

## Title: Build It! Graph It!

### **Brief Overview:**

This introductory unit will focus on second grade data collection and graphing. Students will explore surveys, tally charts, bar graphs and pictographs through examining student interests. Teamwork and individual work will be used through a variety of activities. This unit includes three lessons and a summative assessment. Some students may need additional lessons and practice to master the concepts.

### **NCTM Content Standard/National Science Education Standard:**

- Select and use appropriate statistical methods to analyze data.
- Develop and evaluate inferences and predictions that are based on data.
- Collect, organize and display relevant data to answer questions.

### **Grade/Level:**

This unit is designed for second grade students. Accommodations can be made for ESOL, special education, and GT students.

### **Duration/Length:**

This unit takes about a week (including the summative assessment), using approximately an hour of time each day for four to six days.

### **Student Outcomes:**

Students will:

- Collect and analyze data that has been gathered using a survey and tally chart.
- Generate, create and analyze bar graphs.
- Generate, create and analyze pictographs.
- Students will work individually and in teams to create a variety of informational displays.

### **Materials and Resources:**

#### **Lesson 1**

- Chart paper
- Large 100 square chart paper
- Attention getting device (such as a rain stick) for classroom management
- Markers
- Pencils

- Rulers
- Overhead transparency and markers
- Student Resource Sheets #1-4 (1 for each student)
- Teacher Resource Sheet 1
- Pictures of four school lunches
- Large wall charts of a survey, tally chart, bar graph (labeled with name of chart)
- Blank writing paper for students

## **Lesson 2**

- Large chart paper
- Large 100 square paper
- Overhead projector
- Crayons or markers (yellow, black, red and brown)
- Student Resource Sheet 5 (2 copies for each student plus extras for extension)
- Student Resource Sheet 6 (1 copy for each student and large example on wall or overhead)
- Pictures of four fruits for favorite fruit survey
- Student Resource Sheet 7 (extra copies for those who need extension)
- Large wooden cubes and/or Unifix cubes in brown, red, yellow, and black

## **Lesson 3**

- Large chart paper
- Large 100 square paper
- Overhead projector
- Glue sticks or glue bottles
- Large chart of eye color from day two
- Student Resource Sheet 8 (two for each student plus some extras for extension)

## **Advanced Preparation**

### **Lesson 1**

- Put kid friendly samples of a survey, tally chart, bar graph and pictograph (labeled with name of chart) on the wall. Examples of these can be found in teacher stores or created.
- Prepare copies of Student Resource Sheets # 1-4 and Teacher Resource Sheet 1 (1 for each student).
- Have pictures of four school lunches ready.

### **Lesson 2**

- Have pictures of four fruits ready.
- Enlarge the Tails paper (Student Resource Sheet 6 for the wall).

- Prepare 2 large blank survey and tally chart papers for the wall (Student Resource Sheet 3).

### **Lesson 3**

- Display eye color tally sheet from day two on the wall.

### **Development/Procedures:**

### **Lesson 1 (1-2 Days)**

#### **Preassessment –**

- Refer to the large wall charts (survey, tally chart, bar graph and pictograph). Write the following questions on the chart or overhead.
  - What are surveys used for?
  - What are graphs and charts used for?
  - How can graphs help us organize information?
- Put students into groups of four (heterogeneous) and have them discuss the questions above.
- Discuss answers as a class and record on chart paper or overhead. (Display answers in classroom for future reference)
- Refer to the bar graph on the wall. Give students blank writing paper and have them write down two pieces of information about the data displayed on the bar graph. Collect papers.
- Students will briefly share answers as a class.  
Note: Make anecdotal records about the student responses. Keep answers from each student for a comparison of pre and post unit data.

#### **Launch –**

- Distribute Student Resource Sheet 1 to each student. Give students about three minutes to look over their data.
- Direct questions (Teacher Resource Sheet 1) to the whole class. Discuss why it is difficult to answer questions with the information in paragraph form.
- Now Distribute Student Resource Sheet 2. Ask the questions again and see if students can answer the questions more easily.
- Discuss how graphs can organize and display information more easily and clearly.

