SUPER FUN
2ND GRADE DATA COLLECTION AND GRAPHING

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Our goal is to improve student's abilities to collect, organize, and interpret data at the 2nd grade level. This school year our district will be implementing a new math curriculum (Everyday Mathematics). Therefore, in many of our lessons we explored the options available to us through our new materials. We also included some of the lessons we have done in the past that we felt were beneficial and fun for the children. Our hope is that children will learn the vocabulary words median, mode, range, maximum and minimum. They will also be assessed on their ability to display data, organize the information into a graph, and interpret that graph.

Our hypotheses:
Null Hypothesis: Lessons will have no affect on the student's performance on the assessment.
Alternative Hypothesis: Lessons will improve student's performance on the assessment.

Before we begin our data, statistics, probability, and graphing unit, children will be given the pre-test. We will enter their scores in Excel. This unit will take approximately two weeks. At the end of this time period we will reassess the children using the same test. This information will also be entered into Excel. At this time we will be able to see if the null or alternative hypothesis was correct. We will also use this information to improve our teaching for the next year (at which time we could compare the data over time).

We also plan to use an unpaired t-test to compare how our two classes performed on the assessment. Then we will use the results to identify strengths and weaknesses in our instruction.

We feel that a box plot would be helpful to show improvement after the lessons. We would also use statistical tools such as the median to see growth. In the event of outliers, we could also review their progress to determine a course of enrichment or extra practice.

Results: Pre-test _____   Post test_____

Conclusion:

The information that we gather can be used as a tool to inform parents of their child's progress in this area of mathematics. We can also share the information with other 2nd grade teachers in our district.

Birthday Bar Graph

Standard: Each student will represent data using concrete objects, pictures, and graphs. (NCTM standard, K-2)

Materials: Large poster board (divided up into twelve rows and two columns), cupcake cutouts, crayons, tape

Lesson: The teacher will begin by asking the students to predict which month has the most birthdays. Then the teacher will explain that there is a fun way to discover the answer to that question using pictures. The first step is to collect data (the teacher should explain that data is information about a topic). The teacher will explain, "When you're collecting data, all the information is important. Since we're collecting data about birthdays, what do we need to find out about each other first?"

The teacher will then pass out the cupcake cutouts. The children can decorate them and write their name on the cupcake with large letters. When the children are finished, they should gather on the rug and bring their cupcake with them. The teacher should explain that we are using pictures to make a graph. When you use pictures to make a graph, it's called a pictograph. The teacher should ask each child to come up and put their cupcake in the appropriate month, explaining why they need to be next to each other (not covering up someone else's) and emphasizing why it's important to be neat while collecting data(if cupcakes where on the line and scattered, it would be hard to interpret).

When all the children have placed their cupcakes on the graph, the teacher can encourage kids to tell what information they see. Some examples would be, "Which month has the most birthdays? How do you know? Which month has the least? Do any months have no birthdays? Do you think it's likely that nobody in the school has a birthday in that month?" The teacher should also ask the children, "What would be a good title for this graph? Why is that the best choice?"

After some discussion about the birthday graph, the children will find a partner. Each child will ask their partner questions about the graph. The teacher should walk around and monitor the questions to check for a general understanding among the students.

Summary: The children should be gathered again after they've had some time to talk about the graph with each other. The teacher will ask review questions such as, "What kind of a graph is this? What does the title of the graph tell us? What did we learn from this graph?

The Four Food Groups

Standard: The students will pose questions and gather data about themselves and their surroundings. (NCTM Standard, K-2)

Materials: "Dietary Guidelines for Second Graders" activity sheet, "What is Your Favorite Food?" activity sheet, pencils, crayons

Lesson: The teacher should begin by explaining the food groups to children, referring to the Dietary Guidelines for Second Graders sheet. The five basic food groups are: 1. Fruits, 2. Vegetables, 3. Grains, 4. Meat and Beans, 5. Milk. Discuss why these are the foods that children should eat the most of. Discuss things that should be eaten sparingly: fats, oils, and sweets.

Each child should be given the "What is Your Favorite Food?" activity sheet. The teacher should have a transparency and go around and ask each child what their favorite food is, making a tally mark under whatever food group it belongs to. The children should be following along, making the same marks on their sheets.

