Digital Microscope Cameras - database and classroom use

CTEL Emerging Technology Small Grant Proposal

Technology

Joseph Staples
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Karen Wilson

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Robert Kuech

Department of Teacher Education

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Department of Geography-Anthropology.

Spring 2010
Digital Microscope Cameras - database and classroom use

Statement of Need/Problem

Digital imaging technology in microscopy is well advanced and more affordable than ever. Nevertheless, this technology is still underutilized in classrooms and student research. We propose a project with distinct but interactive elements:

1. Develop a online visual database of arthropods for teaching and public access that will feature invasive species (primarily terrestrial arthropods) and arthropods that figure predominately in Maine Dept. of Environmental Protection’s Aquatic Biomonitoring Assessment.
2. Test the instructional value of access to digital cameras and microscopes as well as online digital images in the classroom.
3. Introduce pre-service K-12 science teachers to the use of digital imagery in the classroom.

Digital microscopy images of arthropod specimens currently maintained in teaching and research collections in the Department of Environmental Science and Maine State Department of Environmental Protection’s (DEP) Biomonitoring Unit will be collected and then placed into a searchable database on the internet. These images will then be made available for classroom use and public access.

To assess the instructional value of using digital microscope imaging methods and technologies in the laboratory classroom, students in select laboratory classes in Anthropology and Geosciences, Human Education and Development, and Environmental Sciences will be given access to and instruction in the use of digital microscope imaging methods and technologies during regular laboratory classes. After initial review of these methods and technologies, students will be divided into two groups. The first group will use microscopes fitted with digital microscope cameras and computers. The second group will use standard microscopes without cameras. Both groups will have access to online digital images and groups will be given evaluation forms before and after the class to assess their comprehension of microscopy methods. Evaluations will compare students with access to digital microscope cameras and online reference images to those who have access to online images only.

Pre-service teachers in the education programs would be instructed in the use of the cameras and data base to use as part of their teaching methodology. The teaching interns will use the cameras and database to allow their students access to authentic inquiry-based techniques using digital technologies. Education students will learn how to use digital photography to gather and present data, which they could also present to their students. These pre-service interns would learn how to post the collected data to an electronic database and then learn how to access and utilize the information on the database.

Technology

Techsen™ imaging produces excellent research grade digital cameras that can be fitted to any microscope. When attached to a computer, the supporting TSVview™ software allows the user to acquire images and movies in difference sizes and resolutions as well as the ability to collect measurements for allometric and morphometric analysis of specimens.

Scienscope™ provides quality stereo microscopes that contain an internal iris that is important for imaging minute insect specimens with quality image resolution and depth of field down to 0.5 mm
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We will purchase two trinocular stereo microscopes for use in classroom demonstration and student research.

We will work with CTEL and Instructional Technology to develop the proper online database format. Once the study is finished we will submit the results will be made available to CTEL and the USM community. We also will continue to create digital records of collection materials for use in instruction and research as well as for public access.

