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ORIGINAL ARTICLE

Online education in cytotechnology programs: a pilot study

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Introduction The University of Nebraska Medical Center's cytotechnology program has received requests for an on-line program. The purpose of this study is to demonstrate that on-line education with virtual microscopy (VM) achieves similar screening and interpretation skills as traditional teaching methods using light microscopy (LM).

Materials and methods The pilot phase was conducted using the first two courses in the program. The students were divided into two groups; traditional and virtual. The virtual group replaced LM with VM, while the traditional group utilized traditional teaching methods. At the end of the two courses, the virtual group was shown how to use LM and was given glass slide examinations.

Results The mean of the female genital tract (FGT) screening quizzes and exams of the traditional group was 92.5; the mean for the virtual group was 86.8. For the respiratory tract (RT) course, the traditional group had a mean of 96 for their screening exams while the virtual group's was 85.3. The glass slide examinations (FGT Mean = 98, RT Mean = 95.3) given to the virtual group at the end of the pilot study demonstrated their ability to apply screening and interpretation skill learned from VM to LM.

Conclusion The study concludes that screening and interpretation skills of the traditional and virtual groups were similar. It appears possible to train students using VM as the sole method of teaching. The study

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will be extended to another cohort of students using the entire curriculum to further demonstrate the soundness of these results.

Introduction

Cytotechnologists evaluate cellular specimens under a microscope for the presence (or absence) of disease, including cancer, precancerous lesions, benign tumors, and infectious processes.[1] Cytotechnology (CT) educational programs use light microscopes (LMs) and glass slides to teach cytomorphology to their students. There are currently only 25 active accredited CT programs in the United States, with at least one more closing at the end of this academic year. Although programs are closing, there is a need to continue to train cytotechnologists in the United States. There is also a need to train cytotechnologists in many international locations where few or no schools exist. For expanding educational programs to these underserved areas by utilizing distance/satellite site training facilities, or for the purposes of anywhere, anytime, online training, we believe that virtual microscopy (VM) has potential advantages over LM.

The traditional method of training with LM and glass slides has a few disadvantages, including stains that fade over time, plastic coverslips that may curl at the edges when they become old and may allow air bubbles, and glass slides that are easily broken. When any of these occur, finding a replacement for the glass slide is necessary. If a slide is identified as having a rare diagnosis, finding a replacement becomes a challenge. Because of the disadvantages in the traditional teaching method using LM and the advantages of using VM, several health professions education programs (medical, dental, and veterinary schools) have switched to VM over the last few years.[2-7] There are disadvantages in using VM, some that we have experienced are the need to scan multiple times to get the image in focus, large file sizes that take up storage space, and long downloading times. Nevertheless, we feel that the advantages outweigh the disadvantages for this technology.

An advantage of VM is that students have access to virtual images (VIs) at any time from anywhere[7]—they do not have to be in a classroom setting. This is different from LM, where the students must be in the classroom to have access to microscopes and glass slides. There are other advantages to using VM, such as using a tool in the software to compare up to four virtual slides side by side, which a student is unable to do using LM. Still images or pictures can be used in side-by-side comparisons, but one is unable to pan the images to get the same feeling as screening a slide. With VM, students also have the option of taking snapshots using the VM software, without the need to purchase a high-quality, high-cost camera and a camera-adaptable microscope head.[8] Because teaching with VM involves using a computer instead of a microscope, it is possible for many students to view the same image at the same time[6] with multiple computer screens, a large high-definition monitor, or projected image, without needing a multi-headed microscope—something that can be expensive, take up additional space, and have a limited number of microscope heads for viewing. The VIs can also be shared over the Internet for distance students to see the same images as the traditional students at the same time. VM also alleviates the need for microscope maintenance, annual microscope cleaning fees, and the need for glass slide storage space.[9] VM can potentially reduce or eliminate the need for purchasing new microscopes.[7] Annual cleaning, maintenance, and microscope replacement costs can be quite expensive for small cytotechnology programs with small budgets.

VM was added as an adjunct educational resource in University of Nebraska Medical Center's (UNMC's) CT program after recognition of its potential advantages over traditional teaching methods.[10] To our knowledge, we have conducted the only research project to date investigating if CT students are able to learn cytomorphology with VM and to apply the knowledge to glass slide screening and interpretation using LM. In the previous study, a nonparametric statistical analysis indicated no difference in the glass-slide test scores between the students who learned using VM (median 93.5) and the students who learned using LM (median 87).[10]

UNMC is currently the leader of distance education in CT. At this time, over 2000 glass slides have been digitized to create annotated teaching slides, e-modules, daily unknown virtual slides, and virtual slide screening exams. In our experience, one of the major advantages of using VM for training was to standardize the curriculum between the students on the UNMC campus and the students at distant sites.

Considering the requests from potential online students, the main objective of this study was to assess the feasibility of a complete online training program using VM. We believe that this will not only allow our program to expand our distance learning but will also improve the quality of education we offer to all students, standardize the training/teaching between on-campus and distance-learning students, and will allow the program to keep pace with technological advances that will engage and challenge students.

Materials and methods

After being awarded the American Society of Cytopathology Foundation Investigator Grant and obtaining approval from UNMC's institutional review board, we developed additional