Fraction Mash Activity 6: Puzzling Pics

Complex Visual Modeling, Order of Operations, and Deeper Understanding of Rational Numbers

Overview
Students will create complex visual models of sums of fractions. These puzzled images will encourage students to use fraction-language to describe each other’s creations and to think about the order of operations that are needed to solve their classmates’ fraction puzzles.

Big Idea
Fraction Mash is an efficient and easy way to create a mashup of two images that clearly represent the sum of two fractions with the same denominator and express two parts that make a whole. For example, \(\frac{3}{5} + \frac{2}{5} = \frac{5}{5}\) results in a sum of 1. However, when the concept of a Fraction Mash remix is taken into account, the fractions involved can very quickly become more complex. For example, if one uses the same equation of \(\frac{3}{5} + \frac{2}{5} = \frac{5}{5}\) to mash up two colors with a grid of 5 columns, the outcome may be 3 red and 2 blue. If that simplistic red-blue color pattern is brought back into Fraction Mash and mashed with a picture that is all white but in 10ths with horizontal columns, the outcome is much more complex.

In this advanced Fraction Mash activity, students will be asked to take simple mashups, remix them to be more complex, and then try to make sense of the fractional outcomes. In working through these problems, students will deepen their understanding of order of operations of the mashups that happen in
Fraction Mash.

NOTE: The concept of the “whole” is important to consider with Fraction Mash. For the purposes of this app, the “whole” is the picture itself – the image that fits within a frame. The parts of one picture combine with parts of another picture to make one whole picture: the mashup.

Learning Objectives
Students will use a series of sums of fractions represented by visual models to create puzzles that will deepen their understanding of order of operations and fractions in general.

From this activity, students will be able to:
• Plan a series of sums of fractions that results in a visual model representing the operations.
• Use grid overlays to represent the concept of the “whole” in fractional relationships.
• Break down many seemingly complex components of a visual model into simple algorithms that created them.

Vocabulary
• Fraction
• Denominator
• Numerator
• Grid
• Whole
• Combination/Remix
• Order of Operations
• Sum

Grades
Elementary and Middle School, 3-7

Standards Addressed
Grade Level: 3, 4, 6, 7
Common Core Standards-Math
CCSS.MATH.CONTENT.3.NF.A.2.A
CCSS.MATH.CONTENT.3.NF.A.3.A
CCSS.MATH.CONTENT.3.NF.A.3.B

Mathematical Practices
MP1
MP2
MP4

Classroom Strategies

Single-device implementation
Create a visual model before class and use an interactive white board or projector to share/discuss with students who are familiarized with the app. Students will work together to decipher the way in which the app was used to create the puzzle image. After they successfully decipher the image, discuss using the provided questions, and then create a new puzzle picture with the class. Another option is to have students work in groups to create their own puzzle photos on paper and then one at a time, program them into Fraction Mash. Challenge the class to figure out how each group achieved its design.

Multiple-device implementation
Student groups of two to four per iPad is ideal for this activity. Each group will create a puzzle photo for other groups to solve. Have groups create and solve puzzle photos in the time you have allowed for the activity.

Tips and Tricks: This activity can get very complex, very fast. The steps suggested are meant to keep it simple but allow for teachers to escalate the complexity as they see fit. Using single colors as starter images (perhaps with a face in the mix) is a good way to keep things simple to start off. After that, the sky is the limit.
App Features You Will Use

| In Create Mode, you will use: |  
|-------------------------------|------------------- |
| ![Fraction Mash](image) | Swipe right to increase or left to decrease the numerators and denominators. This controls how many parts are in your mash-up and how big they are. |
| ![Import or Take a New Picture](image) | Import or take a new picture |
| ![Grid](image) | (Visible when you choose to take a new photo) Turn the grid on/off. |
| ![Overlay](image) | (Visible when you choose to take a new photo) View a semi-transparent overlay of the other picture. |

| ![Squares](image) | Change grid options to slice the picture the way you want. Custom allows you to choose how many parts as the number of rows times the number of columns. |

In Combine Mode, you can use:

| ![Equation](image) | View the equation that expresses the sum of the mashup |
| ![Smooth](image) | Turn on/off an effect that blends images. |

Expected Activity Time

**Puzzling Pics** (20–40 minutes)

Materials and Prep

- Puzzling Pics Student Sheets
- iPad with Fraction Mash app
- Wifi access for sharing mashups

Activity Prompt

**Intro:** Have you ever seen the Rubik’s Cube or other puzzles that are seemingly simple to solve once you learn how they were created?

