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Learning Through the Virtual Lens

Final exam scores rise after an instructor puts histology slides on computers.

Last spring, Renee Dintzis witnessed a remarkable improvement in her students' final histology exams. The average score was 8 to 13 percentage points higher than in any of the previous five years, even though the exam questions hadn't changed.

To Dintzis, an associate professor of cell biology, and Harry Goldberg, the director of the School of Medicine's Office of Academic Computing, the reason for the surging scores was clear. With Goldberg's guidance and the office's funding support, the course had been converted to virtual microscopy. No longer were students relegated to examining slides of tissue sections through microscopes in the lab. They could learn histology using an Internet program, customized at the academic computing office, that integrates scanned slides with detailed annotations and audio "micro-lectures."

Learning to identify tissues, tissue features and diseases through a microscope was once a rite of passage for first- and second-year medical students. Today, that's no longer the case here. While some microscopes remain in labs and students are expected to know how to use them, most of the learning takes place via computers.

Following the success of Dintzis' and Goldberg's efforts in the histology section of the Organ Systems course, the switch to the virtual environment has since been made to all other medical school courses, including the yearlong pathology class taken by second-year students.

"Essentially, there are no courses using traditional microscopy any longer in the first two years," says Goldberg, also a member of the Biomedical Engineering Department with an expertise in technology-assisted teaching.

In 2005, a University of Pennsylvania survey of North American medical schools found that 21 percent used virtual slides and another 36 percent planned to use them within three to five years. But Goldberg says he doesn't know of any other medical school that has integrated virtual slides with micro-courses, lectures and ancillary content, as Hopkins has done.

There were several reasons to make the switch. "The labs were getting kind of subdued—quiet," says Dintzis, a longtime histology instructor. "Some students would just suddenly appear for the summary at the end of the lab. Some rarely looked at their scopes at all. We also had students

who didn't come to lectures."

In addition, the supply of slides had steadily dropped over the years, as they were either lost or damaged. Dintzis, who speaks of slides with the same reverence that an art collector might describe prized paintings, was getting worried that some slides might eventually be lost forever. "Some were irreplaceable," she notes. "They were very beautiful sections gotten at a time when there wasn't as much deterioration of tissue. Autopsies were done more frequently than they are now, and so the material was more available then."

Also, traditional microscopy was less convenient. In the past, students periodically had to remove their gaze from the microscope to refer to manuals. The constant back and forth might give them headaches, Dintzis says. If they still had questions, they'd have to flag down busy teaching assistants or professors. Students might waste several minutes trying to make sense of artifacts, such as glue, on the slide before realizing what they were looking at. If they wanted to get into the lab after hours, they might have to find security guards to unlock the room.

Those challenges disappeared in Hopkins' virtual microscopy project, which serves as a set of slides, a manual, a professor and a teaching assistant all in one. Students can zoom in and out of specific parts of the slides and move the slide around, just as they would with microscopes. If a student doesn't know where to find the glomerulus in kidney tissue, for example, clicking a button on the left side of the screen will indicate where it is. Another mouse-click will launch a micro-lecture in which Dintzis describes the glomerulus's function.

Goldberg says students log on to the program at all hours, according to server statistics. The accessibility of the virtual slides on the Internet, in addition to the user-friendly, information-rich nature of the virtual environment, gets credit for the students' higher scores.

Dintzis also jettisoned traditional auditorium lectures and replaced them with online presentations.

The move to a virtual classroom, which took about seven months of intermittent work by Dintzis, Goldberg, medical illustrators and others, has actually improved the quality of class time. Because the students have presumably already reviewed the slides, they're coming to class with better questions, Dintzis says. Since there's no need to study slides during lab periods, each lab section is broken up into three-person teams that make presentations on assigned topics, such as the structure of liver tissue.

Overall, student evaluations of the histology section were very positive. Students, who had used microscopes for other coursework earlier in their first year, called the new approach an example of using technology to improve education, a "refreshing shift" from the type of thinking typically done in lecture, and much better than looking through microscopes. On the negative side, a student lamented that "all the slides online were 'textbook slides' that had very good examples of everything. This would not be the case if we were using real microscopes."

Goldberg acknowledges that if students rely on virtual microscopy, their ability to use a traditional microscope may be reduced. However, he adds, "our goal is to teach histology, and to move away from spending a significant portion of each class teaching students how to set condensers or identify imperfections in the image." ■

—Jamie Manfuso