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Data Logging with Stream Ecology

Marlborough School grades 6-8 Marlborough, NH

Each year, Marlborough School works with Trout in the Classroom to raise brook trout eggs and release the hatchlings into the Minnewawa Brook.

Key Questions & Anchor Phenomena

Key questions all connected to conditions in the brook locations being considered for release of brook trout hatchlings in the spring. Based on initial observations made at the locations using the probes, students generated their own driving questions for further study of the location.

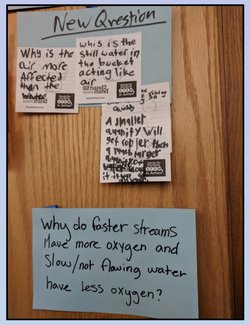
GRADE 6

"Which parts of our watershed have the best water chemistry for releasing brook trout – the brook or its tributaries?"

Phenomenon
The Minnewawa Brook has higher nitrite and almost no ammonia, while its tributaries have less nitrite and more ammonia.

"Which parts of our watershed have the most available oxygen?"

Phenomenon
Waters removed from the stream flow have much lower oxygen.



GRADE 7

"Which locations in our watershed have the greatest biodiversity of invertebrates?"

Phenomenon
More invertebrate species are found in murky and plant-covered parts of the stream than rocky sections.

"How do direct sunlight and shade cover cause the water temperature to change in faster and slower areas of the stream?"

Phenomenon
Sunny sections of water warm up quickly but cool off quickly once the sunlight is blocked.

GRADE 8

"What forces and conditions do brook trout eggs and hatchlings endure in the stream?"

Phenomena
Water flow in the stream changes the shape of the stream bed over time
Forces in the stream remain around 0.5 G but can spike to over 2.0 G

"Why do some parts of the stream flow faster than others?"

Phenomenon
Ping Pong balls floated faster down some parts of the stream than in others

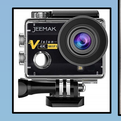
The Tools

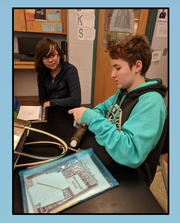
Hands-on learning through lab data collection was at the core of investigating each phenomenon. Students learned and practiced a broad range of data collection skills using tools as simple as a ping pong ball and string, or as complex as digital oxygen probes, waterproof data loggers, and digital video cameras.

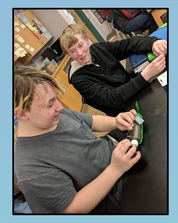
- Water quality test kits:
  - pH
  - nitrate/nitrite
  - phosphate
  - ammonia
- Milwaukee dissolved O_2 probes

- Onset HOBO pendant temp/light data loggers
- D-shaped invertebrate sampling nets

- Jeemak 4K underwater action camera
- Onset HOBO G pendant data logger
- Makerspace tools





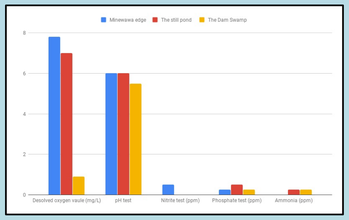


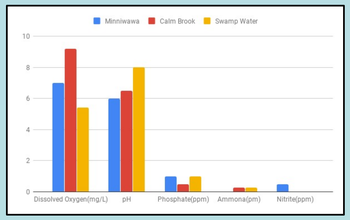
The Data

The aim of this project was to transform this tradition of raising brook trout from a school side event into a hands-on, technology-rich, data driven element at the heart of the middle school curriculum for all three grade levels, making use of the school's proximity to local waterways. Creating and interpreting graphs is an identified skill in which students needed improvement across all grades.

<u>Through using these tools, students gained experience in:</u>

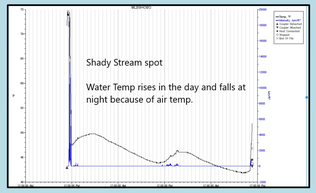
- Creating their own data charts
- Recording data in the field
- Using spreadsheets to make graphs
- Reading and analyzing data
- Identifying anomalous data in a set or potential data errors

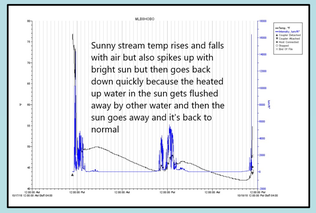




<u>Through using these tools, students gained experience in:</u>

- Reading data from complex data charts
- Extrapolating individual high and low data points from a graph
- Describing daily patterns in data and inferring the cause of each major change
- Evaluating possibility of cause-effect relationships between two data sets
- Identifying and explaining anomalous data in a set or potential data errors





<u>Through using these tools, students gained experience in:</u>

- Identifying anomalous data in a set or potential data errors
- Reading data from complex data charts
- Extrapolating individual high and low data points from a graph
- Using spreadsheets to make graphs
- Using formulas for calculations
- Recording data in the field
- Reading and analyzing data
- Using trend lines to see patterns in data
- Creating data charts
- Taking measurements