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Undergraduate Education in Forensic Clinical Anatomy: Online Versus Offline

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Abstract: Medical education has been affected by the epidemic in recent years and thus has encountered many challenges. Regardless of the specialty, medicine requires hands-on experience, therefore the epidemic has prevented students from getting those opportunities. This has put too much strain on current medical students, compromised the quality of instruction, and decreased students' motivation. As the cornerstone of medical education and the pathway to all higher medicine courses, anatomy faces the greatest challenge at the same time. This article compares the different aspects of teaching anatomy online and offline and discusses how to teach anatomy more efficiently. It explores what is currently needed in teaching forensic clinical anatomy so as to introduce more students to the subject and tries to figure out how to improve the medical education system so that medical students are less stressed and in a better state to learn as well. This article concludes that a hybrid approach to teaching and learning—one that incorporates both online and offline—is more successful.

Keywords: medical education, forensic clinical anatomy, online learning, offline learning, undergraduate education

1. Introduction

By describing and delineating the structural characteristics of living species, such as humans, animals, and plants, anatomical science, a branch of biology and medicine, serves as the foundation for medicine. The definition of forensic clinical anatomy is "the use of anatomical knowledge and techniques in a practical setting" [1]. It is a branch of anatomy used to identify, evaluate, and pinpoint preserved human remains in order to ascertain factors such as age, sex, genetic makeup, and cause of death, which is widely used in Crime scene investigations. It is uncommon for students majoring in human anatomy or forensic anatomy to decide to pursue further studies in these fields, either because some of them do not enjoy handling cadavers or because they are more inclined toward surgeons for their career plans. As a result of this trend, there is a severe shortage of researchers, practitioners, and students in anatomy and forensic science. Due to the rapid outbreak of the Covid-19 pandemic, universities around the world have been forced to choose to teach online in order to keep up with the pace and quality of instruction. This article compares the advantages and disadvantages of two teaching methods using paper databases cited from Google Scholar and PubMed, cross-referenced with some keywords, from the basics to the details, for example, medical undergraduate education; anatomical sciences education; online learning; offline learning; forensic pathology, etc. Additionally, this article explores if a combination of offline and online training is preferable, whether there are

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better ways to educate, and how to interest students in these fields using cutting-edge instructional tools and techniques. In other words, the educational strategy outlined in this research might encourage and attract more students to enroll in forensic science or clinical anatomy programs, thereby addressing the specialty's present talent deficit.

2. The Difference Between Offline and Online

2.1. Offline Learning Mode Versus Online Learning Mode

The original mode of learning that allowed students to engage with their classmates and teachers on a regular basis face-to-face is known as traditional education. Within the confines of a real classroom, offline learning offers pupils a real learning environment. It enables close student-teacher interaction and active participation in real-time discussions and debates, which benefits the student's entire physical and intellectual growth. Students who enroll in offline courses must travel to the site of their educational institution. A lecture hall is typically used for instruction, which occurs in a set location.

Technology has fundamentally altered the ways that offline education is delivered. In reality, students can now easily access educational resources from the comfort of their homes thanks to the flexibility of online education. Online education also aids students in setting their own learning pace and offers wonderful opportunities for students who do not have access to regular classrooms. Although students don't need to spend much time commuting, online learning still requires access to the internet and equipment like laptops and tablets.

2.2. Offline Lectures Versus Online Lectures

Offline lectures require students to attend lectures at their educational institution. A lecture hall is typically used for instruction, which occurs in a set location. The instructor and the student will be able to connect more effectively during in-person lectures [2]. Students can ask any questions they desire and receive prompt responses during offline sessions. Additionally, face-to-face lectures improve the learning experience for pupils since, for instance, the teacher's eyes and body language might stop students from straying during class. It can be challenging to develop, for instance, extended interactions or other personal dynamic relationships between professor and student in online classes because most students do not turn on the webcam until the professor requests it. On the other hand, face-to-face lectures make it simpler for lecturers to receive student feedback. It is possible for teachers to clearly understand the body language, feelings, and questions that students are expressing, which can make it simpler for them to modify the speed or tempo of teaching and raise the quality of the class. There will be a rise in the engagement and enthusiasm of the students. In forensic clinical anatomy, group activities like case studies, and presentations are common. However, if the class is held offline, everyone will essentially utilize text communication, which results in reduced efficiency and passion for the class. But on the flip side, offline teaching can spend students' commuting time, as well as not every professor or every class being recorded, as there is some privacy involved, such as photos of some bodies or organs not being included in class materials shared with students. Students are forced to attend classes in person because recordings and photos may not be available.

