Pennsylvania Adult Education Resources

Lesson Plan Template for Math, English Language Arts (ELA) or English as a Second Language (ESL)

Lesson Overview

Lesson Title: Volume – Calculating Rectangular Prisms in Real World Situations	**Lesson Timeframe:** One class session
Lesson Author: Angela Kenes; Carolyn McClinton; Chelsea Snyder; Jill Casey; Renee Macko – Intermediate Unit 1 Adult Education	**Date Created:** 10/26/2020
Content Area(s): Math	**General Topics/Skills Covered:** Finding volume of various cubes and rectangular prisms. Determine how many cubic boxes fit in a room.
NRS Level(s): 5	**Prerequisite Skills:** Calculate area of shapes; measure with a ruler; multiply fractions. Knowledge of prior vocabulary: length; width; square; rectangle; polygon; plane; perimeter; area; one-dimensional; two-dimensional

Standards and Skills Addressed

College and Career Readiness Standards (CCRS):

5.MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.

b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

5.MD.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

Standards and Skills Addressed

5.MD.5a Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of a the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. 5.MD.5b Apply the formulas V = l x w x h and V = b x h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.

English Language Proficiency Standards (ELPS) (if applicable):	**Target Grammar/Language Forms (for ESL):** N/A

Standards for Mathematical Practice:

- Model with mathematics.

Foundation Skills Framework (Workforce Skills):

- Recognizes, measures, and uses geometric shapes and sizes.
- Recognizes, measures, and uses distance, weight, area, and volume.
- Recognizes and applies measurement formulas.
- Identifies and interprets basic geometric functions, patterns, and formulas, as required.

Digital Literacy Skills:

Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways. (ISTE Standard 1c: Zoom polling)

Objectives, Materials, and Vocabulary

Lesson Objective(s): • The student will calculate volume units, volume of a cube and volume of a rectangular prism independently 7/8 times by the end of the instructional period. • Students will calculate how many boxes a “storage” room will hold with 1/1 accuracy.	**Lesson Objective Tips:** • Check it with SMART. (Is it Specific, Measurable, Achievable, Relevant, and Timely?)

Objectives, Materials, and Vocabulary

• Students will complete final exam with 5/6 accuracy by the end of the instructional period.	
Texts, Materials, Resources: • Clear cube/clear rectangular prism, 1-inch cubic blocks • Tape measure and rulers • Smart phone, tablet, or computer • Digital white board • Internet connection • Cubic cardboard box • Miscellaneous three-dimensional containers • Paper and pencils • White board and markers • Twine or string • Three-dimensional objects for display: cube, rectangular prism, cone, sphere • Projector • Empower book "Over, Around, and Within," Lesson 11 • Contemporary's *Number Power-Geometry,* pages 112-119	**Lesson Vocabulary:** **Cubic Unit –** unit used to measure volume **Volume –** The number of cubic units of space on the interior of a solid **Cube –** a three-dimensional shape that contains six square faces. At each vertex, all sides meet at right angles. **Rectangular solid (prism) –** A three-dimensional figure in which each face is either a rectangle or a square. Opposite faces are congruent. **Congruent –** Having the same size and shape **Surface area (SA) –** The sum of ALL the areas of the faces of a solid **Cylinder** – has the shape of a common tin can. The top and bottom surfaces are circles that are parallel to each other. The distance between the top and bottom is called the height of the cylinder. **Cone –** has one circular surface called the base. The vertex of a cone is a point that lies directly above the center of the base. The distance between the vertex and the center of the base is called the height of the cone.

Instructional Activities

Lesson Introduction: 1. The instructor will write the objective on the whiteboard (classroom setting) or present via a slide or on white board in Zoom instruction: The student will be able to calculate volume units, volume of a cube and volume of a rectangular prism independently 7/8 times. Students	**Lesson Introduction Tips:** • Explain how the lesson objectives will be shared with learners. • Make connections to learners' goals and prior and future lessons.

Instructional Activities

will be able to calculate how many boxes a "storage" room will hold with 1/1 accuracy and complete final exam with 5/6 accuracy. 2. Show the students a box and a cube. Have the students guess how many cubes will fit in the box. 3. Review the difference between one- and two-dimensional objects: Display how a piece of twine has one dimension (length) and can be used to measure a perimeter. Display how a piece of paper has two dimensions (length and width) and represents area or surface area.	
Lesson Body: **Direct Instruction: Entire class, 30 minutes** **1.** Introduce new concept: Shapes that have volume are three-dimensional and have length, width, and height. Display various three-dimensional objects. **2.** Discuss shapes that have volume: **cube, rectangular prism**, **cone**, **cylinder** (encourage students to add vocabulary words and definitions to their vocabulary folder). **3.** Students will partner to identify real-life examples of each: (can of soda, ice cream cone, shoe box, etc.) **4.** Complete *Number Power Geometry* page 113 "Label each figure with its solid figure name." If utilizing Zoom instruction, have the students submit their answers using Zoom polling to obtain feedback. Show first seven minutes of the *Mathantics* "volume" video. https://www.youtube.com/watch?v=qJwecTgce6c&t=19s	**Lesson Body Tips:** • Provide enough detail that another instructor could teach this lesson based on the information in this lesson plan. • Include how you will group the students; approximate timeframes for each activity; and how you will integrate technology. • Describe where in the lesson sequence, and how, the instructor will model the target skills and/or tasks for the learners.

