HOW WE TEACH | Classroom and Laboratory Research Projects

Approaches used for teaching anatomy and physiology in the university pre-professional program at King Saud bin Abdulaziz University for Health Sciences

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Memon I, Alkushi A, Shewar DE, Anjum I, Feroz Z. Approaches used for teaching anatomy and physiology in the university pre-professional program at King Saud bin Abdulaziz University for Health Sciences. Adv Physiol Educ 44: 188–191, 2020; doi:10.1152/advan.00167.2019.—Many medical schools offer pre-professional programs to undergraduate students. The main purpose of the university pre-professional program (UPPP) is to equip students with the necessary knowledge and skills required to successfully cope with the academic demands of further education provided by professional colleges. The aim of this commentary article is to describe the role of UPPP at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in preparing students to continue studies at the College of Medicine (COM) and other health-related colleges. The anatomy and physiology course is presented as a representative model. An outline of the UPPP in the context of the curriculum, teaching strategies, learning facilities, and assessment is presented. The pre-professional program at KSAU-HS prepares school graduates to become self-learners and enable them to learn effectively in the clinical context in a problem-based learning curriculum at COM.

learning facilities; physiology and anatomy course; pre-professional program; self-learner; teaching strategies

INTRODUCTION

We teach basic medical science courses, including anatomy and physiology, to pre-professional students at the King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in the university pre-professional program (UPPP). The UPPP is offered at College of Science and Health Professions (COSHP) and its aim is to equip high school graduates with educational skills necessary for pursuing professional studies at the College of Medicine (COM) and other health science colleges. In the UPPP, gross anatomy and physiology is taught through systemic approach in a course scheduled in the spring semester of the second year. Male and female students have separate logistics on the same campus with the same curriculum, teaching approaches, facilities, and assessment system. Number of students joining the UPPP varies each year. For instance, in academic year 2017–2018, 1,050 students joined the UPPP, out of which 760 students successfully completed the courses, and the remaining 290 students either dropped or failed in one or more courses.

The COM at KSAU-HS follows a hybrid curriculum and utilizes teaching strategies that revolve around problem-based cases, which are supported by a limited number of lectures and skill-developing sessions. In the first phase of the COM curriculum, which is offered in the UPPP, students are encouraged to switch their learning style from a didactic, teacher-centered method to problem-based, student-centered methods. In the third semester of UPPP, a medical terminology course is offered along with behavioral science, computer science, biochemistry, and health informatics courses. Basic medical science-related courses like anatomy and physiology, histology and embryology, principles of diseases (general pathology, immunology, and microbiology), basic pharmacology, health professions education, medical ethics, and patient safety, are offered in the fourth semester. In this paper, we present the anatomy and physiology course as a representative teaching model. Anatomy and physiology is a 4-credit-hour course conducted over 15 wk. We describe this course in the context of curriculum, teaching approaches, teaching and learning facilities, and assessment.

Curriculum

Curriculum at the COM is delivered in three phases. Phase 1 is the UPPP phase, which primarily utilizes didactic teaching and prepares high school graduates for university education. The UPPP, in its freshman year, provides students with basic skills in English language, enabling them to study in English. Furthermore, the freshman year of the UPPP provides students with skills in basic science courses, such as physics, chemistry, and biology. The courses offered in the four semesters of the UPPP are listed in Table 1. All high school students admitted to the university are enrolled in a unified teaching track in their freshman year. In the succeeding year, students are segregated into the Pre-Medical, Pre-Dental, Pre-Pharma, and Pre-Applied Medical Science groups, based on their combined grade point average of freshman year and their college choice. In the second year of UPPP (phase 1) of COM, students are enrolled in basic medical science and advanced English courses. Anat-
In the first phase of the anatomy practical, the tutor explains subdivision into three subgroups, attend the practical together. Students in the laboratory manual. A group of 80–100 students, the content covered in the practical session is provided to laboratory. Objectives of the practicals follow a systemic approach. Anatomy and physiology teaching is merged with other basic courses lectures, are conducted in well-equipped lecture rooms, and students are segregated into groups according to their prospective colleges. Lectures are followed by physiology lectures, and practical sessions are scheduled after the lectures. The aim of including CBL sessions is to prepare and familiarize students with student-centered learning approaches and learning in a clinical context. Medical students are offered PBL curriculum in the second phase at the COM. Although CBL sessions are not conducted with pure fidelity to the CBL model, these sessions do, nonetheless, introduce students to modern teaching and learning methods. Students are expected to participate actively in these sessions, generate ideas, and learn in a clinical context; hence this is a step toward a student-centered learning system. These sessions are mandatory and form part of the continuous assessment.