Online lectures that teach self-discipline and time management skills are readily available to students. Students can easily manage their own learning pace with the correct equipment and a dependable Internet connection [3]. Students can watch the lecture videos in different locations and different time zones, which is more convenient for students because commuting time is drastically reduced. However, students must use electronic devices and have reliable Internet access to view online lectures. There will be less interaction between students and professors, as the number of students in synchronous classes will be much smaller if there is no attendance requirement [4]. Meanwhile, Zoom, the most common tool for professors to synchronize lectures, has only 300 seats,

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which means that not every student may be able to attend a lecture due to the limitations of Zoom meetings. Also, since the class is online, some professors may ask students to send emails or post on the discussion boards if they have questions about the topic, which will make the class less efficient.

2.3. In-person Practical Sessions Versus Online Practical Sessions

The in-person practical component typically entails a classic corpse dissection session or seminars employing anatomical models, and meticulously dissected cadaveric material which means the classic anatomy dissection section and the workshop practical section make up the two parts of the offline practical [5]. An eight-person group of students dissects a cadaver under the supervision of a teaching assistant as part of the classical anatomy class. Many different anatomical specimens, including plastinated or unplastinated specimens, and skeletal and anatomical models, are available in VR at some universities to aid student learning for use in practical seminars or work sessions. According to data analysis, 453 students at the University of Melbourne registered for an anatomy course. Students who participated in the practical sessions in this anatomy course usually obtained higher final grades than those who did not [5]. This might be because lab courses give students a practical opportunity to analyze anatomical material, which is undoubtedly a greater learning opportunity than simply learning from a textbook.

The online practical sessions would be considerably different from the offline labs. The online practical sessions can be learned in two ways: by watching the instructor's anatomy videos or by using the online tools or online dissection audio-visual resources which are known as DAVR [6]. The instructor's dissection video might not be particularly clear and adequately explained. Also, there are a limited number of online tools available to help students learn, especially to simulate the deconstruction process or the autopsy process. In order to help them get ready for dissection, DAVR took pictures of cadavers during the sequential phase of dissection, which focused on recognizing anatomical components and their anatomical relationships in the order they were taught [6]. However, either way, students' engagement as well as their experience decreases because anatomy is a "hands-on" course and students learn better if they can actually see the organs.

2.4. In-person Lab Test Versus Online Lab Test

Most in-person lab tests use "spot" tests or bell-ringing tests, in which students stay at each station for basically 90 seconds to 120 seconds to answer a question, and then a bell prompts the candidates that they must move to the next station for another question [7]. Most lab quizzes are short answer questions that range from 30 to 50 stations in length, and depending on the instructor, they make up 30% to 40% of the final grade. Students are required to look at specimens from each station to answer questions such as naming a structure, explaining its role, and demonstrating the importance of that function. The number of anatomical concepts and objects that must be memorized is substantial. In offline lab quizzes, there may be some unavoidable extenuating circumstances, such as specimens that are too old to be easily identified and used to answer questions. Furthermore, since the school sets the time for the in-person quizzes, students could experience scheduling issues. If a make-up exam is required, instructors and teaching assistants will also need more time to reorganize each station before the exam.

