Design and Implementation of Animated Pulmonary Pathophysiology: Towards an Interdisciplinary E-Learning Module
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Abstract

Conventional medical education often presents concepts in disciplinary silos, making it difficult for students to integrate these concepts – even though they may be about the same organ system. One of the goals of Vanderbilt Medical School’s Curriculum 2.0 is to facilitate this integration. We believe that e-learning modules that animate the relationships between interdisciplinaty competencies will help students visualize these connections and gain a better grasp of the underlying basic principals of disease processes. We propose to create and evaluate an e-learning animated platform that will integrate concepts across the various disciplines of histology, physiology, and pathology using the pathophysiology of the lungs as a proof-of-concept model system.

Background

Several studies show that multimedia learning is more effective than conventional chalk-on-blackboard lectures or static images presented in PowerPoint presentations in multiple disciplines, especially in teaching complex or multidisciplinary concepts. Of the vast e-learning tools at our disposal, animation is the most preferred by students, and one of the most in-demand, along with online self-assessment tools and video demos for they can allow for an integration of ideas in ways that may not be apparent through discontinuous lectures. Despite these benefits, animations that portray integrated knowledge and cross-disciplinary conceptual connections in the biomedical sciences are rare. Those specifically designed for medical students appear to be even more scarce. In this study, we propose to examine the potential of using an animated platform to facilitate medical students’ ability to visualize and interconnect concepts leading to better understanding of how systems in the body work.

Purpose

1. To create an animated platform that will integrate concepts from histology, physiology, anatomy, and pathology in a coherent portrayal of how the respiratory system works.
2. To assess the effectiveness of this animated platform as an e-learning module via a randomized controlled trial.
   a) Subjects will be VMS1 students.
   b) Outcomes measured quantitatively will be:
      1) comprehension of relationships between different disciplines
      2) ability to apply concepts learned
   c) A Likert survey will be used to assess student satisfaction with the learning module as well as compare perceived benefits to actual quantified benefits (test result)
   d) Feedback and suggestions for future improvements will be requested.
3. Post-experimental viewings of the animation will be monitored and recorded by status of the viewer (control or experimental group) as an indirect measure of audience perceived utility and satisfaction.

Materials and Methods

Closed-ended multiple-choice test questions will be used to evaluate the animated module under the following outcomes criteria: ability to i) comprehend relationships between different disciplines in medicine as it pertains to the respiratory system ii) apply conceptual understanding in answering clinical-oriented questions. These quantitative outcomes will be analyzed based on the following data stratifications:

1) Differences in performance on test questions between control vs. experimental groups.
2) Differences in performance between students with different learning styles.
   a) A follow-up questionnaire will evaluate student opinion and attitude to the e-learning module.
   Additionally, the animated module is unique in multiple ways: i) novel live image-animated sequence hybrid ii) portrays a spirogram-volume flow loop relationship never before shown iii) randomized controlled trial with unique subpopulation analysis and potential to contribute to the literature.

Outcomes and Significance

Figure 1 – Outline of conceptual framework of the animated e-learning module detailing the interdisciplinary connections for the ultimate goal of creating better clinicians. Representative screenshots of the conceptual framework is included: from top right clockwise – a) brief anatomical overview correlated to bronchoscopy videos pointing out important landmarks b) histological concept from the basis of a discussion on breathing physiology c) discussion of normal airway resistance in physiology transitions to pathological bronchopaths in asthma d) final learning chapter for interpretation of real patient data in PFT reports e) concepts of resistance and compliance applied to pathophysiology of emphysema f) spirometry and flow volume loops as diagnostic tests in normal and pathological states g) clinically diagnostic chest X-ray in restrictive lung disease.

Figure 2 – A) graphical representation of the randomized controlled study to assess the effectiveness of the animated e-learning module. All assessment test questions will be obtained from an independent question bank to reduce bias towards testing animation content via a vs lecture material. Students will be randomized to the control or experimental groups in a stratified manner based on their B) different Kolb’s learning styles.

Figure 3 – A) Screenshot of the Adobe Flash CS3 Professional program to be used in creating the e-learning animated module. B) Timeline of animation development and evaluation with indicated benchmarks (divided into Phase I: storyboarding, Phase II: production, and Phase III: evaluation). Blue checkmarks indicate completion.

References


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