



UNIVERSITY OF MAINE AT FARMINGTON  
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT  
EDU 361 Secondary/Middle Math Methods

**Teacher's Name:** Mrs.Bean, Mr. Cab, Mr. Coleman

**Lesson #:** 1

**Grade Level:** 8th

**Numbers of Days:** 1

**Topic:** Google Sketchup / Geometric Construction (Area and Volume)

**Room Arrangement:**

Seven desks will be formed into a semicircle facing the front of the room; this will allow for students to participate in a gallery walk and allow the teachers great proximity to all students and help them with any questions they may have.

**PART I**

**Objectives:**

Students will understand the importance of volume and area and how it pertains to the construction of real world structures.

Students will know how to calculate the areas and volumes of 3-dimensional and 2-dimensional polygons used in real world structures.

Students will be able to do create a mockup of an indoor swimming pool on the campus of Mt. Blue Middle School and calculate the total area it would take up on the campus.

Product: Students will create an indoor swimming pool on the campus of Mt. Blue Middle School using Google SketchUp and the Google Earth location feature.

**Common Core State Standards (CCSS) Alignment**

**Common Core State Standards**

**Content Area: Geometry**

**Grade Level: 8th Grade**

**Domain: Geometry**

**Cluster:** Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

**Standard(s): Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.**

Which CCSS Mathematical Practice(s) will be addressed (list the number and the description):

- 4. Model with Mathematics
- 6. Attend to precision.
- 7. Look for and make use of structure.

**Rationale:** (for both the CCSS standards and the practice(s))

In this lesson students will make connections between geometric shapes area, perimeter, and volume and actual architecture and building construction in real life. Students will be able to create a model indoor swimming pool through the use of Google SketchUp and show how their constructions and calculations can be more precise with dynamic geometric construction software. Students will be solving a real world issue by looking on Google Earth for potential areas for their much desired indoor swimming pool and model real world applications of geometry with their Google SketchUp mockup. Students will be making sense and use of structure and patterns of geometric shapes and understanding how calculating area and volume allows them to determine if the building and pool are feasible in the location of their choosing.

### Assessments

**Pre-Assessment: Quick Draw! We will be handing out white boards to each small group and having them draw certain objectives. This activity will help us determine what formulas and polygons students are comfortable with, and their familiarity with basic geometric ideas.**

### **Formative (Assessment for Learning)**

#### **Section I – checking for understanding during instruction**

Thumbs Up Thumbs Down will be used frequently in order to determine if students are understanding each part of our lesson and will allow the one of the non-lead teachers to address any of the students concern. This checking for understanding strategy is quick and effective which is critical to our lesson since our time constraint is only sixty minutes.

#### **Section II – timely feedback for product (self, peer, teacher)**

Students will self assess with the use of a graphic organizer that guides them through their product creation. Peer and teacher assessment will occur through a gallery walk at the end of class that allows each student to show the pool and building that they have created in Google SketchUp. This is an informal assessment as for most students this will be their first exposure to Google SketchUp.

### **Summative (Assessment of Learning): (Description of Product)**

Students will create an indoor swimming pool on the campus of Mt. Blue Middle School using Google SketchUp and the Google Earth location feature. Students will determine the amount of space they have to work with based off the Google Earth picture of the Mt. Blue Middle School campus and then decide what style of building and pool they want to create.

### **Integration**

#### **Technology and SAMR Level**

Students will be using Google SketchUp at the modification level of SAMR because they will also integrate the Google Earth feature that actually brings the Mt. Blue Middle School campus on to their design template. Students will be using Google SketchUp to do geometric constructions in the form of an indoor swimming pool based on real world constraints that would not be possible without the Google Earth feature in Google SketchUp.

#### **Other Content Areas:**

This lesson encourages students to use skills outside the mathematics classroom including Geography since they will be using Google Earth and reading maps in order to determine what space of the campus they want to use for their indoor swimming pool. Students will also be using their creative side when it comes to making decisions about what they want to make their structure look like; students will be making decisions about color and texture and analyzing what will look best which incorporates Art content skills. Finally students will use English content skills when they self-evaluate their experience on our exit ticket which asks them to express in words their experience.