An online lab test follows a similar format to an offline test. In brief, online lab tests are bell-ringing quizzes administered through a learning management system such as Quercus or Moodle. Importantly, because the tests are administered on the platform and there are strict time limits for each question, they are fairer. Also, professors or teaching assistants often use high-resolution photographs of specimens rather than real specimens from the website for the tests. This avoids the problem of unclear offline specimens. In addition, online quizzes are mostly asynchronous, which

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means students can do them any time within 24 to 48 hours. This effectively avoids time conflicts for students. And even if a student still has a time conflict, setting up a make-up quiz online will save the professor's time as well as the teaching assistant's time more than offline.

2.5. In-person Exam Versus Online Exam

The in-person written exam in forensic clinical anatomy accounts for 60% to 70% of the final grade and usually consists of multiple choices with a few short or lengthy answers. The time and place will be determined by the faculty, and the exam duration should be between 90 and 120 minutes. Due to possible scheduling conflicts for students, students may request a postponement of the exam. Nevertheless, the format of the postponed exam may vary, depending on the instructor, and can be either an oral exam or all short and long-answer questions. Since the tests are taken offline, proctors conduct identity checks, monitor the tests, and warn and take away students' materials if they are found to be using prohibited items while taking the test. As a result, there is very little cheating on offline tests as students do not risk doing so in front of proctors. However, due to technology development, a very small percentage of students now cheat on offline tests using devices such as hidden cameras and headphones, although this can be prevented by vigilant checks by proctors and patrol officers. In China, for example, electronic security testing devices are used before national college entrance exams, and illegal devices found will be seized [8].

Online exams are virtually asynchronous, meaning that students can take the exam at any time and any place within 24 to 48 hours. However, the format of the exam is similar to the offline exam, with an increased number of short and long-answer questions. Cheating rates have increased significantly as a result of the fact that online exams are delivered through a platform. As an illustration, asynchronous exams, particularly lab quizzes, make it easier for students to finish the test since one student can take it first, gather the questions, and then finish the exam with other students. According to this report, 73% of students cheat on online examinations, but after using cutting-edge technology to secure them, that number reduces to 13%. However, the 13% percentage of cheating is still far higher than the rate of cheating in traditional tests [9]. The instructors became aware of the widespread cheating and devised several methods to avoid it: Smart Exam Monitor that can provide identity verification, and a record of the physical environment; or requires participation in a zoom session during the exam, and two cameras must be turned on, one aimed at the head and the other at the computer's keyboard; or different question or answer sequences; or automatic selection of random questions from the question bank [10]. Even with the use of all the tactics, some students managed to cheat on the online exams, making the in-person exams more equitable. Unfortunately, the above-mentioned cheating rates only apply to students who were caught cheating. Since students may employ more sophisticated technology to escape online proctoring, no articles' data dare to guarantee that all cheating students have been included. Therefore, it is possible that the actual rate of cheating will be higher than the rate that was previously given.

3. A Combination of Online Teaching and Offline Teaching

A survey found that the communication and flexibility of online medical science courses contributed to 41.3% of 340 students' satisfaction with their participation [11]. According to another survey study, 68% of the 174 medical students were using online learning for the first time and believed that all courses—aside from anatomy—could be taught online [12]. For instance, medical ethics and law, etc. Students preferred an early morning class to a late-night class. In lecture sections only, omitting lab sessions, nearly half of the students expressed interest in continuing the online course. But the biggest problems they identified were with Internet connectivity, challenges with Zoom meeting time limits, and other technological issues. They believed that clear shared screens, increased eye contact, and

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perhaps class recordings were better suited for online courses [4]. After the COVID-19 shutdown in March 2020, medical student respondents from the class of 2023 believed that online anatomy was inferior to in-person laboratory sessions [12]. Due to their flexibility and the availability of recordings, the students consequently favored the online lectures; but, in the lab portion, they claimed that the offline lectures would assist them to understand the course material and aid in memorizing. Only a few students had issues with the tests' preferences on the exams. Some students reported less test anxiety, whilst others reported more. The majority of students preferred the traditional proctored setting in a lab or classroom because they thought it guaranteed an even playing field for all test takers [13].

