**Lesson Planning 6.RP.A.1 Defining and Writing Ratios**

*(This lesson should be adapted, including instructional time, to meet the needs of your students.)*

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| **Background Information** | |
| **Content/Grade Level** | Ratios and Proportional Relationships/Grade 6 |
| **Unit/Cluster** | Understand ratio concepts and use ratio reasoning to solve problems. |
| **Lesson Topic** | Defining and Writing Ratios |
| **Essential Questions/Enduring Understandings Addressed in the Lesson** | **Essential Questions**   * What is the connection between a ratio and a fraction? * How are ratios used in the real world? * How is a ratio or rate used to compare two quantities or values?   **Enduring Understandings**   * Knowledge of a ratio is not always a comparison of part-to-whole; can be part-to-part or whole-to-whole. * Knowledge of the difference between a ratio and a fraction. |
| **FOCUS** | **6.RP.A.1:** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. **(Major** **Standard)**  It is critical that the Standards for Mathematical Practices are incorporated in ALL lesson activities throughout the unit as appropriate. It is not the expectation that all eight Mathematical Practices will be evident in every lesson. The Standards for Mathematical Practices make an excellent framework on which to plan your instruction. Look for the infusion of the Mathematical Practices throughout this unit. |
| **COHERENCE** | **Across-Grade Coherence: Content Knowledge from Earlier Grades**  **3.NF.A.1:** Understand a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a*/*b* as the quantity formed by *a* parts of size 1/*b*.  **Within-Grade Coherence: Content from other Standards in the Same Grade that Provide Reinforcement**  **6.EE.C.9:**  Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.  Note: Students’ work with ratios and proportional relationships **(6.RP)** can be combined with their work in representing quantitative relationships in real world problems that change in relationship to one another. Formal use of proportions will be covered in grade 7. |
| **RIGOR** | **Procedural Skill**  As students practice writing ratios while working real world problems, they apply their knowledge of whole numbers and the significance of order in a ratio.  **Conceptual Skill**  Students develop the meaning of part-to-part, part-to-whole, and whole-to-part relationships when writing ratios.  **Modeling/Application**  Students develop an understanding of ratios as they use rainbow cubes and balls to understand ratios. |
| **Student Outcomes** | **Students will:**   * Know three ways to write a ratio, 9:10, 9 to 10, * Develop a definition of ratio * Use ratio language to describe a relationship between two quantities * Express ratios as part-to-part relationships * Express ratios as part-to-whole relationships   **Common Misconceptions by students:**   * Fractions and ratios are the same. A ratio is just another name for a fraction. * Students may not see ratios as a comparison of two amounts. They will likely focus on just one quantity. * The transition for these students will be in that they need to take into account two quantities when applying ratio reasoning. * Students may want to use additive properties when reasoning with ratios. However, equivalency and reasoning with ratios must include multiplicative properties. * 2 wins to 3 losses is NOT the same as 3 losses to 2 wins (not equal to ). |
| **Method for Determining Student Readiness for the Lesson** | Use warm-up to determine student understanding of fractional part to whole relationship. |

