M2C3 MATH MODELING LESSON OVERVIEW

LESSON TITLE: Wooly Pockets

STANDARDS ALIGNMENT:

GRADE 3	GRADE 4	GRADE 5
3.OA: Represent and solve problems involving multiplication and division. 3.OA 3: Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities. 3.MD: Solve problems involving measurement and estimation. … 2. Measure and estimate liquid volume and masses … using standard units… Add masses or volumes that are given in the same units by using drawings to represent the problem.	4.NF:3d. Solve problems involving addition and subtractions of fractions referring to the same whole and having like denominators. 4.NF:4c. Solve problems involving multiplication of a fraction by a whole number, e.g.; using visual fraction models and the equations to represent the problem. 4.MD: Solve problems involving measurement and the conversion of measurements. 4.MD 2. Use the four operations to solve word problems involving … liquid volumes, … and money. … Represent measurement quantities using diagrams…	5.OA Write and interpret numerical expressions. 5.NBT Perform operations with multi-digit whole numbers and decimals to hundredths. 5.MD: Geometric measurement: understand concepts of volume and relate volume to multiplication and addition. 5.MD:3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (Understand unit cube and how to measure with a unit cube.) 5.MD:4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft and improvised units. 5.MD:6. Recognize volume as additive.
MP: 1 Make sense of problems and persevere in solving them. MP: 3 Construct viable arguments and critique the reasoning of others. MP: 4 Model with Mathematics MP: 6 Attend to precision.	MP: 1 Make sense of problems and persevere in solving them. MP: 3 Construct viable arguments and critique the reasoning of others. MP: 4 Model with Mathematics MP: 6 Attend to precision.	MP: 1 Make sense of problems and persevere in solving them. MP: 3 Construct viable arguments and critique the reasoning of others. MP: 4 Model with Mathematics MP: 6 Attend to precision.

CONNECTIONS (Consider while planning):

• Previous Math Knowledge: *What prior math knowledge and experiences does this lesson consider and/or build on?*

- Representing math ideas with pictures, symbols, and words.
- Operations with fractions.
- Measurement – Volume, cubic measures
- Estimation
- Computation with money

Task created by Molly Reed, M2C3 Teacher from Tucson, AZ.

- Understanding how plants grow and that they need sunlight, soil, and water.

• Cultural/Community/Family Connections: *How does the lesson connect to, or build on the knowledge, practices, or experiences of children and families? On community contexts??*

- Students may have had experiences gardening at school, at home and with the community.
- Students may have had experiences knowing how to "garden" and the purpose of soil. They may have purchased soil and have experience filling up a space in order to plant.

• Language Considerations: *How does this lesson connect and distinguish between everyday language and math language? What might be specialized vocabulary used in this lesson? Are there connections to home language?*

- Volume
- Soil measurement is given in cu. ft. (cubic feet). What is cubic measurement?
- Assumptions, modeling, documentation, reflection, recording

TASK Variations:

Routine 1: Mathematizing World - Open Ended (10 minute) - [Show images of the Wooly Pocket gardens]

- What do you notice? What do these pictures make you wonder about? Brief class discussion.
- What questions do you have? What would you need to know to answer those questions?

Routine 2: Full Modeling Task (60-90 minute) Students participate in entire modeling cycle Sensemaking and assumption building

Show the ten-pocket image and make sure students understand that each pocket holds some soil. Show the bag (s) of soil along with their costs.

Using a Wooly Pocket sample or replica discuss how the pocket can be filled with the soil needed to grow plants.

Show the 10 pocket Wooly Pocket garden image and ask: How much soil would the class need for 2 pockets; How much would they need for all 10 pockets?

Task

Our school received ten Wooly Pocket vertical gardens. Five classrooms were given two Wooly Pockets each. Molly needs to see if she has enough funding to purchase soil for all the Wooly Pockets. Figure out how much soil is needed for each classroom's Wooly Pockets.

Questions to think about:

- What do you know?
- What do you need to find out?
- What do you need to *assume*?

Create a model that shows:

- The amount of soil needed for one Wooly Pocket.
- The amount needed for all Wooly Pockets.

You can use pictures, numbers and words in your model.