Self-directed learning sessions. In the UPPP, students are encouraged and provided with opportunities to become self-learners. In a 15-wk (4 credit hours) course, ~15 self-directed learning (SDL) sessions are devoted to independent learning. Students are responsible for organizing most of the SDL process. They are expected to take initiative and responsibility for their learning. For example, individual students select, manage, and assess their own learning activities. Peers can provide collaboration, whereas teachers provide scaffolding, mentoring, and advice. SDL sessions are seen as instrumental in facilitating students to switch their learning habits from a teacher-centered to student-centered learning process, which is the essence of the PBL system.

Teaching Approaches

Lectures and practicals. At COSHP, we teach gross anatomy and physiology to the UPPP students through a systemic approach. Anatomy lectures are followed by physiology lectures, and practical sessions are scheduled after the lectures. Anatomy and physiology teaching is merged with other basic medical science teaching courses in close linkage. Anatomy topics are followed by relevant histology, physiology, pathology, and pharmacology topics. Anatomy and physiology lectures, as well other courses lectures, are conducted in well-equipped lecture rooms, and students are segregated into groups according to their prospective colleges. Lectures are engaging and delivered through PowerPoint slides. Teachers also use smart board facilities to draw diagrams, graphs, and flowcharts. In the UPPP, gross anatomy and physiology practicals are conducted in the anatomy and physiology dry laboratory. Objectives of the practicals follow a systemic approach. The content covered in the practical session is provided to students in the laboratory manual. A group of 80–100 students, subdivided into three subgroups, attend the practical together. In the first phase of the anatomy practical, the tutor explains and demonstrates anatomical structures with the help of the models, bones, and plastinated organs. ELMO epidiascope is used to display the structures on the screen. Following the briefing session, students study the anatomical structures on the models and work independently at different preset practical stations. In physiology practicals, following briefing and demonstration, students perform practical activities under the supervision of the teachers. The tutors remain present throughout the practical for assistance and support, and attendance is mandatory.

Case-based learning sessions. In addition to the lectures, approximately five case-based learning (CBL) sessions are scheduled in the course, and they are integrated horizontally with the lectures. The aim of including CBL sessions is to prepare and familiarize students with student-centered learning approaches and learning in a clinical context. Medical students are offered PBL curriculum in the second phase at the COM. Although CBL sessions are not conducted with pure fidelity to the CBL model, these sessions do, nonetheless, introduce students to modern teaching and learning methods. Students are expected to participate actively in these sessions, generate ideas, and learn in a clinical context; hence this is a step toward a student-centered learning system. These sessions are mandatory and form part of the continuous assessment.

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Learning Facilities

Faculty. Experienced faculty members, mostly medical graduates with Masters and PhD degrees in their respective disciplines, deliver most of the teaching activities. Faculty members who are at professorial ranks deliver lectures, whereas practical sessions are delivered by lecturers and teaching assistants under the supervision of a senior faculty member. For professional development of the faculty members, training workshops are arranged on a regular basis. These workshops and seminars mainly focus on teaching and learning methods, assessment, curriculum design, and delivery. Additionally, continuous professional development is highly encouraged by the university, and funding is made available to attend yearly international conferences or workshops. This helps senior faculty members to present their research activities and also to stay updated on current advancements in their areas of expertise.

