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DESIGN, IMPLEMENTATION AND DELIVERY OF CUSTOMIZED DIGITAL RESOURCES IN LARGE MULTI-SECTION ANATOMY & PHYSIOLOGY LABORATORY TO IMPROVE OUTCOMES ON LABORATORY ASSESSMENTS

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Design, Implementation and Delivery of Customized Digital Resources in Large Multi-section Anatomy & Physiology Laboratory to Improve Outcomes on Laboratory Assessments

Abstract

Assessment in our 2 semester Anatomy & Physiology lab consists of lab exams testing working knowledge of human anatomy. Covering over 1000 items per lab exam, 8 exams total, we developed custom resources to prepare our students. Our focused resources include visual model reviews and quizzes to incentivize early consistent study, narrated model videos for auditory reinforcement, customized image banks and full practice exams. All resources are available online to students via Blackboard and represent exactly what they would expect on lab exams. This can be a model for other courses.

Introduction

Anatomy & Physiology is a required course for undergraduates pursuing degrees in, and entry into the Health Sciences such as Nursing, Physical Therapy, Nutrition and Occupational Therapy. Hunter College's Anatomy & Physiology course has minimally specialized pre-requisites: 1 semester of general chemistry with lab (itself requiring basic math proficiency). Upon entry to the course, especially for those students having no formal biology studies at the undergraduate level, a great challenge is found in the volume of material in lab, and also the conceptual difficulty encountered in lecture. In our 2-semester Anatomy & Physiology lab we cover over 1000 items per lab exam and give 4 lab exams per semester, 8 in total. Lab is worth about 50% of their grade in the course, plus extra credit for incentivizing quiz preparation, with

lecture being 50%. The exam format is pure recall, no multiple choice or matching, using actual lab materials, models, equipment, and specimens used during lab. This assessment format is time-proven and necessitated by the volume of material and its importance to their further studies. Meaningful retention and use of the material learned is the measure of success of any course in this area. Adequate performance on these exams requires much study time at lab, and even more beyond, with regular reinforcement to elicit stronger memory formation. It is like learning a visual language and thus requires a great deal of practice. However, the question of just how to study for lab, and how much, when one is away from lab presents some pitfalls: use of lab manuals and figures to learn anatomy, image searches and other references, all some degree or another differing from the exact materials on which they will be assessed. Many students misplace their efforts in one of several ways: studying less than ideal material, studying at the wrong time(s), for the wrong duration, or without follow up to reinforce the importance of the work put in earlier. Any deficiency in study skills would become apparent during lab exams. Thus we undertook making a set of resources to focus students' attention and provide access to the lab materials in the truest way possible, and to prepare them much more directly for their exams. The resources we developed consist of model & slide image banks, model review PowerPoints, quiz questions, narrated model videos, and full demonstration lab exams which have been setup as normal, then photographed. All of these resources are placed on the course Blackboard site in our case, and made available to all students with guidance on how to use the resources and what purpose each has. This approach has proven to be powerful and we are in the process of observing the extent of increased engagement and improved performance in lab. These developments can provide a model to other courses with similar needs, and an assessment

and outcomes focused methodology to course design and delivery, and usage of digital resources to these ends.

Materials & Methods

Narrated Model Videos

Anatomical models used in lab were used to make narrated multi-angle videos showing close-ups of all structures along with mentions of their names and functions. A red or black pointer (a pre-painted chop-stick) was used to point to specific small structures on the models. We covered all structures used in the model keys and thus all anatomical structures that could be on exams. Included in the scripts written by Frank Martinez were functions of the structures, and mention of physiological pathways, and typically the structures were covered in a sequence resembling these pathways.

We proceeded to film over 50 such videos, one or more per model used in lab, ranging from 2 minutes to over 14 minutes in length each. Multi-angle video was shot at 720p and 1080p, using a Panasonic HDX-200 p2 camcorder and a Canon EOS dSLR and synced in Apple Final Cut Pro. Narration audio was scripted and captured simultaneously with the video using a Neumann TLM-193 microphone and captured at 48khz / 24bit. Footage was edited in Apple Final Cut Pro by Todd Miller. Music for play during titles and outro was recorded using Apple Logic Pro at 48khz / 24bit and imported into Final Cut for the titles and credits. Music credit is to Todd Miller. Final video files were exported to .mp4 format and then transcoded using Adobe Media Encoder to final mp4 format for uploading to a Kaltura streaming server with the help of Mr. Joseph Pelaez at Hunter College.

The videos are accessed online through our blackboard site via a playlist item inserted as a short java script that creates the playlist and contents from the Kaltura server such that videos

are arranged by topic into playlists, and each can be selected, started, stopped, and the playhead may be positioned at will, and audio can be muted, or adjusted in volume.