Discuss the data table with the children. Ask, "Which is the most popular food group among children in the class: Which is the least? Why do you think children prefer one food group over another? Do you think children in other parts of the world would have similar results on the data tables? Do you think adults prefer the same foods as children?

With the transparency still up, remind children how a bar graph is drawn using vertical or horizontal bars to represent data. Ask questions such as, "What do the labels at the bottom of the graph refer to? What do the numbers on the left side of the graph refer to? Suppose 15 children chose a dairy product as their favorite food. How would you show this on the graph? How would you show on the graph that 7 children had chosen a fruit or vegetable as their favorite food?" The teacher should demonstrate the student's responses on the transparency.

Children should use crayons or color pencils to color the bars of the graphs on their sheet. They may work in partners to complete the bar graph. The teacher should monitor students as they are working to assess their knowledge of transferring data to a graph. When the students have completed making their graph, the teacher should ask them to write one thing they have learned from reading the graph. The children can be encouraged to write more than one thing.

Summary: We found out that _____ was the most popular food group. How did we find that out? Do you think that this graph would look the same if we gathered data from a different 2nd grade class? How could we use this graph? (Give the information to the cooks, chose snacks for a party, etc.).

Source: Bell, Max, et al. Everyday Mathematics. Chicago: Wright Group/McGraw-Hill, 2007.

How Many Pockets? Bar Graph

Standard: The student will describe parts of the data and the set of the data as a whole to determine what the data shows. (NCTM Standards, K-2)

Materials: "Pockets Data Table" activity sheet, "Graphing Pockets Data" activity sheet, plain white paper, markers, pencils

Lesson: Ask children to tell how many pockets they have on their clothes. Have children with the greatest and least number of pockets stand. "Who has more? How many more?"

Ask children to pretend that a new child is joining the class. Ask them to predict how many pockets the new child will have. Have children report their predictions and how they made them. Help children to see that the middle number would be a good prediction for the new child. Then use the following procedure to find the middle, or median, number of pockets.

Step 1. Ask children with the greatest and least numbers of pockets to come to the front of the room and stand on opposite sides. They should face the class holding their pieces of paper that shows how many pockets they have.
Step 2. Ask the remaining children to come to the front, one by one, and to place themselves in order between the children already in line.
Step 3. When they are all lined up, check to see that they are in the correct order. While the children are lined up, emphasize which child has the minimum or least number of pockets and which child has the maximum or greatest number of pockets.
Step 4. Ask the two children on the ends of the line to take two big steps forward. Then ask the children on the ends of the remaining line to step forward.
Step 5. Continue asking pairs of children on the ends to stop forward until only one or two children are left. If one child is left, then the middle number of pockets is that child's number. If two children are left, the middle number of pockets is halfway between their numbers.

When the children are seated again, some good discussion questions are: Is the middle number a good prediction for the new child? Would you be surprised if the new child had more or fewer pockets than the middle number? How do you think the greatest and fewest number of pockets would change if our school had uniforms? How do you think the middle number might change?

Using the Pockets Data Table activity sheet (one for each child, and one transparency) have each child tell aloud how many pockets they have and record the data. The children should record the data on their sheets. When the data has all been recorded, some good questions are: How many children have five pockets? What is the most common number of pockets?

Using the data table, children can use the Graphing Pockets Data activity sheet to construct a bar graph. When the children are finished, ask questions such as: Which bar is the tallest? What does that bar mean? What does the shortest bar tell you? The range of a set of data is the largest number minus the smallest number. What would our range for this set of data be?

Summary: The teacher should ask questions such as: What is a median? Why would we use a median to help us? What does the range tell us? How could that help us?

Source: Bell, Max, et al. Everyday Mathematics. Chicago: Wright Group/McGraw-Hill, 2007.

How Do You Get Home?

Standard: Students will represent data using concrete objects, pictures, and graphs. (NCTM Standard, K-2)

Materials: Large Poster Board, people cut outs

Lesson: The teacher should begin by asking the children to talk with their group about all the different ways a child could get home from school. Each group can then share some of their ideas with the class. Now ask the children to think about how they get home. The teacher should construct the graph given their answers (such as riding the bus, walking, riding bike, getting picked up in a car, etc.) Give each child a person shaped cut-out. They can color the person and write their name on the shirt.

