Playful Mathematical Inquiry: Fractions in Grades 3 – 5
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UNDERSTAND: Fractions are a type of number that can represent quantities.

KNOW:

What is the learning trajectory for developing an understanding of Fractions?

Grade Three
- Understanding fraction concepts (see below – everything up to equivalent fractions)

Grade Four
- Everything above and comparing and ordering fractions with common denominators; estimating fractions with benchmarks

Grade Five
- Everything above and equivalent fractions – understanding that equivalent fractions are two ways to represent the same amount (having the same whole)
- Comparing and ordering of fractions and decimals
- Understanding the relationship between fractions and decimals

The following Critical Learning Phases are blended from

Recognizing Equal Partitions
- Partitioning circles and rectangles into two, four, six, and eight equal shares. This is fundamental to the understanding of fractions as part of a whole.

Recognizing Equal Shares
- Recognize that equal shares of identical wholes need not have the same shape

Recognizing Fractions As Numbers
- Recognize fractions are a number that represents equal parts of a quantity or amount
- Connects concrete or pictorial images of fractions to symbolic notation
- Describe equal shares using words *halves, thirds, half of, a third of*
- The denominator of a fraction indicates the number of equal parts the whole has been divided into. The numerator tells the number of parts being referred to.
- Understands the more fractional parts used to make the whole, the smaller the parts

Recognizing Fractions as Equal Parts of a Whole/Region

Recognizing Fractions as Numbers of Equal Parts of Set/Group

DO:

What will my students DO to show me their knowledge and understanding?
What curricular competencies do we want to focus on?

Reasoning and Analyzing
- Use reasoning to explore fraction concepts
- Model fraction situations (e.g., parts of a whole/region, parts of a set, parts of a linear model, equivalent fractions)

Understanding and Solving
- Apply mathematical understanding of fractions through play, inquiry, and problem solving
- Visualize fractions concepts
- Engage in problem-solving experiences that are connected to play, story, and perspectives relevant to local First Peoples communities

Communicating and Representing
- Communicate their understanding of fractions in many ways including orally, concretely, pictorially, symbolically, in written text and/or using screen-casting apps such as ShowMe.
- Use and interpret mathematical vocabulary (e.g., partition, half, half of, halves, thirds, fourths, denominator, numerator, equivalent fractions)
- Explain and justify their mathematical thinking as it relates to fractions
- Represent understanding concretely, pictorially, and symbolically

Connecting and Reflecting
- Reflect on mathematical thinking
- Connect fractions to application in the world

Recognizing Fractions as Equal Parts of a Linear Model	• Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts
Compares and orders fractions with the same denominator	
Understands equivalent fractions are different ways to represent the same amount (having the same whole)	
Compares and orders fractions with different denominators	

How will I find out what my students already know? How will I activate their prior knowledge?

We will use Talking Points. As a class, together we will introduce and model how Talking Points work. Students will read the five statements and note whether they agree, disagree, or are unsure and glue this into their Math Journals. Then we will return to the carpet and form a circle. Students should bring their pencils and journals with them.

TALKING POINTS ACTIVITY – Activity adapted from http://cheesemonkeysf.blogspot.ca/search?q=talking+points

ROUND 1 – (10 min) Begin by reading aloud each talking point. Then ask the students to mark in Round One whether they AGREE / DISAGREE / or are UNSURE. Do this for all the Talking Points. Next, go around the group, and have each student say in turn whether they AGREE, DISAGREE, or are UNSURE about the statement AND WHY. Even if they are unsure, they should also state a reason WHY you are unsure (e.g., I don't think it makes sense because…). All students are respectful of each other and do not add comments to another person's explanation. Remind your students that they are free to change their mind during your turn in the next round.

Note: Typically, students do three rounds of talking points. In small groups this would work well, but since we are working with the whole class, we felt our students could not sit this long.

EXPLORATION TIME: Provide various provocations at different tables with materials for the students to explore.
What is a fraction? What makes a fraction a fraction? (e.g., circle fractions)
When do we use fractions in our daily life? (e.g., books, pencils and paper)
How might these materials help you think about fractions? Place the following items at different table: rectangles with scissors, Cuisenaire rods, pattern blocks, square tiles, unifix cubes, etc.

ROUND 2 – After the students have had an opportunity to hear the thoughts of their peers, as well as engage in creating patterns, ask the students to return to each talk point and note whether they AGREE / DISAGREE / or are UNSURE.

