The Foot Book, Grades K-3

Key Concepts:
Science: Nature of Science
Math: Measurement and Data
Objectives:

The students will be able to (TSWBAT) record and communicate observations orally, in writing, and in graphic organizers (Writing W.2.7).

TSWBAT ask questions, make observations, and gather information from scientific investigation (K-2-ETS1-1)

TSWBAT estimate and measure length using standard and non-standard measurement units (Measurement and Data 2.MD.1, 2.MD.3, 3.MD.4).

TSWBAT describe measurable attributes of objects, such as length. TSWBAT describe several measurable attributes of a single object (Measurement and Data K.MD.1).

TSWBAT order objects in order by length (Measurement and Data 1.MD.1, 2.MD.4).

TSWBAT reason abstractly and quantitatively and solve one- and two-step "how many more" and "how many less" problems (Mathematical Practice MP.2, Measurement and Data 3.MD.3).

Inquiry Activity Materials:
Each student/student group should have:

- paper (construction, copy, card stock, etc.)
- metric ruler
- scissors
- science log, notebook, foldable (some place for students to record data)

Engage: The students should have a background knowledge of how to count. Show and read to the students Dr. Seuss's *The Foot Book*, or present each student with a printed copy of the text of the book (see attachment). Ask students using a method of selection (random, name sticks, etc.), "How big is your foot?" "How do you know how big your foot is?" Students may answer with shoe sizes, holding hands out with specific space between each. Some students may ask for a ruler.

Explore: Students will trace their foot on paper (construction, copy, card stock, etc.) and cut out their foot. Some students may need assistance with this activity. Provide students a list of objects in the room for them to measure with their traced foot (see attached handout "How Many Feet?"). Some students might fold their foot in half or fourths if the foot does not measure the object exactly. Guide them to use fractions/decimals when writing their measurements. Allow students 5-10 minutes to measure the objects and record their data on the worksheet.

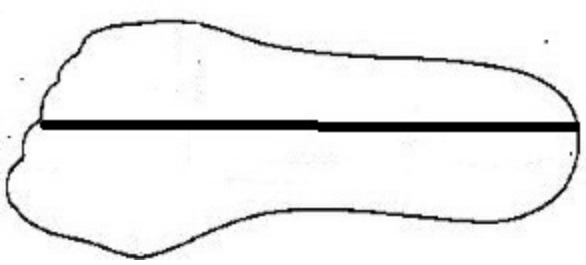
Explain: Ask a random student to provide the answer to the first object measured. Survey the whole class using a method similar to "thumbs up/thumbs down" if they agree with the answer given. Place the students in small groups of 2-3, and have them share their data with each other (about 1 min.). Bring the students' attention back to the whole class and ask students what they learned from communicating within their small groups. Create a chart on the board that displays

the object measured and its measurements.

Object Measured	Foot Measurements

Students answers should show that different numbers of feet measured the same thing. Ask students using a method of selection (random, name sticks, etc.) “How could they have come up with different measurements for the same thing, when they all used a “foot”? Guide the students to measure the objects using a standard measuring device.

Elaborate: Students will use a standard ruler to draw a line down the middle of their foot, running length wise. Students will then place marks on the line at every inch (see drawing below).



Have students predict how many inches long they think the object is and write this number in the corresponding column on their worksheet. Allow students to work in pairs as they hypothesize their answers. Have students record this second set of data on the worksheet. Again, in small groups of 2-3, have students share their data with each other (about 1 min.). Bring the students’ attention back to the whole class and ask students what they learned from communicating within their small groups. Add a third column to the chart on the board to display the second measurement.

Object Measured	Foot Measurements	Measurements in Inches.

Ask students using a method of selection (random, name sticks, etc.) how the measurements tools were similar. Guide the students to be specific when they use opinionated terms. Ask the students Why? Do you agree? Can you elaborate? Tell me more. Can you give an example? For example, easier needs elaboration - they foot with inches gave specific measurements or the foot without inches was similar to rounding. Next, students will write their answers to the analysis questions.

Evaluate: The answers to the analysis questions should be similar to the following answers:

1. Complete the Venn Diagram to compare and contrast the two measurement types. (table used for simplicity)

Foot Measurements only	Commonalities	Measurements in inches only
estimated measurement measured in “feet” not the same measurement found by all students	used numbers	specific measurement measured in “inches” same measurement found by most students

2. When talking about how big things are with someone else, why is know its measurement a good idea? *Answers may vary. Errors in communication will be minimal if everyone is on the*

same page.

3. Provide an example for your answer to #2. *Answers may vary. shoe shopping, clothes shopping, school supplies, TVs, etc.*

4. Place the objects in order from shortest to longest.

5. Write a word problem that asks for a comparison of the lengths of two different objects. (grade 3 only) *Answers will vary.*

Extensions:

Nature of Science:

- For older students, have them write an analysis paragraph from their Venn Diagram. Score the paragraph using a rubric that indicates the components of a well-written paragraph.
- Create a Foot Book where the students will record their data. Both feet will need to be traced so that the front and back covers match. Cut out a pattern of a shoe/bottom of a shoe/foot to represent the front and back covers. Paint the bottoms of the students' feet and stamp them on paper for the front and back covers. Students can label their left and right feet. Another possibility is to have the front cover could be top of the shoe, and the back cover could be the bottom of the shoe.
- There are 27 pages in the book. Ask older students to determine the average number of times the word "foot" appears on each page? They should create a T-chart to organize the page number and total number of "foot" words.

Measurement/Graphing

- Graph the students' shoes according to characteristics (background color, brand, style, etc.). As a whole class, decide what characteristic the students will observe. Students
- Have students measure different animal tracks. Animal prints can be teacher-provided (printed and measured by hand) or students can research actual size. Students can organize data in a table and graph the data. Have the students order the sizes of the prints (i.e., smallest to largest) in their graph.

Environmental Science:

- Introduce idea of carbon footprint. A great website is Zero Footprint Calculator (http://calc.zerofootprint.net/youth/).