Task 2: How much will the soil cost?

Our school received ten Wooly Pocket vertical gardens. Five classrooms were given two Wooly Pockets each. Molly needs to see if she has enough funding to purchase soil for all the Wooly Pockets.

Molly says she needs $200 to purchase enough soil for all ten Wooly Pockets. Cardinals say she will need $300.

Who do you agree with, and why? Or if you do not agree with either estimate, then tell how much you think the soil will cost and justify your answer.

Questions to think about:

- What do you know?
- What do you need to find out?
- What do you need to *assume*?

Create a model that shows:

- The cost for enough bags of soil for one class (two Wooly Pocket gardens).
- The cost for enough bags for all five classes (ten Wooly Pocket gardens).

You can use pictures, numbers and words in your model.

Task 2 Extension: Ask students to consider the three options for soil and determine which would cost the least to buy.

POSSIBLE STUDENT ASSUMPTIONS:

- Students may make an assumption about of the amount of soil each pocket holds. For example, they may assume one bag of soil fills two pockets. This assumption could eliminate any meaningful discussion of cubic measure.

ANTICIPATED STUDENT STRATEGIES:

Students might:

- Estimate how much soil each pocket holds by looking at the pocket and bag of soil. They could say ½ bag of soil per pocket. ½ bag/pocket x 10 pockets = 5 bags of soil.
- Investigate how much soil each pocket holds. They should understand that how high to fill the pockets. The soil is sold in cu.ft., a measure that may be unfamiliar to most students. If time and materials are available an exploration of cubic measurement would be advantageous.
- Determine the dimensions of a pocket, by measuring or reading the pocket specifications and calculate the volume.
- Determine the dimensions of the pocket, create it, (if sample is unavailable) and fill it with unit cubes to determine the volume. Then convert the unit cubes to cubic ft.
- Ask how much soil each pocket holds. Students could be given a copy of the product specifications or the teacher can give them that amount (0.40 cu.ft. or 4/10 cu.ft.). Since both the soil amount per pocket and the packages of soil are in cu.ft. there is no need to convert measurements. 10 pockets x 0.40 cu.ft./pocket = 4 cu.ft. of soil needed. Students not familiar with decimal notation can use 4/10 cu.ft. To simplify the mathematics of the task further, the measure ½ cubic foot could be used.
- Determine that they do not need two full bags of the soil option presented in Task 2. They could discuss why they must buy two bags, and not one bag, even though the amount they need is closer to 3 cu.ft. than 6 cu.ft. If they answer the task extension, they could buy 2 bags of option 2 or they might want some extra soil and buy 1 bag of option 1 and 1 bag of option 2.

- Round off the cost of each bag to determine the approximate cost.
- Drop the units cu.ft. It is important that students keep track of the measurement units as they work through the problem and present their solutions.

MATERIALS

- Wooly Pocket_Lesson Slides
- Wooly Pocket_Student Tasks
- Chart paper
- Markers
- Math Modeling Recording Sheet
- Measuring Tools (optional)
- Wooly pocket or a replica (optional)
- Soil (optional)
- Unit cubes (optional)

LESSON OUTLINE

BEFORE: Lesson Launch using slides
-Introduce students to math modeling process.
-Review group task work.

DURING: Lesson Exploration
-Students will be shown the image of the Wooly pockets and asked to record what they notice and what they wonder on their own sheets. The class will do a quick share, and I will record student responses on the board.
-After reflecting on these notes, the natural transition will be to discuss mathematical questions that could come from the task.
-Students will then work on identifying what we know, what information we need, and what we need to assume.
-Then students will be given their task card which asks them to:

- Record your group solution to the task on a group poster.
- Your poster should:
    - List and justify your assumptions and decisions.
    - Show your model, computation, and solution.

- Describe how your model could be used in other situations where people are planning a wooly pocket garden or any garden.

AFTER: Lesson Summary
-Students will share their group findings in presentation form. While groups present, students will evaluate work from one other group and compare findings. Students will then be asked to reflect on their findings and how they might change their approaches or keep them the same.

Ensuring group participation: Each student will have their own colored marker for the group work component to record ideas.