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How Does a Little Add Up to a Lot?

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CMST Lesson Plan

FOCUS QUESTION

How does a little add up to a lot?

DESCRIPTION

Students find the amount of water wasted due to a leaky faucet as a result of designing and carrying out their own experiments that model this common, real-world situation. Graphing their data, students are then able to write an equation for the line of best fit. This equation, in turn, allows them to make predictions concerning the amount of water wasted over a long period of time or the amount wasted by multiple leaks.

PERFORMANCE INDICATORS

- Students will be able to design and execute an experiment that models real events.
- Students will be able to communicate their results in a variety of ways.
- Students will be able to use their results to make predictions.

NYS STANDARDS (from *Intermediate Level Science Core Curriculum*)

Standard 1 Students will use mathematical analysis, scientific inquiry, and engineering design to pose questions, seek answers, and develop solutions.
Standard 2 Students will access, generate, process, and transfer information, using appropriate technologies.
Standard 4, 7.2d Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Pollution has cumulative ecological effects such as acid rain, global warming, or ozone depletion. The survival of living things on our planet depends on the conservation and protection of Earth's resources.
Standard 6 Students will understand the relationships and common themes that Connect mathematics, science, and technology and apply the themes to these and other areas of learning.
Standard 7 Students will apply the knowledge and thinking skills of mathematics, science, and technology to address the real-life problems and make informed choices.

MATERIALS

- ❑ Timer
- ❑ Container of water
- ❑ Paper cup
- ❑ Paper clip
- ❑ Funnel
- ❑ Graduated cylinder

PROCEDURE

1) Estimate how much water a leaky faucet would waste in a single day.
2) Now, design an experiment that would allow you to more accurately predict the amount of water wasted in a day as a result of a leaky faucet. You may use the materials on page 1 in your design; if you need additional materials, just ask.
3) Perform the experiment.
4) Make a table of the results.
5) Graph the results on graph paper or in Excel. Draw the line of best fit and find its corresponding equation.
6) Using your graphing calculator, enter the data in lists, set up the graph using the STAT PLOT menu, select the appropriate settings for the viewing window and, finally, plot the scattergram. Enter the equation for the line of best fit in the y = menu, graph and, if necessary, adjust the line of best fit.

REFLECTIONS

1) Graphing
    a) What was your dependent variable? Explain.
    b) Do your results indicate a linear relationship? Explain.
    c) Explain why the line that fits your points the best not always be the line of best fit.
2) Making Predictions
    a) Based on your experimental results, predict the amount of water a leaky faucet would waste in a day, a week, and a year.
    b) Based on your experimental results, predict the amount of water that would be wasted in a day by the City of Rochester if every household had one leaky faucet.
3) Thinking about Results
    a) Summarize your experimental results in one sentence.
    b) What are some possible sources of experimental error?
4) Big Picture
    a) Fixing a leaky faucet as soon as possible is just one way that individuals can help conserve natural resources. Make a list of other things that you or a family member can do in order to protect and conserve resources.
    b) Think of another experiment that can estimate the amount of resources that are wasted. What would be measured? How would you measure it?

EXTENSION

Design a similar experiment that models a running faucet and determine the amount of water wasted due to the faucet running while an individual brushes their teeth. After gathering data and finding the equation for the line of best fit, predict how much water is wasted over an extended period of time (e.g. average lifespan) or how much is wasted for multiple people (e.g. the experimenter's family).

RUBRIC

Experimental Design	Recording Results	Forming a Conclusion	Character and Charm
Design is comprehensive and appropriate. **5**	Data table and graphs are well organized and constructed. **5**	All reflection questions are thoroughly answered and supported. **5**	Teamwork was evident, station was left how it was found, technology used appropriately. **5**
Design is either not comprehensive or not appropriate. **3**	Data table and graphs are either not well organized or not well constructed. **3**	Half of the reflection questions are thoroughly answered and supported. **3**	Inappropriate behavior OR inappropriate use of equipment OR left a mess. **3**
Design is neither comprehensive nor appropriate. **0**	Data table and graphs are neither well organized nor constructed. **0**	None of the reflection questions are thoroughly answered or supported. **0**	Inappropriate behavior and inappropriate use of resources and left a mess. **0**

TOTAL= ___ /20 = ___%

RESOURCE

PBS Mathline
http://www.pbs.org/mathline