Math (problem solving)

- Have students write a story problem pertaining to the book. They should include the solution and strategy used to solve the problem in complete sentences.
- Possible math problem questions:
    1. How many inches in a foot?
    2. How long is your foot, measured in inches (estimated and actual)?
    3. What is the total length of both of your feet?
    4. What percent of the words in the book is "foot"?
    5. What is the ratio of the word "foot" to the total words?
    6. If each "foot" has 4 toes, how many toes are there?
    7. Paint with the kids' feet and create your own Foot Book.
    8. Count the number of feet in your class, then recount by 2s.
    9. Graph shoes according to characteristics.
    10. Make a pattern with the kids' shoes.
    11. Knowledge of left and right (twister)
    12. Animal tracks
    13. Measure things around the house with foot
    14. Create a ruler from own footprint
    15. Introduce idea of carbon footprint

The Five Hundred Hats of Bartholomew Cubbins, Grades 1-6

Key Concepts:

Science: Nature of Science, Physical Science (motion and forces)

Math: Ratios and Proportional Relationships, Expressions and Equations

Objectives:

The students will be able to (TSWBAT) conduct investigations using ratio and rate reasoning to calculate the change in speed (Ratios and Proportional Relationships 6.RP.3.b, Forces and Interactions 3-PS2-2, Energy 4-PS3-1).

TSWBAT 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 (Expressions and Equations 6.EE.9).

TSWBAT estimate and measure length, mass, and elapsed time using International System of Units (SI) (Measurement and Data 1.MD.C.4).

TSWBAT communicate observations orally, in writing and in graphic organizers: T-charts and line graphs (Writing W.2.7).

Inquiry Activity Materials:

Each student group should have:

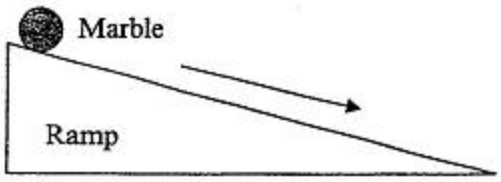
- ramp (ruler with ridge, rubber tubing, etc.)
- marble
- meter stick/metric tape to measure 1 meter
- stopwatch
- 4 textbooks
- log, notebook, foldable (some place for students to record data)

Engage: Students should have an understanding that ratios compare two things. Show and read to the students Dr. Seuss's *The Five Hundred Hats of Bartholomew Cubbins*, or present each student with a printed copy of the text of the book. Ask the students to imagine the king's carriage rolling down the mountain road to visit the different villages mentioned in the book, and determine what would happen if the carriage hit one of the fruit vendors on the side of the road (the vendor's cart would fall over/move). Ask the students Think-Pair-Share with a partner about how the height of the mountain (slope of the road) would affect how far the vendor's cart would move. Write the students brainstorming responses on the board for all students to see.

Explore: Students should identify the independent and dependent variables. The following are different levels of inquiry the class can conduct:

Structured: Student groups of 2-3 can investigate how the height of a ramp made from a ruler (with a ridge down the middle) affects the speed a marble rolls 1 meter from the top of the ramp. Rubber tubing or a water hose could be used in place of the ruler ramp. Have students follow a procedure for the setting up the apparatus - as seen below. Students will use a stop watch to record the time it takes for the marble to reach the 1 meter mark. Students will add 1 book at a

time to reach 4 books tall. Students will record the data in a T-chart: number of books/time.



Guided: Give the students the problem question and the materials needed to solved the problem, but do not provide them instructions on how to set up the apparatus. In Guided Inquiry, students should not only determine the outcome, but also how to solve the problem.

Open: After the Think-Pair-Share, students should discuss with their partner(s) a problem to solve. Open Inquiry requires the teacher to be prepared for a variety of investigative problems. An idea to meet this challenge is to have the students provide the a materials list several days before the day of investigation. The teacher can approve or deny the materials or request students bring certain materials the need for the lab. Guide students to investigative questions that test one variable. Students might investigate:

- how height of a ramp affects the time a marble takes to travel a distance
- how height of a ramp affects the distance a marble makes a cup move
- how different surface types affect time a marble takes to travel a distance
- how different surface types affect distance a marble makes a cup move

While students are investigating the problem, they should record their data in a T-chart.

Explain: Provide the students a large piece of paper, such as poster board, and have the group write and draw a summary of the lab report. Students should include the investigated problem, (materials used, drawing of their apparatus if guided/open format), data in table, analysis of data. Groups should select a speaker to share the data with another group. Inform students that even though a speaker was chosen to present the data, all students must be able to discuss the findings of the other group's data as well as their own. Students groups that investigated different problems can be grouped together. Each group shares the data and findings with each other; this will take about 3-5 minutes. While the students are with their partnered group ask students using a method of selection (random, name sticks, etc.), to share the results of the explorations. Students should be able to explain how they collected the data and the analysis developed from the data (ratio).

Elaborate: The students should use the data to determine the ratio in their analysis. For example, the ratio for the number of books to the time it took for the marble to travel 1 meter is 1:5 for one book the marble took 5 seconds to travel 1 meter. Write the answer in all three ratio methods (words, fractions, odds). Inform the students how to reduce ratios if needed. Students will determine the speed and discuss the relationship between distance and time.

Evaluate: Ask students the predict answers to the following questions.

1. Write the following as ratios: an inch to a foot, a centimeter to a meter. (1:12)
2. Determine the girl to boy ratio for the class. (answers will vary)
3. Write the answer to question #2 in all three ratio methods (words, fractions, odds). (girls to boys, girls/boys, girls:boys).
4. Bartholomew wanted to know if adding more weight to the king's carriage would affect how fast it went down the mountain. Design an investigation to test this problem. Include materials, procedure, and how to collect the data. (students can perform this investigation)

Extensions:

Physical Science:

- Have students calculate speed of standard walking, speed walking, walking backwards, and skipping. Older students can calculate the rate of acceleration.

- This detailed lab can have a scientific approach by talking about forces and friction: Does the type of surface affect the acceleration of a toy car down a ramp?

Counting:

- Students can count to 500 by ones, twos, fives, and tens.

Ratios and Proportional Relationships:

- Students can write and solve each other's ratio problems.
- Use ratios to compare the following: number of people who wore jackets/didn't wear jackets, cars/trucks that drive by the school, number of pencils/pens in a student's pencil bag, etc.

