Culturally Responsive Array Modeling

Grade: 4th & 5th

Materials Needed

- Manipulatives such as candy, buttons, beans, etc.
- Grid paper
- Pencils
- Colored pencils or markers
- Computers with Scratch or Scratch app
- "Cassie's Word Quilt" book by Faith Ringgold

Concepts

- Multiplication
- Arrays
- Area
- Abstraction

Learning Objectives

- I can utilize an array model to represent a multiplication problem
- I can estimate the size of a product and use this estimation to determine the reasonableness of a calculation
- I can use multiple strategies to find the product of two two-digit numbers

What do students need to know prior to this lesson...

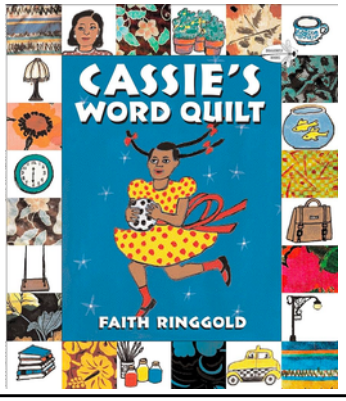
- Students should have had a formal introduction to multiplication and understand the basics of multiplication
- Students should have a basic understanding of what an array is
- Students should have a basic understanding of area

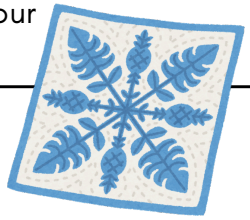
This lesson provides students with the opportunity to practice and apply all of those skills while they think about supporting a local shelter with blankets.

Introduction

Make learning from this lesson relevant to students.
Some suggestions include:

1. Review students' prior learning to multiplication, arrays, place value or other content connected to the CCSS (see Standards page).
2. Read "Cassie's Word Quilt" by Faith Ringgold. What connections can students make to the story?
3. Other activity of your choice based on your classroom's interests and backgrounds.

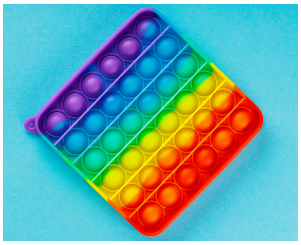




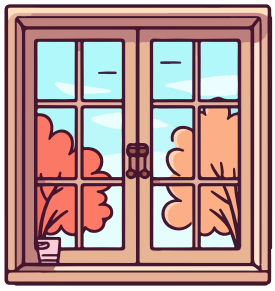
Engagement Activity

There are a variety of hands-on activities that you can engage your students to discuss multiplication and arrays. Some of those activities might include:

- Build an Array!
  - Provide students with the Build an Array! handout, manipulatives (this could be candy like Skittles or M&Ms, or buttons, or beans, etc.), and multiplication fact cards.
  - Ask students to build an array with the manipulatives to represent the multiplication card(s) given to them and have them explain different multiplication cards.
- Pop-Its Array
  - Provide each student or pair of students a large Pop-Its and multiplication fact cards and have students "pop" the correct number of rows and columns (array) to represent the multiplication fact.
    - You can also reverse engineer the process and have students create arrays on the Pop-Its and then exchange with another person to figure out the multiplication represented by each array.



- Facilitate a class discussion using the following question: "How do you use multiplication in your life?" where students make connections between activities in their lives and multiplication, especially using area or arrays.
  - Some classroom examples of arrays include:
    - Windows
    - Cubbies
    - Rows of desks
    - Work displays
    - Material bins
    - Tiles (both floor and ceiling)



  - Some home / outside of school examples include:
    - Muffin tray
    - Eggs in carton
    - Pictures hanging on the wall
    - Pictures of TV shows on Netflix / other streaming devices
    - Quilt
    - Chess / checker board game
    - Mailboxes
- Estimation Number Talk
- How many chocolates? How many eggs?

Relevant Background Activities

Math

- Complete this practice
- Answer question #2 from the practice above by performing the 2-digit multiplication using grid paper or another method
- Other multiplication practice using arrays or area from your curriculum that is relevant to your students' learning needs

Computer Science

Explore CS First to acquaint students with Scratch. Try these lessons:

- Welcome to CS First (familiarize yourself with the platform)
- Game Design - Lesson 6: Launcher Game (variables)

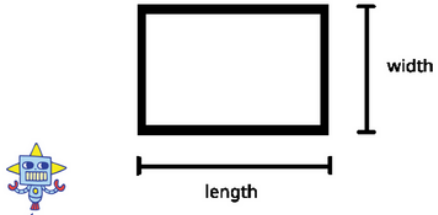
Performance Task

Isabella and her friends are making emergency blankets or quilts for their local shelter. Isabella measures the length and width of one of the pieces of fabric they have to use to make the blankets. The piece of fabric has a length of 15 inches and a width of 10 inches:

1. Estimate the area of each quilt section and record this estimation for later.
2. On grid paper, draw an array representing the piece of fabric. Design your own quilt using different colors and patterns for each section of the array.
3. Each quilt needs to be 45 by 30 inches. How many pieces of fabric will be needed to make one blanket?
4. Each piece of fabric costs $7.25. Calculate the cost of one of the blankets that you designed in the Performance Task. Use a strategy of your choice.
5. The homeless shelter has 50 occupants. Calculate the cost of making enough blankets so that everyone gets a blanket. Use a strategy of your choice.