In this activity, you will create some puzzles with Fraction Mash that appear to be very complex but can be understood and solved in very simple ways when you see how they were put together.
Puzzling Pics: Start by creating a simple puzzle for your classmates. Also solve one of theirs. Then ramp up the complexity to create more puzzles and use your new skills to solve the tougher puzzles also created by your classmates.

What To Do
Puzzling Pics (20–40 minutes):
Open the app, and select “Make A Mashup.”

- Have students start with four very simple images. For example, start with four basic colors: red, blue, yellow and green. Another option is to have one of the pictures be a face and the rest as solid colors.
- Have students create a simple puzzle with the four basic images using these rules: Mashup the first two images using vertical bars and a denominator no greater than 10. Save. Go back to Create, import that first mashup, and then remix with one of the other basic pictures. Change to using the horizontal bar grid and a denominator no greater than 10. Do this one more time using the last basic image and the pie slices grid with a denominator no greater than 10. Each mashup should have some of the components from each image included, and it also helps to keep the grid on at each mashup.
- Once they have created the puzzle that is the result of three remixes, have students exchange iPads and solve each other’s puzzles. A correct solution clearly describes the steps taken to create the image, using fractional sums in the solution.
- Be sure to have students save their puzzles, including the steps they took to make them.

- After the simple introduction, ramp-up the complexity and have students make and solve more fraction puzzles.

Discussion
Students should be encouraged to describe the puzzles they created and the tricks they learned to reading and solving the puzzles.

Ask students:

- As you created your puzzles, did you intend to make them with a specific degree of difficulty? Was it difficult to find the balance between making the puzzle tough to solve but not so easy that it was boring?
- What were some things that made the puzzles especially difficult to solve?
- What happened if they you only used vertical columns? Or only horizontal rows?

Extensions and Inquiring Further
These puzzles can get very complex, so one extension is to simply allow students to take their creations to the most extreme cases possible in the time allotted. Are they still solvable?

OR:

Explore the ways in which the creation of these visual models could be explained using other operations of fractions? Could some of the states of the creations of these puzzles be models for multiplication of two fractions? As students explore the grids and operations, delve deeper into the complexity that Fraction Mash can create with the combinations of different grids, denominators and remixes.
Fraction Mash Noticing Tool

Name: _________________________________ Date: ____________

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Start with four simple pictures and create a visual puzzle for your classmate to solve. Switch with a classmate and solve a puzzle that they designed.

To Do:

1. Start with four very basic pictures in your camera roll. For example, pictures that are just solid colors work well for this activity. (Note: Black isn’t the best choice because the grid lines are hard to see with black.) Bright colors work well.

2. Choose the first two pictures and import them into Fraction Mash. For the first mashup use vertical columns as the grid and choose a denominator that is less than or equal to 10. Tap Combine, keep the grid on, and save your first mashup to the camera roll.

3. Go back to Create and import your newly saved mashup into the left frame. You will be mashing with another basic picture in the right frame. This time, set horizontal bars and a denominator that is less than or equal to 10. Tap Combine, keep the grid on, and again save your mashup.

4. Go back to Create and import the last mashup you just made into the left frame and mash with the fourth basic picture on the right. This time, use pie slices as the grid and again a denominator less than or equal to 10. Combine, keeping the grid on, and save. That is your first puzzle to hand to a classmate for them to solve.
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Reflection Questions:

1. Describe your process for solving the first puzzle created by one of your classmates.

2. Look at the first puzzle you made. Describe the puzzle using fractions to account for each piece in the picture. For example, \( \frac{1}{3} \) of Image 1 + \( \frac{5}{10} \) of Image 2 + \( \frac{1}{6} \) of Image 3 = The Puzzle. In your final puzzle, are there parts that are hard to describe?

On the number line from 0 to 1, make tick marks representing the amount of each image in your puzzle, and clearly label each tick.

3. As you created more difficult puzzles, how did you strike the balance between making them hard but not too hard?
4. How many remixes do you think could go into the creation of a puzzle if the goal was for someone to be able to solve it? Describe the ways in which you are able to deconstruct the puzzles and solve them. (Optional: What if the goal was just to create something beautiful or artistic. How many remixes do you think could take place?)