WAMC Lab Template

Math Concept(s): Linear Equations
Source / Text: Cord Algebra 1, page 50-51
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Date: June 23, 2021

Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

In groups of 2 or 3 students will use the dissolved oxygen kits in the lab to determine the dissolved oxygen saturation of water at four different temperatures. Students will then graph their results, and determine if their points on the coordinate plane all fall on one line.

Lab Plan

Lab Title: Dissolved Oxygen or Where Have All the Salmon Gone?

Prerequisite skills:

- Ability to collect data in a table
- Ability to graph that data
- An understanding of the first half of Algebra 1, Pre-algebra
- Equation of a line and slope of a line

Lab objective:

Learn how to use the DO kits in the lab
Students will find out that salmon are mostly dying because of water quality and not overfishing or other reasons not related to water quality.
Students will graph 4 points and see that it creates a line. They will then determine the equation of that line and its slope.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems.
A.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A.CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
A.REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A.REI.D.11 Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Standards for Mathematical Practice:

- Making sense of problems and persevere in solving them
- Model with mathematics
- Reason abstractly and quantitatively
- Look for and make use of structure

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- RST.9-10.3 Follow complex multistep procedure while carrying out experiments, taking measurements or performing technical tasks, attending to special cases or exceptions defined in the text
- RST.9-10.4 Determine meaning of symbols, key terms, or other domain specific words and phrases as they are used in specific technical context.
- Translate qualitative or technical information expressed in words in a text into visual form and translate information expressed verbally or mathematically into words.

K-12 Science Standards

- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Technology

- 1.2.1 Communicate and collaborate to learn from others.
- 2.4.1 Formulate and synthesize new knowledge.

Engineering

- HS.ETS1-2 Design a solution to complex real-world problem by breaking it down into smaller, more manageable problems that can be solved by engineering.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

Global Awareness | Financial/Economic/Business/Entrepreneurial Literacy | Civic Literacy
Health/Safety Literacy | Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
- xThink Creatively
- xWork Creatively with Others
- Implement Innovations

Critical Thinking and Problem Solving
- xReason Effectively
- Use Systems Thinking
- Make Judgments and Decisions
- xSolve Problems

Communication and Collaboration
- xCommunicate Clearly
- xCollaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
- Access and Evaluate Information
- Use and manage Information

Media Literacy
- Analyze Media
- Create Media Products

Information, Communications and Technology (ICT Literacy)
- Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
- Adapt to Change
- Be Flexible

Initiative and Self-Direction
- Manage Goals and Time
- Work Independently
- xBe Self-Directed Learners

Social and Cross-Cultural
- xInteract Effectively with Others
- xWork Effectively in Diverse Teams

Productivity and Accountability
- Manage Projects
- Produce Results

Leadership and Responsibility
- xGuide and Lead Others
- xBe Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Dissolved Oxygen Kits
- 7 Beakers
- Ice
- Bunsen burners
- Digital thermometers
- Lab books to write down their lab results

Set-Up Required:

- The lab will be set up with one dissolved oxygen kit be group. Each group will receive 7 beakers, ice, a Bunsen burner and a thermometer.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Students will be aware that they are being assessed on their oral communication abilities. Students need to communicate effectively to complete the lab. Students are also assessed on collaboration and how well they all complete the task by including all group members and taking a leadership role when needed.

Cooperative Learning:

- Students will need to attend to safety issues as there will be an open flame and hot water at their lab bench. Staying safe takes a group effort. Students will collaborate and communicate as stated above.

Expectations:

- They will be collecting data in the lab that will be graphed on a coordinate plane to determine if they all fall on one line. Students have been learning about linear equations. This is a chance for them to see an application of linear equations in the natural world. If you know the value of dissolved oxygen saturation (DO) at one temperature, can you calculate the DO for other temperatures that you don't know?During the dissolved oxygen lab the teacher will move between lab groups to make sure all students are participating and filling in the lab sheets. I will check the quantities for DO that students are obtaining from their lab to make sure that it is reasonable.
- Students will gather data on dissolved oxygen saturation from water of four different temperatures. They should see that when this data is graphed on a coordinate plane it creates a line. They will then determine the equation of that line.

Timeline:

- This lab takes place after students have learned about linear equations. The lab itself should take one block period - 1 hour and 10 minutes.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab. This is a lab where students are gathering data in the lab related to dissolved oxygen, the most important parameter that affects the viability of aquatic animals. The five salmon species of Mason County need low water temperatures, under 10 degrees C to thrive. Student will see that as temperature increases dissolved oxygen decreases. This is very important as global climate change is making the

salt water and creek water warmer. This increase in water temperature is causing stress on juvenile and reproducing adult salmon. This stress has caused up to a 50% decrease in some salmon populations in the last 25 years.

Career Applications

- Students that are interested in career in fish and wildlife related industries will learn about linear functions and how that affects the 5 salmon species of Mason County, Washington.
- Students that are interested in STEM careers will be introduced to a real-world application of linear functions.
- Students that are interested in being a water quality technician or biologist will see connections between algebra and science.

Optional or Extension Activities

- Students will follow up with a field trip to the Puget Sound to collect dissolved oxygen data in the field and compare with their finding in the lab. Water temperature in the Puget Sound will be discussed in relation to climate change and increasing water and air temperature in Washington State.

**********End of Lab**********

Attachments below:

Lab Instructions for Dissolved Oxygen Lab

Introduction

In groups of 2 or 3, students will use the dissolved oxygen kits in the lab to determine the dissolved oxygen saturation of water at four different temperatures. Students will then graph their results, and determine if their points on the coordinate plane all fall on one line.

Materials

Materials

- Dissolved Oxygen Kits
- 7 Beakers
- Ice
- Bunsen burners
- Digital thermometers
- Lab books to write down their lab results

Methods

In your lab group heat up one beaker of water, cool one beaker with ice, and have one beaker of room temperature water. Using your thermometer create beakers with the following temperatures 2 degrees C, 10 degrees C, 25 degrees C and 50 degrees C.
Find the dissolved oxygen saturation at each temperature, record your data in your lab book. Students will then graph their results in their lab book.

Assessment Tool for Dissolved Oxygen Lab

Students' lab books will be checked to be sure that they have reasonable answers for the dissolved oxygen for each of the four temperatures. Students will graph 4 points and see that it creates a line. They will then determine the equation of that line. It should look similar to the one below.