**The Number Strand: Outcome N4.6**

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| **Outcome** | **Indicators** | | |
| N4.6 Demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to:   * name and record fractions for the parts of a whole or set * compare and order fractions * model and explain that for different wholes two identical fractions may not represent the same quantity * provide examples of where fractions are used.   [C, CN, PS, R, V]  *In support of the K-12 Mathematics goals of Number Sense, Spatial Sense, Mathematical Attitude and Logical Thinking.* | 1. Represent a fraction using concrete materials. 2. Identify a fraction based on a symbolically concrete representation (e.g., circles representing cookies) 3. Name and record the fraction for the included and not included parts of a set. 4. Name and record the fraction for the included and not included parts of a whole. 5. Represent a fraction pictorially by indicating parts of a set. 6. Represent a fraction pictorially by indicating parts of a whole. 7. Explain how the denominators of fractions can be used to compare two unit fractions with numerator of 1. 8. Order a set of fractions that have the same numerator and explain the ordering. 9. Order a set of fractions that have the same denominator and explain the ordering. 10. Identify which of the benchmarks 0, ½, or 1 is closer to a given fraction. 11. Name fractions between two benchmarks on a number line. 12. Order a set of fractions by placing them on a number line with given benchmarks. 13. Provide examples of when two identical fractions may not represent the same quantity (e.g., half of a large apple is not equivalent to half of a small apple, half of a group of ten cloudberries is not equivalent to half of a group of sixteen cloudberries). 14. Provide an example of a fraction that represents part of a set, a fraction that represents part of a whole, or a fraction that represents part of a length from everyday contexts. | | |
| **Learning Space:** [**Top**](#top) | | | |
| The students have only briefly been introduced to fractions in grade 3 as being part of a whole, and comparing fractions of the same whole with the same denominators. Thus, it is very important to have students reveal and discuss the intuitive understandings that they have about fractions. These understandings can then be challenged and/or developed upon. It is very important that the students see a connection between fractions and division into equal groups or equal sharing. If this connection is made from the start the relationship between fractions and decimals will be logical, if not obvious.  It is important that the students do a lot of hands-on concrete and pictorial modeling of fractions, recognizing fractions as a part of a whole, part of a set or group, and part of a number line. In each of these contexts, what is taken to be “the whole” should be varied so that students do not make assumptions based on the whole that might cause confusion for the students as they move into more complex contexts for fractions. For example, the number line should be of variable lengths, different fraction block shapes should be used as the whole, and different quantities for a group should be considered (8 students, 12 students, 20 students…).  Construction of a variety of representations of fractions helps students to understand that the relative size designated by a fraction is dependent upon the context. For example, ½ the elephants in the zoo is very different in quantity to ½ the grains of sand in the fish tank. Concrete and pictorial representations of fractions of the same whole, but divided into different numbers of parts (the denominator) are also key in developing the students’ ability to compare fractions of the same whole. The notion that a fraction is a “fraction of some set quantity” is crucial for the students to comprehend. For example, 2/3 is meaningless without an assumed whole or quantity, such as of the class or of one hour.  Benchmarks also play a crucial role in the students’ understanding of fractions. Often, benchmarks are thought of in terms of number lines, but students can define and use benchmarks within a whole or a group. Regularly comparing to benchmarks of 0, ½ and 1 helps students to compare the quantity related to particular fractions. The use of benchmarks also becomes useful in subsequent grades as the students learn about operations involving fractional parts.  It is important to not forget to have the students represent and write fractions for none of the parts of the whole or group as well as all of the parts of the group or whole. The students should also recognize, and represent symbolically that these two quantities are equal to 0 and 1 respectively. As well the students should be representing these fractions concretely, pictorially and on a number line.  Opportunities to relate contexts in terms of fractions will occur regularly in other subjects. The fraction of students that preferred one activity over another, the fraction of rocks collected that belong to a particular category, and the fraction of students who did the assigned reading. Moreover, there will be numerous opportunities throughout grade 4 mathematics to highlight fractions and fractional concepts such as in the students study of area or bar graphs.  As a final note, the students should be introduced to the terms “numerator” and “denominator” as they are getting used to talking about the role of the bottom number and the role of the top number in a fractional quantity, but it is not expected as part of this outcome that the students memorize these terms, nor should they be assessed on them. | | | |
