

## **Teaching Faculty and Academic Professional Development Grant**

### **Statement of the Problem:**

Although not well-studied, many authors believe that numerous problems exist with hands-on labs and have tried a variety of approaches to improve them (Adams, 1998; Becker & Cardulla, 1995; Sandra & Ferguson, 1998). One approach is using a virtual lab or a computer lab, in addition to or instead of a hands-on lab. With this idea in mind, a study was undertaken in the Fall of 2005 with the hope that this type of approach would assist students in General Microbiology labs at the University of Wyoming.

General Microbiology labs at the University of Wyoming are conducted in a completely hands-on environment. In preparation for each lab, the instructor, teaching assistant and support staff, expend an immense amount of time setting up each lab. This is extremely meticulous work, requiring the growth of numerous microorganisms and the preparation and/or organization of growth media, stains and hardware. In addition, the microorganisms used in the lab have a limited lifespan and thus can only be used for a short period of time. This intense preparation makes it difficult to keep the hands-on portion of a lab available for student use longer than just the one day that the lab is scheduled.

The difficult and time-consuming lab setup dictates the exact procedures that the students must follow. The students have a lab manual that they are expected to read before coming to lab. They then follow the procedure laid out in the lab manual and complete the accompanying questionnaire. This is the only exposure that students have to the unique material in the lab. On the lab practical exams, the students are responsible for knowing the material from a total of thirteen labs. Although students always have access to their lab manual, instructor, teaching assistants, other students, a support webpage and any notes or drawings they may take during the lab itself, these are not the same as actually doing the procedure and seeing the results at the completion of the hands-on lab. This inability to review labs that may have been completed many weeks prior to the lab practical exam makes it extremely difficult for students to attain the high level of practical skills and knowledge that is required on the lab practical exam.

In addition to the problem of students not being able to review procedures and results, it is possible that students may be unable to produce the correct results when they initially perform the lab. Students are enrolled in this class because they are neither knowledgeable in the subject matter nor proficient in the skills taught in the lab. While this imperfection is an expected and accepted part of the lab class, mistakes in procedures may leave a student at a disadvantage when they are faced with the lab practical exam. The addition of virtual labs to the curriculum could help them better understand and remember the concepts and skills presented in the lab procedure and presenting the information in a way that will be found on lab practical exams. In a hands-on lab, the possibility of observing the wrong organism or making errors in a procedure, coupled with the lack of ability to review the material before taking the lab practical exam, can present a huge stumbling block to students.

During the time period from fall 2003 through fall 2005 the first 13 virtual labs were designed, developed and used in the General Microbiology classroom. These labs can be viewed at [http://multimedia.uwyo.edu/virtual\\_edge/](http://multimedia.uwyo.edu/virtual_edge/) The work done during the

fall of 2003 was partially funded by the Paul Stock Grant. Student response was measured using a survey after the lab practical exam in fall 2005. Students were given access to the virtual labs but not required to access them. Student response to using the virtual labs was overwhelmingly positive. 70% of the students reported using the virtual labs. When students were asked if the virtual labs helped them prepare for the lab practical exam the  $r= 4.37$  on a 5 point Likert scale. Students also felt that the labs helped them feel more confident about the lab procedures,  $r=4.22$ . When students were asked if the project should be continued the response was extremely positive,  $r=4.65$ .

The student response for this project was extremely positive and it is the wish of the instructor to continue through labs 13-26.

**Procedure:**

Using a microscope equipped with a digital camera and a digital video camera, lab procedures will be electronically documented. All materials will then be compiled with the text from the lab manual to create the virtual labs.

**Faculty in Charge:** Rachel M. Watson

**Budget:**

• Undergrad Student (\$6.50/hr x 4 hr/week x 15 weeks)	\$390
• Director MX 2004	\$499
• Studio 8	\$299
• Western Digital Dual-option External 320GB Hard Drive	\$215
• Olympus SP-350 Digital Camera	\$249
• Olympus 1GB xD-Picture Card	\$70
• <u>Panasonic PV-GS19 MiniDV Digital Camcorder</u>	<u>\$250</u>

**Total Amount For Project** **\$1,972**

**Justification of Budget:** \$1,972

The time commitment required to set up and demonstrate the labs and lab procedures is considerable. In order to keep from causing undue stress upon the instructor it is important that there is a knowledgeable undergrad that could be paid to help with these procedures.

Several software programs will be needed. Director MX 2004 will be used to create many interactive elements of the virtual labs. Studio 8 contains Dreamweaver, Fireworks and Flash that will be used to develop all additional graphics, build the webpage to house the virtual labs and build additional animations. Personal laptops will be used to create the project and they do not have enough hard drive space to keep all the video/ multimedia so an external Hard Drive is necessary. There is one digital camera used by faculty in microbiology but since it is used by many groups, having one that could be housed in the lab for immediate use would be extremely helpful. A large memory card is always needed to hold the pictures at the resolution that is required.