WAMC Lab Template

Math Concept(s): Definition and Properties of Squares

Source / Text:

Developed by: Eric Delacorte E-Mail: delacorte@skschools.org Date: June 21, 2022

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 teams of 2 to lay out a standard 1-meter by 1-meter units, oriented north-south based on a given southwest corner. Ideally, the layout can be done outdoors using steaks and string; alternatively, it can be done indoor on the floor with masking tape. The objective and instructions will be given in the classroom, then teams will proceed outside to work areas where they will have steaks, string, hammers, compasses, and tape measures provided.

Lab Plan

Lab Title: Unit Layout

Prerequisite skills: measuring tape, hammer, compass

Lab objective: given a southwest corner location, lay out a perfect 1m x 1m square on the ground (using tape or string depending on location) oriented to true north.

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

Mathematics K–12 Learning Standards:

- HSG.CO.C.11
- HSG.MG.A.3

Standards for Mathematical Practice:

- MP1) Make sense of problems and persevere in solving them.
- MP4) Model with mathematics.
- MP5) Use appropriate tools strategically.
- MP6) Attend to precision.

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

- SL.9-10.1
- RST.11-12.3

K-12 Science Standards

- HS-ETS1-2

Technology

- 5.c

Engineering

- HS-ETS1-2

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

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

Materials

- Magnetic compass
- Metric Tape measures
- Large steak nails (6”-8”) & string (masking tape can be used as alternative if indoors)
- Hammer

Set-Up Required:

- Locations chosen for SW corner of units (possible inclusion of datum point for mapping)

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Students must be able to work productively with a partner to orient themselves to a task, and effectively produce an accurate result.

Cooperative Learning:

- The measuring and layout is very difficult with one set of hands. Students must work well enough together to get a good square on the ground.

Expectations:

- Given a set location for SW corner of units, student will work in pairs to lay out a 1 meter by 1 meter square on the ground in string that is oriented north-south & east-west.

Timeline:

- 20 minutes for unit layout
- 5-10 minutes to check work

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

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Career Applications

- Archaeology
- Ecology
- Construction

Optional or Extension Activities

- How does this activity change if we were laying out 1 meter by ½ meter test units?
- How does this activity change if we were laying out a 5 meter by 5 meter surface scrape?
- How do we map our units on a cite map?
- Write a proof to show that the unit staked out is a square, without relying on a protractor to measure corner angles.

Rubric

4	3	2	1
Unit side lengths are 1 meter, corners are square (90 degrees), unit sides are oriented with cardinal directions (north, south, east, west).	Unit side lengths are 1 meter, corners are not quite square, or sides are slightly off cardinal directions. Unit is perfect, but given corner is not the southwest corner.	Unit sides are not 1 meter, or the unit is clearly a rhombus, or the orientation is noticeably off.	Unit is easily visually not a square.

WAMC Lesson Plan

Name(s): Eric Delacorte
Email Address: delacorte@skschools.org
Lesson Title: Square Cubed law
Date: June 22, 2022
Text: STEM Correlation: Math Standards Lesson Length: 1 day

Big Idea (Cluster): Ratio and Proportion, Area and Volume	
Mathematics K–12 Learning Standards: HSG.SRT.A.1, HSG.SRT.B.5	
Mathematical Practice(s): MP2, MP6, MP7	
Content Objectives: use scale factor to	Language Objectives (ELL): WHST.11-12.4
Vocabulary: scale factor, length, area, volume, ratio, square (operation), cube (operation).	Connections to Prior Learning: how does scale factor impact area and volume
Questions to Develop Mathematical Thinking: • How many dimensions is the object you are looking at? • When the size of an object changes by a scale factor what does that do to each measurement of that object? • How do you calculate area? • How do you calculate volume?	Common Misconceptions: • Area and volume scale the same as length • That area and volume are completely unrelated to scale factor

Assessment (Formative and Summative):

- Formative: end of lesson exit ticket.
- Summative: assessment question on end of unit test. (Stack of $1 grows by a factor of five, what is the new value?)

Materials:

- Blocks (could be Lego, could be wood, could be connecting blocks)

Instruction Plan:

Introduction: When we scale up an object, how does the surface area and volume change? Is it always the same and predictable?
Explore: In pairs build a shape with blocks, calculate the surface area and volume…build the same shape in a different size, what is the new surface area and volume? What is the relationship between the scale factor, ratio of surface areas, and ratio of volumes? Then compare results with the other pairs.
When I observe students: Building shapes, calculating surface areas, calculating volumes, making ratios
• Questions to Develop Mathematical Thinking as you observe: How many dimensions is the object you are looking at? • When the size of an object changes by a scale factor what does that do to each measurement of that object? • How do you calculate area? • How do you calculate volume?
Answers: the objects are three dimensional. Each measurement grows by the same scale factor. Length times width.

Length times width times height.
Summarize: conversation about what pairs observed when comparing their results with others. Exit ticket: Write a conjecture in your own words about the relationship between scale factor, area ratio, and volume ratio.

Career Application(s):

- Iterative design, architecture, manufacturing, prototyping, mechanical or civil engineering.

Leadership/21st Century Skills:

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

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