**If You Hopped Like a Frog**

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| Students explore characteristics of animals while gaining practice with comparing and reasoning multiplicatively through measurement. |

**NC Mathematics Standards:**

**Operations and Algebraic Thinking**

**NC.4.OA.1** Interpret a multiplication equation as a comparison. Multiply or divide to solve word problems involving multiplicative comparisons using models and equations with a symbol for the unknown number. Distinguish multiplicative comparison from additive comparison.

**Additional/Supporting Standards:**

**NC.4.MD.1** Know relative sizes of measurement units. Solve problems involving metric measurement.

* Measure to solve problems involving metric units: centimeter, meter, gram, kilogram, Liter, milliliter.
* Add, subtract, multiply, and divide to solve one-step word problems involving whole-number measurements of length, mass, and capacity that are given in metric units.

**NC.4.MD.2** Use multiplicative reasoning to convert metric measurements from a larger unit to a smaller unit using place value understanding, two-column tables, and length models.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Use appropriate tools strategically
4. Attend to precision

**Student Outcomes:**

* I can explain how a multiplication equation can be used to compare.
* I can measure to solve problems involving metric units.
* I can multiply to solve problems involving whole number measures of length in metric units.

**Math Language:**

* multiply
* compare
* times as much/times as far
* equation
* measurement units such as centimeters and inches

**Materials:**

* Book: If You Hopped Like a Frog or If Dogs Were Dinosaurs by David M. Schwartz
* If You Hopped Like a Frog handout
* measuring tapes or meter sicks
* pencils
* large white paper/poster board
* coloring materials such as crayons, markers, or colored pencils
* calculators

**Advance Preparation:**

* Have pictures of each animal available for students to reference when creating visual representations.
* Teacher should read the notes from the author in the back of the book about each of the animals being discussed for background information.
* Obtain a copy of the book If You Hopped Like a Frog or If Dogs Were Dinosaurs.
* Have an example of a finished product for students to see.

**Launch:**

1. Read and Introduce (10-15 minutes)

Tell students you will be reading the book, If You Hopped Like a Frog, which tells some amazing animal facts. Allow students a moment to turn and talk about one amazing animal fact that they know. Read the book aloud to students and discuss the amazing feats of each animal. List the following amazing animal facts on the board that appeared in If You Hopped Like a Frog.

* A frog can hop 20 times the length of its body.
* A snake can eat something twice as wide as its head.
* Fleas can jump 70 times their own height.
* A spider can move 33 times the length of its own body in 1 second.

**Explore:**

1. Measure and Create (range of estimated time)

Instruct students that their job is to relate each animal fact listed on the board to themselves and create a poster/representation of their findings.

Have students work in pairs to take height measurements of one another, as well as the width of their heads from ear to ear. Depending on the time of year that your class is completing this lesson, measurements can be taken in centimeters (to incorporate metric measurement from the fourth grade MD standards) or inches (to review customary measurement from third grade). Have students record their measurements to the nearest centimeter (or inch). Students will then work to relate their measurements to the ones you have posted on the board by using multiplicative comparison.

* Example: If I were a frog, I could jump 3302 cm/1300 in.

165cm (student height) x 20 (frogs can hop 20 times their body length) = 3302cm

Students will record their measurements and comparisons on the If You Hopped Like a Frog handout. Encourage students to show each comparison using a model and an equation.

Once students have completed all of the multiplicative comparisons and related their own measurements to the animal feats, they should be given a large sheet of paper in which to represent their comparisons (see examples). Encourage students to create exaggerated and humorous illustrations to accompany their findings in the spirit of Schwartz’s book, If You Hopped Like a Frog. Students should include written text and calculations explaining their work along with their illustrations.

**Discuss:**

1. Presentations and Debriefing (range of estimated time)

Allow students time to share their work with the class and discuss their mathematical comparisons. Have select students share the strategies that were used to come up with their comparisons.