Have each child come up and put their person in the correct row of how they get home. When each child's data is collected on the graph, ask the children, "How do most kids get home? Is it likely that any one rides an elephant home? Do you think that's true of everywhere around the world?" Looking at the graph, explain to the children that the mode is the part of the data that happens the most often. Ask the children, "What would be the mode of our graph (the one that occurs the most). Ask the children, "How could it help us to know the mode? (making predictions, understanding the data).

Summary: The teacher should demonstrate finding the mode of a set of numbers or using a previously made class graph. Each child should then write one thing they learned using the How Do You Get Home? graph.

What's the Weather?

Standard: Students will represent data using concrete objects, pictures, and graphs. Student will discuss events related to their experiences as likely or unlikely. (NCTM Standard, K-2)

Materials: Poster board

Lesson: The teacher will introduce the lesson by asking students to make predictions such as, "Is it likely that we'll have snow this month? Do you think we'll have more sunny or cloudy days? How many days do you think it'll rain this month." Have children record their responses. Over the course of a month, students will collect data of the weather using tally marks (one for each day). The teacher will demonstrate using tally marks correctly, and each child will also collect the data individually. At the end of the month, students will construct a bar graph of their data.

Using the bar graph, have the children interpret the results. Ask the children, "What type of weather did we have most frequently (the mode)? Looking at your results, were your predictions correct? Is it OK to have made an incorrect prediction? Would your graph look different if you liked in another part of the country, or another part of the world?"

Summary: Have the students compare their graph to a similar graph from a different climate. With their group, students should discuss the similarities and differences. Each student should write 2 sentences comparing the graphs.

Guess the Colors

Standard: Each student will sort and classify objects according to their attributes and organize data about the objects. Students will also discuss events related to students' experiences as likely or unlikely. (NCTM standard, K-2)

Materials: brown paper bags for half of the class with a total of 3 blue and/or red cubes, Guess the Colors record sheet

Lesson: The teacher will begin by jokingly telling the students, "Don't look in the bag!" Tell the students, "Today you will be guessing what color cubes are in your bag! There are three cubes in the bag. Some cubes are blue and some cubes are red." Students will take one cube out of the bag and make a tally mark on the Guess the Colors sheet for either blue or red. The student will put the cube back in the bag and allow their partner to draw out a cube and make a tally mark. The pair of students will continue to take out, tally, and replace 8 more cubes for a total of 10 tally marks. On the Guess the Colors sheet, students will write their prediction of how many cubes are red and how many cubes are blue. Students will check their prediction by finally looking in their bag and recording the actual number of blue and red cubes.

Summary: Ask students, "Based on your tally marks were you more likely to guess the colors of your cubes?" Have some students share their data, their prediction, and their actual number of cubes. Discuss by using the phrases "likely" or "unlikely". Ask students, "What would happen if there were four cubes in the bag? Could you conduct another experiment to predict the colors of the cubes? How many times would you pull out a cube if there were 4 cubes in the bag? Why is it important to pull out cubes that many times?" If time allows, tell one student to put either red or blue cubes in the bag for a total of 4 cubes and repeat the activity.

Source: "Guess the Colors." *Creative Teaching Press Instant Math Centers 2-3* 2000: 108.

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Toying with Probability

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Standard: Each student will represent data using concrete objects, pictures, and graphs. Students will also discuss events related to students' experiences as likely or unlikely. (NCTM standard, K-2)

Materials: paperclip, Toying with Probability sheet

Lesson: The teacher will begin by showing a spinner from a game such as Twister. Ask questions about the likelihood of landing on left foot green compared to landing on right hand red. Have students come to the conclusion that it is equally likely to land on left foot green as it is to land on right hand red. If desired, continue to test the spinner by playing a game of Twister. Provide students with a paperclip to create a spinner for the Toying with Probability sheet. Tell students to look at the cat's spinner of toys. Students will make a prediction about the toy on which the spinner is most likely to stop and the toy on which the spinner is least likely to stop. Students will begin their experiment by spinning the spinner and coloring a box on their graph to show the type of toy that their spinner landed on. Students will continue to spin for a total of 20 spins.

