Area Builder PhET Simulation Grades 3-5
by Molly Martin

Overarching Understandings and Essential Questions:
* Problem solvers use mathematical models to translate real world situations into representations that can be used to find/defend solutions.
* How do you create a model to use in problem solving?

Mathematical Practices:
* Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts.

Students will know:
* Key Vocabulary: area, formula, dimension, unit, model
* Area and how to calculate it

Students will be able to:
* Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as it would be by multiplying the side lengths.
* Multiply fractional side lengths to find area of rectangles.

Prior Knowledge:

* Determine product using a rectangular array {Use Arithmetic PhET for review}

5 x 2 = 10

● Calculate area and perimeter of a rectangle
● Identify fractional parts of a rectangle

Materials:

* PhET Area Builder simulation:

https://phet.colorado.edu/sims/html/area-builder/latest/area-builder_en.html

* desktop, Chromebook, tablet, or laptop for each student or pair
* one inch graph paper

* one inch tiles

* recording sheet

Activate Prior Knowledge 3-5-3

1. Students write and draw for **3 minutes** all they can about a rectangle with an area of 24.

2. Students share for **5 minutes** as a whole class or small group all they included in their writing/drawings.

3. Students revise their original writing/drawing for **3 minutes** to include any missed concepts.

4 x 6 = 24
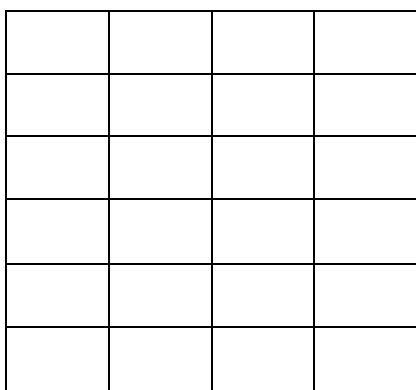
¼ of 24 = 6

½ of 24 = 12

¾ of 24 = 18

4 + 4 + 6 + 6 = 20

Drawings may include shaded diagrams, etc. Students should also create other models such as: 8 x 3, 12 x 2, 24 x 1

Introduction:

* Using one inch graph paper and one inch tiles, students will work in partners to build and record as many rectangle shapes as possible. Furthermore, they will use different colors to represent fractional parts of each rectangle.

I do, we do, you do…. (This is a gradual release/scaffolding structure that allows kids to be independent learners after teacher guidance.)

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* Teacher will model how to access phet.colorado.edu, Elementary School, Area Builder sim.

* Students will have the opportunity to explore the Area Builder sim independently or in pairs for about 5 minutes, and share with others what they discovered about the navigation, games and levels, as well as tools, etc. A possible prompt may be: **What is the first part of this sim that grabbed your attention or that you wanted to interact with? Explore one problem on Level 1, Level 4, and Level 8. Compare the differences. Be prepared to share.**

* Discuss the dimensions tool and how it relates to an area array.

* Distribute one recording sheet to each student and discuss expectations; students may work in pairs, but each student is required to complete their own recording sheet to turn in. Teacher sets expectations for assignment/recording sheet by modeling a possible mathematical diagram, possible dimensions, complete thoughts/sentences to communicate mathematical reasoning, etc.

Guided Exploration:

- Using Area Builder sim and the recording sheet, students will navigate, explore and advance through the game levels (keeping score).
- Level 4 includes calculating area of irregular polygons. Scaffold for students to concept of building the area of a rectangle and subtracting the units that are cut out of the rectangle. Many students will be able to be successful with this concept without guidance.
- Level 5 and 6 are the goals of this lesson.
  Students use the prompt:
  Example: Your goal: Area = 10, ½ green ½ blue, Perimeter = 14

Interventions/Extensions:

* Students can draw their successfully built area models on sticky notes and add them to the board.

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* Teacher can scaffold instruction with one inch tiles and or graph paper as they relate to the sim goals in levels 5 and 6.

* Advanced students can share their models with others.

* Advanced students can write their own goals for model building using the level 5 and 6 template.

Name: _____

PhET Area Builder Simulation

Record It!

1. Using the double mat on Explore, build 2 rectangles. The second rectangle should be twice the size of the first. Draw and record your results using dimensions (Ex: 2 x 3):

A=   A=

P=   P=

2. Level 1 and/or 2 – Record your score and time. Try again to beat your score and time.

Trial 1:   Trial 2:

Score - _____   Score - _____

Time - _____   Time - _____

I used/did not use (circle one) the tools because _____

_____ .

3. Explain how Level 3 and 4 change from the first two levels? _____

_____ .

Describe or draw how area can be calculated in these levels. Provide an example:

4. Complete both Levels 5 and 6. What area model was the most challenging for you and why?

_____

_____ .

Draw area model with dimensions and fractional parts: