Virtual histology programs, while widely accepted and increasingly used, have not yet been shown to enhance learning as compared to learning with light microscopy, likely due to the lack of interactive educational tools. The objective of the study was to investigate the educational value of the interactive annotations and game-based quiz tools on the new virtual histology program designed to simulate an in-class interaction with an expert.

Twenty-three virtual slides representing four organ systems were made available on the new virtual platform to the first-year graduate students enrolled in a histology course at the University of Colorado School of Medicine. Practical scores were collected on the quantitative performance analyses on topics that were available on the new virtual histology program vs. those unavailable. A survey was conducted at the end of the course to gauge students' perceived value of the interactive tools on the website. Four weeks after completion of the course, a comprehensive practical was administered to investigate whether content presented in the new program yielded better retention of the material compared to the control content without instructor simulation tools. The results reveal that students consistently performed significantly better on the content available on the new virtual histology lab featuring the unique instructional tools. The survey results suggest that game-based quiz function and its leader-board were perceived as the most educationally valuable and motivating tools for studying histology on the new virtual lab. The innovative learning tools on the new virtual histology program show promise as an effective asynchronous educational tool suitable for the new health science curricula.

Introduction

Recently, there has been a prominent shift from the use of light/optical microscopy to the use of virtualized slides in histology courses across the world. Though the virtual histology labs (VHL) that simulate microscopic study of tissues on a computer screen have many advantages, they have not yet been shown to enhance learning over light microscopy most likely due to lack of interaction with an expert outside the classroom (Donnelly et al. 2012). A new, experimental VHL (exp-VHL) with instructor-simulation tools was produced at the University of Colorado School of Medicine (http://teachhistology.com) to address these challenges. In addition to traditional interactive simulated microscopy features, the exp-VHL features instructional annotations and a game-based quiz function which provides instant feedback and an ability to track individual progress. Instructional annotations and low-risk quizzes have been identified as the most desired features students seek in VHL programs that would promote asynchronous histology mastery (Yen et al. 2014). The game-based interactions have been shown to improve both learning and retention when the results for mathematics, language, biology and engineering quizzes of students using game modules study were compared to those taught in a conventional lecture (Wouters et al. 2013). The ability of exp-VHL to keep track of individual progress in the game-based quizzes, helping students pinpoint their weak areas, could therefore motivate students to spend more time among the subject areas. This study investigated whether a combination of detailed interactive annotations and a gaming interface quiz system can improve learning and retention of the subject.

Methods

Experimental Design: 24 first year graduate students enrolled in introductory human histology class were recruited. 23 virtual tissue slides representing 4 histology topics (bone, neural tissue, muscle and lymphatic tissues) on exp-VHL (http://teachhistology.com) with annotations and game-based quiz function (Figure 1) were made available in addition to the control VHL (cntrl-VHL) without annotations or quizzes.

Data Collection: Students' de-identified histology practical scores were collected for the three exams during the course and the scores for the exp-VHL content were compared to the cntrl-VHL content. 30 days after completion of the course, students were invited to take a comprehensive retention practical and the same comparison was made between content available on the exp-VHL, as well as cntrl-VHL.

Statistical Analysis: Paired two-tailed T-test was computed for each practical.

Results

Students performed better on the content available on exp-VHL: Histology practical scores were higher on the content available on cntrl-VHL on the 1st practical. On the rest of the practicals including the retention test, performance was significantly higher for the content available on exp-VHL (Figure 2, Table 1). Students value instructor simulation tools on exp-VHL, but don't consider it can replace the instructor. The annotations and quiz tools were ranked as the most valuable tools on exp-VHL (Figure 3) but none felt that it could effectively replace an interaction with an expert (Figure 4).

Conclusions

We would like to thank the MSMAA program, Dr. Danielle Royer, Class of 2016 MSMAA students, Fred Gonzalez, Jessica Kafi, Katie Mitchell for their participation, aid and support in the development of this project.

Acknowledgements

#4661 Quantitative Analytics on Educational Value of the Unique Instructional Tools on a New Virtual Histology Laboratory
Oana Rosenthal BS, Mai Ly BS and Lisa M.J. Lee, Ph.D.
Department of Cell and Developmental Biology, University of Colorado School of Medicine, Aurora, CO U.S.A.