**Instructional Model** (Select one: direct instruction, inquiry training, concept attainment, learning cycle, concept of formation, unguided inquiry, cooperative learning) *NOTE: Must use different instructional models during the unit.*

In this lesson we will be using the Learning Cycles instructional model.

*Instructional Models from: K-12 Classroom Teaching: A Primer for New Professionals by Andrea M. Guillaume California State University, Fullerton; Published by Pearson. Chapter 7, pages 143-178*

#### **Rationale:**

The use of Learning Cycles will help students to get a real world example of what they will be doing to keep them engaged. They will have the opportunity to think about topics before they see direct instruction, and they will have a chance to practice on their own by making a pool that they can customize.

## Groupings

### **Section I - Graphic Organizer & Cooperative Learning used during instruction**

Students will use a graphic organizer that helps them determine the amount of space they have to create their indoor pool and then calculate their final products area and volume. Students will participate in a cooperative learning activity Quick Draw where they will each get an opportunity to draw a polygon and label important parts of the polygon and how to solve for its volume, if students get stuck they can use their team members for assistance.

### **Section II – Groups and Roles for Product**

Students will be in small groups that allow them to discuss the possibilities of their project but will produce individual work for their final product of the indoor swimming pool. Their role is to think about what type and style of building they want surrounding their pool (which can also be modified) and ensuring that they have taken into consideration the available area of the campus and how much of that space they are using for the pool.

## Differentiated Instruction

**Motivational Strategy** (Tell which Posamentier and Krulik motivational strategy will be used and credit them. Describe how you are using it and why.) *NOTE: Use a variety across the unit.* The motivational strategy we are using in this lesson is “Indicate the Usefulness of a Topic” because we are showing students how geometric figures are used in a variety of real life situations. This strategy is a way to get students engaged in the topic by helping them see when they will use it in their lives and how it can be useful to them.

Strategy from Krulik, K. & Posamentier, A. (2012). *The Art of Motivating Students for Mathematics Instruction*. Part of The Practical Guide Series. McGraw Hill: New York, NY

**Multiple Intelligences Strategies** *Note: Address at least six. Delete any you do not address.*

**Logical:** Students will use a graphic organizer to plan out their own indoor swimming pool on the campus of Mt. Blue Middle School.

**Verbal:** Students will have a chance to talk about their decisions and ideas with their group.

**Visual:** Our quick draw activity will give them plenty of opportunity to express their visual creativity.

**Intrapersonal:** The project they’re doing is their own work along with the creative aspect.

**Interpersonal:** They’re sitting in teams so they can bounce ideas off of them and ways to improve upon their building.

**Naturalist:** Based on where they want to design their pool they have a chance to build their pool

in the middle of the woods or take into account how much of nature they want to potentially destroy with their building and swimming pool.

**Kinesthetic:** When students are done with their pools, they will do a gallery walk to see other students' pools and consider different things they could have done. Once they are done walking around they will go back to their seats.

### **Modifications/Accommodations**

*From IEP's ( Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

**Plan for students who are missing pre-requisite skill(s): (graphic organizer and hook)** The purpose of the graphic organizer is to make sure students are aware of what the pre-requisite skills are. As for actually knowing them, the quick draw activity to start the lesson will fill in the blanks for the students who may not know how to find volume or area of the shapes they will be using.

**Plan for accommodating Special Education:** We're using differentiated instruction to make sure all students are on the same page as well as using the checking for understanding strategie Thumbs Up Thumbs Down to make sure we are as accommodating as possible to any possible questions and concerns.

**Plan for accommodating English Language Learners:** In our lesson the majority of our time is spent with visual representations and explanations as well as giving them plenty of opportunities to discuss with their peers and instructors what they're doing.

### **Extensions (tiering, gifted students, the students who already know it, etc...)**

Students will have the chance to improve upon their pool building. The students who already know it can add a more complex roof, or add a deep end into the pool. Adding the deep end via sloping pool will prove to be a real challenge since they will have to know the volume of a trapezoidal prism. This is challenging as it will require them to calculate 3 separate volumes and then add them up.