People, Activities, and Work Plan

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Planning (January to March)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joe Stapes (DES) (Lead)</td>
<td>Acquisition of cameras, computers and microscopes. Selection of terrestrial insects (Specifically common agricultural and forest pests, current and potential invasive species). Basic instruction in the use and maintenance of imaging software, digital microscope cameras and microscopes for faculty and students. Contribute to a methods for acquisition of digital images. Planning and implementing an online database.</td>
</tr>
<tr>
<td>Bob Kuech (Dept. of Teacher Education)</td>
<td>Acquisition of cameras, computers and microscopes. Contribute to a methods for acquisition of digital images. Planning and implementing an online database.</td>
</tr>
<tr>
<td>Rob Sanford (DES)</td>
<td>Access and instruction for environmental science students and consultation on learning objectives and educational development. Contribute to a methods for acquisition of digital images. Planning and implementing an online database.</td>
</tr>
<tr>
<td>Karen Wilson (DES)</td>
<td>Provide samples and identification for important aquatic samples (specifically those used in the Maine DEP biomonitoring program). Instruction in basic microscopy imaging for aquatic specimens. Contribute to a methods for acquisition of digital images. Planning and implementing an online database.</td>
</tr>
<tr>
<td>Nate Hamilton (Geo-Anthro)</td>
<td>Provide samples and identification for important archeological specimens (flora and fauna). Instruction on basic microscopy of archeological specimens. Contribute to a methods for acquisition of digital images. Planning and implementing an online database.</td>
</tr>
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</table>
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<table>
<thead>
<tr>
<th>Faculty</th>
<th>Implementation (March to November)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joe Staples (DES) (Lead)</td>
<td>Uploading images to online database. Laboratory classroom instruction (microscopy and digital imaging). Student evaluation. Technical consulting for faculty and students. Online Data Collection (May through November 2010).</td>
</tr>
<tr>
<td>Bob Kuech (Dept. of Teacher Education)</td>
<td>Uploading images to online database. Laboratory classroom instruction (microscopy and digital imaging). Student evaluation. Online Data Collection (May through November 2010).</td>
</tr>
<tr>
<td>Rob Sanford (DES)</td>
<td>Uploading images to online database. Laboratory classroom instruction (microscopy and digital imaging). Student evaluation.</td>
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<table>
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<tr>
<th>Faculty</th>
<th>Evaluation (November)</th>
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</thead>
<tbody>
<tr>
<td>Joe Staples (DES) (Lead)</td>
<td>Summary of student evaluations. Summary of online access.</td>
</tr>
<tr>
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Project Outcomes and Evaluation
Allowing better access to digital microscopy technologies and arthropod collections currently maintained at USM is expected to enhance the academic experiences for students while providing a valuable public and educational resource for Southern Maine and beyond.

- Laboratory and classroom instruction: Student evaluations collected from laboratory and select pre-service education courses will compare results from students with access to digital microscope cameras and online reference images vs. those who have access to online images only.

- Online access to digital images. We will record the number of hits on the USM insect database throughout the course of this project.

Dissemination
A report of our findings will be made available to CTEL and the USM community.
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### Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Cost per unit</th>
<th>Price Per line</th>
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<tbody>
<tr>
<td>Camera (9.0 mp) CMOS sensor (+S/H) and software</td>
<td>X3</td>
<td>$240</td>
<td>$720</td>
</tr>
<tr>
<td>Camera (9.0 mp) CCD sensor (+S/H) (for very small specimens in lowlight) and software.</td>
<td>x1</td>
<td>$900</td>
<td>$900</td>
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<tr>
<td>Recycled USM desktops and monitors (+S/H)</td>
<td>X4</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Scienoscope Microscope (+S/H)</td>
<td>x2</td>
<td>$253</td>
<td>$506</td>
</tr>
<tr>
<td>Corel Photo Shop (post processing)</td>
<td>X4</td>
<td>$40</td>
<td>$160</td>
</tr>
<tr>
<td>SCIENSCOPE LCD Back Light Illuminator</td>
<td>X1</td>
<td>$167</td>
<td>$174</td>
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<tr>
<td>Miscellaneous supplies (translucent paper, gray (18%) sculpting clay, insect pins)</td>
<td>--</td>
<td>$40</td>
<td>$40</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Equipment Subtotal $2500</td>
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<tr>
<td>Faculty Compensation</td>
<td>x5</td>
<td>$500</td>
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<tr>
<td></td>
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<td>Total $5000</td>
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Emerging Technology Small Grant Sign-off Sheet

<table>
<thead>
<tr>
<th>Role</th>
<th>Sign</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Faculty member</td>
<td>(sign)</td>
<td>(print)</td>
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<tr>
<td>Date:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department chair</td>
<td>(sign)</td>
<td>(print)</td>
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<tr>
<td>Date:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dean/School head</td>
<td>(sign)</td>
<td>(print)</td>
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<tr>
<td>Date:</td>
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