Graphing:

- Each student can bring a hat to class. Graph the types of hats, base color of the hats, hats with a bill, etc.
- Count to 500 by ones, twos, fives, and tens.
- Create math problems to see which combinations make 500.
- Bring a collection of hats to graph.
- Using tally marks, count the number of: girls in your class, cars that go by the school, pencils in your class, etc.

Horton Hears a Who

Key Concepts:

Science: Nature of Science, Physical Science (sound)

Objectives:

TSWBAT generate and compare multiple solutions that use patterns to transfer information (4-PS4-3)

TSWBAT apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (4-PS3-4)

TSWBAT generate a pattern that follows a given rule and identify apparent features of the pattern that were not explicit in the rule itself. (CCSS. Math. Content. 4.OA.C.5)

TSWBAT recognize and generate equivalent fractions (CCSS.Math.Content.4NF.A.1)

TSWBAT justify conclusions by using a visual fraction model (CCSS. Math.Content.4.NF.A.2)

TSWBAT made a line plot to display a data set. (CCSS.Math.Content.4.MD.B.4 and 5.MD.B.2)

Inquiry Activity 1 Materials:

Musical PVC Pipes

Note	Length (inches)
F	9.77
G	8.71
A	7.76
B flat	7.32
C	6.52
D	5.81
E	5.18
F	4.89
G	4.35

A	3.88
B flat	3.66
C	3.26
D	2.91
E	2.59
F	2.44

Engage: Read the book “Horton Hears A Who” to the students before beginning the lesson. Ask questions to start the lesson such as: When you hear a very small sound, what do you do to help you hear it? Why do you think this works? Make a voice for your partner that sounds like you think a Who would sound. Now make a voice like Horton would sound. How do these differ? Today we are going to see what factors can change the sounds we make.

Explore: Musical PVC Pipes

Allow students to play with the pipes by banging the end against the palm of their hand. The pipe does not have to be hit by the palm with much force to create the sound. Let students perfect their method of making the sound and try out each tube. Ask questions about the sounds. Is there are pattern? What is the relationship between length of the tube and pitch of the sound?

Explain: Discuss with students any differences in sound they noticed during the exploration. Students should have discovered that the longer pipes give lower notes and shorter pipes make higher-pitched notes. The air inside the pipe vibrates and the longer it has to vibrate, the slower it will vibrate which leads to a lower note. Ask them to predict what sound various lengths of pipe would have. How about different widths? Perhaps have a pipe of a different width for them to try. Why does the pitch change?

Elaborate: Have students practice making music with the pipes.

Twinkle, Twinkle Little Star- play the melody and harmony lines in unison. Bottom and top notes go together!

Melody	F	F	C	C	D	D	C	B flat	B flat
Harmony	C	C	A	A	B flat	B flat	A	G	G

Melody	A	A	G	G	F	
Harmony	F	F	E	E	C	

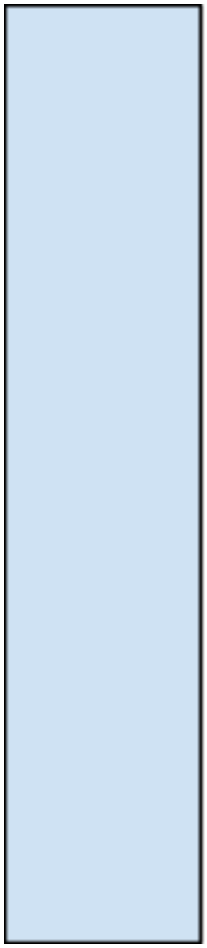
Melody	C	C	B flat	B flat	A	A	G	(repeat this line)
Harmony	A	A	G	G	F	F	C	(repeat this line)

Repeat 1st line.

Evaluate: Provide students with the sheet below as an evaluation piece.

Inside each drawing, tell the pitch of the note (high or low) that pipe would have.

Also write WHY you chose high or low.



Inquiry Activity 2 Materials:

Craft Pom poms (1 inch size is best)

Fraction Box Handout

Graphing Handout

Markers, Colored Pencils, or Crayons

Engage:

The story *Horton Hears a Who* has made clovers very popular. You work for a company that is packing clovers to send all over the country so everyone can enjoy their beauty. You want to keep up with the different 'clover' you box and send out. Since you will be packing them in boxes, you need to know how many clovers you have and how many boxes you will need to send out your clovers to other classrooms in the country.

Explore:

Students have the fractions handout and put a 'clover' in each section of a box. Not all boxes will be full. The students then determine the fraction of the box that is not full. This can be practiced several times by just finding the fraction for a certain color instead of a fraction for the entire pile of 'clover'. Students use markers, crayons, or colored pencils that correspond with the color of the 'clover' to show their answers. They also need to show simplification of the fraction.

Explain:

Check for understanding and go over possible answers. Have one student group share their work with another group. They should compare and contrast their results based on the different number of pom poms they have.

Elaborate:

Students count their 'clovers'. At this point, have students separate the 'clovers' by color and arrange them in a graph. Depending on the skills of your students, they might arrange them in a bar graph, then collect that data set to create a data chart, then make a line graph or pie chart. This shows that data can be shown in multiple ways.

Evaluate:

In addition to evaluation that was done throughout the lesson, have students write a letter to Horton telling him how they decided how many boxes to use to pack up their clovers. At the end of the lesson, allow students to choose a 'clover' to take home with them and have them share the lesson with their parents.

Extensions:

Life Science:

- Put a speck of dust on a microscope slide and examine it. Have students write a descriptive paragraph/sentences about the dust as seen through the microscope.
- Use hand lenses to find small critters in water or in grass. Have students create a foldable that compares the characteristics of the critters seen with and without the aid of the hand lenses
- Create a homemade stethoscope. Students can use the stethoscope to compare the sounds they hear with and without the tool.
- Make a diagram of the ear with felt and removable parts

Nature of Science:

- Order by small, smaller, smallest. Order pictures of objects (more abstract) in order from smallest to largest.

Physical Science

- This lesson could lead into a discussion of frequency and wavelength.

