Dream House Performance Task - Lesson Plan

Brief narrative overview of lesson:
This performance task is introduced in Mathematics Unit 2: Operation Computations. The unit focuses on evaluating expressions, the order of operations, and multiplying and dividing whole numbers and decimals. During this unit, we spend about 5 days working on the task. After that, it becomes a go-to task throughout the year. Students work collaboratively in groups of 3 (sometimes 4, depending on class size).

Describe your general learner outcomes:
The students will think critically to solve a real world problem involving operations with whole numbers, fractions, and decimals. They will apply their understanding of the formula for area and perimeter, as well. Students will use picture models and equations while working on the task.

Identify the Common Core State Standards and Standards for Mathematics Practice:
Common Core State Standards
5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions with and without evaluating them.
5.NBT.3. Read, write, and compare decimals to thousandths. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
5.NBT.4. Use place value understanding to round decimals to any place.
5.NBT.5. Fluently multiply multi-digit whole numbers using the standard algorithm.
5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5.NBT.7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
5.MD.1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.) 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 would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
5.NF.5. Interpret multiplication as scaling (resizing), by: Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n × a)/(n × b) to the effect of multiplying a/b by 1.
Addt'l: 3.MD.C.5a, 3.MD.C.5b, 3.MD.C.6, 3.MD.C.7a, 3.MD.C.7b, 3.MD.C.7c, 3.MD.C.7d, 3.MD.C.8

Standards for Mathematics Practice:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools and strategies.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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Assessment Evidence:
  Performance Task: Students will work collaboratively to complete the performance task, adhering to all criteria outlined in the problem. They will create a floor plan using Google Drawings, which includes calculations and flooring options. Tables will be used to track and organize calculations. Extension: Add paint.
  Performance Criteria
  Expectations for collaboration are posted in classroom (group norms) and reviewed periodically throughout the engagement in the task. Students also use Peer Feedback Statement Stems (posted in Google Classroom and hard copies in SEL folder). A problem-solving rubric is provided to give students feedback on the project.

Materials Needed:
  Copies for each student: Dream House Performance Task + Problem-Solving Rubric, Floor Plan Example and Google Drawing Model, Flooring Grid. A SmartBoard is used to display information. Student laptops equipped with Google Suite for Education. The Home Depot and/or Lowe's Home Improvement websites. Graph Paper. Extension material: Paint Grid

Time Needed:
  60-minute math block for the first five days; additional time throughout the year as a Go-To Task

Resources:
  Common Core State Standards for Mathematics, Unit 2 curriculum guide for grade 5, and *Building Thinking Classrooms in Mathematics* by Peter Liljedahl

Active Learning Plan:
  Collaborative groupings: Created randomly using a deck of cards.

  Initial engagement with task: Students use vertical whiteboards to analyze or make sense of the task. This step happens BEFORE discussing the performance class as a whole group.

  Whole Group: Display the performance task on the SmartBoard. Have groups share out things they noticed or wonder about the problem. Focus on potential strategies needed to solve the problem. Record all ideas and thoughts generated during the discussion on the SmartBoard. **MUST DO: Stay under budget** for the entire project = **$200,000** and design a floor plan with **at least 900 square feet**.

  Step One: Design a floor plan on graph paper. This is a sketch and initial idea. Add dimensions for each room. ** Draw student attention to the following: Room dimensions being equal to total outside dimensions and doorways are included in dimensions.

  Step Two: Create the floor plan in Google Drawings. Add dimensions as well as calculations for area and perimeter. Provide calculators to check calculations and for future calculations.

  Step Three: Use Home Depot or Lowe's website to "shop" for flooring. Add floor samples to rooms in Google Drawings. Complete the flooring grid.

  Extension… Step Four: Use Home Depot or Lowe's website to "shop" for paint. Add paint samples to rooms in Google Drawings. Complete the paint grid.

  Students move between tasks and work collaboratively throughout the project. Add checkpoints or check-ins to review student problem solving and progress (before moving on to another step). Encourage critical thinking with higher level questions. Avoid giving strategies or ideas, but encourage students to work with their partners to develop a plan.

Curricular Connection:
Work with the Arts Department for students to create a 3-D model of their dream house floor plan.

Source: 5th-Grade Teacher Kim Hannan, Whiting Lane Elementary School, West Hartford, CT, via Edutopia.org