#### **Teacher Facilitation –**

- Explain the term “survey” as way of asking a question and collecting information about that question. Refer to the example survey on the wall.
- Refer to the blank overhead (or wall chart) survey and tally chart (Student Resource Sheet 3). Add pictures of four foods and discuss if necessary.
- Conduct a class survey and have each student vote on their favorite lunch.
- Record information on the blank wall survey and tally chart (or overhead) (Student Resource Sheet 3).

- Discuss the results as a class and identify the information you can get from the survey. Use math word wall terms such as: most, least, all, some, more than, less than, none, etc.

**Student Application –**

- Distribute Student Resource Sheet 4 and have students survey 10 other students about their favorite sport. Model with two students beforehand how to ask the question and record the data as a tally mark.
- Have students work in pairs to collect and record the information.
- Have students write down two pieces of information they learned from their surveys and tally charts (collect and keep).

**Embedded Assessment –**

- Make anecdotal records about how students collect the information and complete their surveys.
- Assess individual student answers about survey and tally chart.

**Closure –**

- Discuss as a class results of the survey. Discuss why students may get different answers and results.

**Reteaching/Extension –**

- Walk around to monitor and assist students as needed.
- Students who master activity quickly can think of their own survey question and complete a tally chart.

**Lesson 2 (1-2 Days)**

**Preassessment –**

- Return sport tally charts from lesson 1 to each student. Give them a blank bar graph (Student Resource Sheet 5) and ask the students to display the information in a bar graph. Collect papers and use to see who will need additional support and who is ready for extension/enrichment.

**Launch –**

- Conduct a survey on hair color of the students in the class.
- Use large chart paper or an overhead to record the information in a tally chart format (see Student Resource Sheet 3).
- Have each child pick up a cube that matches his/her hair color.
- Ask children how they can use the cubes to show the hair color of the class. (Put them in stacks by hair color.)
- Ask children what they can do to explain what each color cube means. (Label each hair color.)

- Explain to the children that they are building a 3-D bar graph. Ask them what else could be added to make the information clearer. (Title, numbers, labels etc.)

**Teacher Facilitation** – Refer to the large TAILS poster on the wall (see Student Resource Sheet 6). Keep the words covered (cover everything except the acronym TAILS). Explain that TAILS stands for the parts of a bar graph, and that they can use TAILS to make the information on bar graphs clear (just like they did with the 3-D model). Today they will be creating a bar graph using TAILS.

- Ask the students what they think the T could stand for. Explain that T stands for title. Brainstorm a good name for the graph (ex. Hair color). Emphasize that the title should tell what the graph is about. Ask students where they think the title would go (think about the title on a book). Place the title in the appropriate space at the top of the graph.
- Help them understand the word axis for letter A. (The vertical and horizontal lines. Point out how the 3-D cube graph is lined up on the side and across the bottom). These lines already appear on the hundred chart and we do not have to add them.
- Ask the students to help you put in increments (numbers) on the left hand side going up the graph scale. Ask students how many squares we would color if there were no one with that hair color. Use the 3-D graph to show that each block stands for one student. Point out that the bar graph must start with 0 on the bottom and that the increments should increase by the same number (ex. count by ones, twos, etc.). Point out that the numbers go on the lines and not in between.
- L stands for labels. Label the x-axis, “Color of Hair”, and explain that this label tells about the different kinds of hair. Have the students label each color of hair.
- Label the y-axis, “Number of Students”, and explain that the y-axis label tells how many. In this case, it tells how many students have that color of hair.
- Finally, explain that S stands for space and that we need to leave a space between each bar so that the graph is easier to read.
- Take the information from the survey, tally chart and 3-D bar graph of cubes. Have each child come up to the board and shade in the square under their hair color (guide them to the correct space).
- After the graph is complete, use the TAILS paper (Student Resource Sheet 6) to make sure all the parts of the graph are complete. Distribute a copy of the TAILS paper to each student to keep as a reference.
- Discuss the graph as a class and have students make statements about the graph using math language (ex. greatest, least, equal etc.)

