Recalling Math Facts through Coding

Strands:	Suggested time:
Number Algebra Social-Emotional Learning in Mathematics and the Mathematical Processes	2 x 40-50 minute periods
Topic:	**Grade:**
Using coding to help recall multiplication facts.	5

Overall and Specific Expectations:

Algebra

- C3. solve problems and create computational representations of mathematical situations using coding
  - C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves conditional statements and other control structures concepts and skills
  - C3.2 read and alter existing code, including code that involves conditional statements and other control structures, and describe how changes to the code affect the outcomes

Number

- B2. use knowledge of numbers and operations to solve mathematical problems encountered in everyday life
  - B2.2 recall and demonstrate multiplication facts from 0 × 0 to 12 × 12, and related division facts

Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

- A1. Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will apply, to the best of their ability, a variety of social-emotional learning

skills to support their use of the mathematical processes and their learning in connection with the expectations in the other five strands of the mathematics curriculum.

In this lesson, to the best of their ability, students will learn to **identify and manage emotions** and **think critically and creatively** as they apply the mathematical process **selecting tools and strategies** (select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems), so they can express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities, and so they can make connections between math and everyday contexts to help them make informed judgements and decisions.

Visual Arts

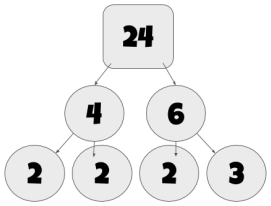
- D1. Creating and Presenting: apply the creative process to produce a variety of two- and three-dimensional art works, using elements, principles, and techniques of visual arts to communicate feelings, ideas, and understandings

Learning Goals:	**Success Criteria:**
We are learning… ● how to recall and demonstrate multiplication facts up to 12 x 12 ● how to use existing code to observe the relationship between multiplication facts and their opposite role in division ● how to manipulate existing code to discover different fact combinations that result in the same product ● how to apply code to a spreadsheet to create artwork	I can…. ● recall multiplication facts efficiently to create a pixel art image within a timely manner. ● identify which part of the times table chart I have difficulty with (i.e. the 7 times table). ● use code to help me memorize my math facts ● explain the relationship between multiplication and division equations. ● use a coding system to create an image.
Prior Learning:	**Resources and Materials:**
● Students must understand what a fact is and how to do a factor tree to find various facts.	● Computer access ● Google slide "Conditional Coding in Google Sheets"

• Students should be familiar with vocabulary, such as: product, factors, quotients, dividend, divider, etc.	• Google Sheets • Multiplication chart (Printed or digital) PDF version

Learning and Teaching Activities:

Starting Learning	Opportunities for Differentiation
Write on screen or board this equation: 6 x 4 = 24 Ask students, “What kind of equation is this? Are there words that we can use to describe the parts in this equation?” (i.e., 6 and 4 are the factors and 24 is the product). Then ask, “is there a way to use these same numbers, but write them in a different equation?” Students may suggest, 4 x 6 = 24 (note that the order of factors doesn’t matter). If they don’t suggest it independently, encourage students to write these same three numbers as a division equation. Ex. 24 ÷ 4 = 6 Explain the difference between the dividend (24), the divisor (4) and the quotient (6). Ask students to write out a different division equation using the same three numbers, identifying the three parts in a division equation. Ex. 24 ÷ 6 = 4	Allow students to consult the multiplication chart as needed. Students can work together in pairs. **Opportunity for Assessment** Diagnostic Assessment: Note students’ understanding of the relationship between products and quotients.



Dividend (24), the divisor (6), and the quotient (4)
Screen/write out 24 - explaining that it is a product of a multiplication statement. Have students find any multiplication statements that would result in this product (the goal here is for students to find several different answers).

Active Learning

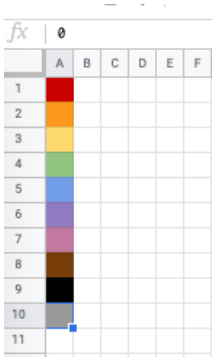
To begin, have students follow along Google Slides Conditional coding in Sheets opened as a class. If possible, project the slides while students work individually on computers to follow instructions and program their own Google Sheet.

Possible modification: Teachers could also share the premade Google Slides for exploration purposes prior to having students code their own Google Slides. In this case, be sure to assign each student their own copy.

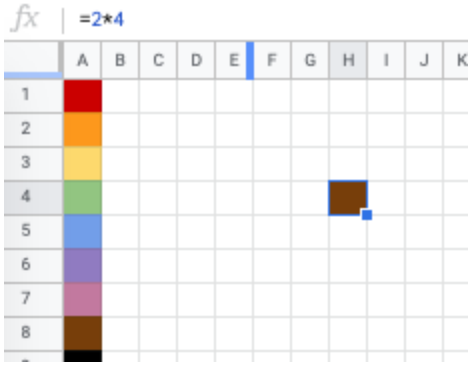
In the first tab, students will see that the digits 0 through 9 have all been colour coded. Ask students, "How could you make blue using a multiplication or division equation?" Students will respond that the answer would have to be 5, so they can list some equations that might work (like =35/7 or =60/12 or = 1 x 5).

