LoVoTECS

Teacher Research Experience

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Project Background

- Lotic Volunteer (Temperature, Electrical Conductivity, and Stage) Network

- Plymouth State University coordinated research initiative
  - Funding from NSF through a cooperative agreement with NH EPSCoR - “Ecosystems and Society” project
  - Research Objective: Build a state-of-the-art, broad scale and high-frequency hydrologic sensing network using simple sensors operated by a diverse group of collaborators, including educators, researchers, government agencies, non-profit organizations, and citizen scientists.
Volunteer Network

- 50 locations with paired sensors dispersed statewide
- Designed to include all watershed sizes, shapes and attributes
- Volunteers collect data using in-stream electronic sensors, data is uploaded to network
- Data allows for a greater understanding of the impact of human activities on the hydrology and water quality of rivers and streams across the state
Network Design

In Stream/River Measurements-
• Specific conductance
• Water temperature
• Stream height (Stage)

Data-
• 1 to 5 minute frequency (Spring-Fall)
• 15 minute frequency (Winter Months)
• Year-round
• 100 sites

Rain/Snow Pack Measurements-
• Specific conductance
• Volume
LoVoTECS Sites
Streams & Rivers

Hosts-General

Barometric & Precipitation Sites

LoVoTECS Sites
▲ Hosts-General ★ Academic Host

▲ Precipitation ● Barometric
K-13 Education Outreach

Educator Volunteers

- 13 schools representing diverse participation - middle school, high school, community college and intro-level four year college

- Statewide distribution

Objective: Provide an opportunity for educators and their students to participate in real research experiences through the gathering and analysis of data, promoting important scientific process skills and inquiry.
Next Generation Science Standards (NGSS)

In development – final draft to be released in April
LoVoTEC S and NGSS

Project supports the eight practices of science and engineering that the K-12 Framework for Science Education identifies as essential for all students to learn:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information
Educator Trainings

1. Field:
- identify research site of interest (both to the educator and research team)
- development of a research question for the study site
- equipment set-up
- training on use of sensors and data downloading and uploading procedures

2. Fall Workshop:
- displaying, graphing and analyzing data with HOBOware software
- training in the conversion of data to Excel and manipulation of data
- developing new research questions with students across study sites
Some Current Sites

Marshall Davensen – Keene High School

Jessica Warkentien – Newport Middle School

April Cartwright – Pittsburg High School
Keene High School
Keene High School

Research Question: “What is the impact of urbanization on Beaver Brook?”
Keene High School
Newport Middle School

Student generated research question: "What impact do humans have on the conductivity levels in each branch of the Sugar River?"
Newport Middle School
Newport Middle School
Projects:
Fall – Chemistry class used sensors to collect data. The students used the data for graph analysis exercises and discussions on different ways that solution concentration can be measured.

Spring – Biology class will use the conductivity and stream depth data as part of a larger stream study associated with an annual trout project.
Pittsburg High School
Next Steps

- April Teacher Workshop focused on
  1) data manipulation and analysis with Excel;
  2) cross-referencing data
  3) developing cross-site research questions

- August Teacher Institute
  - curriculum/lesson development

- Recruitment of 2nd cohort of teachers – Phase Two for next year
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