Instructor Guide

Spring Days 6-7: Data Analysis

Overview

In this final phase, students synthesize their learning by analyzing their full-year monitoring data. Using the Spring Data Analysis worksheet and their data dashboards, they identify patterns, interpret water chemistry, E. coli, and macroinvertebrate results, and compare findings to healthy reference ranges. Working in teams, they then produce a clear, evidence-based stream health report that explains what their data show and how stream conditions connect to human activity in their watershed.

Standards Alignment

AFNR Natural Resource Systems Career Pathway Standards, Common Career Technical Core (CCTC)

NRS.02. Analyze the interrelationships between natural resources and humans.

> **NRS.02.02.** Assess the impact of human activities on the availability of natural resources. (NRS.02.02.01.a., NRS.02.02.01.b., NRS.02.02.03.b., NRS.02.02.01.c., NRS.02.02.03.c.)

NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

> **NRS.04.01.** Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques. (NRS. 04.01.01.b., NRS. 04.01.01.c.)

Michigan Science Standards, High School Performance Expectations

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Learning Objectives

- Students will interpret water chemistry, *E. coli,* and macroinvertebrate data to estimate and characterize the overall water quality of their study sites.
- Students will compare water quality measurements across sampling periods and study sites to identify similarities, differences, and patterns.
- Students will use their data interpretation and comparisons to construct explanations using claims that are supported by evidence and scientific reasoning.

- Students will connect water quality to human activities and recommend actions for improvement.
- Students will develop new questions, hypotheses, and investigation ideas for future stream monitoring efforts.

Materials

- Stream Team Field Guide
- Spring Day 6 Data Analysis worksheet
- Computers or tablets

Advanced Preparation

1. Ensure students have access to their stream site plots/dashboards in Google Sheets.
2. Confirm students have their Field Guide available for "healthy stream" reference ranges.
3. Make copies of or share links to the Spring Day 6 Data Analysis worksheet, "*Telling Your Stream Story*."
4. Construct a Google Site webpage for sharing results and ensure students have editing access.

Lesson Sequence

Time period: 2 class periods completed in the classroom.

Elaborate: Data Analysis and Interpretation (60 minutes)

1. Pass out the Spring Day 6 Data Analysis Worksheet. Explain to students that the worksheet is intentionally divided into smaller sections to help them analyze their data step-by-step, just like scientists do. Let students know they will focus on one part of the analysis at a time. First, they will be comparing values to healthy ranges, then they will look for patterns and outliers. Finally, they will draw conclusions based on the evidence in their data and make predictions. Emphasize that breaking the work into sections will make the process more manageable and allow time for discussion, thinking, and evidence-based explanations rather than rushing to finish. Encourage students to fully complete and discuss each section before moving on.
2. Display dashboard with all parameters visible. Remind students: "Today you are the scientists telling the story of your stream using data." Invite students to begin thinking in terms of full-year trends with a brief discussion.

    Sample Discussion Questions:

    - *"What kinds of patterns might we expect to see over a full year?"*

- *"What does 'healthy stream' actually mean in terms of data?"*

3. Demonstrate to students where to find the plots for the seven water quality measurements collected during sampling days. Invite students to work on question 1 of the Spring Day 6 Data Analysis Worksheet with a goal of completing this work in 10 minutes. Circulate through the room while students complete their analysis.

   Sample Discussion Prompts while circulating the room:
   - *"Which parameters mostly stay in the healthy range?"*
   - *"If one value is out of range, is it one day or a consistent pattern?"*

   Sample Discussion Question for whole group quick share:
   - *"What's one parameter your group feels confident about and why?"*
4. Have students continue working in small groups to analyze overall trends, connections between variables, and unusual values while they answer questions 2-5 on the worksheet. This should be completed in about 15 minutes. Circulate through the room while students complete their analysis.