**Student Application** –

- Now explain to students that they will build a 3-D eye color bar graph. Each student will take one cube matching the color of his or her eyes (blue, brown, green, etc).

- Create a class tally chart based on the survey.
- Now the class will use this data to build a 3-D bar graph. Each student will place his or her cube in the appropriate place.
- Distribute blank bar graphs to each student (Student Resource Sheet 5). Have the students work as pairs to display the eye color tally chart information in a bar graph. (Accommodations can include labeled increments.)
- Students should use their TAILS paper (Student Resource Sheet 6) to make sure their graph has all the parts to make it show the information clearly.

**Embedded Assessment –**

- Distribute writing paper and have students individually write two statements about their bar graph using math terms (ex. More, less, equal, etc.).
- Have students discuss the information on the graph using math words.
- Analyze to see who needs more practice creating bar graphs and who is ready for extension. Collect papers for records.

**Reteaching/Extension –**

- Support students who may need help with creating a bar graph by pulling them into a small group while the others work in pairs.
- Students who master the concept early can take an extra tally chart (Student Resource Sheet 7), and complete the survey and tally chart –about clothing color, shoe type, or type of pets--with other students who are also finished. Then they can use a blank bar graph (Student Resource Sheet 6) to create a bar graph from their data independently.

**Lesson 3 (1-2 Days)**

**Pre-Assessment –**

- Display the eye color tally chart from day two. Distribute the blank pictograph sheets (Student Resource Sheet 8). Students may use the tally chart and TAILS paper (Student Resource Sheet 6) to complete their pictograph for eye color.
- Discuss the pictographs as a class and have students make statements about the pictograph using math words. Collect and keep for future lesson planning.

**Launch –**

- Distribute baggies of cereal to each student. Have them sort the cereal by color (or shape or size, depending on the type of cereal or crackers you buy).

**Teacher Facilitation –**

- Introduce the term “pictograph” and refer to the example from day one (available at teacher’s stores). Discuss why this type of graph is called a pictograph. Point out the similarities (They both should have a title, axis,

labels and space.) and differences (Bar graphs have increments and bars while pictographs have pictures and a key.) between pictographs and bar graphs.

- Ask the students to think of an appropriate title and labels for the cereal pictograph. Then use the teacher sample of cereal and have students help glue the cereal on the class pictograph (show them how to leave spaces).
- Demonstrate how to make a key. At this stage, students will use one piece of cereal to represent one piece of cereal.
- Discuss the pictograph with the class and have the students make statements about the graph using math terms.

#### **Student Application –**

- Distribute blank pictograph papers (Student Resource Sheet 8) and have students use their sorted piles of cereal to create individual pictographs. They may use their TAILS paper and the class cereal pictograph to help them check their graphs.

#### **Embedded Assessment –**

- When students have completed their pictographs, Distribute student writing paper and have students write two statements about their pictographs using math terms.
- Gather students together and discuss the pictographs as a class. Talk about why each student's graph may look different from the other. Collect graphs for future lesson planning.

#### **Reteaching/Extension –**

- Take students who need extra support to work in a small group as they create their pictographs. Keep pictures of vocabulary terms on a word wall for easy reference.
- Students who master the pictograph early can take a new blank pictograph sheet (Student Resource Sheet 8) and create a new graph for their cereal with a different key. (Counting by twos or fives would be good practice).

#### **Summative Assessment:**

This assessment will demonstrate a student's understanding of surveys, tally charts, pictographs, and bar graphs. It includes selected response and brief constructed response questions. Answer Key can be found on Teacher Resource Sheet 4.

