THOMPSON RIVERS UNIVERSITY | Education & Social Work

Bachelor of Education (Elementary) & Bachelor of Education (Secondary) STEM Lesson Plan

Lesson Title: Connecting Volume and Displacement Lesson # 2- Not the first volume lesson Date: February 2024

Name: Krystal Devick Subject: Math Grade(s): 7

Rationale:

This lesson is important because students will deepen their understanding of the relationship between the volume formula and real life evidence (abstract and contextualized). The concept of volume may be challenging for many students and may require multiple means of demonstration.

Core Competencies:

Communication	Thinking	Personal & Social
	Critical Thinking: I can ask questions and consider options. I can use my observations, experience, and imagination to draw conclusions and make judgments. I can ask open-ended questions, explore, and gather information. I experiment purposefully to develop options. I can contribute to and use criteria. I use observation, experience, and imagination to draw conclusions, make judgments, and ask new questions. I can describe my thinking and how it is changing. I can establish goals individually and with others. I can connect my learning with my experiences, efforts, and goals. I give and receive constructive feedback. Creative Thinking: I can get new ideas in areas in which I have an interest and build my skills to make them work. I generate new ideas as I pursue my interests. I deliberately learn a lot about something by doing research, talking to others, or practicing, so that I can generate new ideas about it; the ideas often seem to just pop into my head. I build the skills I need to make my ideas work, and I usually succeed, even if it takes a few tries.	

Big Ideas (Understand)

The constant ratio between the circumference and diameter of circles can be used to describe, measure, and compare spatial relationships.

Learning Standards

(DO)	(KNOW)
Learning Standards - Curricular Competencies	Learning Standards - Content
• Use reasoning and logic to explore, analyze, and apply mathematical ideas • Apply multiple strategies to solve problems in both abstract and contextualized situations	• volume of rectangular prisms and cylinders

Instructional Objectives & Assessment

Instructional Objectives (students will be able to…)	Assessment
• SWBAT measure a rectangular cuboid and determine the dimensions and volume using *l*x*w*x*h* formula. • SWBAT understand the correlation between displacement and volume.	• Observe: Teacher will move through the classroom to see if groups are able to use both the ruler for measuring and the water displacement. The teacher will observe if all members of the group are participating. • Discuss: Teacher will listen to peer-to-peer discussions on how to solve for volume. Teacher will ask questions to continue thinking (what if it was a different shape? Would this always work? How do you know? Etc.). • Product: Exit ticket sentence describing ways they were able to determine volume and deeper connection thoughts (see specific questions below).

Prerequisite Concepts and Skills:

Students must be familiar with measuring using a ruler. Students must be able to complete subtraction up to three or four digit numbers. Know lxwxh = volume of rectangular cuboid.

Indigenous Connections/ First Peoples Principles of Learning:

This lesson is connected to the principle that learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

As Jo Chrona states: "Meaning is made from direct experience. Learning is achieved by doing and thinking, through engaging in a hands (and minds on) approach. It "provides a tactile and tangible connection between knowledge and life" (Battiste, 2002). The experiential aspect of making meaning from learning also reinforces the need for meaningful reflection to process the experience into knowledge and understanding." © Jo-Anne L. Chrona, 2014.

Universal Design for Learning (UDL):

Students will work in table groups for this experiment and support each other's learning, lending different strengths and perspectives to one another. Discussion, collaboration, and experimentation will be a focus during this lesson. This collaborative approach allows the lesson to support multiple means of engagement. The table group arrangement offers students a flexible learning environment, less structured than traditional individual desk rows.

Multiple means of representation with this lesson include discussing the definition of volume, writing the definition on the white board, and physically measuring it in two ways. The video clip under the extensions section may also be utilized for students who thrive with more musical or visual connections.

Multiple means of expression with this lesson are available as students are able to:
1. Orally discuss what volume is as a class, with the teacher, and in their table groups, and/or

2. Answer written questions on exit ticket (if a student is unable or unwilling to produce a written exit ticket, they may have a quick chat with the teacher about the answers).

For differentiation, when students are struggling, the teacher may bring out the blocks/sugar cubes utilized in Lesson 1 for students to refresh their understanding of how volume is the 3D space an object occupies. To extend the learning, if a student has completed the task *and* thoughtfully considered all the questions posed on the Exit Ticket, they may be provided with a second Jenga tile and asked how they could find the volume by submerging both tiles at once. What about 3 tiles? Is there a pattern forming (ratio)? For *extending (gifted)* students, have them find the volume of a cylinder using displacement of an object and working backwards to calculate radius, diameter, height, and circumference. The teacher would need to have prepared thoughtfully for this extension, not overwhelming students, as the formula for volume of a cylinder ($V=\pi r^2 h$) needs to be introduced. Students may then connect that both rectangular cuboids and cylinders take the area of the base and multiply by the object height to calculate volume. This will build on concepts of area that students were previously familiarized with.

