WAMC Lab Template

Math Concept(s): Graphing/Interpreting Piecewise Functions
Source / Text:
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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):

Students will work in pair to plant grass and measure the height of the grass every school day. They graph this data each day and assess the trend. Students will be able to write an equation for the linear trend of growth. Students will cut grass and continue to measure growth. Students will be given the option to do any combination of cutting grass, neglecting to water grass, water with fertilizer, etc. After 15 school days, the class will come together to look at the graphs of each partnership. Groups will then work on writing equations for each section of their graph and in the end will produce a piecewise function to represent their grass' growth over the 3 weeks. They will use this function to answer questions and make predictions about their grass height.

Lab Plan

Lab Title: Graphing Grass

Prerequisite skills:

- Using a ruler
- Graphing coordinate points
- Writing equations
- Regression analysis (linear, exponential, root, etc.)

Lab objective: Students will write piecewise functions that represent the height of their grass over 3 weeks.

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

Mathematics K–12 Learning Standards:

- F-IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions
- F-BF.1c (+) Compose functions

Standards for Mathematical Practice:

- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics

- Use appropriate tools strategically
- Attend to precision

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

- RST.9-10.3 Follow precisely a complex multistep procedure when 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
- RST.9-10.7 Translate quantitative 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-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

Technology

- 1.2.1 Communicate and collaborate to learn with others
- 1.3.2 Locate and organize information from a variety of sources and media
- 2.2.1 Develop skills to use technology effectively

Engineering

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

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
☒ Think Creatively
☒ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☐ Make Judgments and Decisions
☐ Solve Problems
Communication and Collaboration
☒ Communicate Clearly
☒ Collaborate 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
☒ Be Self-Directed Learners
Social and Cross-Cultural
☒ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☒ Manage Projects
☒ Produce Results
Leadership and Responsibility
☒ Guide and Lead Others
☒ Be Responsible to Others

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

Materials

- Paper cups
- Thumbtacks
- Potting soil
- Access to water
- Grass seeds
- Wax paper
- Student sheet with graph
- Rulers
- Graphing calculators

Set-Up Required:

- Bring in all materials
- Print student record sheet with graph

<u>Lab Organization Strategies:</u>

Leadership (Connect to 21st Century Skills selected):

- Students will be aware of their impact on growing grass, which transfers over to an awareness on human interaction with the environment
- Students will have the opportunity to determine in which ways they can affect growth of their grass, encouraging creative thinking with their partners
- Students will be responsible for measuring the height of their grass each day without direction. They will be responsible for measuring and watering their grass in the event their partner is absent.
- Students will need to utilize a graphing calculator to perform regression analysis on each leg of their graph to write the piecewise function.

Cooperative Learning:

- Students will be working in partnerships to measure and water their graph each day. They will be responsible for completing these tasks each day in the event their partner is absent. They will need to work together to determine the ways they will affect their grass growth.

Expectations:

- Students are expected to measure and water their graph each day. They are expected to test out different methods of altering the rate their grass is growing. They are expected to graph the height of their grass vs time and write a function to represent the height of their grass over the course of the experiment.

Timeline:

- Students will be measuring the height of their graph each school day for the first six minutes of class over the course of 15 school days. After 15 school days, the class will spend two 45-minute class periods graphing, doing regression analysis, and writing a function to represent the height of their grass. Students will also be answering discussion questions during this time.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- What other real-world situations can piecewise functions represent? Can representing these situations with piecewise functions help us understand the system more or make predictions?

Career Applications

- Horticulture
- Landscaping
- Engineering
- Environmental Agency

Optional or Extension Activities:

- Make a graph representing the slope of the piecewise function.