### **Materials, Resources and Technology**

(7) Whiteboards (1 for each team)

Expo Markers in team colors  
Paper towels and/or erasers for whiteboards  
Laptop/Projector  
Handout for Google SketchUp tips and tricks (Created by Sean Cabaniss)  
Graphic Organizer for product (Created by Kristi Bean)  
Handout for area and volume formulas (Created by Kristi Bean)  
Name tags for students (Created by Kristi Bean)  
Table markers to establish groups (Colored and labeled shapes made by Kristi Bean)  
[Google Form](#) - exit ticket

### **Source for Lesson Plan and Research**

[Google Form](#) - Exit ticket poll  
[www.sketchup.com/](http://www.sketchup.com/)  
<http://www.mathopenref.com/volume.html> - for area and volume formulas

***PART II: Note: The purpose of Part II is to take everything from Part I and make it come alive with details in such a way that you can easily teach from it but also a substitute unfamiliar with your content area could carry out the lesson.***

### **Agenda (60 minutes):**

Break up into groups by handing out team colors to students as they walk in (red, blue, green, yellow, light blue, orange, purple)

- Sitting down and getting ready ( 5 min MAX )
- Hook (10 min) [Kristi]
  - Draw a cylinder
    - Label the radius and height
    - What is the volume?
  - Draw a cube
    - Label the length, width, and height
    - What is the volume?
  - Draw a square pyramid
    - Label the length, width, and height
    - What is the volume?
  - So wouldn't it be nice if we could create these shapes to perfection and find the exact area? Well now we can!
- Play around in SketchUp (8 minutes)
  - Chris shows them basic shapes and tools
  - Then he introduces the task
- Sean takes over (10 minutes)
  - Goes over handout
  - Shows them how to insert a map in GSU

- Work time (20 min)
  - as we walk around make sure they have their measurements
- gallery walk (2 min)
  - Chris will do this
- Exit ticket (5 min)
  - Sean will lead this

### **Teaching and Learning Sequence** (2-3 pages)

Before the lesson begins, as students enter the classroom they will be given a note card telling them which team they will be on which will also determine which table they sit at (tables will be labeled with team colors to match the handouts given to students as they walk in). There will be 7 groups of 3 students each, and each group will be given a team color. Students will sit down at their desk and fill out the name tag sheet that is placed at their seat. (5 minutes)

#### **Open**

##### **1. Engage (use a real-world phenomenon to hook the students; elicit questions; determine background knowledge):**

To begin class each group will be given a whiteboard and a marker and lead in activity called Quick Draw. Each team member will be given the opportunity to draw a certain shape, label important pieces, and write the volume formula for that shape. The goal of this activity is to test pre-requisite skills as well as hook the students on the idea of drawing in a quicker, easier, and more accurate way with Google SketchUp. (Kristi as lead teacher; 10 minutes)

#### **Body**

##### **2. Explore (work with concrete materials; determine emerging concepts and terms):**

Chris will then have the students open their laptops and explore Google SketchUp, then Chris will show them how to draw basic shapes, make them three dimensional and how to measure and label important features. Students will be given an opportunity to draw some basic shapes and will be given a handout with helpful hints about how to use Google SketchUp (5 minutes)

##### **3. Develop (formally develop concepts and terms from the explore phase; use readings, direct presentations, and other methods to ensure mastery of the objectives):**

Sean as lead teacher will have students look at the handout on area and volume formulas for different polygons and explain why this is important when planning to build a new structure.

#### **Close**

##### **4. Apply (provide a novel problem to which new knowledge can be applied or make some other real-world connection):**

Students will then go to Google Earth and find their middle school by searching “Mt. Blue Middle School.” They will be able to drop the selection right inside the document and start building from there. The students can either construct their product by making the pool first followed by the building or doing the building first, removing the roof, and then putting the pool

inside.

Students will work on this for at least twenty minutes. Throughout this time we will be walking around and guiding students as they become more curious about how they want to enhance their project. Things to consider are how to add a texture, how to make a door to their building, how to add slope to their pool, and anything else they want to challenge themselves with. Following the construction of their pool and building, they will turn their laptops to the front of the room and do a gallery walk to look at their peers' products.