According to a cross-sectional study, 74.3% of 81 instructors were satisfied with the online medical science courses they were teaching not just forensic clinical anatomy courses, and 92.9% of faculty members were pleased with their students' enthusiasm for online learning [11]. Increased workloads and the time needed to create teaching and evaluation materials are burdens on faculty members, and senior professors in particular need technical support from the university [11]. Additionally, Cidral argues that the success of online learning depended on the instructor's accessibility [14]. Therefore, when institutions give enough online materials and technical assistance to improve student-instructor interaction, students may have an adequate experience and be more satisfied with their online education.

In summary, the acceptance and preference of students and professors vary from case to case. Most of the students prefer to go online for lectures, and offline for lab sections. It can be deduced that the best teaching strategy is a combination of online and offline delivery. It is reasonable to execute various course sessions in a way that is more effective and well-liked by students and instructors. The aforementioned data indicate that offline experiments are the most effective strategy and the method preferred by students. The lectures are recommended to be conducted online, allowing students to access video screens for repeated viewing, which will help them review and reinforce their learning. All types of exams need to be administered offline to ensure fairness to all students.

4. The Way to Improve Medical Education System

Along with each of the above-mentioned factors, it is also crucial to pay attention to mental health. A cross-sectional study found that students with poor mental health did not feel stress as a result of spending more time online. Students who enjoyed communicating with others found the lockdown to be more stressful [15]. Instructors should create a lecture style that incorporates active learning and regular breaks to lessen student stress on days when they have entire online courses. The current stereotype of most students, not only medical students or other non-medical students, about forensic clinical anatomy, is that it requires a very large amount of memorization, scary experiments, and tedious exams. In the meantime, there aren't many studies on forensic clinical anatomy education, but those that do tend to focus on the field's continual need for innovative teaching strategies. Therefore, it is urgently necessary to develop innovative and captivating teaching techniques at this moment. Online resources are too few to offer additional medical courses in addition to forensic clinical anatomy. Online resources might offer a more entertaining way to include pupils in learning. For example, online tools can simulate autopsies and help students of forensic clinical anatomy. In addition, the course syllabus cannot be limited to lab exams and written exams; professors could add interesting assignments or projects that do not need to account for a large percentage of the final grade or use them as bonus points to engage more students in the course. They can use online tools to reconstruct a crime scene or restore a body based on the cause of death, or reason about the cause of death based on the condition of the body. However, the examples provided above, are all centered on the creation of online tools, which further demonstrates the urgent need for and development of online learning aids.

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Finally, since studying medicine is extremely challenging and stressful, schools should pay closer attention to the psychological issues that medical students face. The school should try to make a more diversified curriculum and simplify medical education in order to develop more talent and meet the demands of the field, particularly true in the field of forensic clinical anatomy, which is an area where there is a shortage of talent.

5. Conclusion

Overall, the lectures and lab quizzes perform well online and are appreciated by both students and professors. However, lab quizzes can be administered in the classroom using a tablet or laptop computer. This means that students would need to use the university's laptops to complete the quizzes in the classroom or exam center, which not only more effectively distributes the professor's grading workload but also ensures the accuracy and clarity of the exam-related specimen images and the equality of all students because it successfully prevents cheating issues. Both the written exam and the lab should always be given in person. Numerous studies have demonstrated that offline labs are favorable for teaching forensic clinical anatomy while in-person labs and written exams are preferred by both students and instructors. In conclusion, a mixture of online and offline teaching techniques which combines the advantages of their two teaching methods is recommended to teach forensic clinical anatomy.

Though with only four years of online education due to the epidemic, every university is now gradually returning to offline instruction, resulting in not many studies taking preliminary data collection at that time, a more profound and extensive combination of online and offline training is an irresistible trend. So more detailed and targeted research experiment studies need to be conducted in the future so as to lead both forensic clinical anatomy education and medical education to better educational outcomes.

