Switching from face-to-face to an online teaching strategy: how anatomy and physiology teaching transformed post-COVID-19 for a university preprofessional program

Ismail Memon,1,2 Zeeshan Feroz,1,2 Abdulmohsen Alkushi,1,2 Nabeel Qamar,1,2 and Farwa Ismail3

1Basic Sciences Department, College of Science and Health Professions, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Kingdom of Saudi Arabia; 2King Abdullah International Medical Research Center, Riyadh, Kingdom of Saudi Arabia; and 3PricewaterhouseCoopers, New York, New York

Abstract

The College of Science and Health Professions offers a university preprofessional program. Like most medical schools in Saudi Arabia, the teaching delivery strategy in the university preprofessional program is on campus and face-to-face. During the month of March 2020, teaching activities of the spring semester were proceeding as normal; however, the sudden emergence of COVID-19 disturbed routine activities and compelled authorities to switch all teaching activities from face-to-face to online. Training sessions and workshops for all stakeholders on online delivery methods were arranged. Blackboard and other online facilities were utilized. All teaching materials, including newly made video clips for anatomy and physiology practicals, were uploaded on Blackboard and discussed online with students. Students’ anxiety related to the exam was reassured by giving them the option of open book quizzes during summative continuous assessment. All scheduled teaching sessions, lectures, and practicals were conducted proficiently. Revision sessions and assessment quizzes were conducted with students’ satisfaction. At the end of the semester, a final exam was conducted online as an open book exam. Students with technical issues while attempting the exam were given an opportunity to make up for it. After a successful final exam, the cumulative block grades showed students secured higher grades in the open book exam. Following that, the King Saud bin Abdulaziz University for Health Sciences has managed to conduct on-campus close book exams that abide by self-distancing and standard operating procedure policies.

anatomy; COVID-19; face-to-face learning; online teaching; open book exam; physiology

INTRODUCTION

In a traditional medical curriculum, basic medical science subjects such as anatomy, physiology, biochemistry, pharmacology, and pathology are usually offered in the first 2–3 yr of an undergraduate program. However, modern medical curricula have basic medical science subjects integrated vertically with clinical subjects, which are taught simultaneously throughout the undergraduate program (1, 2). In most medical schools in Saudi Arabia, teaching delivery is on campus and face-to-face. The College of Science and Health Professions (COSHP) at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in Riyadh, Saudi Arabia, is one such school that offers a preprofessional program for medical, dental, pharmacy, applied medical science, health informatics, and nursing students. The teaching strategy in all colleges at KSAU-HS is face-to-face. Lectures, practicals, and clinical sessions are conducted on campus, and all colleges are well equipped with most of the modern facilities necessary for classroom teaching (3). All teaching, learning, and assessment related activities are strongly supported by a web-based learning and management software, Blackboard Learn.

COVID-19 Outbreak and Its Effects

The COVID-19 outbreak started in Wuhan, China, in December 2019 (4). The World Health Organization declared the outbreak a public health emergency of international concern on January 30, 2020, and as a pandemic on March 11, 2020 (5, 6). In Saudi Arabia, on March 2, 2020, the Ministry of Health announced its first case in the country, and the number of infections continued to rise from there (7). In the month of March, teaching activities of the spring semester at COSHP were in full swing, but the sudden emergence of a worldwide COVID-19 catastrophe halted most routine activities and forced authorities to explore alternatives. In conditions of fear and uncertainty, KSAU-HS decided to follow the recommendations of physical distancing from World Health...
Organization and switch all on-campus teaching activities from face-to-face to online from March 8, 2020 (8).

## RESCUE ACTIONS TO REALLOCATE TEACHING ACTIVITIES

The abrupt transition from face-to-face teaching to online teaching was a challenging task for students, teachers, administration, and staff. To cope with this tough situation, the university took successive steps and prepared all stakeholders for off-campus online teaching and learning activities. Like other colleges at KSAU-HS, COSHP also arranged training sessions and workshops for teachers, students, assessment, and administrative staff on online delivery methods. In all the endeavors to prepare for online teaching, Blackboard Learn remained instrumental. Blackboard was already in use at KSAU-HS for academic activities, but for online teaching, it remained vital. In addition to Blackboard, other online facilities, including Zoom and Microsoft Teams, were also utilized as per convenience.