Instructional Activities

5. Discuss **cubic units**: Display a one-inch cube and a larger, clear cube. Show how the one-inch cubes fill the larger cube to represent cubic units to determine the cubic volume. **6.** The instructor will model finding the volume of the clear cube by filling the cube with one-inch cubic units. **7.** The instructor will model how to determine how many volume units are in problems 1 and 2 on *Number Power Geometry* page 115 by counting the volume units. Proceed to Guided Practice 1. **8.** The instructor will model how to solve the volume of the cube for problem 1 in *Number Power Geometry* page 117. Proceed to Guided Practice 2. **9.** The instructor will model how to solve the volume of the cube for problems 1-3 *Number Power Geometry* page 118. Proceed to Guided Practice 3. **10.** The instructor will model measuring a three-dimensional object and enter the measurements into page 118 of *Empower: Over, Around, and Within Student Book.* Proceed to Guided Practice 4. **11.** The instructor will introduce the activity on page 116 of *Empower: Over, around, and Within Student Book.* The instructor will show a sample box. The box should be cubic (all sides equal length) for the introductory exercise. The instructor will have the students work in teams of two-three students, if in classroom setting. The students will complete activity independently if at home via Zoom instruction. Proceed to Independent Practice 4.	

Instructional Activities

12. The instructor will have the students complete the final assessment. Proceed to Independent Practice 5. **Guided Practice:** • 1-3 students work individually • 4 students work in groups of two-three • 30 minutes *(All answers calculated during Guided Practice will be submitted via Zoom Polling.)* **1.** The instructor and the students will complete numbers 3-4 (*Number Power Geometry* page 115) together using guided practice. Proceed to Independent Practice 1. **2.** The instructor and the students will complete numbers 2-5 (*Number Power Geometry* page 117) together using guided practice. Proceed to Independent Practice 2. **3.** The instructor and the students will complete numbers 4-7 (*Number Power Geometry* page 118-9) together using guided practice. Proceed to Independent Practice 3. **4.** Working in teams of two-three students, they will collaborate to measure various three-dimensional objects and enter the measurements into page 118 of *Empower: Over, Around, and Within Student Book.* They will calculate the volume for each of these objects using guided practice. If utilizing Zoom technology, this could be done in breakout rooms.	

Instructional Activities

Independent Practice: • 1-3 students will work individually • 4 In classroom setting, number 4 will be completed in groups of two-three students. In Zoom, will complete independently. • 45 minutes *(All answers for Independent Practice will be entered into a prepared Google Form.)* **1.** The students will complete numbers 5-6 (*Number Power Geometry* page 115) independently. Return to Direct Instruction 9. **2.** The students will complete numbers 6-8 (*Number Power Geometry* page 117) independently. Return to Direct Instruction 10. **3.** The instructor and the students will complete numbers 8-10 (*Number Power Geometry* page 118-9) independently. Return to Direct Instruction 11. **4.** The students will complete the activity on page 116 of *Empower: Over, Around, and Within Student Book.* Upon completion, the students will submit answer to instructor. Return to Direct Instruction 13 once finished.	
Assessment: **1.** Independent Practice numbers 1-3 contains eights problems in which the lesson objective is to complete 7/8 correctly.	**Assessment Tips:** • Describe the ongoing assessments that you will use to check learners' progress toward the lesson objectives. • Describe the cumulative assessments that will measure the extent to which learners met the lesson objectives.

Instructional Activities

2. The students will correctly calculate the number of cubic storage boxes the "storage" room will hold with 1/1 accuracy. **3.** Test Practice: *Empower: Over, Around, and Within Student Book.* Page 121. Criteria for mastery: 5/6 correct. **4.** Use technology to assess student understanding. Examples for technology would include Kahoot, Quizlet, etc. Students will download Kahoot App on their phones or can use the website on their phones or computers. https://kahoot.com/	
Lesson Conclusion: 1. Revisit the Introduction, number 2, where the student was challenged to guess how many cubes would fit into the box. The instructor will provide an answer, feedback and entertain any discussion. 2. Provide the students with an opportunity to talk about the process of today's activity and what they learned in today's lesson. 3. Ask the students to think of ways volume could be used in vocational settings. **Career Pathways**: Have students brainstorm in groups to list professions that use volume. Some examples might include construction – hauling material or filling a pool; manufacturing – how much product will fill a can; medical – how much liquid is in a beaker.	**Lesson Conclusion Tips:** • Review lesson objectives. • Provide an opportunity for student reflection. • Connect to prior and future learning.

Instructional Activities

4. End the lesson with a Zoom poll to obtain student feedback regarding how confidently they feel they have learned the content.	

Lesson Extension:

- **Homework:** Aztec: Lesson on Solid Figures and/or Khan Academy
- **Additional enrichment / practice opportunities:** *Empower: Over, Around, and Within Student Book,* pages 119, 120.

Check to ensure that your lesson addresses the Key Shifts in the CCRS:

ELA Key Shifts:	**Math Key Shifts:**
☐ Text Complexity	☒ Focus
☐ Evidence	☒ Coherence
☐ Building Knowledge	☒ Rigor

Instructor Reflection After the Lesson

Instructor Reflection Questions (to be completed after teaching the lesson):

- What went well in the lesson?
- What did not go well in the lesson?
- Did the learners meet the lesson objectives? If not, why?
- What changes will you make for the next time you teach the lesson?