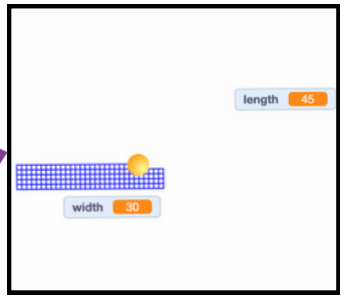
Scratch Activity

1. Use this Scratch program to calculate the area of one quilt section (#1 from Performance Task)
2. Students compare their estimation to the results from the Scratch program and from their grid paper multiplication and write a reflection.
   - I noticed…
   - I wonder…
   - Next time, I plan to…



Extensions

Scratch extension - Use the Scratch program to visualize the array representing one of the pieces of fabric. Remix a Scratch program to represent one section of the quilts/blankets. Use https://scratch.mit.edu/projects/888029721/ or https://scratch.mit.edu/projects/888023523

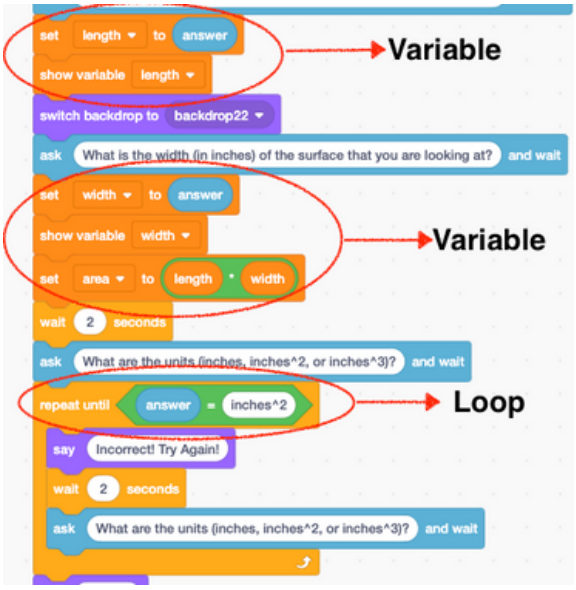


Computer Science Concepts:

An explicit call out of a few select computer science concepts is important for students to realize that they are engaging in CS. In this lesson you can explicitly call out:

- Variables
- Loops

It's recommended that only 1-2 concepts are introduced at a time. This allows students to grasp the concepts in a manageable way.



Assessment

- Teacher observation of student work in Scratch activity (formative assessment of conceptual understanding - got it/didn't get it)
- Students choose one of the following Scratch Activities to Demonstrate Understanding. This is a great opportunity for students to participate in pair programming and work together to solve the problem.

When they have completed the activity, have students complete this reflection.

- Formative assessment from your own curriculum

Career Connections

Did you know...

That there are many careers that use *area* in their everyday workday, let's take a look at some of those careers:

- **Fashion designers** need to understand how much fabric or material needs to be used to create that beautiful dress or shirt. Area helps fashion designers understand how much is needed to create their design.
- **Architectural engineers** design and support the construction of buildings and one of their main goals is to make sure buildings are sustainable. Architectural engineers use area to figure out if a building is energy efficient and up to code with building laws.

Common Core Math Standards	
4.NBT.3.	Use place value understanding to round multi-digit whole numbers to any place.
4.NBT.5.	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
4.OA.3.	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
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.NF.5.a.	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.

Computer Science Student Standards

CA CS 3-5.AP.11.	Create programs that use variables to store and modify data.
CA CS 3-5.AP.14.	Create programs by incorporating smaller portions of existing programs, to develop something new or add more advanced features.
CA CS 3-5.AP.17.	Test and debug a program or algorithm to ensure it accomplishes the intended task.
CSTA 1B.AP.09.	Create programs that use variables to store and modify data.
CSTA 1B.AP.12.	Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
CSTA 1B.AP.15.	Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.

CSTA Teacher Standards

1a.	Apply CS practices
2c.	Represent diverse perspectives
2e.	Use accessible instructional materials
4c.	Design inclusive learning experiences

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