Creation of some model videos was supported in 2010 by a Faculty Innovations in Teaching with Technology (Miller, Martinez, & Pereira, FITT 2010 Projects: Human anatomy digital video modules, 2010) *Presidential grant at Hunter College.*

Model Image Banks

From the narrated model videos, directly in the non-linear editor Apple Final Cut Pro, suitable frames showing every structure within each video file were exported as tiff files. These tiff files were batch converted to jpeg using Adobe Photoshop. Some models were photographed separately as still images using a Canon EOS dSLR camera. All final jpeg image files were then placed onto slides of a PowerPoint file at 4 per slide. This PowerPoint was then converted to adobe PDF file for delivery via our course Blackboard site. This layout allows online viewing, and also printing where the letter-size page can be cut to approximately 4 index-card sized images which can be notated on the back if desired.

Quiz Questions

Our typical lab exam has several stations that are questions on definitions or concepts from Marieb & Smith's Anatomy & Physiology laboratory manual (Marieb, 2016), termed 'thought questions'. These exam questions were turned into quiz questions and given as a quiz the week prior to lab exams. The questions were also made available to students following compilation into an excel file with the questions arranged by topic. These excel files were converted into adobe PDF files and uploaded to our course Blackboard site. Students can use this file to make sure they are covering everything in the lab manual that will be on a lab exam as 'thought questions'. Frank Martinez wrote the vast majority of the Quiz Questions, and some were written prior by Mr. Agustin Pita of Hunter College.

Model review PowerPoints

Images from the Image Bank PowerPoints were selected and copied into new PowerPoints to make a model review PowerPoints. These differed from the image bank in several key ways: the image(s) are provided with leader lines (created in PowerPoint) pointing towards anatomical structures but with empty title boxes. There could be several such blanked leader lines on each slide. For example, 3 structures in the images may be pointed to, and the pointers connect to blank boxes. On the next slide, these boxes would have the names of the structures filled in that were pointed to on the previous slide. So a student would look at each slide, and determine the structures asked, and then check their work on the next slide. These files were created for every model and made into adobe PDF files and uploaded onto the course blackboard site. These PDF files could also be used by the students to print or make files that every slide either shows the answers, or does not by changing the print ranges. The former can also be used as a model key.

Creation of model review PowerPoints was supported in 2015 and 2017 by 2 separate Faculty Innovations in Teaching with Technology (FITT) Presidential grants at Hunter College ((Miller & Martinez, FITT 2015 Projects: Using digital interactive lab activities to improve student outcomes in Anatomy & Physiology lab, 2015), (Miller & Martinez, FITT 2017 - Using Digital Interactive Lab Activities to Improve Student Outcomes in Anatomy & Physiology Lab - BIOL 120, 2017).

Model review quizzes

The model review PowerPoints were used to make 5-question quizzes in two differently colored versions, pink & blue (similar to A and B versioning of exams) to be used for adjacent students to prevent easy copying of answers. A set of pink & blue quizzes was given to each lab section instructor (thus each lab section had a unique quiz). These quiz PowerPoint files were

projected to the class, with adjacent students doing the alternating colors as mentioned, and were asked different structures. The questions were printed on their answer sheets, where they would write the structure or function of the item asked on the corresponding projection. These quizzes were given the week prior to the lab exam, to incentivize early study, and were the same models used on the lab exams.

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Demonstration (Practice) lab exams

From the lab exam versions that are being used in a given semester / year, questions were selected in a semi-random manner and made into a new exam file. The resulting exam was setup and photographed and made into a PowerPoint file and then exported as an adobe PDF file and uploaded to the course Blackboard site. Students are instructed that this practice lab exam would have some stations (typically 3 out of 25) that would be the same as their lab exam for their section. The practice exam (just like a regular lab exam) would have 25 stations, each in 2 parts (A. and B.), and in 2 colors, pink and blue. Thus the Blue version would have stations 1-25, A. and B. parts, and the same for the Pink version. Thus the practice exam is 2 exams, totaling 100 questions. Students were also instructed to do one color (select pink or blue) soon after the lab the week prior to their lab exam. Using the answer key at the end of the PDF file, they can score themselves, and do corrective study if required. Then 2 to 3 days prior to their lab exam they can do the other color for further practice.

Survey of students' use of lab resources and study habits

Two surveys were conducted to specifically ask about lab resource usage and study habits. In the first survey, students in one laboratory section (n=21) were asked how many hours per week, hours per day, and days per week they studied for laboratory in Biology 120 (Anatomy & Physiology 1) in Fall 2016. In the second survey, a comprehensive survey of lab resource usage consisting of 25 questions (Miller, APPENDIX 1: BIOL 122 Lab Study Resources Survey April 2018, 2018) was administered to the Biology 122 (Anatomy & Physiology 2) course during Spring 2018. 93 responses were collected and analyzed, in terms of assessment, at the mid-point of the semester where 2 out of 4 sets of lab quizzes and lab exams had been completed.

Results & Discussion

Study time and Distribution

Early and consistent study was evidenced by survey of students in the course. During the Fall 2016 Biology 1 survey of one section (n=21), students that were on track to get A or B in the lab were spending 10-20 hours per week, outside of attended lab and lecture time. This amount of study required spread over many weeks, keeping up with the pace and flow of information (Figure 1).