| **Learning Experience** | | |
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| ***Component*** | ***Details*** | ***Which Standards for Mathematical Practice does this component address?*** |
| ***Warm Up/Drill*** | Students will individually complete numbers 1 – 5 and will then review the answers to compare and contrast the various answers.  1. Which is another way of expressing?   1. + + + 2. + 3. 1 4. All of the above   2. Model answer choice A by shading the fraction bars below.   |  |  |  | | --- | --- | --- | |  |  |  |  |  |  |  | | --- | --- | --- | |  |  |  |  |  |  |  | | --- | --- | --- | |  |  |  |  |  |  |  | | --- | --- | --- | |  |  |  |   3. How would your model look different if you shaded a model for answer choice B?  4. What is the value for the shaded part of the fraction bars  below?   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  |   Answer: + = or 1  5. What are all the possible ways of expressing the model given in #3? |  |
| ***Motivation*** | Note to Teacher: Give students a picture of an assortment of sports balls (see sample below). **(Attachment 1)**          Given the values 2, 5, 7, and 14, discuss how these values are represented by the balls in the picture. Prior to teaching the lesson, make sure students understand, when comparing objects mathematically the word ***to*** is used. |  |
| ***Activity 1***  UDL Components   * Multiple Means of Representation * Multiple Means for Action and Expression * Multiple Means for Engagement   Key Questions  Formative Assessment  Summary | UDL Components:   * Principle I: Representation is present in the activity. Prior knowledge about fractions is activated through the tasks and visual diagrams and pictures of balls in the Warm-up and Motivation. This technique sets the stage for new learning about ratios. In addition, the colors of the rainbow cubes emphasize various comparisons among ratios. * Principle II: Expression is present in the activity. It encourages students to stop and think before choosing the correct category, and the activity prompts students to categorize. * Principle III: Engagement is present in the activity. Students work with a partner or in a small collaborative group to engage in this task. Students are given immediate feedback, which is aimed at supporting them in their progress in a timely and understandable manner.   Directions:   |  |  | | --- | --- | |  |  | |  |  |  |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  |  * Display the above models and ask students to write the fraction of the shaded region. Then ask them to describe what the numerator and denominator represent. * Discuss with students that a fraction represents a part-to-whole relationship.   Divide class into pairs or small groups; Give each group a scoop of rainbow cubes.   * Use the cubes to write fractions that compare each color to the total cubes. (Examples: red to total; blue to total; etc.; all comparing color/part to total/whole.) Use labels when writing these fractions. Students should understand terminology: “part-to-whole.” * How many red cubes do you have? Have many yellow cubes do you have? Compare red cubes to yellow cubes by writing a fraction? (This is a part to part relationship, which we will refer to below.) * With your partner, continue to write other ratios with the rainbow cubes. (Students should include part-to-part and part-to-whole.) * Define ratio (a comparison of two quantities or measures) & the 3 ways to write it. (Example:, 2:3, 2 to 3).   (SMP#1, #4)  Practice writing ratios, including part-to-part and part-to-whole and use of all 3 methods to write a ratio (Example: , 2:3, 2 to 3). Practice using ratio language. Ask students to write ratios using objects in the classroom. Sample responses could include, but are not limited to:   * Males to females * Chairs to desks (Note: This may be a 1:1 relationship)   Group students and have each student (1) share their ratios and (2) explain the type of relationship represented in those ratios. Students should be able to defend their thinking.  (SMP #6, #7)  Formative Assessment  Using **(Attachment 1)**  ask the students to write down 2 part- to-part examples and 2 part-to-whole examples and label them in 3 different ways. | Students make sense of problems and persevere in solving them as they see relationships between various representations using the rainbow cubes.  (SMP #1)  Students model ratios based upon various objects with similar classifications.  (SMP#4)  Students give attend to precision as they write the ratios for each problem.  (SMP#6)  Students look for and make use structure by recognizing the patterns associated with ratios.  (SMP#7) |
| ***Activity 2***  UDL Components   * Multiple Means of Representation * Multiple Means for Action and Expression * Multiple Means for Engagement   Key Questions  Formative Assessment  Summary | UDL Components:   * Principle I: Representation is present in the activity. This activity presents students with an explicit opportunity for the significance of the order in which ratios are written. * Principle II: Expression is present in the activity. This task encourages students to stop and think before choosing the correct category and prompts them to think of the correct order of a ratio. * Principle III: Engagement is present in the activity. This activity allows for active student participation, exploration, and experimentation. The activity is designed so that outcomes are authentic and can be personalized to the students’ lives.   **Part A**  Directions:   * Hand out the Bird Ratio **(Attachment 2)**. * Divide students into groups of 2-3 and have them discuss what they notice and wonder about the provided ratio given the image in each box. * In whole-group, discuss the observations and highlight the importance of the order in which the ratio is written.   (SMP #1, #2)  **Part B**  Directions:  On a 10-question quiz a student answered 8 questions correctly. What is the ratio of the number of questions answered correctly to the total number questions? Allen says the answer is 10 to 8. Is he correct? Justify your answer.  (SMP #6, #7) | Students make sense of the problems and persevere in solving them as they see relationships between various ratios in a problem.  (SMP#1)  Students learn to reason abstractly and quantitatively as they make sense of the different quantities and their relationships in these problems.  (SMP#2)  Students attend to precision as they calculate efficiently and accurately in each given situation.  (SMP#6)  Students look for and make use structure by recognizing the patterns associated with ratios.  (SMP#7) |
| ***Closure*** | On a note card, draw any given ratio and provide the three ways to representation the value. |  |

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| **Supporting Information** | |
| Interventions/Enrichments   * Students with Disabilities/Struggling Learners * ELL * Enrichment/Gifted and Talented | **Students with Disabilities/Struggling Learners:**   * Students need an understanding of the language of fractions. Numerator and Denominator * Be sure these students work with concrete things as they are learning about ratios.   **ELL:**   * Students need an understanding of the vocabulary of fractions. * Be sure these students work with concrete things as they are learning about ratios.   **Gifted and Talented:**   * The students could develop a station for the class to review ratios. |
| Materials | Rainbow Cubes, Picture of assortment of sports balls |
| Technology | Optional: Interactive white board |
| Resources | * “Teaching Student Centered Mathematics; Grades 5-8” by Van de Walle * “Developing Essential Understanding of Ratios, Proportions, & Proportional Reasoning” by NCTM * “Good Questions for Math Teaching; Why Ask Them and What to Ask; Grades 5-8” by Lainie Schuster and Nancy Canavan Anderson * NCTM Ratio, Proportions & Proportional Reasoning * Progressions document 6-7,Ratios and Proportional Relationships |



Attachment 1

   

  

Attachment 2 – Part A “Bird Sheet”

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