Once they finish the gallery walk, they will go to a google form to complete their exit ticket.

### **Content Notes (2-3 pages)**

- See attached handout of area and volume formulas (called '[content notes](#)')
- See attached hand out of Google SketchUp tips and tricks. (called '[Google SketchUp Cheat Sheat](#)')
- See attached graphic organizer for product (called '[Graphic Organizer Geometry](#)')

### **Handouts**

Google SketchUp Product Graphic Organizer

Area/Volume Notes Handout

Student Name Tags

Table Markers

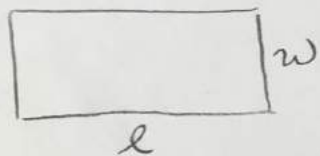
Google SketchUp tips and tricks handout



Triangle



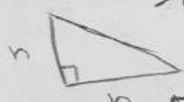
$$\text{area} = \frac{1}{2} b \times h$$



Rectangle

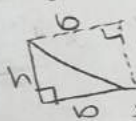
$$\text{area} = l \times w$$

Right Triangle



$$\text{Area} = \frac{1}{2} b \cdot h$$

why ?



If we copy our right triangle we can form a rectangle.



$$\text{area} = \pi \cdot r^2$$

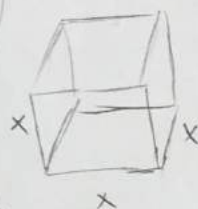
Circle

Pyramid



$$\text{Volume} = \frac{1}{3} \times \text{base area} \times \text{height}$$

Cube



$$\text{Volume} = x^3$$

$$\text{Volume} = \text{area of base} \times \text{height}$$



Right circular Cylinder



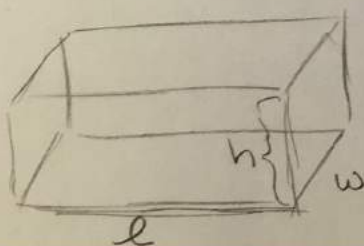
Right circular Cone

$$\text{Volume} = \frac{1}{3} \times \text{area of base} \times \text{height}$$



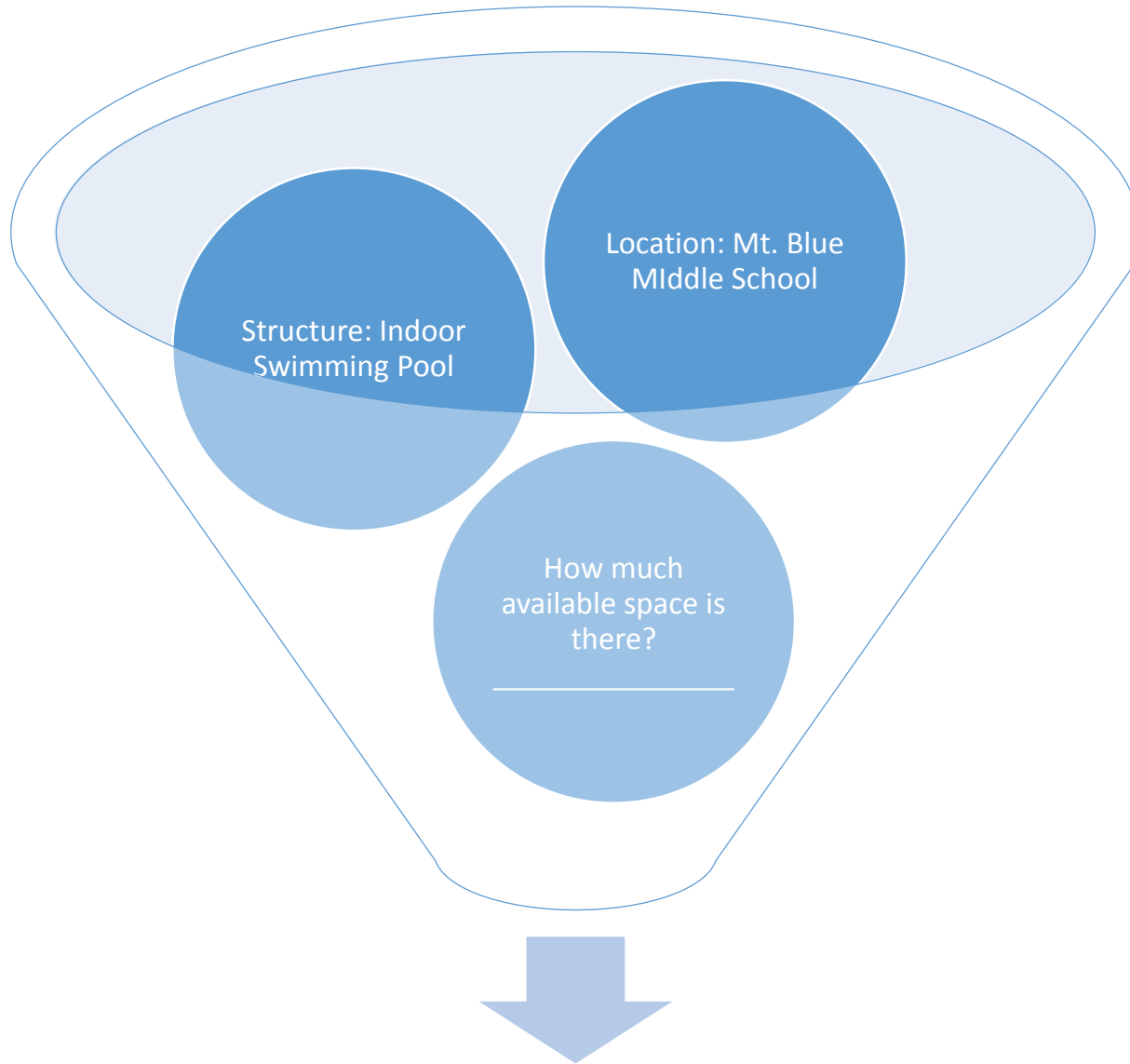
Sphere

$$\text{Volume} = \frac{4}{3} \pi r^3$$



Rectangular Solid

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$



What is the area, perimeter, and volume of the pool you created?

Area \_\_\_\_\_









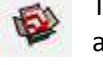

Perimeter \_\_\_\_\_

Volume \_\_\_\_\_











Hook  
Quick Draw

1. Draw a cylinder. Label its radius and height. Do you know how to calculate the volume of a cylinder?
2. Draw a cube label its height, width, and length. How do you calculate its volume?