| **What Students Should… [Top](#top)** | | | |
| **Know**   * the top number in a fraction can be called the numerator * the bottom number in a fraction can be called the denominator * that fractional parts are written using the format of * that fraction names can be read as numerator value ordinal denominator name “of the whole” e.g., is two thirds of the whole, or as numerator value “out of” denominator “equal parts of the whole” e.g.,  is two out of three equal parts of the whole. | | **Understand**   * the meaning of a particular fraction is dependent upon the context, .e.g., 1/3 of a group of elephants is quite different from 1/3 of the desks in a school, and this is different than 1/3 of a chocolate bar. * the denominator or bottom number in a fraction name identifies how many equal parts are present in the whole object or set being considered * the numerator or top number in a fraction name tells how many of the equal parts in the whole object or set being considered are of specific interest * for fractions less than or equal to one, the fraction name will never have a numerator value larger than the denominator value * fraction names that have the same numerator as the denominator represent the whole object or set and thus has a value of 1 * fraction names that have a numerator value of zero represent zero of the equal parts of the whole object or group and thus has a value of 0 * the fractions they are looking at represent a quantity greater than or equal to zero and less than or equal to one * fractions can be ordered according to quantity represented, just like whole numbers and decimals and that they have a designated position on a number line | **Be Able to Do**   * compare two fractions with a numerator of 1 * order fractions with the same numerator * order fractions with the same denominator * compare fractions to benchmarks values * place fractions on a number line with given benchmarks |

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| **Key Questions:** [**Top**](#top) |
| * What does a fraction tell you, or describe, about a given situation or context? * Why can a fraction represent a different “count” of objects in different situations? * What is meant by “a whole” when talking about fractions? Does it have to be what is typically thought of as “all” of the object or group of objects? * Where have you heard fractions being said and what did they tell you in those particular situations? * How much does a fraction with a top number (numerator) of 0 represent? Does the value of the bottom number (denominator) matter? *Note: grade 4s have not yet considered division by zero, so a point should be made of excluding a denominator of zero. This could be done by having the students briefly consider a whole or group being divided into zero pieces of groups of size zero. Students will easily realize that in terms of their number and spatial sense that this would be a case that could be left to another grade.* * How much does a fraction with the same top number and bottom number represent and why? *(See note above for the case of zero).* * How can you determine which of two fractions represents a larger quantity in a particular situation. * Is it possible for two different fractions to equal the same quantity? *Note: the intent of this question is to engage the students in really thinking about what the fractions represent. It is not intended to lead to the determining of equivalent fractions as that concept occurs in grade 5.* |

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| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**  Fractions as signifying quantity.  **Suggestions for assessment tasks:**   1. Ask the students to explain whether fractions are numbers (represent a quantity) or not. 2. Ask the students to represent a fraction of 5/8 as: 3. part of a whole or region 4. part of a group or set 5. part of length 6. part of an area   and in each case explain their reasoning. Also ask the students how else they could represent a fraction, and what the fraction represents.   1. Give the students pattern blocks and ask them to select pattern blocks to demonstrate a particular fraction such as 1/3. When the students have represented 1/3, ask them to identify what 1 would look like and explain why. Next, suggest a different pattern block to represent 1 and ask the student if their representation is still of 1/3 and to explain their reasoning. 2. Ask the students to write a fraction that represents the smallest quantity of a whole divided into five parts. 3. Ask the students to write a fraction that represents the largest quantity of a whole divided into five parts. 4. Ask the students to match fractions with different representations (on cards, or pre-built). Include in the sets fractions that represent 0 and fractions that represent 1. 5. Given a fraction in context, explain what that fraction tells about the quantity involved.   **What to look for:**   * See [*Fractions as Quantity Checklist and Anecdotal Record Sheet*](file:///C:\Users\ru593\AppData\Local\Temp\Fractions%20as%20Quantity%20Checklist%20and%20Anecdotal%20Record%20Sheet.doc)*.* * See [*Fractions as Quantity Rubric*](file:///C:\Users\ru593\AppData\Local\Temp\Fractions%20as%20Quantity%20Rubric.doc)*.*   **Big Idea:**  Comparing fractions.  **Suggestions for assessment tasks:**   1. Give the students two fractions within the same context and ask them to identify which fraction they would want to be given and explain the reasoning. 2. Ask the students to identify errors made on a given number line showing two or more fractions between zero and one. 3. Give the students a set of fractions in different forms of representation (concrete, pictorial, and symbolic) and ask them to order the fractions from least to greatest.   **What to look for:**   * See [*Comparing Fractions Rubric*](file:///C:\Users\ru593\AppData\Local\Temp\Comparing%20Fractions%20Rubric.doc)*.* |