Be selective in choosing students to share. The discussion should focus on why a multiplication equation is used for each of these comparisons (ex. 20 x 36 inches = 720 inches (length of hop). Relate the multiplication equations to models such as tables, bar/tape diagrams, pictures, and manipulative representations. Be sure students can explain what each part of the equation represents. You may also want to compare an additive comparison strategy (7 + 7 + 7 = 21) to a multiplicative comparison strategy (3 x 7 = 21) and discuss how they relate to one another.

Close the lesson by reviewing the learning target: I can explain how a multiplication equation can be used to compare. Have students explain what they have learned and why a multiplication equation can be used to represent and solve each comparison.

**Evaluation of Student Understanding**

**Informal Evaluation:**

* Observe the strategies students use to determine each comparison. Monitor students for accuracy as they relate their measurements to the animal facts.

**Formal Evaluation/Exit Ticket:**

* Pose the following problem to students: An ant can lift 50 times its own weight. If Joey, who weighs 85 pounds, was as strong as an ant, how much would he be able to lift?

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

**Interventions:**

* Provide students with smaller numbers that can easily be modeled. For example: A caterpillar is 7 cm long. If a caterpillar could hop 20 times its body length like a frog, how far could it hop?
* Encourage students to use a bar/tape diagram or table in order to model each comparison.

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| Length of caterpillar | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Length of hop | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

**Extensions:**

* Allow students to research other amazing animal facts and find mathematical comparisons between themselves and the animal facts that they find.
* Have students convert their measurements from centimeters to another metric unit.
* Challenge students with problems involving fractions. For example: If you are 4 ½ feet tall and you could hop 20 times your body length like a frog, how far could you jump? (90 feet)

**Possible Misconceptions/Suggestions:**

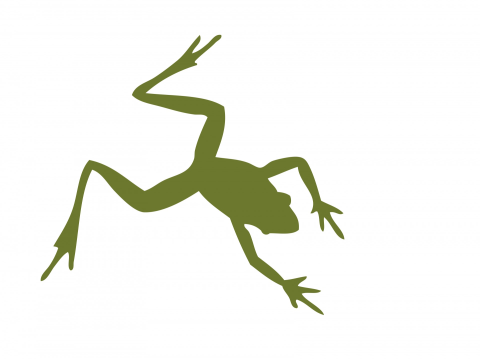
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| **Possible Misconceptions** | **Suggestions** |
| * Uses an addition equation to represent each multiplicative comparison. * Uses a correct multiplication equation to represent the multiplicative comparison, but is unable to correctly solve the equation. | * Encourage students to make a model of the comparisons with manipulatives or drawings (snap cubes, bar/tape diagram, table) and relate the model to multiplication. * Instruct students to use a calculator to solve the problem. |

**Special Notes:**

* You may use either book (If You Hopped Like a Frog or If Dogs Were Dinosaurs) for this activity. Both involve comparisons and interesting facts. You may still use this lesson even if you are not able to obtain the books. Present interesting animal facts and pictures to students in order to promote interest in the lesson.

**Possible Solutions:**

Solutions will vary based on students’ measurements.

**If You Hopped Like a Frog**

A frog can hop 20 times the length of its body.

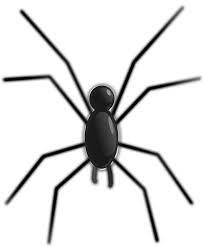
My Height Measurement:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If I could hop like a frog, I could hop \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Fleas can jump 70 times their own height.

My Height Measurement:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

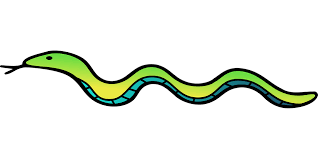
If I could jump like a flea, I could jump \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



A spider can move 33 times the length of its own body in 1 second.

My Height Measurement:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If I could move like a spider, I could move \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in 1 second.



A snake can eat something twice as wide as its head.

My Head Measurement:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If I could eat like a snake, I could eat something \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ long.