Class rooms. Lectures and other teaching activities are conducted in state-of-the-art, centrally air-conditioned rooms, which are equipped with modern electronic and digital equipment and software systems. Smart boards are available for incorporating sophisticated teaching and learning methods,
Laboratories. Anatomy and physiology teaching is supported by dry practical sessions. A joint laboratory for anatomy and physiology contains all of the necessary tools to conduct a purposeful practical session. For anatomy practicals, plastic torsos, plastic models of different regions and organs, plastinated organs, and limbs are available. Articulated bony skeletons and painted and plain human bones are also available. Bony skulls and plastic models of brain are in abundance for small group teaching. ELMO epidiascope is commonly used in teaching osteology to small groups. For physiology practicals, all required devices, such as spirometer, sphygmomanometer, and stethoscope, are made available for practicals on lung functions and blood pressure. For instance, in the practical on spirometry, students perform flow-volume measurement test, record readings for forced expiratory vital capacity (FVC), forced expiratory volume after 1 s, and percentage of FVC, followed by repeating practice. A multimedia projection system is also available.

Blackboard. Blackboard is an online software facility accessible to all students, faculty, and academic staff. It is an essential resource containing information about courses, teaching materials, quizzes, announcements, examination results, services, and calendars. All teaching materials are uploaded on Blackboard in advance and are available to students before their lectures.

Anatomy.tv. It is a software powered by Primal Pictures, which is available for free to all students and faculty members, and it can be accessed from any computer on campus. More so, users can access Anatomy.tv via a link from their Blackboard account. This software incorporates the world’s most accurate, detailed, and evidence-based three-dimensional (3D) images of Human Anatomy. It can integrate lectures, practicals, and assessment. It helps users to discover a diverse learning experience independently by using features like 3D atlas, 3D real-time, functional anatomy, anatomy and physiology imaging, clinical specialties, therapy and quizzes. Another amazing feature of this software is the weekly online seminars, showing tutorials to the users to make most of the Anatomy.tv.

Library. A Learning Resource Center is integral to the academic activities of an institution. The COSHP library provides excellent learning resources in digital and physical formats for students to fulfill their academic requirements. The COSHP library has the latest information communication technology tools to support most educational and research activities. It has a good collection of relevant books, computers, digital collections, electronic (E)-books, E-databases, evidence-based medicine databases, E-journals, and reference books. At the library, all bibliographic information is available on Symphony System, which helps the faculty members and students share the interlibrary collection.

Student affairs. The student affairs department is an important pillar of the UPPP. Student affairs enhances students’ life inside the college and supports their educational, social, intellectual, and personal development to prepare them for a thriving profession. Student affairs team members guide the students throughout their academic lives and help them in solving any problems that might hinder their educational journey. Some major activities supervised and conducted by the student affairs services include conducting orientation programs for new students, coordinating and executing students’ arrangement during exams, monitoring students’ attendance (lecture and exams including), and providing emergency help services to all students. The student affairs department also assists the student club in the college with extracurricular activities, and they also support the implementation of the annual plan of activities inside and outside the college to suite the students’ schedules and exam dates.

Assessment

In the UPPP, assessment consists of two parts: continuous assessment and end-of-block assessment. Continuous assessment carries 45% weightage. It includes CBL (5%) and mid-block examination (40%). End-of-block examination carries 55% weightage. It comprises a written multiple-choice question (MCQ) examination (35%) and an Objective Structured Practical Examination (OSPE) (20%). The content of the written end-of-block examination is related to all lectures and case discussions of the whole block. The MCQs asked in the examination match the course learning outcomes (Bloom’s taxonomy). After final examination, analysis of course learning outcomes and related questions are reviewed.

DISCUSSION AND CONCLUSIONS

To become an accomplished physician, a dentist, or any other health professional, the starting journey involves joining a bachelor’s program. For a high school graduate, getting entry to a medical or dental undergraduate program is a challenging task. Even if one succeeds in gaining admission, chances are that the student may find the academic demands to be very high and get stressed due to continuous assessment procedures. In this respect, a pre-professional program can adequately prepare students for a medical career, by equipping them with the necessary skills in academic knowledge and learning.