Summarize: Students will share their data and their responses to the questions: "On which toy did the spinner stop most often?" and "Tell why you think this happened." Discuss by using the phrases "likely" or "unlikely". Ask students, "If the cat only had two toys, could you draw a spinner that makes it equally likely for the spinner to stop on each toy?" If time allows, have students draw their spinner on the back of their paper and test their spinner.

Source: "Toying with Probability." *The Education Center, Inc. The Mailbox Primary* April/May 2004: 43.

<u>**Graphs: Comparing Speeds of Animals and People**</u>

Standard: Each student will represent data using concrete objects, pictures, and graphs. Students will also describe parts of the data and the set of data as a whole to determine what the data show. (NCTM standard, K-2)

Materials: *Math Journal* 2, pp. 302 and 303, Teaching Aid Master (*Math Masters*, p.415), one sheet of paper per child

Lesson: Students will observe the graph on *Math Journal* 2, p. 302. The teacher can monitor children's progress toward reading a graph as students write some things that the graph tells them on an Exit Slip (*Math Masters*, p.415). Have students cover the left side of the graph with the edge of a sheet of paper. Ask students, "Which animal can cover the longest distance in 10 seconds? Which animal covers the shortest distance in 10 seconds? Which animal can run about twice as far as the ostrich in 10 seconds? Which animal can run about the same distance as the wild horse in 10 seconds?" Have students name the animals in order of distance covered in 10 seconds, from greatest distance to least distance. On *Math Journal* 2, p. 303, students will copy the list of animals from greatest distance covered in 10 seconds to least distance. Model finding the distance covered by a cheetah in 10 seconds. Model approximating the distance for the jack rabbit. Explain that the bar for the jack rabbit ends halfway between the lines marked as distances of 600 and 700 feet. A good estimate for the jack rabbit distance is 650 feet. Allow students to complete the table. Model finding the middle (median) distance by drawing a line through the first and last rows of data on the table. Then draw lines through the first and last remaining items. Continue to draw lines through the first and last remaining items. The only item remaining shows the middle (median) distance. Allow students to find the median on their journal page. Allow students to find the longest distance and the shortest distance. Note that these distances are the items on the top and bottom of the list in the data table. Model finding the difference between the greatest and the least numbers in a data set is called the range. Allow students to find the range on their journal page.

Summary: Conclude that graphs are useful to make comparisons quickly and easily. Extra practice is provided on *Math Masters*, p. 399.

Source: Bell, Max, et al. Everyday Mathematics. Chicago: Wright Group/McGraw-Hill, 2007.

The Mode of a Set of Data

Standard: Each student will represent data using concrete objects, pictures, and graphs. Students will also describe parts of the data and the set of data as a whole to determine what the data show. (NCTM standard, K-2)

Materials: *Math Journal* 2, pp. 305-307, two stick-on notes per child

Lesson: Have students take two stick-on notes. Students count the buttons on the clothes that they are wearing and write that number on a stick-on note. Students put the stick-on note in the right place above the number line and save the other stick-on note. Note that the stick-on notes form a line plot. Ask students, "How many children have 2 buttons? 5 buttons? 0 buttons? What is the smallest number of buttons mentioned? What is the largest number of buttons mentioned? Which number of buttons is the most frequently mentioned?" Note that the number of buttons reported most often is called the mode. Label the mode on the line plot. Have students remove the last stick-on note at each end of the line plot. Repeat this over and over to find the median. If one note remains, the number on that note is the middle value (median). If two notes remain, the numbers on those notes are the middle values, and the median is one of these middle values or any value between the two. Label the median on the line plot. Discuss the data on journal page 305. The table shows the heights of 30 children at ages 7 and 8. Model showing the change in height for one child. Assign one student number from the data set to each child in your class. Students write the height change for their assigned student number on a stick-on note and attach it to the appropriate place above the number line on the board. Students complete the frequency table on page 306. Ask students, "How many children grew at least 3 cm in one year? How many grew 5cm or more? How many grew less than 5 cm?" Students make a bar graph on journal page 307. Note that the sticky-notes also form a bar graph. Ask students, "What numbers should be written blow the horizontal axis?" Allow children to work with partners, or independently, to find the minimum, maximum, median, mode, and range on journal page 307.