Bartholomew and the Oobleck

Key Concepts:

Properties of matter, Nature of Science

Objectives:

TSWBAT make observations about the properties of matter (5-PS1-3)

TSWBAT design a solution to a problem that includes specified criteria for success and compare multiple possible solutions to a problem. (Engineering Design 3-5-ETS1-1 and 3-5-ETS1-2)

TSWBAT represent measurement quantities using diagrams and solve real world problems from these (CCSS.Math.Content.4.MD.A.2 and 5.MD.A.1)

Inquiry Activity Materials:

large bowl or tub per group

newspapers to cover work station

water

cornstarch (To make Oobleck, add water slowly to the cornstarch until you have a thick mixture)

(optional) green food coloring

laboratory scale or balance

graduated cylinder or other volumetric device

items to build a structure that does not stick to Oobleck (small cups, popsicle sticks, tape, styrofoam, toothpicks, balloons, straws, etc.)

Engage: Give a short synopsis of the book. To encourage students to read the book, do not tell the ending. Tell the students you have collected some of the oobleck and are working to determine some of the properties.

Explore: Let students know Oobleck is totally safe to handle. Although Oobleck is safe to eat, you should request students do not eat it since you need all of it for observation and testing. Allow students to handle the Oobleck and make observations. Students should notice Oobleck will act one way when you keep it moving and react another way when you keep your hands still. Have them rest their hands on the Oobleck as compared to punching the Oobleck and see the differences. Have students use a laboratory scale or balance to determine the mass of a small cup of oobleck (I usually provide a cup of oobleck for them to measure at a station). Have them determine the volume of a sample by using a graduated cylinder or other volumetric device (again,

this is usually provided).

Explain: Have students rinse their hands and list off some of the properties of Oobleck. At first they will tend to answer with statements such as:

It is gooey It is cold It is green It is funny/gross

Guide students to think more scientifically by asking questions:

Is it a liquid or a solid? Why do you think so?

It is smooth so what size particles do you think it might have?

A variation is to have them complete a Venn diagram comparing/contrasting oobleck to another substance students are familiar with such as Jello gelatin.

Elaborate: Students are challenged to create a structure (or 'Oobleck lander') that will not sink into the Oobleck, but will support 5 pennies. Students work in groups and brainstorm a design, create a drawing, then build the design. (Oobleck can be stored, covered in the refrigerator for about a week. Water may need to be added daily to keep it at the same consistency.)

Evaluation: Students present their designs to the class. Have a gallery walk where students use sticky notes to comment on the work of others. Finish with a reflective writing assignment.

This activity is an adaptation from Oobleck GEMS Guide, Lawrence Hall of Science, University of California, Berkeley, CA

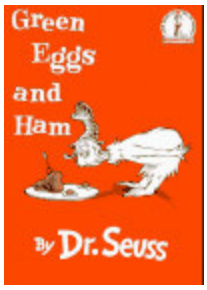
Physical Science:

- Make oobleck and have students try to classify oobleck as a solid or liquid according to their definitions. (Non-newtonian fluid http://scifun.chem.wisc.edu/homeexpts/lumpyliquids.htm)

Earth Science:

- Students make a bar graph of their favorite kind of weather/season. Students can write an analysis of the class data
- Students can make homemade weather instruments to record the weather.
- Students record basic weather data using online weather resources (www.weather.com)
- Practice reading thermometers by inserting the thermometers in different temperatures of water.
- Brainstorm "weather" words and then categorize them.

Green Eggs and Ham, grades 2-3



Key Concepts:

Science: Nature of Science

Math: Patterns in numbers

Objectives:

The students will be able to (TSWBAT) record and communicate observations orally, in writing, and in graphic organizers (Writing W.2.7)

TSWBAT draw a scaled bar graph to represent a data set with several categories (Measurement and Data 2.MD.10, 3.MD.3)

(optional) TSWBAT explain patterns in arithmetic (Operational and Algebraic Thinking 3.OA.9)

Inquiry Activity Materials:

Each student group should have:

- 1 ½ teaspoons of green food color
- 1 ½ cups of water
- measuring cup
- 2 tablespoons vinegar
- beaker, bucket, or pan of water to rinse eggshell
- 3 plastic cups (9-10 ounce) or beakers
- 3 large pieces of hard boiled egg shell
- large poster paper
- labels or masking tape
- transparent tape
- white glue
- paper towels (1 towel cut into squares measured
- stirring rod/spoon
- (optional) rubber gloves/tongs to protect hands from the dye.

Engage: Prepare 350 mL (~1 ½ cups) dye solution for each group as follows: mix 7 mL (~1 ½ teaspoons) green food color with enough water to make a total of 350 mL (~1 ½ cups) of solution. Using some of the dye solution without adding any vinegar, the students will dye one large piece of eggshell a pale green to represent the eggs Sam I am asks “Do you like green eggs and ham?” Create a table as shown below on large poster paper and hang it on a classroom wall/board. Tape the piece of pale green eggshell at the top of the chart on the poster paper. Tell the students that this is a sample of the eggshell the Sam I am had. Explain to the students that they are going to investigate what solution Sam I am used to dye his eggs.

Group #	No vinegar	2 tsp. vinegar	4 twp vinegar
1	(tape pieces of eggshell here)	(tape pieces of eggshell here)	(tape pieces of eggshell here)
2	(tape pieces of eggshell here)	(tape pieces of eggshell here)	(tape pieces of eggshell here)
3	(tape pieces of eggshell here)	(tape pieces of eggshell here)	(tape pieces of eggshell here)

Explore:

Students should identify the independent and dependent variables. The following are different levels of inquiry the class can conduct:

Structured: Model the following steps for students:

1. Using labels of tape, label three different cups or beakers with the different amounts of vinegar to be studied: 0, 10 mL (~2 teaspoons), and 20mL (~4 teaspoons).
2. Measure 100 mL of the prepared dye solution into each labeled container.
3. Add to each container the amount of vinegar specified on the label and stir.
4. Write the amount of vinegar in each container on a piece of paper towel and place the papers in front of the appropriate containers.

Students in groups of 3-4 will follow a procedure the same as the teacher model above. Have students tape their eggshell pieces to the cut strips of paper towels. The students will then tape paper towels on the class chart.

