Creating Research Opportunities for Biology and Environmental Courses Using Online Data

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The Cornell Lab of Ornithology
Education
Goals of Talk

- Describe biology curriculum and faculty professional development project (CCLI Type 2)
- Update on outreach and usage of previous NSDL projects (Macaulay Library, Science Pipes)
- Seek advice on effective NSDL integration
- Identify partners and collaborators
Online Research in Biology Staff

• PI:
  – Nancy Trautmann

• Co-PIs:
  – Colleen McLinn
  – Mike Webster
  – Irby Lovette
  – David Winkler

• Web Programmer:
  – Heng-Scheng Chuang

• Undergraduate Intern:
  – Ileana Betancourt
The Problem

- Undergraduate research experiences can have a big impact

...but typically only small numbers of students benefit from them
Goals of the Project

• Use rich online databases to engage students in investigating authentic questions
• Through inquiry-based instructional design, bring the teaching of science closer to the practice of science
• Create manageable student research opportunities in large introductory courses, classes with no lab or field component, and online-only courses
Opportunities of Online Data

• Enhance field studies, by
  – using online datasets to set the scene for student fieldwork
  – viewing field data within broader temporal and geographic trends
Databases and Tools

• Macaulay Library
  – Online access
    • 100,000 animal sounds
    • 40,000 videos online
  – Sound visualization software

• Citizen science data
  – eBird
    • > 21 million observations
  – Project FeederWatch
  – NestWatch
  – Celebrate Urban Birds
Science Pipes
Educational Uses of Science Pipes

Courtney Wilson, Nancy Trautmann, Jim MaKinister, Barbara Barker

The Science Teacher, 77(7), 34-39
October 2010
Approach

• Gathering information
  – Interview faculty about needs
  – Review AOU survey of ornithology courses
  – Collect syllabi (ESA Syllabus Exchange)
  – Review textbooks for fit
  – Review existing lessons
  – Sit in on lectures/labs
  – Workshop
Workshop: Get Your Students Twittering Social Networking in Ornithology Classes

Margaret Rubega, U Conn

Found Canada geese have different strategies for guarding nests with chicks or eggs that haven't yet hatched. Chicks= silence, eggs= noise. 12:54 PM Apr 27th

Holden Caulfield once asked where the ducks go in the winter and never really got his answer. He should walk by Mirror Lake at Uconn today 2:13 PM Feb 10th
Teaching Observation and Inference Through Online Photo Tagging

Margaret Voss and Caren Cooper

*American Biology Teacher, 72*(7), 437-443. September 2010
Outcomes of Workshop

• List of 60 names
• 4 PowerPoint presentations on web
• Blogged about by postdoc in attendance
• List of books, articles, other resources
• Notice about grant and opportunity to participate

“Congratulations on the very successful workshop on teaching ornithology. I look forward to hearing more about the website. I hope you have plans to publicize both the event and the web resources. There is a lot of innovative teaching in the traditional 'ologies, and it should be celebrated and supported.”
Advisory Board and Pilot Faculty

- Franklin and Marshall
- Loyola Marymount University
- Mercy College
- St. Mary’s College of Maryland
- Tompkins Cortland Community College
- University of the South
Topics

• What is a species?
• Why is one sex more elaborately ornamented than the other in some species?
• Have changes in land use altered bird species abundance or distribution?
Curriculum Development Approach

• Consult with subject matter experts and resource providers about possible educational uses
• Consult with faculty advisors about needs
• Collaborations with lecturers
• Graduate seminar on teaching professional development
Graduate Seminar Details

- 1 credit and 1 hour a week
- Guest presenters, short readings
- Presented lighting talks to Community College faculty member
- Presented draft versions to class for peer review
- Final event – invited faculty from Cornell, Ithaca College, Tompkins Cortland Community College
- Refined and edited lessons for website launch
Outcomes of Graduate Seminar

• “I really appreciated the combination of theory (of good teaching) and practice (piloting the lessons). I noticed the participants really used the theory in developing their lessons.”
Two Modes of Implementation