### Teaching Strategies

During the COVID-19 pandemic, virtual teaching has become an important alternative to on-campus teaching (9). Several different strategies were adopted at COSHP to shift to an online teaching method. All teaching materials (lectures, quizzes, and practicals) were uploaded on the learning material section of Blackboard for each group. Students had access to most functions of Blackboard except for features like answer keys, which were limited to the teaching faculty. Additionally, audio recordings of the PowerPoint (PPT) slides (Fig. 1) were also uploaded to Blackboard 1 wk before the scheduled teaching sessions. Statistics tracking was enabled for each uploaded lecture to gather data on the number of students accessing a particular file.

In anatomy and physiology subjects, practicals are an essential component of teaching. The instructors played a proactive role by recording video clips of laboratories (Fig. 2) explaining bones, plastic models, prosected specimens, and physiology practicals. These uploaded videos were discussed online with students by instructors during the scheduled time slots. Regular announcements were generated before each scheduled session as a reminder for the students.

On the scheduled date and time, the instructors and students came online on Blackboard Collaborate Ultra allowing students to ask questions and instructors to elaborate on concepts that were unclear. These live interactive sessions were conducted in two ways based on mutual understanding between students and instructors. One where the instructors invited the students to ask questions from the uploaded audio recorded PPT slides, and the other where the instructors first delivered live lectures on the uploaded slides and then responded to students’ questions. Although attendance was not mandatory in the online interactive sessions, students were encouraged to actively participate in these sessions. Based on some informal discussions between teachers, one learned that attendance was higher in those sessions where the tutors delivered lectures on their uploaded slides. It is a customary observation that students in the preprofessional program are more interested in didactic lectures, although not a healthy practice, than in interactive sessions. Instructors played a dynamic role in developing and maintaining the learning interests of students in this panicky situation. Furthermore, accepting the importance of group discussions in anatomy and physiology, a discussion panel was created on Blackboard for each lecture and practical session. Students were free to discuss any query using this panel as well. The faculty involved in teaching anatomy and physiology at this institution took appreciable efforts to quickly change their teaching style during this great public health emergency.

### Assessment Strategies

Assessment is a compulsory part of any course to evaluate learning. Conducting a fair, stress-free, and infallible online assessment was not an easy task; hence, suitable and accommodating measures were taken. The Anatomy and Physiology-211 course is presented here as an example. Before the pandemic, the contents of the course were...
divided into three blocks with summative assessments. At the end of each block, a multiple-choice questions (MCQ) exam was planned from the content covered in that block. The last exam also included an objective structured practical examination. At the end of the semester, students were supposed to be graded cumulatively. This spring 2020 semester, the Block-1 exam had been conducted before the school had to shift online. After the COVID-19 upheaval, the assessment system for the rest of the semester was modified to be conducted online as an open book exam (OBE). Table 1 shows the plan of online assessment and grading prepared for premedical, predental, and prepharmacy students.

All post-COVID assessments were conducted on Blackboard Learn. Soon after switching the school to an online system, students started showing their apprehensions and concerns about online exams and grading procedures. In response, like many other medical schools (10, 11), the COSHP opted for OBE, which was found to lessen the students’ anxiety. Having said that, academic misconduct and dishonesty in such situations is unavoidable (12). During COVID, OBEs are one of the most commonly conducted assessment methods (13).

Students were briefed about the whole exam process, and a formative rehearsal (practice without grading) for the online exam was conducted to ensure the practical suitability of the exam process. The availability of internet to students participating in the exams was confirmed. Students with technical issues while attempting the exam were given an opportunity to rectify. Here, we present grades of students in premedical, predental, and prepharmacy groups, for both male and female colleges, during the academic year 2018–2019 on-campus Close Book Exam (CBE) and the academic year 2019–2020, off-campus OBE.

Students of both male and female premedical colleges had an even distribution of grades in 2018–19. However, most students scored an A+ in 2019–20 (Fig. 3). Figure 4 shows students in both male and female predental colleges performed considerably better in 2019–20 than in the 2018–19 exam. Female predental students had no grade lower than a B in the 2019–20 exam.

Figure 5 shows that students in both, male and female prepharmacy colleges performed substantially better in 2019–20 than in 2018–19. The majority of prepharmacy male students failed in 2018–19; no one failed the 2019–20 exam.