References

[1] *Porzionato, A., Macchi, V., Stecco, C., Boscolo-Berto, R., Loukas, M., Tubbs, R. S., and De Caro, R., (1915). Clinical Anatomy and Medical Malpractice-A Narrative Review with Methodological Implications, Healthcare, Basel, Switzerland, 10(10).*

[2] *Doherty, S. (2022, August 21). Balancing online and offline studies. eLearning Industry. Retrieved January 18, 2023, from https://elearningindustry.com/balancing-online-and-offline-studies*

[3] *Edu, T. L. (2022, November 18). Online classes VS offline classes. Leverage Edu. Retrieved January 18, 2023, from https://leverageedu.com/blog/online-classes-vs-offline-classes/*

[4] *Saha, Satyajit and Roy, Hironmoy & Ray, Kuntala. (2021). ORIGINALSARTICLE Online anatomy lecture using zoom application and its learning experience of undergraduate medical students.*

[5] *Gonsalvez, D., Ovens, M. and Ivanusic, J. (2015). Does attendance at anatomy practical classes correlate with assessment outcome? A retrospective study of a large cohort of undergraduate anatomy students. BMC Med Educ 15, 231 https://doi.org/10.1186/s12909-015-0515-y.*

[6] *Choi-Lundberg, D. L., Cuellar, W. A., and Williams, A. M. (2016). Online dissection audio-visual resources for human anatomy: Undergraduate medical students' usage and learning outcomes. Anatomical sciences education, 9(6), 545–554. https://doi.org/10.1002/ase.1607.*

[7] *McLaughlin, L. (2022). Guides: Succeed at exams: Bell-Ringer exams. Bell-Ringer Exams - Succeed at Exams - Guides at University of Guelph. Retrieved January 18, 2023, from https://guides.lib.uoguelph.ca/c.php?g=697429&p=5011755.*

[8] *Sun, R. (2021, June 03). Public security stepping up checks to safeguard gaokao. Chinadaily.com.cn. Retrieved January 18, 2023, from https://www.chinadaily.com.cn/a/202106/03/WS60b8cafca31024ad0bac3772.html*

[9] *National News. (2022). 73% of students cheat during online exams: Survey. Education World. Retrieved January 18, 2023, from https://www.educationworld.in/73-of-students-cheat-during-online-exams-survey/x.*

[10] *University of Alberta. (2022). Delivering remote exams - powered by Kayako Help Desk Software. Delivering Remote Exams. Retrieved from https://support.eclass.ualberta.ca/index.php?/Knowledgebase/Article/View/425/1/delivering-remote-exams%2520.*

[11] *Elshami, W., Taha, M. H., Abuzaid, M., Saravanan, C., Al Kawas, S., and Abdalla, M. E. (2021). Satisfaction with online learning in the new normal: perspective of students and faculty at medical and health sciences colleges. Medical education online, 26(1), 1920090. https://doi.org/10.1080/10872981.2021.1920090*.

[12] *Kaufman, R. E., Patel, K., and Edmondson, A. (2022). Transitioning from In Person to Online Human Anatomy:Student Perspectives from the COVID-19 Pandemic. The FASEB Journal, 36(Suppl 1), 10.1096/fasebj.2022.36.S1.R2507. https://doi.org/10.1096/fasebj.2022.36.S1.R2507*.

[13] *Jaap, A., Dewar, A., Duncan, C., Fairhurst, K., Hope, D., and Kluth, D. (2021). Effect of remote online exam delivery on student experience and performance in applied knowledge tests. BMC medical education, 21(1), 86. https://doi.org/10.1186/s12909-021-02521-1*.

[14] *Cidral WA, Oliveira T, Di Felice M, et al. (2018). E-learning success determinants: brazilian empirical study. Comput Educ. 122:273–290.*

[15] *Matsuo, M., Sesoko, S., Kosa, A., Noda, S., Koura, S., Miyabara, H., and Higuchi, T. (2022). Factors affecting the mental health of medical students during the COVID-19 pandemic: A cross-sectional study. Medicine, 101(47), e31897. https://doi.org/10.1097/MD.0000000000031897*.