Name _____   Date _____

Talking Points	Rounds Agree/Disagree/Unsure	
	1	2
Equal parts of a fraction are all the same shape.		
Fractions can describe equal parts of a linear region (e.g., a string or ribbon).		
Equivalent fractions describe the same equal parts.		
Fractions are always less than one.		
Fractions can be used to describe groups of items.		
Fractions cannot be placed on a number line.		
¼ is bigger than ½ of a pizza.		

Journal Prompts:

What talking point are you feeling confident about? Explain your reasoning.

Which talking point are you unsure about your answer? Why?

What do my students know about fractions? And what misconceptions do they have?

What questions do my students have about fractions?

What opportunities are there for integrating aboriginal perspectives?

Structured and Guided Inquiry Questions:

What is a fraction? What makes a fraction a fraction?

<u>Inviting and inspiring materials:</u>
- Various sized rectangles and circles
- Markers
- Scissors

<u>Guiding Questions:</u>
What do you call the parts of a fraction?
Can you use numbers and symbols to describe your fraction model?

Where do we see and use fractions in our world?

<u>Inviting and inspiring materials:</u>
- Images
- Eating Fractions by Bruce McMillan
- Whole-y Cow Fractions Are Fun by Taryn Souders
- Apple Fractions by Jerry Pallotta
- Give Me Half by Stuart J. Murphy
- Pizza Fractions by Jerry Pallotta
- The Hershey's Milk Chocolate Fraction Book by Jerry Pallotta
- Pencils and paper
- Plastercine
- Water paints

<u>Guiding Questions:</u>
When have you seen and used fractions?
Describe a situation in which you used fractions.
What sentence can you write that has fractions in it?
Can you express fractions you see in the environment using these materials?

How many ways can you equally partition the shapes in two or four?

<u>Inviting and inspiring materials</u>:
- Various sized rectangles and circles
- Paper
- Markers
- Scissors

<u>Guiding Questions</u>:
How do you know the pieces you created are equal?
Can you partition the shape another way?

Can equal parts of the same whole be different shapes?

<u>Inviting and inspiring materials</u>:
- Cutting the Cake lesson from Marilyn Burns 50 Problem Solving Lessons pg. 97 -98   https://bit.ly/2G1bMU0

<u>Guiding Questions</u>:
Can the fourths be different shapes?

What happens to the parts of a whole as it is divided into more equal parts?

<u>Inviting and inspiring materials</u>:
- The Lion's Share book
- Pink construction paper squares
- Journals

<u>Guiding Questions</u>:
What happens to the equal pieces of cake with each animal? How does this relate to fractions?

How might these materials help us think about fractions of a whole/region?

<u>Inviting and inspiring materials</u>:
- Cuisenaire rods – Great lessons in Beyond Pizzas and Pies pg. 10 – 13

- Pattern blocks with tracing triangular paper
- Coloured pencils
- Circles
- Rectangles
- Square tiles and/or grid paper
- Geoboards and elastics
- Tangram Squares

Guiding Questions:

If _____ represent a whole, what do the others represent?

Create a design using square tiles. Can you describe the colours using fractions?

Can you build a model to explain your thinking?

Can you draw a picture to show what one-third could look like?

Look at the pages from the different stories. How might you describe what you see using fractions? What questions could you ask that fractions could help you answer?

How might the following materials help us think about fractions as groups of?

Inviting and inspiring materials:
- The Cookie Fiasco by Dan Santat
- Counters of different colours, shapes, and sizes (e.g., pompoms, glass beads, feathers, mini erasers)
- Photos of groups/families

Guiding Questions:

What fraction of the group is wearing _____?

What fraction of the set is red?

Point to one part of the fraction represented and ask – what part of the fraction is this? How do you know?

Can you make a model with a denominator of 4?

Look at the pages from the different stories. How might you describe what you see using fractions? What questions could you ask that fractions could help you answer?

How might the following materials help us think about fractions as equal parts of a linear region?

Inviting and inspiring materials:
- Number lines
- Playdough

- Rulers and measuring tapes
- Ribbons
- A book about a race (e.g., A book about a car race)

Guiding Questions:

Can you describe your model? What numbers would represent the model?

Are there other ways you could partition this measurement?

Look at the pages from the different stories. How might you describe what you see using fractions? What questions could you ask that fractions could help you answer?

