

CD-ROMs as Teaching Tools for Microscopy: A Survey of *Microscopy-Tutor*TM Users

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In a classroom or laboratory setting, it is not always possible to supply students with their own equipment or to ensure that the equipment the students do get is properly used. This is a particular problem with microscopes, where it is difficult to monitor what students are seeing through the eyepieces. Although video cameras mounted on microscopes make it possible to present images of specimens on one microscope to groups of students, these cameras do not show students how to obtain similar images of specimens on their own scopes. To obtain good images, or any images at all, requires training students in the proper use of their microscopes. An instructor can point out the parts of the microscope and describe how the microscope should be used. However, using words to describe how to operate a microscope is usually not sufficient. If a picture is worth a thousand words, moving pictures can best demonstrate the proper use of equipment. To this end, several CD-ROMs that feature animated graphics are available to help teach users the correct use of light microscopes.

What are the advantages, and the disadvantages of using such CD-ROMs to teach, and how are these CD-ROMs accepted by users and instructors? To examine these questions, I surveyed by mail researchers who had purchased the CD-ROM *Microscopy-Tutor*TM. (<http://www.lww.com/product/0,0,0-7817-1217-3,00.html>). *Microscopy-Tutor*TM, produced by the Department of Laboratory Medicine at the University of Washington, is an interactive CD-ROM that covers the theory and operation of a light microscope using text, figures, and animation. A mailing list of approximately 300 names and addresses of purchasers was obtained from the publisher (Lippincott Raven Publishers, MD) and a short survey with postage paid return envelope was mailed to each name. The survey recipients were limited to residents of the United States and Canada, and included professionals at high schools, colleges and universities, medical schools, and government and research laboratories. Unfortunately, the mailing addresses in several instances were for shipping and receiving offices, and 5% of the surveys were returned as undeliverable. It is therefore not known how many of the purchasers actually received the survey, so an estimate as to the return rate was not possible. Twenty surveys were returned with responses, which are discussed below.

The survey consisted of four parts: 1- *Microscopy-Tutor*TM in the research lab; 2-*Microscopy-Tutor*TM in the classroom; 3- background on recipient's microscopy training, and 4-recipient's knowledge of microscopy resources. The results clearly reflect the diversity of needs by the recipients, and ranged from high schools, some clinical labs, and medical schools who found the CD too detailed, to one or two respondents who wanted even more detail. Because of the small sample size, the results may represent only a small vignette into the use of CD-ROMs in teaching. Furthermore, the responses are not those of the students themselves, but rather the users' interpretations of student responses, which may not reflect the true feelings of the students.

1- Microscopy-Tutor™ in the research lab; More than half of the instructors had incorporated the CD into the research laboratory; of these, about half required the students to use the CD and half deemed it a supplemental tool. The material presentation was found to be clear, the graphics understandable, and most students were thought to enjoy the presentation and format. Some of the strengths of *Microscopy-Tutor™* include its clear and simple format, its ease of use, and its graphics, animations and explanations. Weaknesses noted included the need to upgrade the computer to run the image and movie intensive program, the fact that the equipment depicted bore little resemblance to the equipment available in the user's classroom, and that the program was for many users too detailed to meet their needs.

2- Microscopy-Tutor™ in the classroom; half the respondents had incorporated the CD into their courses. The classes ranged in size, with the majority consisting of 10–20 students. The student response was again noted as favorable, although with a larger component of 'mixed' response but no unfavorable responses. Multimedia approaches such as videos, websites and CD-ROMS were successful additions to the teaching program, which covered principles of optical microscopes and the theoretical basis of fluorescence, darkfield, polarized, and phase contrast microscopy.

3- background on recipient's microscopy training. Class lectures, handouts, and one-on-one instruction were the major ways purchasers learned microscopy, with a few who were self-taught or used a CD-ROM. No doubt this reflects when they learned microscopy, as their students, while still relying on class lectures and one-on-one instruction, showed an increasing number using a CD-ROM as source of learning. The faculty, rather than staff, at the various institutions are responsible for teaching microscopy, generally light microscopy or fluorescence microscopy, as only 1 user had any electron or scanning probe microscopes.

4- recipient's knowledge of microscopy resources. Another way to learn about microscope operation is to see the microscope in operation online. Half of the respondents knew of remote presence microscopy or telemicroscopy and only 1 had tried a remote SEM, with disappointing results. Since the bulk of the respondents used only light microscopes, and most of the on line scopes are electron microscopes, this lack of participation was not surprising. What was disappointing was the fact that while half of the group knew about the Microscopy Society of America, only 1 was a member, and only 1 had ever attended a meeting. Few knew of the various MSA programs or had viewed the MSA website.

In closing, it appears CD-ROMs will continue to increase in importance in the classroom and laboratory instructional program. Instructors will need to be sensitive to the different ways people learn, as at least one survey noted that the CD format was 'a dimension to learning that older students do not readily migrate to'. As low-cost digital editing programs become more commonplace, the instructional CD-ROMs may be tailored to site-specific equipment, making such tools much more applicable to the classroom and laboratory. It remains to be seen, however, whether or not this approach will overcome the need for hands-on, one-on-one instruction that almost half of the surveys noted was the best approach to teaching microscopy theory and operation.