- One-time labs as part of curriculum (guided inquiry)
- Longer-term independent or pair investigations (open inquiry)
Guided Inquiry Examples

• Species Concepts
Owls in Trees

**Part 1:** Learn how to use the Macaulay Library and to interpret a spectrogram view of sound

**Part 2:** Analyze owl calls, identify vocal characters, build a tree based on that data

**Part 3:** Repeat for owl images/natural history information. Compare trees based on behavioral data to trees based on DNA

**Part 4:** Develop hypotheses about how other bird vocalizations relate to evolutionary history, and test these via independent research using Macaulay Library
Open Inquiry: Science Pipes

- Tool for easy and user-friendly scientific workflows and graphs
- Access data from Project FeederWatch and eBird
- Filter by species, year
- Make graphs without Excel or data entry!
- Tutorials available

http://sciencepipes.org
http://birds.cornell.edu/orb
Usage Tracking
Automated Survey Prompts

Survey Settings

Email 'reply-to':
heng-scheng.chuang@cornell.edu
Enter a reply address.

Email Subject:
Feedback requested
Enter the email subject.

Email Text:

Please give us your feedback!
http://somesurveylink.net/c0d

-the Management

Path: p

Disable rich-text
Enter the email text that the user should receive to solicit a reply. The email text should contain a link for the survey. Leave this field blank to remove the survey email.

Send email after:
1 day
Time from when the user downloads a file to when the user receives a survey.
1. What student learning outcomes did you hope to achieve with the “Species Concepts in Birds” assignment?

(Rate how important each student learning outcome was to you, from low to high importance. Then, please list any additional learning outcomes you hoped to achieve).

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Low Importance</th>
<th>Medium Importance</th>
<th>High Importance</th>
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<tr>
<td>Knowledge of specific science concepts that you had identified in advance</td>
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<tr>
<td>Knowledge of science content more generally</td>
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<td>Science process skills such as ability to articulate a research question, develop a valid investigation, and accurately analyze and interpret the data</td>
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<td>Awareness of the variety of data sources and media types used in scientific research</td>
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<td>Awareness of the growing role of the Internet in scientific collaboration, data sharing, and research</td>
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<td>Other learning outcomes:</td>
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Evaluation: In Progress

• Faculty Satisfaction:
  – Satisfaction among participating faculty?
  – Extent and depth of use?
    • Surveys, Quantitative Indicators, server logs and web metrics
Evaluation: In Progress

• Student Research:
  – Degree of open-endedness?
  – Evidence of valid, accurate, defensible research?
    • Pre/post student surveys, review of artifacts, develop rubrics for assessment of inquiry by faculty
Evaluation: In Progress

- Program Success
  - Extent of dissemination?
  - Empower broad range of faculty?
  - Successfully facilitated student research projects?
  - Engaging underserved audiences?
  - Program model lessons learned?
Online Assessment Tools

Waypoint Outcomes

CREATE
Rubrics
Evaluations
Surveys

SHARE
Across courses
Among instructors
Between programs

ANALYZE
Align data with outcomes
Aggregate and disaggregate
Develop longitudinal data

Learn how Waypoint can work for you.

TESTIMONIALS
Current Collaborations

- Cyberlearning at Community Colleges (C3)
  - First line of feedback from undergraduates
  - Discuss pedagogical strategies
  - Disseminate online and in person
Desired NSDL Collaborations

• Dissemination and Outreach
  – Pedagogic Services, EcoEd DL, others

• Research
  – Undergraduate faculty and student surveys and case studies

• Technical Advice

• Grant partners
  – Drupal small grants – sounds good to me!

• Please contact us!
Future Research Goals

• Faculty surveys and interviews on desired student learning outcomes from working with data
  – Understandings about science content, process
  – Abilities and skills
  – Attitudes
  – Motivation
  – Careers

• Review of existing tools for assessing inquiry

• Develop, validate, disseminate new instruments
Online Research in Biology site: http://birds.cornell.edu/orb

Thank you!