Teacher Moves:
If students come across an issue, such as the cell does not change colour, try to lead them to debugging through questioning. Have other students help with the problem solving so students get familiar with the vocabulary. Here are some examples of questions:

- When you applied the conditional coding, did you have all the cells selected that you want to include in the pixel art grid?
- Was the correct condition applied? (i.e., The text is exactly…)
- Was there a mistyped number?



Take some time to show how equations are written in a google sheet (or any spreadsheet program), using = followed by the function you wish to perform.
Students will have to learn that to multiply, the symbol * will be used and for division, the dividend will be written before the divisor, separated by the symbol / .



Explain to students the meaning of the term, “conditional” (what could happen, what might have happened, or what we wish could happen - usually uses the word, “if”).

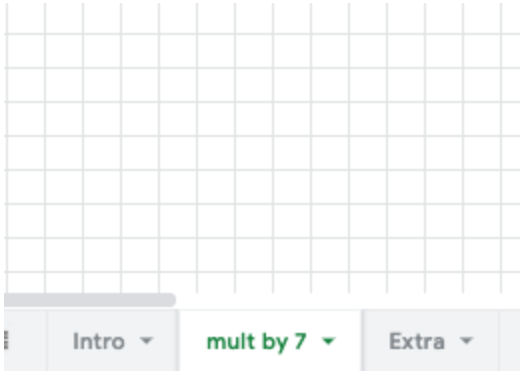
While students are exploring equations being written in a specific cell, you can have some students explore repetitive additions that lead to the same result : i.e. =2+2+2 is the same as =3 x 2. (**Strand A: problem solving:** develop, select, and apply problem-solving strategies)

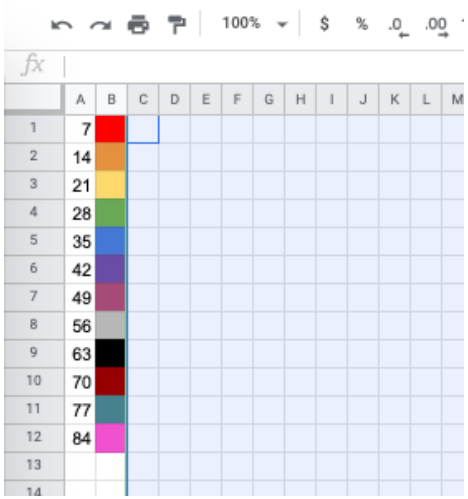
Teacher should enquire with students:

- Are there other multiplication facts you could find that result in the same product?
- What other strategy could be used if you get stuck on a question? (example: A

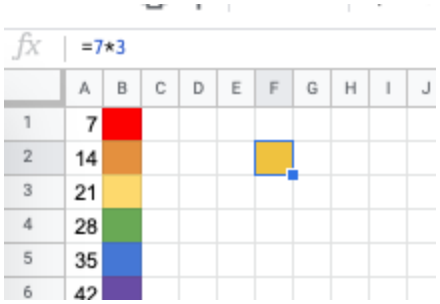
Opportunities for Assessment

Formative Assessment: Note how students express their observations and to what degree they incorporate the vocabulary (factor, product, divisor, dividend, quotient).

Once the programming is complete, allow students to explore the artistic properties of their coded Google Sheets. You could have them create an emoji picture based on their feelings about what they just learned, or have some creative fun to create an original art piece.	student is stuck on 7x6, one could go back to 7x5 and then add another group of 7 to the product to find the answer)	**Opportunity for Assessment** Summative Assessment: Refer to the Success Criteria and the way students create pixel art. Take note of the various levels of complexity, the way they use different equations, and detail.
Consolidation of Learning		
When students are comfortable with the idea of assigning each cell a number to create a specific colour, have them go to their next tab on their sheets. (This example is in the Google Sheets provided for the teacher). Have students create a new pixel art piece using multiplication facts in the cells instead of simply plugging in a number to get the corresponding colour.  Here, have students select a set of multiplication facts that they have difficulty memorizing. For example, if a student has difficulty remembering 7 multiplication facts, have them code their Google Sheets as follows, so that the legend associates a colour with an answer. Start with 7 x 1 all the way through 7 x 12. Students should then have a legend as follows:		**Opportunities for Differentiation** Limit the number of colours so that some students only need to use a few. (i.e. up to 9x9, meaning 9 colours instead of 12). Students can use graph paper to plan out their design and then transfer it into the spreadsheet.



Under the new tab that students have programmed with the products of chosen times table, show students how to select a cell and insert a multiplication equation using the Google Sheets codes. To review, the * is used to symbolize multiplication. (3 x 5 = written as =3*5)



Things to keep in mind:
Sheets recognizes an equation when the typed information begins with " **=** " and multiplications are represented with " * "
Example: = 2*2

This can be modelled in the already prepared Google Sheets. (Second tab)

Further Consolidation/Next Steps for students and teachers:

Once students have been practicing their math facts that are most challenging for them, have them start expanding on their math fact combinations. For example, if students are working on their multiplications of 7, and one of the products is 42, a student might recognize that 2 x 21 will also provide the same product as 7 x 6.

Expand on student's comprehension of quotients and multiplication facts by allowing students to continue to code, but not limiting them to a specific set of multiplication tables. Challenge students to find as many combinations as possible to produce the same colour.

Further Consolidation/Next Steps for students and teachers:

Unplugged: YouCube's The Four 4s Activity The Four 4's

Plugged: Catch a Bouncing Ball (mathies SWF Opener) (Note: this game uses Flash)