of cadaveric material, histological tissues, and osteological structures for identification. However, this could not account for the assessment of spatial and relational anatomy, which can only be achieved when assessing using a cadaver or 3D model (Harmon et al., 2021). Concerns of online assessments being a gateway for dishonesty arose as assessments were not invigilated using webcams due to mobile network limitations. Although this risk could not be fully eliminated, assessment settings allowed for questions to be ordered randomly, time-limited, or only have one attempt.

3.1.3. Near-peer tutoring

Anatomical education frequently employs near-peer tutoring to assist lecturers with large class sizes (Thom, 2021), and therefore, gained popularity at the authors' institution. Near-peer tutors are senior students who have achieved a minimum score of 65% in the anatomy component of their respective degree. Near-peer tutoring affords the opportunity for students to seek assistance from a peer, which may be less intimidating than approaching a more experienced educator. In turn, near-peer tutors consolidate their own knowledge, gain teaching experience, and improve leadership and communication skills (Orsini et al., 2022). Neer-peer tutoring took two forms during the pandemic: asynchronous discussion forums for question and answer sessions, and synchronous one-on-one or small group sessions on Microsoft Teams.

3.1.4. Feedback from undergraduate students

Feedback for anatomy was informal, mainly in the form of unsolicited e-mails from students. However, a researcher from CA investigated the MBChB cohort's perspectives of learning anatomy online (Khan, 2021). It was reported that students appreciated the time and effort that educators invested into their resources to make them clear and understandable. Students enjoyed the ability to pause and re-watch the recorded lectures, and reported feeling less stressed when completing online examinations from their home environments when compared with invigilated assessments on campus. However, requests were received for more demonstrations with models or cadavers in the online content, or the resumption of in-person practical sessions (Khan, 2021).

3.2 Postgraduate Courses in Anatomy

3.2.1. Research and supervision

Postgraduate students were required to halt their research activities and work from home. Communication within research teams was conducted via Microsoft Teams and e-mail. As the lockdown extended, it became apparent that the practical components forming part of the Honours degree would not be able to take place at the institution. Thus, modules that required on-campus facilities were modified to a digital format where possible, such as using Primal Pictures to mimic cadaver dissections. Other modules were taught synchronously on Microsoft Teams or Zoom, such as journal club, which serves to equip students with scientific writing skills. Furthermore, all student timelines for research projects were affected due to the extended closure of the histological and dissection laboratories. Although PG students were understanding of the ongoing challenges, they expressed that working from home negatively affected their morale and motivation, placing emphasis on the value of in-person interactions when collaborating. Additionally, PG students were limited in their experience

of near-peer tutoring, negatively affecting their acquisition of associated skills, such as teaching and communication.

The pandemic however, afforded the opportunity to expand research interests within anatomy to include projects that could be conducted remotely, such as surveys and online interviews. One such study reported on the implementation of the synchronous virtual journal club (Keet et al., 2021). This study reported an overall positive experience with the rapid transition to a virtual environment while maintaining the benefits of teaching and learning (Keet et al., 2021).

4. Return to Campus: Anatomy Classes

A staggered approach was taken for the return of students to campus under strict institutional and governmental COVID-19 protocols. As the national lockdown continued throughout the latter half of 2020, PG CA students were first identified based on their need to complete their research projects and module assignments using the on-campus facilities. A strict roster was implemented, however further negatively affecting research timelines. The BSc students were the second cohort to return to campus for in-person practical dissection sessions, with the final-year students returning in the last quarter of 2020. The second-year BSc students returned for dissection sessions in the beginning of 2021, while their lectures were still conducted online. The BSc anatomy classes consisted of less than 30 students, and thus appropriate social distancing could be achieved in the dissection hall, which was not possible for the larger classes under the government mandated venue number restrictions. However, in-person invigilated assessments were resumed for many courses of the Faculty in 2021, with large classes divided into smaller groups that wrote the assessment in multiple venues at the same time.

As the new academic year of 2022 began in January, face-to-face teaching and learning resumed for all programmes offered at the Faculty as the venue number restrictions were eased by the government. Teaching was delivered in a hybrid format; however, students could choose to attend in-person or virtual lectures. The large MBChB cohort was divided into smaller groups for cadaver dissections. Three students were allocated to one cadaver, which is half of the number allocated in the pre-pandemic setting. Groups had one-hour interactive sessions with pre-dissected cadaveric material for each sub-topic within their system-based anatomy course, which is notably different from how practical sessions were structured before the pandemic, where students had several hours per session to dissect. This change resulted from the shortage of cadavers available for dissection as the body donation programme was closed for much of the pandemic.

5. Conclusion

Throughout the course of the COVID-19 pandemic, anatomical education shifted and adapted. Unique challenges to South Africa required innovative solutions to conduct online teaching and learning, involving an asynchronous approach and provision of resources to staff and students. Anatomy course content was delivered using a variety of educational resources accounting for all learning styles and attempting to mimic a pre-pandemic setting. However, the efficacy and impact of conducting a fully virtual anatomy course has still yet to be determined at the authors' institution. The authors are currently conducting a study involving undergraduate, postgraduate, and academic staff in anatomy of their perceptions of both fully online and blended learning approaches to teaching and learning anatomy and postgraduate research supervision. The resumption of the academic programmes in 2022 are being conducted in a hybrid format to account for the ever-changing circumstances surrounding the pandemic. From our experience, teaching anatomy by means of a hybrid approach with an emphasis on in-person practical sessions complemented by online asynchronous lecture material is feasible.

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