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ACTIVE LEARNING ACTIVITIES FOR STUDENTS IN PHYSIOLOGY

Abstract. Acid-base physiology is an integral part of teaching physiology in the first-year medical curriculum. At this level, content typically includes discussion of the CO2-Bicarbonate buffer system under physiological conditions, discussion of other physiologically important buffer systems, and presentation of physiological classifications of acid-base disorders. Disorders are usually illustrated with examples of clinical data. In this project, the traditional lecture presentation of acid-base physiology in the first-year curriculum of the Faculty of Medicine was replaced by interactive computer training designed primarily for the iPad and other mobile computer platforms. Three training modules were developed, each containing 20 screens of information, on the topics of CO2-bicarbonate buffer system, other body buffer systems and acid-base disorders.

Key words: Training modules, bicarbonate buffer system, teaching, student.

For the training modules, interactive, active learning activities were primarily students ' step-by-step control of explanations of complex physiological concepts, usually presented graphically. In clinical cases, active learning activities were mostly question-and-answer exercises that linked clinical outcomes to relevant concepts of basic science. The student response was surprisingly positive, and the interactive, active learning aspect of learning was identified as the most important feature. In recent years, more and more attention has been paid to the inclusion of active learning in medical education programs [1] and independent learning [2]. The inclusion of active learning and independent learning activities is a mandatory component of the baccalaureate medical education accreditation standards [3]. Computer-based learning, often referred to as "e-learning", is potentially well-suited as a platform for addressing these contemporary educational interests [4]. However, currently the vast majority of computerized resources for medical education are passive learning activities. These include recorded lectures (podcasts), electronic textbooks, PowerPoint presentations, and course notes. Some efforts are currently underway to develop more interactive multimedia training in physiology, including a recent report on an e-learning multimedia resource for clinical training in electrolyte and acid-base diseases [6]. Tablet and laptop computers are currently exceptionally powerful resources that can be used for reliable multimedia representation of physiological concepts. To get a highly interactive, active learning experience for the student, the teacher or instructional programming team must have completed significant programming. In the last few years, software for developing instructions with a graphical interface and menus has become available. These software platforms now allow an individual teacher to create interactive multimedia instructions in an academic environment, without relying on expensive programming assistance.

This report describes the development and use by students of interactive multimedia training in acid-base physiology for first-year students of the Faculty of Medicine. The entire project was programmed and implemented exclusively by the author. The resulting training modules were very well received by the students. Students identified interactive, active learning features of learning as the most important

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aspect of the presentation. The training modules were presented to students in a 20-minute presentation in the lecture hall as part of a lecture on the physiology of respiration (CO_2 as blood gas). Students were given a brief overview of e-learning as a pedagogical science and shown how to access acid-base online learning using the campus ' EEE course management system. This presentation took place 3 weeks before the exam, which covered the topic of respiratory, kidney, and acid-base physiology. Students were informed that previously scheduled lectures on acid-base physiology (scheduled for ~ 1 week before the exam) were canceled. All acid-base physiology should have been studied online and would have included 14% of the examination. Training modules were awarded three points on the exam each. Each clinical case was assigned one point. Questions about the clinical case were simple and case-specific: find out if the students studied the case at all. Theuse of training modules was monitored by counting the number of requests to each module (session counters) per day. The total number of matches each day during the 3-week period between administration and examination is shown in. During the first week after the presentation described above, not a single view was registered in the class. Some activity was observed ~ 1 week before the scheduled exam, during the period when classroom lectures were scheduled earlier.

Students named interactivity as the most important positive feature of online training in acid-base physiology. It is important that teachers considering online learning carefully understand the different types and levels of interactivity that are possible in multimedia education. The most frequently cited classifications of multimedia interactivity are those originally defined in the U.S. Department of Defense Handbook [5]. This guidance document defines four "levels of interactivity". Level 1 is passive learning, in which the student is only the recipient of information. Level 2 is defined as limited interactivity, in which the student responds to simple prompts in a simple and understandable manner. Level 3 involves challenging interactivity, where the student responds to learning cues with more complex difficulty. Often, the curriculum changes direction based on a more meager response. Interactivity Level 4 is a real-time simulation with complex instructions and student reactions.

Currently, most online learning in educational institutions is passive learning (level 1). This includes recorded video recordings of lectures (podcasts), PowerPoint presentations, training materials in the form of text documents or Adobe Acrobat.pdf files, as well as electronic textbooks. The possibilities for interactivity and control on the part of students are very limited, in addition to "turning pages". For the implementation described here, most interactivity is classified as level 2, which includes direct prompts and responses. A wide range of interactions were implemented, which were available as features of the author's software. These included defining an area of interest on a graph, consistently displaying information (usually graphically) under the student's control, optionally branching out to and from individual screens for additional information, and having the student have solid control over navigation throughout each module. In addition, the development software allowed the use of a wide range of interactive question and answer formats. These include "true / false", identification of the corresponding area of the image or graph, multiple choice with one and multiple choice answers, a drop-down list with multiple choice answers, and free-form text input. Considerable effort was made to provide a comprehensive discussion and detailed feedback after each student's response.

A more rigorous view of active learning is to encourage the learner to think critically about concepts and use them in problem-solving activities. Problem-solving is not part of the learning modules, as students have yet to learn the concepts. However, it is a fundamental approach used in case modules.

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Students are actively tasked with correlating clinical results with the main scientific concepts they study in the field of physiology of the respiratory system, kidneys and acid-base bases.

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