3. Draw a square based pyramid label its height. How do you calculate its volume?

# Get comfortable with Google SketchUp

 The <b>Lines Tool</b> allows you to draw a straight line, or switch to a free hand drawing tool to draw any variation of a line you would like.	 The <b>Pan Tool</b> allows you to move laterally across the screen.
 The <b>Shapes Tool</b> allows you to construct rectangles, rotated rectangles, circles, and polygons to make your piece of work a masterpiece.	 The <b>Orbit Tool</b> allows you to rotate around your screen to get a 360 degree view.
 The <b>Tape Measure Tool</b> allows you to accurately measure distances of shapes in your workspace.	 The <b>Push/Pull Tool</b> allows you to turn two dimensional objects into three dimensions.
 The <b>Move Tool</b> allows you to move a specific object or set of selected objects to a desired location.	 The <b>Paint Bucket Tool</b> allows you to fill an area/shape with the color/texture of your choice.
 The <b>Get Models Tool</b> allows you to access a large database of already created SketchUp models including people, buildings, and props.	 The <b>Add Location Tool</b> allows you to insert a screenshot from Google Earth directly into your SketchUp workspace.

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### **Cooperative Learning Activity**

In your groups you will collectively create a structure and each of you are responsible for a specific task. You will each have two minutes to complete your task and pass the laptop onto the next person for a total of six minutes. At the end, if there is time, you will get to add finishing touches to your creation to make it more appealing.

Person 1: Pick a shape and size for the foundation of your building and make it three dimensional. Do not ADD a roof.

Person 2: You are responsible for adding FOUR windows and TWO doors to your structure.

Person 3: Lastly, add a roof and color to your structure.