At KSAU-HS in the UPPP, we hone students’ skills and knowledge of the English language, medical terminology, basic sciences, and basic medical sciences. Taking the anatomy and physiology course as a representative model, we prepare students to cope with their professional courses and help them to become independent learners. At the COM, students embark on a curriculum that is an amalgam of traditional and modern approaches. In the hybrid curriculum, medical schools benefit from the advantages of PBL methodology, solving clinical problems, and, also, partly, continue with the traditional lecture approach in which students decide their own learning outcomes from “triggers” given in the case scenario. Afterwards, they do independent, self-directed study before returning to the group discussion. Therefore, PBL uses related problems to increase knowledge and understanding (13). Pioneers in the PBL are the McMaster University Faculty of Health Sciences, College of Human Medicine at Michigan State University, and medical schools in Maastricht and in Newcastle (1). In the UPPP, students are exposed to the CBL and SDL sessions. Additionally, a 3-credit-hour course, the Health Profession Education course, is fully dedicated to teaching PBL strategies. This course focuses on PBL philosophy and allows students to review and observe whole PBL process. Thus the UPPP curriculum introduces and exposes the students to the PBL. The medical ethics and patient safety course introduces them to the medical ethics and legal issues.
safe and rational medical practice. Integration of anatomy and physiology with other basic medical sciences and health profession education courses is a step toward contextual learning. In an undergraduate pre-professional program, the laboratory component is an active and effective mode of learning anatomy (4). Interactive lectures and structured practical sessions in the UPPP also assist students in becoming self-learners. We conduct anatomy and physiology practicals in the dry laboratory, as we deal with pre-professional students and need to build a foundation of basic medical science subjects, including physiology and anatomy. The authors do agree with the importance of cadaver dissection in the medical training (7). In the second phase of their curriculum at COM, students will be provided with the opportunity to dissect cadavers. Learning medical science becomes comparatively easier and broader when it is linked with real patient case scenarios (5). To develop analytic skills, students are exposed to clinical problems through CBL in the UPPP. Learning basic medical science, specifically anatomy, through clinical cases creates interest among students and could help them in interpreting and solving medical problems (11, 12). SDL is an essential part of the UPPP; it encourages students to take initiatives, search and learn independently, and has been known to play a key role in life-long learning, especially, in health education (8, 10). Incorporation of modern technology in the education system has broadened the spectrum of teaching and learning and has enhanced independent and collaborative learning skills (9). Usage of modern facilities, like Anatomy.tv, Blackboard, and Symphony System, have been inspiring in the UPPP. Assessment is fundamental for students’ self-motivation and learning. It is a major device of self-feedback for both teachers and students. Following feedback from assessment, students identify their strengths and weaknesses and modify their learning. In the UPPP, exam feedback sessions are conducted after mid-term and final examinations. In these sessions, students’ strengths and weaknesses are identified and discussed, and appropriate solutions are suggested that help the students to improve their learning. It also helps the teachers to sharpen their teaching skills (6). It is argued that MCQs do not comprehensively assess cognitive skills and can mislead faculty about the students’ understanding or mastery of the course content (3). Therefore, in addition to written MCQ examinations, OSPE is conducted to test the students’ deeper understanding in anatomy and physiology. Additional facilities like Blackboard, Anatomy.tv, and the library provide a conducive learning environment. From this written commentary, we speculate an inference that the UPPP at KSAU-HS is achieving its objectives of preparing students for their undergraduate programs and transforming their learning habits to become self-learners. This is an observational commentary, and its inference can be affirmed by a student-feedback-based study.

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DISCLOSURES

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

AUTHOR CONTRIBUTIONS

I.M. and A.A. conceived and designed research; I.M. drafted manuscript; I.M., A.A., D.E.S., I.A., and Z.F. edited and revised manuscript; I.M., A.A., D.E.S., I.A., and Z.F. approved final version of manuscript.

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