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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**  Fractions as signifying quantity.  **Suggestions for instructional activities:**   1. It is important to first determine what understandings, misunderstandings, and intuitive ideas students have with respect to fractions. Teachers can begin the exploration of fractions by asking students for examples of fractions they have heard of and how they interpret the meaning of those fractions. To prepare the students for this task, they can be given a homework assignment in which they need to ask parents, siblings, neighbors and others to give the students examples of situations where they encounter fractions. In many cases, the people asked may give an interpretation of the fraction, but it is not a necessary part of the task because the goal is to find out the students interpretation and understanding of fractions. Have a class discussion about the fractions they discovered and what the students feel the fractions mean. If the students have not already generated the notation of , introduce it to them and explain how fraction names are read. For example, 2/3 is read “two out of three” as well as “two-thirds”. Ask the students to explain how all the ways of naming the fractions explain what the fraction represents. 2. Once the students have an idea of what the words and the fractions are about it is important for them to gain a deeper understanding of what fractions actually tell us. Give the class a fraction such as ¾ and ask the students to find a way to create or illustrate this quantity. For example, they might go with the traditional ¾ of a pizza, ¾ of an hour, or ¾ of their friends. The students’ task is to find a way to communicate what that looks like. Have the students share their representations and contexts. Discuss what all of the representations have in common, including the same number of pieces or group members overall, and the same number of pieces being highlighted or selected. Have the students write a summary of how the symbolic representation of the fraction is related to the overall number of pieces and/or group members as well as the number of pieces been highlighted or selected. As a wrap-up of the activity, provide the students with a strip of paper (lengths can be variable) and ask them to determine at least one way to show ¾ of the strip of paper. As a homework assignment, asked the students to generalize what they did in order to be able to place fractions on a number line showing zero and one. 3. Have the students look for examples of where fractions could be used in different types of contexts such as: part of a group, part of whole, part of length, and part of an area. Have the students explore different ways of representing those fractions. Encourage the students to select groups, wholes, lengths, and areas they normally wouldn’t consider. For example, the black irregular hexagon in the fraction blocks as the whole or two cartons of eggs as a set. |
| **Big Idea:**  Comparing fractions.  **Suggestions for instructional activities:**   1. The students homework assignment from suggestion 2 in the previous big idea can be used to be introduced the next exploration of the fractions – that of ordering the fractions. Have the students share their work showing ¾ on the number line. Next, ask the students where they would place ½ on that same number line. Provide the students with a time and opportunity to play with this question and then discuss their conclusions and reasoning. Continue on by asking the students to place additional fractions on the number line. Encourage the students to describe the fraction’s position in a variety of ways such as: it is between ½ and ¼ or it is greater than ¼ but less than ½ (note: students have not been introduced to the formal symbolic notation > and<). 2. Once the students have strategies for ordering and comparing fractions using different models and representations, have them next explore the more specific cases of ordering fractions with the same denominator and ordering fractions that have the same numerator. Have the students hypothesize what they believe to be the relationships in each case and provide their reasoning for the hypothesis. Next, have the students create an inquiry through which they hope to verify their hypothesis. When the students have completed their inquiry, have them share the results with the class and as a class generalize the patterns and rules they have discovered. 3. As a homework assignment, ask the students what they think the smallest fraction of a quantity is possible. Have the students share their ideas and conclusions. Through guiding questions, have the students explore zero as a fraction. Ask the students where they would place on a number line. The same homework assignment could have students also contemplate the largest fraction of a quantity possible. Similar discussions could then be had about writing the whole as a fraction and where that fraction belongs on the number line. |