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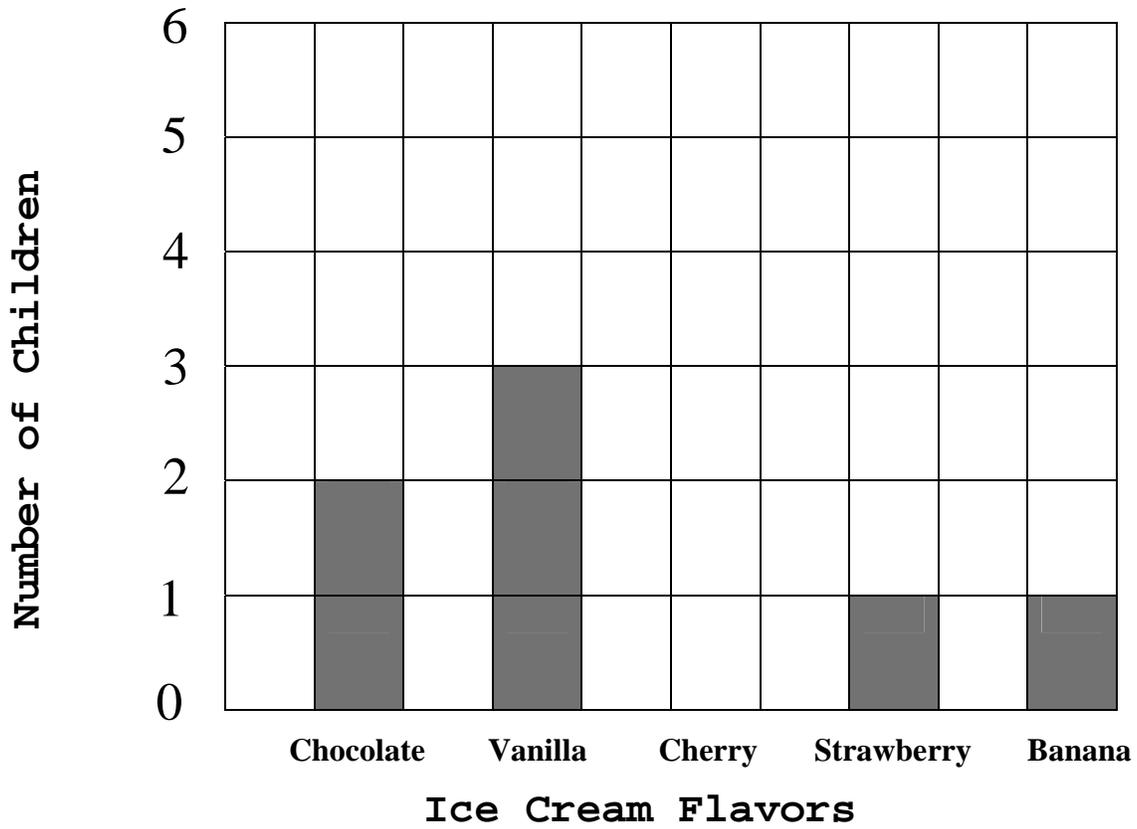
Questions for  
Favorite Ice Cream Graph/Paragraph Comparison

1. How many children chose a vanilla ice cream cone?
2. Which flavor wasn't selected by anyone?
3. How many flavors were chosen only once?
4. Which flavor was selected the most?
5. Which flavors were selected the same amount of times?
6. How many people chose chocolate?
7. Was any flavor chosen more than three times?

## Favorite Ice Cream Flavors

The children at the picnic were going to have ice cream cones for their afternoon treat. The sign listed the flavors they could have. There were five choices—cherry, chocolate vanilla, strawberry and banana. Charlie picked chocolate because he always liked to have a chocolate ice cream cone. Sara preferred to have a strawberry cone. Rick and Fred were both going to have vanilla. Jim was having a vanilla cone, too. Beth and Diane were twins, but always chose different things. Beth chose banana and Diane chose chocolate. The children got in line at the ice cream stand to get their cones. After getting them they sat down to eat them in the shade of a nearby tree.