   Sample Discussion Prompts while circulating the room:
   - *"Do any measurements rise or fall together?"*
   - *"Are any values consistently high or low?"*
   - *"If a value is outside the expected range, what might explain it?" "What evidence supports your explanation?"*

   Sample Discussion Question for whole group quick share:
   - *"What's one interesting pattern or outlier you discovered?"*
5. Demonstrate to students where to find the *E. coli* plots for the data collected during sampling days. Invite students to work on questions 6-9 on the worksheet. This should be completed in about 15 minutes. Circulate through the room while students complete their analysis.

   Sample Discussion Prompts while circulating the room:
   - *"What does this graph show at first glance?"*
   - *"When are levels highest or lowest?"*
   - *"Is this what you expected based on your site conditions?"*
   - *"What might cause spikes in bacteria levels?"*

   Sample Discussion Question for whole group quick share:
   - *"Does your study site generally appear safe based on the E.coli levels, or is it occasionally or always risky for recreation?"*

6. Have students move to the analysis of the macroinvertebrate and water quality rating plots. Remind students that biological data helps show long-term stream health and should support or challenge what they observed in the chemistry data. This should be completed in about 10 minutes. Circulate through the room while students complete their analysis.

    Sample Discussion Prompts while circulating the room:
    - *"Are the quantities of organisms what you expected? Do you notice any surprises?"*
    - *"How does the Water Quality Rating compare with your chemistry findings?"*
    - *"Why might macroinvertebrates be good indicators of overall health?"*

Evaluate: Drawing Conclusions and Reporting (45-60 minutes)

1. Begin by explaining that students are shifting from analysis to communication. Emphasize that scientists don't just collect data; they share conclusions with others so action can be taken. Tell students their final report will be read by people who were not part of the investigation (community members, families, or local partners). Because of this, their writing should be clear, organized, and evidence-based.
2. Clarify expectations for the student reports:
    a. One team report per site
    b. Written for a public audience
    c. Includes claims, evidence, reasoning, and recommendations
    d. Uploaded to the class Google Site with their dashboard
3. Facilitate a short discussion to engage students in beginning the report writing process:

    Sample Discussion Question for whole group quick share:
    - *"If someone has never visited your stream, what would they need to understand first?"*
    - *"Why is it important to communicate science clearly to the public?"*
    - *"How is this different from just answering worksheet questions?"*
4. Walk students through the worksheet sections and briefly explain the purpose of each part.
    a. Introduction: sets context and purpose
    b. Methods: show how evidence was gathered
    c. Discussion/Conclusion: explains what the data means
    d. Recommendations: suggests actions

    e. Future Questions: identifies next steps for science
5. Remind students of the Claim–Evidence–Reasoning (CER) approach.
    a. Claim: what you conclude
    b. Evidence: data from your dashboard
    c. Reasoning: why that evidence supports your claim

    Sample Discussion Questions:
    - *"What makes a claim strong?"*
    - *"What counts as evidence in this report?"*
    - *"Why do we need reasoning, not just numbers?"*
6. Direct teams to begin drafting their reports using the prompts from each section on the worksheet to guide their writing. Encourage teams to reference their field notes and dashboard. Circulate and support students as they work through the writing process as a team.

    Sample support to provide students:

    - Provide sentence stems for struggling writers (e.g., "Our data shows…," "This suggests…," "Because…, we recommend…").
    - Encourage bullet points first, then paragraphs.
    - Remind students to use specific numbers from graphs.
    - Keep teams focused on 2–3 strong claims rather than many weak ones.
7. Ask each team to upload their data dashboard and final site report to a dedicated Google Site page for their stream site. Encourage them to include photos from their fieldwork or links to additional resources. Consider making the Google Site publicly accessible so community members can learn about local water quality.

Optional Evaluate Extension (30-45 minutes)

Have teams prepare a three-minute thesis about their project using Google Slides. Ask each team to include:

- A key takeaway from their research, with at least one plot from their dashboard.
- One recommendation for improving water quality.
- One question they still have for future research.

Give each team three minutes to share their slides with the class. Ensure all team members have a speaking part.