

WAMC Lab #1 Mobile Hanger Balancing Activity

Math Concept(s): Solving Linear Equations & A System of Equations

Source / Text: Big Ideas Algebra One

Developed by: Kathy James E-Mail: kjames@sheltonschoools.org

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Attach the following documents:

- Lab Instructions: Students will weigh each piece of hardware and record the data in a table they make. Then students need to set up equivalencies between the different pieces of hardware so that they can write this as an equation. For example: one large bolt weight may equal 2 washers and a lock washer. It is important that no two side of an equation are the same. Students must use different combinations of hardware to balance.
- Student Handout(s): Students use their own paper and pencil and make a table to organize the data they collect. Students show their balanced equations at the bottom of their data in an expanded form as long bolt + washer + nut = 7washers and then the values to and the work to show both side balance.
- Rubric and/or Assessment Tool: Initial Formative Assessment: Teacher will walk around the class and look at students work; talk to students to see what they understand, ask clarifying questions and answer questions. Summative Assessment: Teacher will check each student's work and see if their equations balance; check off each student's name from a class list as they accomplish two or more equivalencies, then students will continue the lab by attaching their hardware sets to the hanger.

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

Students will work in pairs in the classroom at their tables or desks to measure the hardware kit they are provided. They will organize the data they collect in a table and then look to find equivalencies.

Lab Plan

Lab Title: Mobil Hanger Balancing Activity

Prerequisite skills: It is helpful if students can already solve a equation with one variable, but it is not necessary as this lab may help them understand how equations balance. They will use this knowledge to help them develop their own equations and equivalencies from the various different weights of hardware, creating equations from this data on paper. They will then test out their hypothesis to see if they can get the objects, they have decided are equivalent and balance from a hanger.

Lab objective: Students will learn to weight hardware with precision, create equivalencies with combinations of objects creating a balanced system that can ultimately balance for the two ends of a hanger.

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

Mathematics K–12 Learning Standards:

- A-REI5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produce a system with the same solutions.
- A-REI6 Solve systems of linear equation, exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them
- Reason abstractly & quantitatively
- Construct viable arguments & critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for & make sure of structure

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 test.
- 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.

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.
- 2.4.1 Formulate and synthesize new knowledge.

Engineering

- Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions with in and between systems relevant to the problem.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)			
<input type="checkbox"/> Global Awareness	<input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy	<input type="checkbox"/> Civic Literacy	
<input type="checkbox"/> Health/Safety Literacy	<input type="checkbox"/> Environmental Literacy		
21st Century Skills (Check those that students will demonstrate in the above activity.)			
LEARNING AND INNOVATION <u>Creativity and Innovation</u> x Think Creatively <input type="checkbox"/> Work Creatively with Others x Implement Innovations <u>Critical Thinking and Problem Solving</u> x Reason Effectively x Use Systems Thinking <input type="checkbox"/> Make Judgments and Decisions x Solve Problems <u>Communication and Collaboration</u> x Communicate Clearly <input type="checkbox"/> Collaborate with Others	INFORMATION, MEDIA & TECHNOLOGY SKILLS <u>Information Literacy</u> x Access and Evaluate Information x Use and manage Information <u>Media Literacy</u> <input type="checkbox"/> Analyze Media <input type="checkbox"/> Create Media Products <u>Information, Communications and Technology (ICT Literacy)</u> x Apply Technology Effectively	LIFE & CAREER SKILLS <u>Flexibility and Adaptability</u> <input type="checkbox"/> Adapt to Change x Be Flexible <u>Initiative and Self-Direction</u> <input type="checkbox"/> Manage Goals and Time x Work Independently <input type="checkbox"/> Be Self-Directed Learners <u>Social and Cross-Cultural</u> <input type="checkbox"/> Interact Effectively with Others <input type="checkbox"/> Work Effectively in Diverse Teams	Productivity and Accountability <input type="checkbox"/> Manage Projects x Produce Results <u>Leadership and Responsibility</u> x Guide and Lead Others <input type="checkbox"/> Be Responsible to Others

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

Materials-

Hanger, String, Tape, Scales, Paper Clips, Clothes Pins, Various nuts, bolts, and misc. hardware, Baggies to make kits for each paired group and Paper & Pencil to record data.

Set-Up Required:

- Students will work in pairs and use all of the materials provided. They will need to get out paper & pencil.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Think Creatively; Reason Effectively; Use Systems Thinking; Solve Problems; Communicate Clearly; Use & Manage information; Be flexible; Produce results; Guide & lead others.

Cooperative Learning:

- Students will be arranged in a Complex Instruction Groups.
- Students will be given cards to help them fulfill out there roles.

Expectations: Students will discuss their work with their partner. Students will work in pairs, each person getting a chance to weight various hardware and each student is responsible for an individual paper of work with a table of organized data and possible combinations of equivalent hardware combinations with detailed work shown. For example: 1 long bolt + 2 nuts + 3 washers = 5 small lock washers + 1 long bolts + 1 short bolt. Students will then show the weights of each in the equation and then add up the numbers to show that both sides equal.

Timeline:

- One Class period

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Almost any situation where there is an unknown quantity can be represented by a linear equation, like figuring out income over time; supply and demand.

Career Applications

- Starting a business with total cost of materials and income generated. Supply and Demand Analysis.

Optional or Extension Activities

- Create a poster showing objects balance in a scale; Make a mobile with other material such as sea shells and drift wood.

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Example of LAB Write Up for Mobile Hanger Balancing

Name of hardware	Weight in grams
Long Bolt	5g
Short Bolt	3.2g
Small lock washer	2.1g
Large lock washer	3.4g
Small nut	1.1g
Washer	1.2g
Medium nut	1.4g

(Caution: These weight are made up and may or may not be correct)

Long bolt + Short bolt + Washer + Small nut = Large lock washer + 3 Washers + Small lock washer + med. nut

$$5g + 3.2g + 1.2g + 1.1g = 3.4g + 3(1.2g) + 2.1g + 1.4g$$
$$10.5g = 10.5g$$

Your assignment: Make a table of the data you collect weighting the hardware provided and then create at least 2 equations that balance as your final assessment. The teacher will check off your two equations and then you can test your equations on the hanger.

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