# Favorite Ice Cream Flavors





Survey Topic - Favorite Sport

Choice 1      soccer      

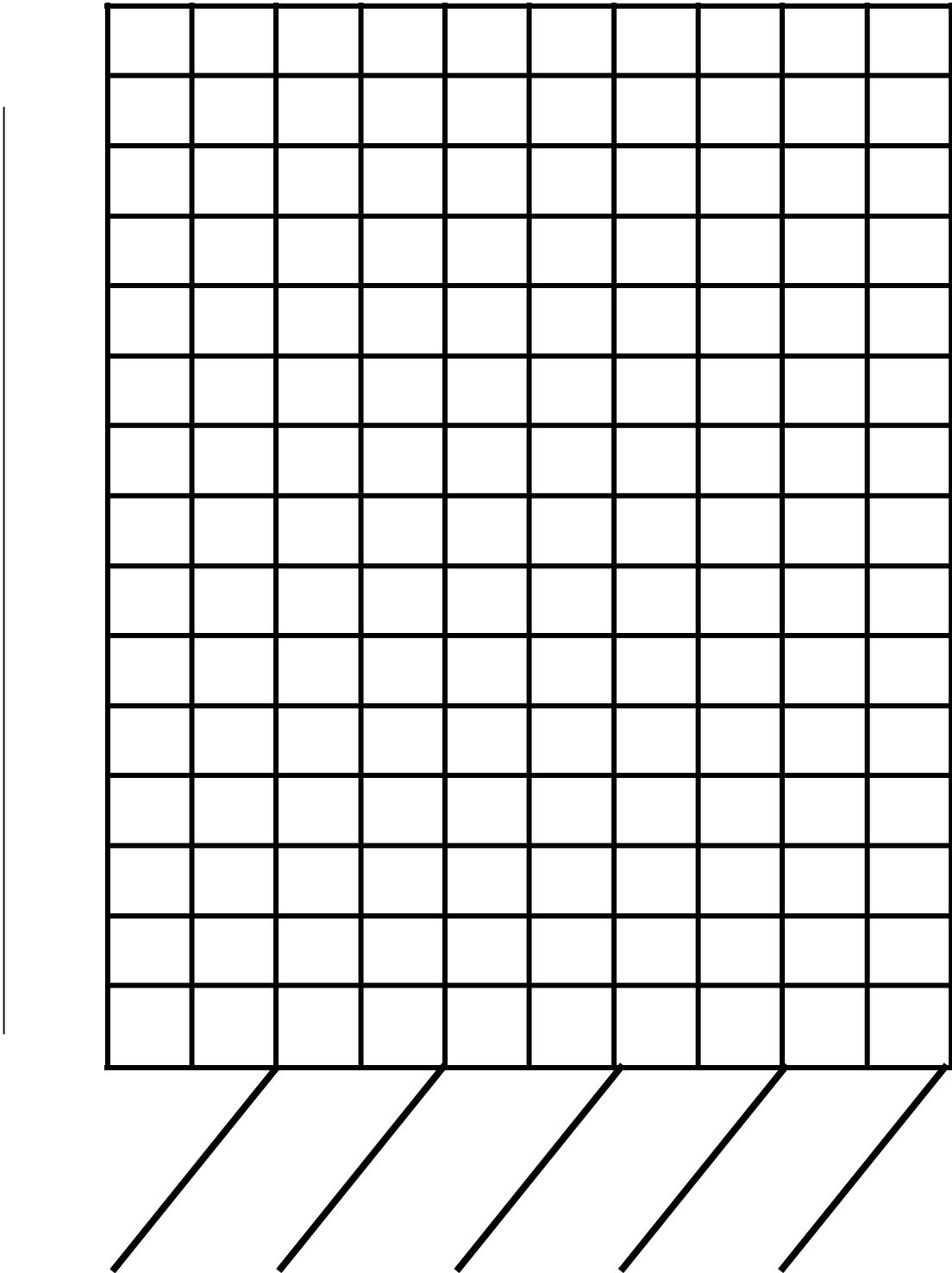
Choice 2      baseball      

Choice 3      basketball      

Choice 4      hockey      

**Tally Chart**

<u>Choice</u>	<u>Number</u>	<u>Tally</u>
Soccer		
Baseball		
Basketball		
Hockey		



Every graph has “TAILS.”