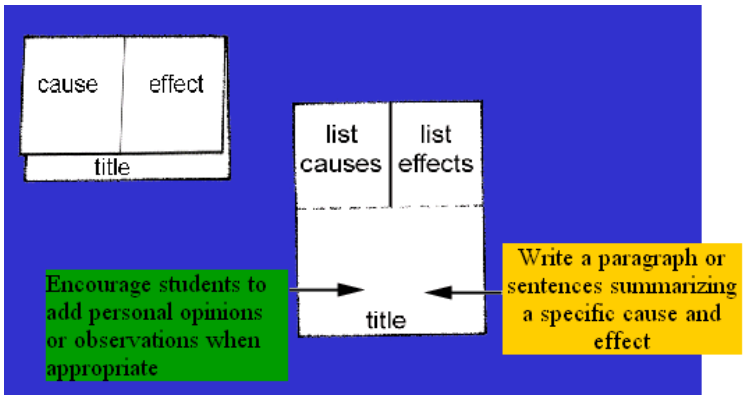
Guided: Give the students the problem question and the materials needed to solved the problem, but do not provide them instructions on how to set up the apparatus. In Guided Inquiry, students should not only determine the outcome, but also how to solve the problem.

Open: After the Think-Pair-Share, students should discuss with their partner(s) a problem to solve. Open Inquiry requires the teacher to be prepared for a variety of investigative problems. An idea to meet this challenge is to have the students provide the a materials list several days before the day of investigation. The teacher can approve or deny the materials or request students bring certain materials the need for the lab. Guide students to investigative questions that test one variable. Students might investigate:

- how naturally occurring pigments in fruits and vegetables compare to synthetic (store bought) dyes
- how different brands of dyes affect the intensity of the color
- how the temperature of the dye solution affect the intensity of the color
- how the pH of the dye solution (acidic, neutral, basic) affect the intensity of the color

Explain: With each group's dyed egg taped to the class chart, have the student discuss within their groups the results. Ask students using a method of selection (random, name sticks, etc.), "Which one is most like Sam I am's egg?" Ask students if they can see a pattern. (They should be able to point out that the more vinegar add, the darker the color. Guide the students into identifying the independent variable by asking them what was different about the tests (amount of vinegar). OPTIONAL: Students can relate the pattern they see to patterns discussed in math (for example, X, 4, 6, 8, and 4, 16, 20, X, 28).

Elaborate: Have the students create a cause-and-effect chart. Each student needs two sheets of white 8 ½-inch x 11-inch paper. Have students fold the paper along the short side (hamburger fold) and cut one side of the half into two (see image below from http://webs.rps205.com/curriculum/ssandvoc/GO.html).



Students write the words Cause on one flap, and Effect on the second flap. Students lift the Cause flap up and write the cause for the book, Green Eggs and Ham (Sam I am keeps pressuring the other character to eat the food). On the under side of the Effects flap students write the results of the Sam I am cause (the character eats and likes the food). Next have the students write the cause and effect from the egg investigation (cause: different amounts of vinegar, effect: changes in color intensity). Students can then continue with their own causes and effects.

Evaluate: Have students write a paragraph or sentences summarizing the definition of cause and effect. Students should include at least two examples they have listed.

This lesson was adapted from “Babushka’s Eggs’periment” from *Teaching Physical Science through Children’s Literature* by Gertz, Susan E., Dwight J. Portman, and Mickey Sarquis.

Extensions:

Measurement and Graphing:

- Graph how many people like green eggs and ham

Life Science:

- List green foods. What makes them green? Photosynthesis intro
- Discuss animals that lay eggs other than the chicken.

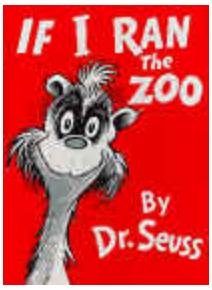
Math (problem solving):

- Students write/solve math problems like the ones below:
    - Cody read *Green Eggs and Ham* to his little sister. She liked the story. She wanted him to read it again. It took him 23 minutes to read the book to her one time. How long will it take him to read it to her two times?
    - I do not like green eggs and ham in a box or with a fox. There are 28 green eggs in the fox's box. The fox took out 3 green eggs for his breakfast. He took out 6 green eggs to make a cake. How many green eggs are left in the box?
    - Green eggs are very hard to find. They are very expensive. One green egg costs $3.65! Aaron wants to make scrambled green eggs. He needs three green eggs. How much will three green eggs cost?
    - I do not like green eggs and ham in the rain or on a train. I wish that Sam-I-Am would go away. He rode the train in the rain for 2 hours and 25 minutes to get to Whoville. If he left at 1:39 p.m., what time did he get to Whoville?

FYI: Did you know that Ted Geisel (Dr. Seuss) wrote Green Eggs and Ham after his publisher wagered $50 that he could not write a book using only 50 different words? After sharing that fun fact, give each student a copy of a grid featuring spaces labeled with each letter of the alphabet and a space beneath it. Challenge them to use the grid to record the 50 different words Dr. Seuss used. Working in pairs, students record words as they read the book. When they come upon

words they already recorded, they make tally marks and graph the data. When finished, the students total up the words to see if they come up with 50. Early finishers are encouraged to read the words written and to write sentences using only the words from the story.

If I Ran the Zoo, grades 1-4



Key Concepts:

Science: Life Science (classification), Nature of Science

Math: Measurement and Data (graphing)

Objectives:

The students will be able to (TSWBAT) classify animals according to common characteristics and what they need to survive (e.g., movement, body coverings) (Measurement and Data K.MD.B.3, Interdependent Relationships K-LS-1-1)

TSWBAT classify animals as vertebrates and invertebrates according to their structure (e.g., mammals, birds, fish, amphibians, reptiles) (Structure and Processes 4-LS1-1).

TSWBAT communicate observations orally, in writing, and in graphic organizers (Writing W.2.7)

TSWBAT draw a scaled bar graph to represent a data set with several categories (Measurement and Data 2.MD.10, 3.MD.3)

Inquiry Activity Materials:

Each student group should have:

- assorted buttons, beans, jelly beans, or other objects that are similar but different.