Summarize: Have students share results and the process they used to find the results from journal page 307. Discuss that there were different ways to find minimum, maximum, median, mode, and range, such as using the line plot, the frequency table, or the bar graph.

Source: Bell, Max, et al. Everyday Mathematics. Chicago: Wright Group/McGraw-Hill, 2007.

Dates on Pennies

Standard: Each student will represent data using concrete objects, pictures, and graphs. Students will also describe parts of the data and the set of data as a whole to determine what the data show. (NCTM standard, K-2)

Materials: about 1,000 pennies, graphing chart paper

Lesson: Each child examines two or three pennies to find the years they were made (minted). Have children call out some of their pennies' years as you record them on the board in a systematic way. Continue until you have a range of years. Use a tally mark to record each reoccurrence. Ask students, "In which year were the oldest pennies minted? The newest pennies?" Distribute a collection of pennies among pairs of children. Have partners record the year and make a tally mark for each penny in their collection. Bring the class together and record on the board the total number for each year found. Construct a bar graph on graphing chart paper to show the years in the class penny collection.

Summary: Students tell observations from the tally marks and bar graph. Ask students, "What is the range of years? In which year were the fewest pennies minted? How many pennies were minted in that year? What is the difference between the fewest number of pennies minted and the most? Why are there fewer older pennies? Are there pennies older than class members? How much older? How much older is the oldest penny than the newest one?"

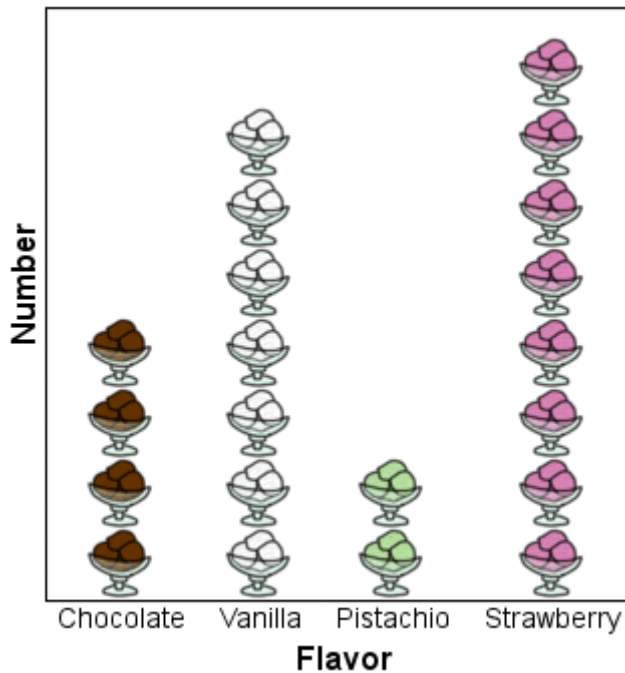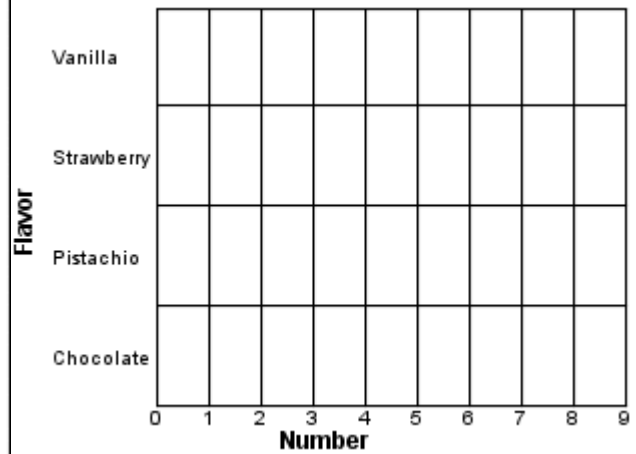**Source:** Bell, Max, et al. Everyday Mathematics. Chicago: Wright Group/McGraw-Hill, 2007.

