FY15 Innovations in Teaching with Technology Awards: Development of an Immersive Virtual Reality Tool for Learning Laryngeal Anatomy and Physiology

FY15 Innovations in Teaching with Technology Awards

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<th>Proposal Title:</th>
<th>Development of an Immersive Virtual Reality Tool for Learning Laryngeal Anatomy and Physiology</th>
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<td>Department(s):</td>
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<td>Funding Awarded:</td>
<td>$14,350</td>
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Students in training to pursue a career in speech-language pathology are required to attain a firm understanding of both normal and disordered laryngeal anatomy and physiology. This is especially true of those who will ultimately work in a hospital setting diagnosing and treating voice and/or swallowing issues. Their understanding of laryngeal anatomy and physiology must include knowledge of the skeletal framework, muscle innervation, muscle orientation, muscle action, and nervous innervation. Inherent in their training must also be an understanding of normal and disordered vocal fold function and the voice qualities associated with normal and various pathological states.

Traditionally, speech and hearing instructors, and students, have been restricted to teaching and learning using textbooks containing two dimensional photographs and illustrations that depict static laryngeal anatomy. In rare circumstances, students may have the opportunity to view cadaver specimens. With the development of flexible endoscopy and rigid laryngoscopy technology, students can view the internal anatomy of the larynx, typically by watching a video recording that was most likely published on a site such as youtube. Where the instructor has access to the necessary equipment, students can view the anatomy in real time. However, this will seldom be the case for speech pathology students. Further, neither textbook, recorded video, nor live
visualization of the larynx offers substantive opportunity for the viewer to interact with what they are seeing within a self-guided learning context.

It is the intent purpose of this project to explore the concept of applying emerging virtual reality technologies to immerse students in the anatomy of the larynx in such a way that they can gain unique perspectives of both form and function through the delivery of rich content and the ability to interact and explore in a way most meaningful to each individual learner.

We plan to utilize Oculus Rift as a virtual reality platform to display a modeled larynx as an immersive learning environment. Users will be able to navigate around and through the larynx, controlling their position and view both outside the larynx and within the interior of the larynx. At selected viewpoints, users will be able to further interact with the model by “asking” questions about what they are seeing, and viewing supplementary information meant to enhance the view, as well as by changing their view (i.e., looking left, right, up, down, etc.).

The work plan will include:

a) Purchase of Oculus Rift Development Kit, commercially available geometric model of the larynx
b) Rigging and animation of the model
c) Development of an app for interaction and control of the model using the Oculus Rift
d) Beta testing
e) Testing and evaluation of learning with student populations

We anticipate that steps a) through c) will take approximately 5 months (1 semester). Beta testing is expected to take approximately 1-2 months. Testing and evaluation by students in Communication Sciences and Disorders is expected to take 3-4 months.

The specific learning objectives of this unit include an understanding of a) the skeletal anatomy of the larynx, b) the muscular anatomy of the larynx, c) the influence of laryngeal muscle activity on laryngeal structures, and d) the function of the larynx in generating sound during speech.

Given the sophistication of today's students in interacting with a computer based environment (e.g., gaming), immersing them in a virtual reality learning experience is expected to enhance their degree of engagement with and retention of the material being presented to them. In addition, human anatomy is three-dimensional. The presentation of laryngeal anatomy and physiology three-dimensionally is expected to enhance learning by allowing the student to “explore” the larynx in a way that is unique and most meaningful to them.

To assess the impact of this virtual reality approach to learning, we plan to conduct two small studies. In the first, we will present students with a powerpoint based module that
exposes the students to a laryngeal anatomy curriculum. Once completed, we will expose the same students to the same curriculum presented via the virtual reality platform. Students will then complete a survey that explores their preferred platform and what they liked/disliked about each. In a second small study, one group of students will be exposed to the powerpoint based curriculum while a second group will be exposed to the virtual reality based curriculum. Each group will then be tested to assess their acquisition of the material presented.

What resources will you need?

The authors of this proposal will provide oversight and guidance to the developer to be hired to conduct the animation and app development associated with this project. Drs. Moon and Karnell have extensive experience with the curricular content, and will provide source materials to be encoded into the app. Dr. Kearney has extensive experience with virtual reality applications and the use of technology in learning. Dr. Kearney has access to some of the software required to complete this project, and will provide lab space for the developer.

Available Resources:
- Curricular content
- Unity software
- Workspace for student developer

Additional Resources Required:
- Geometric Frame Model of Human Larynx
- Oculus Rift Development Kit 2
- PC Computer w/graphics card
- Programming assistance devoted to app development
- Programming assistance devoted to model rigging and animation

What is your rough estimate of costs?

- Geometric Frame Model of Human Larynx $150.00
- Oculus Rift Development Kit 2 $400.00
- PC Computer w/graphics card $1200.00
- ¼ Student R.A. for app development (1 semester) $7600.00
- Hourly Help for model rigging and animation $3650.00

Total requested $14,350

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