**T**itle

**A**xis

**I**ncrements

**L**abels

**S**paces

Survey Topic - Favorite Season

Choice 1      winter      

Choice 2      spring      

Choice 3      summer      

Choice 4      fall      

**Tally Chart**

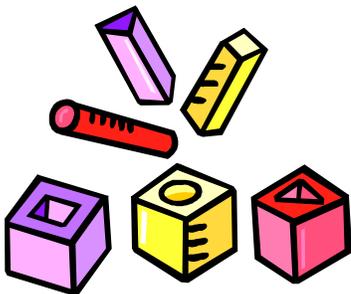
<u>Choice</u>	<u>Number</u>	<u>Tally</u>
winter		
spring		
summer		
fall		



Key \_\_\_\_\_ = \_\_\_\_\_

# Student Performance Assessment

## Build It! Graph It!

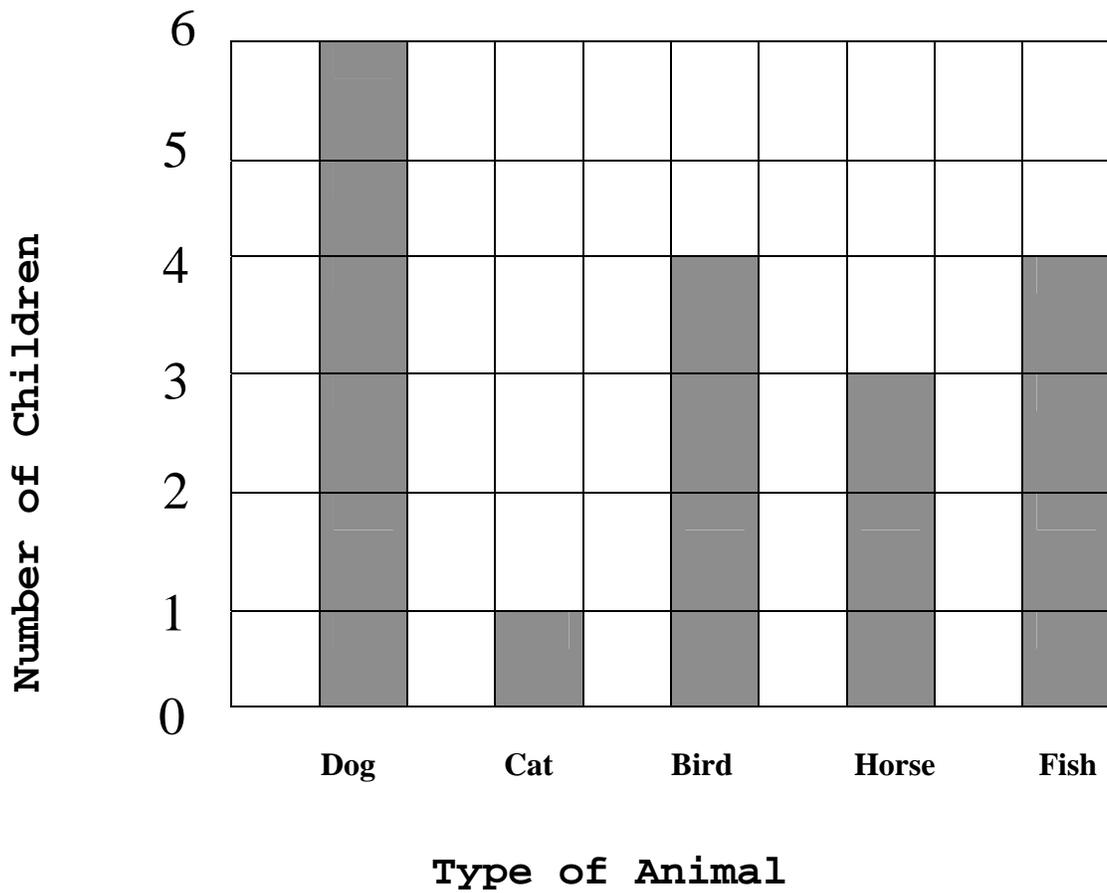


Name: \_\_\_\_\_

Date: \_\_\_\_\_

Read the bar graph below. Use the bar graph to answer the following questions.