Differentiate Instruction (DI):

DI will be student-specific when possible; however, for the purposes of this lesson plan, broad considerations have been made.

ASD – students may be easily flustered and have difficulty following verbal instructions. Exit ticket prompts will be provided in writing on the board so students may reference as much as needed.

ELL – students can work with their iPad translator (when available) and will be able to discuss with table group. Establish familiarity and define relevant terms (i.e. volume) at the beginning of the lesson.

ADHD – students who may have difficulty staying focused will be redirected to apply their attention to the task, helping them to remain focused/motivated.

In all scenarios, if a student is unable or unwilling to produce a written exit ticket, they may have a quick chat with the teacher about their answers.

Materials and Resources

Pencils
Paper
Jenga blocks (1 per student)
Ruler (1 per student)
Beaker (1 per group of students)
Water
Paper towels for clean up
Whiteboard marker
Cylinder object (like a thread spool) for extensions
Media player for extension video

Lesson Activities:

Teacher Activities	Student Activities	Time
Introduction: Teacher prep before lesson will include filling beakers half full of water (ensuring there is space to fully submerge block) and distributing 1 per table along with the Jenga blocks. Start with a class brainstorm of the definition of volume. Land on something similar to *the amount of space a 3D object occupies*. Once the definition has been created and written on the white board, ask students their ideas on finding volume of a rectangular cuboid.	Students will be at lunch, recess or arriving at school. Students will raise hands to contribute to the definition of volume.	10 5
Body: Instruct students to work at a moderate volume as a table group to determine the volume of the Jenga blocks in cm3 using their rulers (students may want to use mm, but it is important for the connection to mL that they do not). Students should remember volume formula from first lesson. CFU: does everyone know what they are doing now (thumbs up)? Teacher will move throughout the classroom while students begin measuring their blocks and listen to the conversations. Teacher may ask questions such as: Can you tell me why you are multiplying? Can you explain what you are doing? Once students have recorded their estimates of the Jenga block volume, the teacher will encourage them to consider why there is a beaker of water on their table. What connections might it have to volume? Students will only be prompted to submerge their Jenga tiles if not a single student connects displacement to measured volume (I suspect the class will get there on their own though). To encourage thinking along this path teacher may ask a question such as: What do you think would happen to the amount of water in the beaker if you added a Jenga tile? While students are working with the beakers the teacher may ask individuals or groups CFU questions such as: What do you see the water	Students will measure Jenga blocks using their rulers. Students may help each other remember the formula for finding a rectangular cuboid. Students will discuss and consider why the beaker of water is present. Students will connect submersion/displacement as a way to measure volume. Students will submerge one Jenga tile and record the current mL on the beaker. Students will then subtract the difference (mL on beaker without Jenga tile) and be left with the volume of the Jenga tile in mL. Students will connect that 1cm3 = 1mL. Students participate in discussions amongst themselves and with the teacher.	8 12 5

doing? Why did it do that? Will that always happen?		
Closure: Exit tickets and discussion. Teacher will write questions on the white board and ask students to complete an exit ticket. The exit ticket will consist of questions designed to deepen thinking around their results: 1. What ways were you able to measure volume today? 2. Were your results the same? 3. Why do you think that is? 4. Would this work with other shapes? After students have had an opportunity to think about and answer the questions the teacher will open discussion asking the class each question consecutively.	Students will consider and record their answers on an exit ticket. Students will voluntarily join discussion and contribute when they feel comfortable.	15

Organizational Strategies:

Reminder of appropriate volume of table talk prior to setting students upon task. Reminder of what respect looks like of other people's thoughts and the importance of good listening skills.

Proactive, Positive Classroom Learning Environment Strategies:

Expectations are clearly stated at the start of the lesson regarding student behavior. If behaviour is not meeting expectations, attention will be brought back with clap pattern if necessary and a reminder of expectations will be stated.

Extensions:

This should not be the first introduction to volume, perhaps the second lesson in a volume unit. The first volume lesson should be building shapes with cubes or sugar cubes in a box to help students visualize volume whist able to directly count it.

After students have completed the lesson if there is extra time, they may enjoy this video showing displacement and volume along with other physical properties. The density/volume/mass formula may be beyond Grade 7 expectations, but the song is super catchy and fun! And it shows displacement! https://www.youtube.com/watch?v=SYsflJxCbQg

Reflections (if necessary, continue on separate sheet):

I enjoy making lesson plans, and although they require significant planning, time, and careful consideration, I think they are valuable at this stage of my learning as they help me consider all the layers that should go into a lesson (and teaching in general). I imagine this lesson would be challenging in implementation as some students may grasp concepts at different rates than their peers; however, hopefully with the thought I put into the UDL and extension sections of this lesson, each student can be met where they are at and their learning advanced.