WAMC Lab Template

Math Concept(s): Proportions

Source / Text:

Developed by: Kris Daratha E-Mail: kristopher.daratha@rsdmail.org

Date: Summer Conference 2023

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):

Lab Plan

Lab Title: Finding New Heights Lab

Prerequisite skills: Students should have a basic understanding of proportions.

Lab objective: The objective of this lab is to help students gain a practical understanding on how the use of proportions can be used to find the height of unmeasurable object.

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

Mathematics K–12 Learning Standards:

- HSA-SSE.B.3 Write expressions in equivalent forms to solve problems

Standards for Mathematical Practice:

- HSA-SSE.1. Make sense of problems and persevere in solving them
- HSA-SSE.4. Model with mathematics
- HSA-SSE.6. Attend to precision
- HSA-SSE.7. Look for and make use of structure

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

- HS-SL-1-A Speaking and listening. Comprehension and Collaboration
- HS-SL-1-B. work with peers to set rules for collegial decisions and decision making
- HS-SL-1-C. Propel conversations by posing and responding to questions that relate to the current information

K-12 Science Standards

- HS-LS2: Scale, Proportional, Quantity: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

Technology

- HS-T-5A. Computational Thinker. Students develop and employ strategies for understanding problems in ways that leverage the power of technology
- HS-T-5B Students collect data or identify relevant data sets, use digital tools to analyze them and represent data in various ways to facilitate problem solving and decision making.

Engineering

- MS-ETS1-4 **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

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 X☐ Environmental Literacy

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

LEARNING AND INNOVATION

Creativity and Innovation
☐ Think Creatively
X☐ Work Creatively with Others
☐ Implement Innovations

Critical Thinking and Problem Solving
☐ Reason Effectively
☐ Use Systems Thinking
☐ Make Judgments and Decisions
X☐ Solve Problems

Communication and Collaboration
X☐ Communicate Clearly
☐ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
X☐ 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
X☐ Adapt to Change
☐ Be Flexible

Initiative and Self-Direction
X☐ Manage Goals and Time
☐ Work Independently
X☐ Be Self-Directed Learners

Social and Cross-Cultural
X☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability

X☐ Manage Projects
X☐ Produce Results

Leadership and Responsibility
X☐ Guide and Lead Others
☐ Be Responsible to Others

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

Materials

- Students (in pairs) will require a meter stick, a tape measure and a pencil and paper

Set-Up Required:

- Teacher needs to have a light source (flashlight) and a stand for every 2 groups for day 1

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Cooperative Learning: Students will be in groups of two. Student A will measure the height of student B and the shadow of Student B, Student B measures the length of the tree's shadow. Students work together to discover the height of the tree

Expectations:

- It is expected that the students will gain an understanding on how proportions can be used by the manipulation of the equation $y1/x1 = y2/x2$

Timeline:

- This should be a two hour lab. One hour for students testing the use of proportions in a classroom using a ruler and flashlight to find the length of the shadows to discover proportions.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Career applications for this lab could be engineering, problem solving

Career Applications

- The ability to find height of trees before falling them

Optional or Extension Activities

- This lab is very diverse. They can take the same principal of proportions to determine the time of day it is based off the shadow, or examine how shadow changes the proportion throughout the day.

Lab Instructions

Day 1:

1) In Partners grab the following materials:
    - 1 Ring Stand
    - 1 Flashlight
    - 2 rulers
    - 1 Textbook
2) Attach the flashlight on top of the ring stand on your table facing toward the table
3) Have one of you hold 1 ruler straight up on the desk, have it in front of the flashlight so a full shadow of the ruler appears on the table.
4) Without moving the ruler being held straight up, measure the length of the shadow. Record your results
5) Remove the ruler being held straight up, and place the textbook where the ruler was.
6) Measure the length of the shadow of the textbook DO NOT MEASURE the height of the textbook
7) Using proportions, solve for the height of the textbook.
8) Now YOU choose 3 objects in the classroom to repeat the process to solve for the height of the objects.

Day 2:

1) Explain to your partner what we did yesterday:
2) Grab the materials for todays lab
    - Meter Stick
    - Tape Measure
    - Pencil
    - Paper
3) Head outside and determine with your partner who is partner A and who is partner B
4) Partner A then measures the height of partner B and the shadow of Partner B
5) Partner A + B work together to measure the length of 3 trees of crying sizes.
6) Head inside and calculate the height of the trees that you measured.
7) Your calculations are due at the end of class

Student Handouts

Day 1:

Object	Length Of Shadow	Height of Object (Calculate NOT Measured) SHOW WORK HERE
Ruler		12 inches
Textbook		
Object #1		
Object #2		
Object #3		

Day 2:

Object	Length Of Shadow	Height of Object (Calculate NOT Measured) SHOW WORK HERE
Student A		
Tree #1		
Tree #2		
Tree #3		

Rubric/ Assessment Tools

Partner Assessed:

How well did your partner collaborate (0-5)?

How much effort did your partner put into this lab (0-5)?

Group Assessed:

Day 1: Number of heights calculated correctly (___/4) IF NO WORK IS SHOWN MAXIMUM SCORE IS 2

Day 2: Number of heights calculated correctly (___/3) IF NO WORK IS SHOWN MAXIMUM SCORE IS 2

Summative Assed:

Individually solve the following 6 problems (1pt each)

1) 2/8 = 3/X
2) 4/10 = X/4
3) 2/18 = X/82
4) 14/3 = X/9
5) 6/4 = 24/X
6) 22/3 = X/6

Total points correct (_____/25)