To be honest, this is not a fair comparison between the grades of academic years 2018–2019 and 2019–2020, because, before COVID, teaching was face-to-face and exams were conducted on campus as CBE, while during the pandemic, teaching was shifted to virtual delivery and the exam was designed as a CBE but was conducted as an OBE.

Agreeing with the notion that canceling exams or passing students on the merit of their previous grades was not a solution (14), our university opted for OBE. During OBE students can achieve higher grades in MCQs as there are chances of academic misconduct (15). Our students’ grades for all groups were considerably higher in OBE during the COVID pandemic (Figs. 1, 2, and 3). Essentially, OBE needs higher cognitive and critical thinking skills; hence exams should be more demanding.

Table 1. Assessment plan (Anatomy and Physiology Course-211) spring semester 2019–2020

| Assessment Item                          | Weightage | Content                          |
|-----------------------------------------|-----------|----------------------------------|
| Block-1 exam (face to face before COVID-19) | 25%       | 15 lectures                      |
| Case bases learning (CBL)               | 10%       | Attendance only                  |
| Continuous assessment, Quiz-1           | 10%       | 6 lectures and 1 CBL             |
| Continuous assessment, Quiz-2           | 10%       | 7 lectures                       |
| Continuous assessment, Quiz-3           | 10%       | 7 lectures and 1 CBL             |
| OSPE                                    | 15%       | 15 practical sessions            |
| Final exam                              | 20%       | 10 lectures & 1 CBL              |
| Total                                   | 100%      | 45 lectures 7 3 CBLs             |

OSPE, objective structured practical examination.

Figure 3. Premedical students’ grade of the final exam, male and female colleges, during the academic years 2018–2019 (on-campus closed book exams) and 2019–2020 (off campus virtual open book exams).
made accordingly (16). The weakness of our OBE was that the MCQs were designed for a CBE. We could not modify the MCQs accordingly because our teaching was conducted on a CBE format, and we did not have enough time to prepare our students for critical thinking type questions. The possible reason for the noticeably improved performance in 2019–2020 could be OBE, and the possibility of academic dishonesty cannot be ignored. To avoid such effects in future, KSAU-HS has prepared itself for on-campus examinations that follow standard operating procedure (SOP) guidelines.

Conducting socially distanced exams on campus under SOP guidelines is a challenging task, and it needs high commitment and adequate resources. Luckily, we had enough venues to conduct exams for the required self-distancing protocols. Additionally, at the time of entry, each student was checked for his/her status of COVID infection through an official application, which is approved by the Saudi Ministry of Health. The student affairs personals dedicatedly monitored the compliance of SOPs and social distancing by the students and invigilators. In every venue, exam material

Figure 4. Predental students’ grades of the final exam, male and female colleges, during academic years 2018–2019 (on-campus closed book exams) and 2019–2020 (off-campus virtual open book exams).

Figure 5. Prepharmacy students’ grades of the final exam, male and female colleges, during the academic years 2018–2019 (on-campus closed book exams) and 2019–2020 (off-campus virtual open book exams).
OUTCOMES

COVID-19 pandemic has created serious impacts in every walk of life including the educational sector. Along with that, providing educational facilities and maintaining physical distance was a big challenge. KSAU-HS, like other teaching institutions around the world, achieved its objectives by adopting online teaching and learning system, and COSHP outdid its expectations to achieve its goals in the Pre-Professional Program. All teaching related activities, lectures and practicals were successfully conducted online, and the students’ satisfaction, informal, was sought. A recent meta-analysis study is in favor of the flipped classroom approach in health education (17). However, during informal discussions with them revealed that they preferred CBE, and their biggest concern was academic dishonesty. This was similar to the findings of Mathieson et al. (14).

ACKNOWLEDGMENTS

The authors acknowledge Hameerali Ismail Memon of the University of Alberta for reviewing the English of the manuscript.

DISCLOSURES

No conflict of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

I.M. and A.A. conceived and designed research; I.M., Z.F., and N.Q. prepared figures; I.M., Z.F., A.A., N.Q., and F.I. drafted manuscript; I.M., Z.F., A.A., N.Q., and F.I. edited and revised manuscript; I.M., Z.F., A.A., N.Q., and F.I. approved final version of manuscript.

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