Each student should have:

- white paper
- markers, crayons, colored pencils

Engage: Show and read to the students Dr. Seuss's *If I ran the Zoo*, or present each student with a printed copy of the text of the book. Ask the students how animals are grouped in a zoo. Explain that they classify everyday: socks, plates, cups, collections like coins. Give each student group of 2-3 the bag of objects to be classified. Tell the students that they will classify the objects according to the characteristics they choose (For example, size, color, etc.). Ask students using a method of selection (random, name sticks, etc.) how they chose to group the objects.

Explore: Tell the students that they will now create an imaginary animal like Gerald McGrew imagined. Students roll a die to determine the characteristics of their imaginary, vertebrate animal. Provide the students a worksheet that lists the characteristics and have them circle or underline all the characteristics of their animal. After determining the characteristics of their imaginary animal, students will draw the animal based on those characteristics. Students can name their imaginary animals. Identify six areas in the classroom for each of the habitat.

1.) Habitat—this animal usually lives in the

1 Water

2 House

3 Desert

4 Forest

5 Jungle

6 Backyards of Arkansas

2.) This animal is

1 Poisonous (skip to #4)

2, 3, Venomous

4, 5, 6, non poisonous and non venomous (skip to #4)

3.) The venom is injected by

1 Fangs

2 Spines

3 Spurs

4 Teeth

5 Harpoons

6 Stinger

4.) This animal has

1, 2 or 3 Warning coloration

4, 5 or 6 Camouflage coloration

5.) Physical characteristics of the animal. This animal has

1, 2 Hard body covering

3, 4 Fur

5, 6 Scales

6.) More physical characteristics. This animal has

1, 2 or 3 Wings

4, 5, or 6 No wings (skip to #8)

7.) *Wing characteristics. This animal has*

1 or 2 two wings (one on each side of the body directly opposite of each other)

3 or 4 four wings (two on each side of the body directly opposite of each other)

5 student chooses the number of wings but they must be on each side of the body directly opposite of each other

5 student chooses the number of wings and where they are placed on the body

8.) Size. This animal is

1 or 2 Smaller than your thumb

3 or 4 Bigger than your thumb, but smaller than your hand

5 or 6 Bigger than your hand

9.) Number of legs. This animal has

1 one leg

2 two legs

3 three legs

4 four legs

5 five legs

6 student choice

10.) Number of eyes. This animal has

1 or 2 one eye

3 or 4 two eyes

5 or 6 compound eyes

Explain: While in the habitat groups, students will share their imaginary animals. Students should discuss what characteristics they see in the drawings that are similar and different. Ask students to discuss how different animals, real or imaginary, can live in the same environment. Students should classify the imaginary animals into groups within their habitat; students create group names. Ask students using a method of selection (random, name sticks, etc.) to explain how the animals were grouped and why.

Elaborate: Students should reclassify the imaginary animals into groups within their habitat into existing animal groups (e.g., mammals, birds, fish, amphibians, reptiles). Ask students using a method of selection (random, name sticks, etc.) to explain how the animals were grouped and why. Students should create a table that organizes the names of the animals under the identified type. Students then create a bar graph with the tallies from each animal type. Students can then compare each habitat's graph. Host a whole-class discussion to compare and contrast the data from each habitat. Compare this with what is found in the "real world."

Evaluate: Students write the characteristics that define the different types of animals (e.g., mammals, birds, fish, amphibians, reptiles). Use a rubric to assess student writings.

Extensions:

Community (Social Studies):

- Host a whole class discussion about responsibilities of a zoo keeper (Dr. Seuss's dad was one).

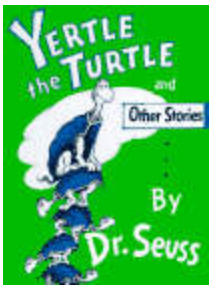
Nature of Science:

- Make the imaginary animals 3-D using clay or play-dough.

Life Science:

- Have students research and exchange information about 3 - 5 native animals with other classes around the world. After exchanging the information, the participants will play a mystery game by posting and answering questions based on the gathered information. (http://www.thinkquest.org/en/, http://www.globalschoolnet.org/index.cfm, http://www.epals.com, http://www.21stcenturyschools.com/global_collaborative_projects.htm)
- Students can create new animals by "crossing" two–What would you get if you crossed and alligator with a giraffe? Make your own combinations and draw them. Students determine what habitat the crossed animal belongs to. This can lead to genetics and selective breeding.
- Students choose an animal or plant in a biome they choose to study. They write an autobiography about as that organism and tell the life history from birth or germination to death in the point of view of the organism. Students describe any interactions with abiotic and biotic factors in the environment. They can also include a discussion of the daily routine.
- Students can access Teacher's Domain classification game online (http://www.teachersdomain.org/asset/lsps07_int_animalclass/) and record the characteristics for each type of animal listed.

Yertle the Turtle



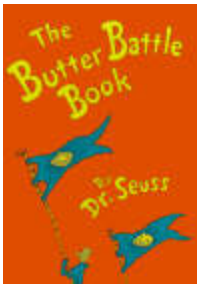
Life Science:

- Use to introduce a unit on Reptiles.

Physical Science:

- Make a periscope/telescope out of materials found in the home. Use to discuss the function of the lens in an eye.
- Compare and contrast the different types of telescopes (reflecting VS refracting).

The Butter Battle Book



Physical Science:

- Have students build sling shots to launch foam balls.
- Students can build catapults using rubber bands and Popsicle sticks to launch marshmallows. Older/more advanced students can use mouse traps as the launching mechanism for a catapult.

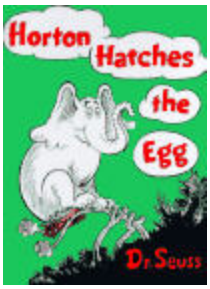
Life Science:

- Discuss the types of animal groups that produce milk. Students create a foldable to compare and contrast the types of animals.

Social Studies:

- Discuss the history of the Berlin Wall
- Compare the story with that of the Cold War

Horton Hatches the Egg



Life Science

- Discuss the types of animal groups that lay eggs. Students create a foldable to compare and contrast the types of animals.

