**Introductory Fraction Exploration**

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| In this lesson, students explore with fraction tiles and make observations and generalizations about fractions. This can also be used to activate prior knowledge in order to see what students know or what misconceptions they already have about fractions. |

**NC Mathematics Standard:**

**Numbers and Operations - Fractions**

**NC.4.NF.1** Explain why a fraction is equivalent to another fraction by using area and length fraction models, with attention to how the number and the size of the parts differ even though the two fractions themselves are the same size.

**Standards for Mathematical Practice:**

1. Establish mathematics goals to focus learning.

2. Implement tasks that promote reasoning and problem solving.

3. Use and connect mathematical representations.

7. Support productive struggle in learning mathematics.

**Student Outcomes:**

* I can explore and explain relationships between equivalent fractions and in relation to the whole.

**Math Language:**

* fraction
* numerator/denominator
* equivalent/equivalency
* halves, thirds, fourths, fifths, sixths, eighths, tenths, twelves
* whole
* partition
* area model/tape diagram

**Materials:**

* fraction tiles
* chart paper

**Advance Preparation**:

* Make sure students have access to full sets of fraction tiles. Ideally one set per student, but pairs would work just as well.
* Create an anchor chart with the title “Relationships between Fractions” and two columns, “What I noticed” and “Why?”

**Launch:**

1. Introduction (5-10 minutes)

Ask students if they have ever had to share something with a sibling or friend because there was only one left (examples – cookies, piece of pizza, candy, apple). Ask them, when you’re sharing with someone, what is the most important thing about sharing? (It’s equal or fair.) Share an example of one half (a picture, breaking a candy bar, etc.) and ask them if they know what kind of number one-half is (a fraction, numbers that come between whole numbers).

Distribute fraction tiles to the students explaining that these tools represent fractions. Allow students time to explore the tiles on their own and make some observations and discoveries about fractions.

Post the following guiding questions on the board for students to respond to.

In your notebooks, write down your discoveries to these questions:

* What are some observations you can make about the fraction tiles?
* What patterns do you see?
* Do you see this pattern anywhere else within the tiles?
* What are some relationships you noticed between different fractions?

**Explore:**

1. Explore (15 minutes)

Give students some time to explore and make observations in their notebooks. Encourage students to discuss with their table groups the things they notice and justify their findings.

Observe:

* What vocabulary do students use in their discussion/notes?
* Do they relate their observations back to the whole?
* Do they notice/understand equivalence?
* Do they notice that equivalent fractions and multiplication have a relationship?
* Can they justify and repeat and patterns/relationships with other fractions?

Ask questions to prompt student thinking:

* What did you notice about these pieces?
* What relationship do these pieces have?
* Is that always true?
* What does this tell you about fractions?

**Discuss:**

1. Sharing (30-45 minutes)

On the anchor chart, record student observations in the first column (leave the why column

blank). Once you have recorded the observations, choose the one you think is the best starting place and ask:

* Do you agree with this observation?
* Why is this observation true?
* Is it always true?
* Can you prove it?
* Can you observe the same/similar thing within other fractions?

This is when you will want to start making generalizations and filling in the why column of the anchor chart. A good starting place is with the student who notices that 1 = 2/2; 2/2=3/3; 3/3=4/4; etc. For the why, students should determine that if a whole is cut into a specific number of pieces, and you have all the pieces, you could make the whole again, therefore it was equal to a whole. Tell students that they will continue to figure out new things about fractions throughout the year and the class can keep adding those new things to the why column.

**Evaluation of Student Understanding**

**Informal Evaluation:**

* Listening to students’ observations and explanations will give you a good idea of how advanced their understandings of fractions are. It will also show you some of the misconceptions they have coming into the unit.

**Formal Evaluation/Exit Ticket:**

* If 1/3 = 2/6 and 2/6 = 4/12, what observation can you make about 1/3 and 4/12?

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* Partner students so they have someone to talk to and listen to. If a student has trouble writing their observations, partner them with a student that can record his/her verbal descriptions.

**Extensions:**

* Given other fractional pieces (fraction towers or circle pieces) do their observations hold up? Can they make new observations?

**Special Notes:**

* Generalizations will vary depending on students’ observations and prior knowledge.
* As you move through the fraction unit, and the rest of the year, continue discussing, proving, and testing each of the other observations and trying to determine an explanation as to why it was true. Follow the natural progression of your students – you don’t have to go in order of the observations on your chart. Come back to this chart frequently and continue to add to the why column as you get to specific lessons in the unit that support it. You do not need to put a why next to every observation on your chart on this first day.

Some important considerations:

* + Discuss the fractions that “match up” (equivalent) and what this could mean.
  + What vocabulary do students use when discussing their observations?
  + What misconceptions need to be further investigated during the discussion?
  + What vocabulary needs to be explicitly introduced and taught throughout the unit?

**Possible Solutions:**

Here are some suggested “whys” students should be able to make generalizations about:

* When the numerators and denominators match (2/2, 3/3, 4/4, etc.), it’s because you have all the pieces of the whole; therefore, that fraction is equal to one.
* Fractions are equivalent, because they contain the same area. The model is just partitioned into more pieces.
* For unit fractions, the bigger the denominator, the smaller the size of the piece, because you have cutting the whole into more partitions.
* When the numerator is half the denominator it is equal to one half.
* It takes multiple small pieces (2 sixth pieces) to make a larger piece (1/3).

**Exit Ticket**

If 1/3 = 2/6 and 2/6 = 4/12, what observation can you make about 1/3 and 4/12? Use pictures and words to explain your thinking.