How can you represent fractions (e.g., as parts of a whole, set, or linear region)?

Inviting and inspiring materials:
- Cuisenaire rods
- Pattern blocks
- Circles
- Rectangles
- Square tiles and/or grid paper
- Geoboards and elastics
- Tangram Squares
- Images of fractions Counters of different colours, shapes, and sizes (e.g., pompoms, glass beads, feathers, mini erasers)
- Ribbons and string
- Rulers
- Empty number lines
- Apps (including geoboard and fractions) https://www.mathlearningcenter.org/

Guiding Questions:

How many ways can you represent a half? A third?

Can you describe your model? What numbers would represent the model?

How are these alike and different?

Can you order the fractions you created?

How might you compare fractions?

Inviting and inspiring materials:

- Fractions cards with symbolic notation and visual images of parts of wholes, sets, and linear regions
- Number lines with fraction cards
- Any of the materials above
- Markers

Guiding Questions:

Use _____ to compare two fractions with the same whole. Which fraction is greater? How do you know?

Can you draw a picture or create a model to show 2/5 is greater than 2/3?

Build three fractions with the same whole? How are they the same? How are they different? Can you order the fractions?

Create a model or draw a picture to show three fractions with a denominator of ___. Use the same shape to show the fractions. How can you compare the fractions?

Can you write a sentence using the following words and numbers? 2/4   ½   whole   greater

How would you fill in the blanks to make these fractions easy to compare? 4/?   And   ?/5   Can you build a model to explain your thinking?

How might the following materials help us think about equivalent fractions?

Inviting and inspiring materials:
- Fraction Kits
- The Doorbell Rang – cookies!
- Any loose materials mentioned above

Guiding Questions:

How many ways can you represent ½? What other fractions are equivalent to ½?

Can you build a model to show to equivalent fractions? Explain how you know they are equivalent.

Journal Prompts:

When I think of fractions, I see…

Today I represented a fractions question using…

I'm proud of…

I'm thinking now…

I know…

This reminds me of…

A connection I have…

I noticed…

I tried…

I wonder…

Which children's literature books could be used as provocations:

Fractions Books
- Eating Fractions by Bruce McMillan
- Whole-y Cow Fractions Are Fun by Taryn Souders
- Apple Fractions by Jerry Pallotta
- Give Me Half by Stuart J. Murphy
- Pizza Fractions by Jerry Pallotta
- The Hershey's Milk Chocolate Fraction Book by Jerry Pallotta
- The Lion's Share: A Tale of Halving And Eating It, Too by Matthew McElliogott
- The Doorbell Rang by Pat Hutchins
- Full House by Dayle Ann Dodds
- The Cookie Fiasco by Dan Santat
- My Half Day by Doris Fisher
- The Wishing Club by Donna Jo Napoli – This is about quarters/fourths and the relationship between four fourths and a whole.
- Polar Bear Math by Ann Whitehead Nagda
- Piece = Part = Portion: Fractions = Decimals = Percents by Scott Gifford
- Fractions, Decimals, and Percents by David A. Adler

Formative Assessment:

How will I document and communicate the students' learning?
- Photos and videos
- Student journals
- Performance based assessment
- Checklists – based on observations
- Anecdotal notes
- Conferences with individual students
- Screencasting apps such as ShowMe or Explain Everything

Summative Assessment:
Ask yourself, what would you students need to demonstrate that would show you they have met the learning standard(s) for fractions? It could be a quiz/test but could it also be a project? Consider using a single point rubric. https://www.cultofpedagogy.com/single-point-rubric/

How will I continue to support my students' understanding of Number Concepts throughout the year?

- Number Talks with images of fractions – From Math for Love - http://mathforlove.com/lesson/fraction-talks/
- Number Talks with Fractions questions – See Number Talks Fractions, Decimals, and Percentages by Sherry Parrish
- Mathematical Instructional Routines including Same/Different http://www.meaningfulmathmoments.com/same-or-different.html and Which One Doesn't Belong (WODB) and True/False http://www.meaningfulmathmoments.com/truefalse-routine.html
- Math Learning Center Apps (Fractions) https://www.mathlearningcenter.org/resources/apps
- Reading and discussing any of the above books
- Rich Problems such as Three Act Tasks https://gfletchy.com/3-act-lessons/
- Open questions from Marian Small's books
- Independent Practice or with Partners Fractions Games