- Students draw and illustrate the life cycle of egg

Earth Science:

- Have students draw/create pictures of the seasons to compare and contrast how life (like that of a tree, or a bear) changes throughout the year.
- Have students mark on a map everywhere Horton, the tree, and the egg travel.

The Lorax

Environmental Science:

- Introduce idea of carbon footprint. A great website is Zero Footprint Calculator (http://calc.zerofootprint.net/youth/).
- Discuss the importance of trees for people and animals.
- Design a poster to discourage the destruction of the rain forest.

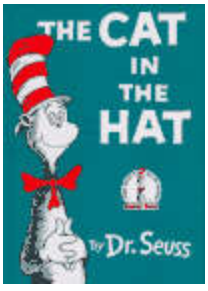
Life Science:

- Draw and illustrate the life cycle of plant.
- Students can draw a food web of biomes (deciduous forest, rain forest, coniferous forest specifically relate to The Lorax).

Math (word problems):

- Students write math problems using content from the Lorax:
    - Each Thneed must be made by hand. If it takes two hours to make a Thneed, how many Thneeds can be knitted in 14 hours?
    - Luis wanted his very own Thneed. He went to the store and found a Thneed just like he wanted! The Thneed cost $4.79. He gave the clerk a 5-dollar bill for the Thneed. How much change should Luis get back?
    - The Lorax, the one who speaks for the trees, is very old. In 12 years he will be 140 years old. How old is he now?
    - So many Truffula trees had been cut down, there were only 26 left. Although the Lorax tried to protect them, it seemed no one listened. The workers from the Thneed factory came and cut down 7 more trees. How many trees were left?

The Cat in the Hat



Counting:

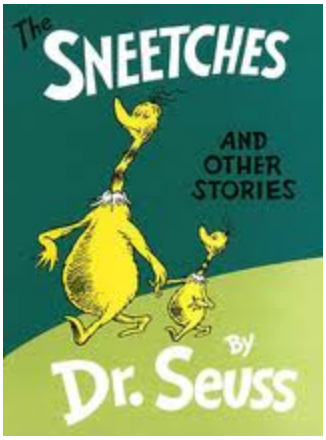
- Count and list objects that the cat can balance.

Physical Science:

- Have students calculate how fast they can walk while balancing an eraser on the heads of students (distance/time).
- Ask students to design and draw a machine that would clean up their rooms.
- Have students build a Rube Goldberg machine that performs a simple task. For a older/more advance students, each Rube Goldberg machine can be linked to each other so that one performed task triggers the initiation of another machine. (http://www.rubegoldberg.com , http://www.rube-goldberg.com , http://www.break.com/index/best_rube_goldberg_ever.html , http://www.wikihow.com/Build-a-Homemade-Rube-Goldberg-Machine).
- Students investigate the movement of simple machines. Students can illustrate each simple machine and describe how it moved in a foldable.

Geometry

- Students research different kite designs and build a kite using tissue paper and bamboo skewers.
- Students write math problems using content from the The Cat in the Hat:
    - What a mess! The Cat in the Hat had made such a mess! They would never get the house clean. But the Cat and all his little cats helped. Everyone started cleaning at 3:44 p.m. and finished at 5:01 p.m. How long did it take them to clean up the mess?
    - The Cat in the Hat lost his hat. He looked under the bed. He looked in the oven. He looked in the fishbowl. He looked in the bathtub. He looked for one hour and 35 minutes before he found his hat in a flowerpot. If he started looking at 11:45 a.m., what time did he find his hat?



Math (word problems):

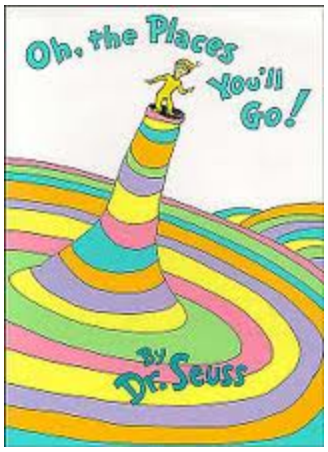
- Students write math problems using content from the Sneetches.

Life Science/Measurement and Data:

- Have students classify/sort buttons, jelly beans, etc. Students can count how many are in each group and create a chart that organizes the objects by classification names.

Money

- Students write money problems using content from the Sneetches.
- Give students fake money (http://printables4kids.com/ has printable money). Students can act out being Star- and Plain-Bellied Sneetches or Sylvester McMonkey McBean. Have students practice making change with the fake money.



Map reading:

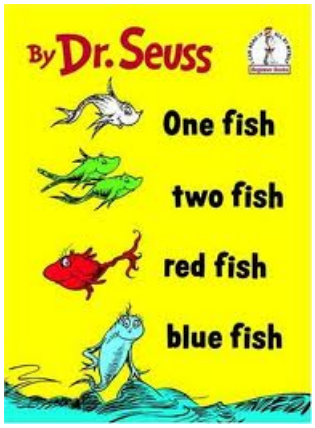
- Students can plot the Longitude and Latitude of a place they would like to travel to. Students can plot this on a class world map.
- Students can write directions to go somewhere in the school building/classroom (i.e., from classroom to bathroom, from principal's office to cafeteria). Student groups and go to designated area and write directions as they travel from one place to another.

Algebra

- Students can write Math functions problems

Input (x)	Relationship	Output (y)
0	x 2	0
1	x 2	2
2	x 2	4
3	x 2	6

For an input of 50, what would be the output?



Measurement and Data:

- Have students classify/sort buttons, jelly beans, etc. Students can count how many are in each group and create a chart that organizes the objects by classification names.

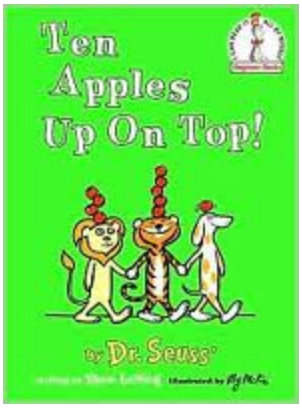
Math Operations:

- Students use a cube with clip art on the sides that show the symbols to add, subtract,

multiply, or divide (double up on the operation that needs most practice). Have numbers from 1-100 (written on popsicle sticks, strips of paper, etc.). Students draw two numbers from a cup/bag. Students roll the cube, write and solve the problems with the set of numbers drawn.