Graphs

Use data from the picture graph to make a bar graph. Answer the questions.

Favorite Ice Cream Flavor

1. Which flavor is least likely to be served at a party?	2. Which two flavors are most likely to be served at a party?
_____	_____

Use the table graph to answer the questions.

3.

Favorite Fruit

Fruit	Number
Apples	4
Watermelons	8
Pears	2
Bananas	6

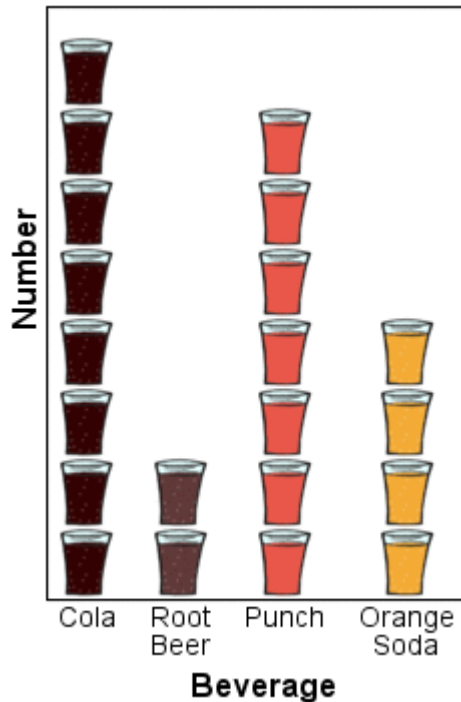**a.** How many people chose either apples or bananas?

_____

b. Which fruit had the minimum votes?

_____

c. Which fruit had the maximum votes?

_____

Use the picture graph to answer the questions.

4.

Favorite Beverage

Number

Cola   Root   Punch   Orange
        Beer   Soda

Beverage

a. How many people chose either root beer or cola?

_____

b. List the beverages in order from the beverage with the fewest votes to the beverage with the most votes.
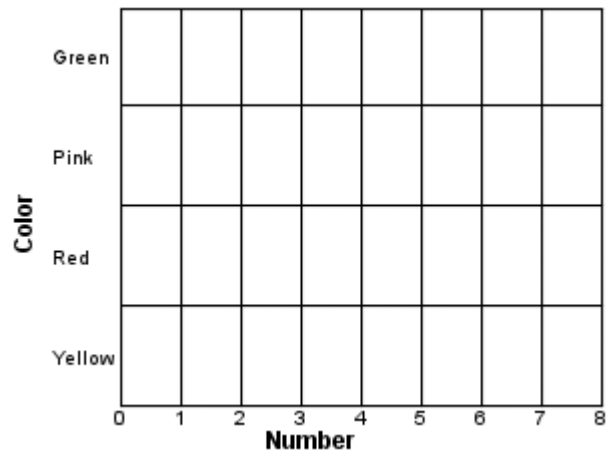
_____

c. How many people answered the survey?

_____

Use data from the table graph to make a bar graph. Answer the questions.

Favorite Color

Color	Number
Pink	2
Yellow	7
Green	5
Red	6

Favorite Color

Green

Pink

Color

Red

Yellow

0   1   2   3   4   5   6   7   8

Number

5. How many people chose green as their favorite color?	6. How many people chose either green or yellow?

Use the tally table to answer the questions.

7. **Favorite Subject**

Subject	Tally	Number
Mathematics	卌 |||	8
Writing	卌 ||	7
History	|||	3
Science	||	2
Art	卌		6
Music	卌		6

a. List the subjects in order from the subject with the most votes to the subject with the fewest votes.

_____

b. What is the range of the data?

_____

c. What is the median?

_____

Use data from the tally table to make a bar graph. Answer the questions.

Favorite Vegetable

Vegetable	Tally	Number
Carrot	卌		6
Peas	卌		6
Broccoli	卌 |||	8
Avocado	||	2
Asparagus	卌 ||	7
Potato	||||	4

Favorite Vegetable

8. What is the most popular vegetable?

_____

9. What is the mode?

_____