Life Science

- Draw and illustrate the life cycle of fish.
- Compare and contrast the different habitats of fish (lakes, ponds, wetlands, rivers, estuaries, water surface, open water, deep water)



Counting:

- Give students groups (2-3) half of an apple. Students can count the number of seeds found in their half. Students can group the seeds by twos, threes, fours, etc.
- Foldable book on counting (see below)

To make the pages, cut 11 x 17 card stock in half (the long way). The girls' book has the number of pages equal the number of girls, and the boys' book has the number of pages equal the number of girls.

Glue (or have the students write) the sentence "_____ has _____ apples up on top." and a photocopy picture of each student on the bottom of each page.

To determine how many apples each student would have on top, have them draw numbers, then distribute paper apples to each table so the students can count out the number of apples they need. The apple shaped calendar cutouts are great for this...the kind with green on one side and red on the other. Since the cutouts were 2-sided, some chose to make a pattern.

The students then glue their apples on top of their photocopied heads. The students then fill in the blanks with their name and the number of apples.

Measurement and Data:

- Students can draw a bar graph comparing the number of seeds each apple half contains.

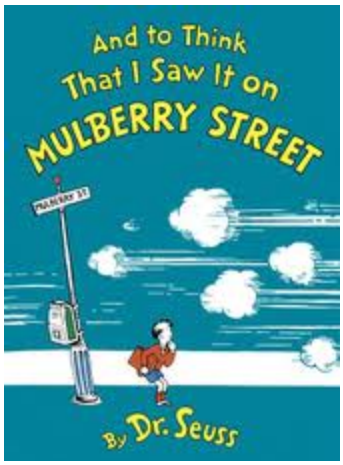
Life Science:

- Students can draw and label the life cycle of a plant.
- Students can investigate how sugar affects the growth of bean seeds. Students can use 6-8 cotton balls, 10 mL of water, 4-6 bean seeds, sugar packets, zero calorie sweetener, and snack-size zip-top bags. Tape zip-top bags to a window. Students should record what they observe at the same time every day. Students can record quantitative data (measurements - length of bean sprout, number of leaves, number of beans sprouting,etc.) and qualitative data (color, odor, how the beans look, etc.).

Physical Science:

- Investigate why objects of different size fall at the same rate (gravity pulls the same on all objects). Use balls of similar size but masses: beach ball, basket ball, volley ball, rubber

supermarket ball. Drop them from a specific height (at least 6 feet) and record how long it takes for them to hit the ground. Each ball will need to be dropped several times (at least 4) in order to allow for human error in starting and stopping the timer exactly. Take an average. An online activity (http://www.planetseed.com/node/20129) simulates Galileo's similar investigation, but this allows the student to "remove air" and drop the ball in a vacuum.



Earth Science:

- Give students a map of school building, home town or state. Have students draw/select two locations from teacher-generated list. Students can write directions to explain how to get from one location to another. Have students switch their work with a partner to check for accuracy.

Nature of Science:

- Divide the book into sections and give it to individual or pairs of students. Remind them that good observations include more than what is seen. Have the students include what Marco smelled, heard, and possibly touched and tasted. Reread the story to include these other observations.
- Give the students a paper sack or a shoe box with an object in it: cork, bottle cap, marble, Styrofoam ball, wooden block, pens and pencils. Without revealing its identity, place an object in a box that the students are unable to see into. Ask the students to guess what may be in the box. Give the students a sample of objects, including the one that is in their box, and an empty box. Have the students compare the known objects' observations with the unknown object to determine what the unknown object is. Students must justify their answer.

Geometry:

- Ask students to walk along the street where they live, or take the students outside to walk along the street where the school is located. They should observe and record the different geometric shapes they see.

Nature of Science:

- Train students to brainstorm: quantity over quality. Give students an object to improve: a backpack, a pencil pouch, a binder, etc. In groups of 3-4 students have 30 sec. to record as many ideas as possible. Praise/reward students with the most ideas.

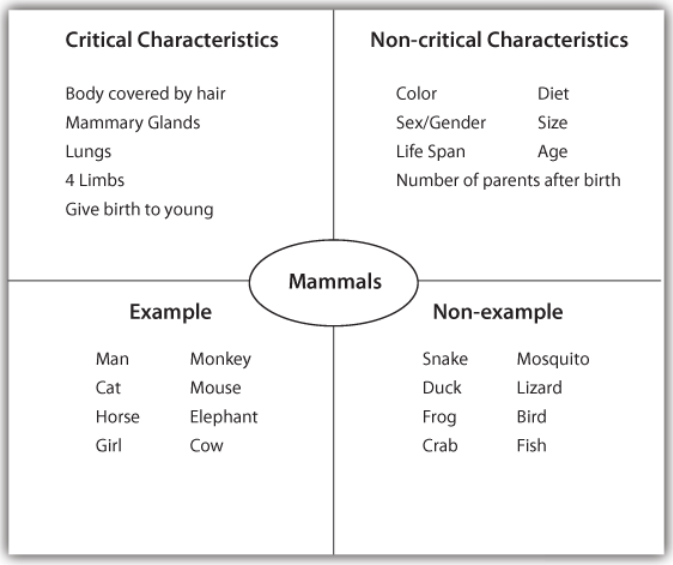
Engineering:

- Students can research inventions of the 20th century: What? Who? When? Why? Students can then research how the invention has been innovated (changed-positive or negative) since its creation.
- Students can sketch an innovation to an object they use daily.

Vocabulary:

- Students can use the Frayer Model for their math and science vocabulary words. The Frayer model forces students to build relationships between the term's definition and the analysis of the definition. (image below found at: http://www.cehd.umn.edu/DHH-resources/Language/frayer.html)

Frayer Model
Example



Life Science:

- Have students play a matching game that relates a real animal with a Seuss animal. After playing the game students can create a Venn diagram of the animals' characteristics.
- Do an activity that compares left-brain and right-brain learners. (http://www.funderstanding.com/brain/right-brain-vs-left-brain/)