## Favorite Animals



1. Which animal got the most votes?

cat

dog

bird

2. Which animal did the fewest number of students like?

fish

cat

horse

3. Which animal got three votes?

horse

fish

dog

4. Which two animals got the same number of votes?

dog and cat

fish and horse

bird and fish

cat and horse

Look at the pictograph on the next page. Answer the questions below.

5. How many students liked both Valentine's Day and Halloween?

9

4

10

6

6. How many students voted altogether?

20

15

17

12

7. Which two holidays received the same number of votes?

Halloween and Valentine's Day

St. Patrick's Day and Fourth of July

Thanksgiving and Halloween

Fourth of July and Valentine's Day

## Favorite Holidays

Valentine's Day 	
Halloween 	
Fourth of July 	
St. Patrick's Day 	
Thanksgiving 	

Key:  = 1 student vote

8. Look at the survey and tally chart below. Create a bar graph on the following page using this data. Use your TAILS paper to make sure you have all parts of the graph.

Survey Topic - Favorite Dessert

Choice 1      ice cream      

Choice 2      cake      

Choice 3      cookies      

Choice 4      candy      

**Tally Chart**

<u>Choice</u>	<u>Number</u>	<u>Tally</u>
Ice cream	5	
Cake	3	
Cookies	4	
Candy	10	





## Vocabulary Terms for Graphing Lessons

Tally Chart – form used to count the data being gathered

Bar Graph – graph using bars to represent the data

Pictograph – graph using pictures to represent the data

Survey – questions to ask in order to gather data

TAILS Components – Title, Axis, Increments, Labels, Space

Axis – Vertical and Horizontal labeled sides of graphs

Increments – Numbered axis of graph – counted in 1s, 2s, 5s, etc.

Data – information to be displayed in an organized fashion

Quantity Terms to use – all, none, most, least, equal, more than, less than

## Helpful Resources

Exploring Statistics in the Elementary Grades – Book One  
Dale Seymour Publications

Cereal Math – Scholastic

NSA Elementary School Summer Institute for Mathematics  
Teaching BCSIMT – 2005

Tiger Math – Learning to Graph from a Baby Tiger  
by Ann Whithead Nagda and Cindy Bickel  
Henry Holt & Company

Used Numbers Sorting: Groups and Graphs Grades 2-3  
Dale Seymour Publications

Used Numbers Counting: Ourselves and Our Families Grades  
K-1  
Dale Seymour Publications

Build It and Graph It!

Student Performance Assessment

Answer Key

<u>Answer</u>	<u>Number of Points</u>
1. dog	1
2. cat	1
3. horse	1
4. bird and fish	1
5. 10	1
6. 17	1
7. Thanksgiving and Halloween	1
8. 6 pts. for title, labels and four correct bars	6
(Take off 1 point for each part missing/ incorrect Ex. Title, labels, or one of the bars)	
9 a. 22	1
9 b. See below (Answers may vary)	2
<u>Total Points</u>	16

Score Guide for BCR

2- A strategy is used correctly to solve the problem. Math vocabulary is included. Explanation is organized and complete. Numbers, pictures and/or words show how the problem was solved.

(Example: I counted each of the bars on my bar graph. Ice cream had 5 votes, cake had 3 votes, cookies had 4 votes, and candy had 10 votes. When I added them altogether I got 22.)

1- Solution is partially correct. Some math vocabulary is used. Explanation is partial. Numbers, pictures or words are used to solve the problem, but it may not be completely correct.

(Example: I added  $5 + 3 + 4 + 10$  and I got 21).

0 – Strategy didn't relate to the question. Answer is incorrect.

(Example: Ice cream is my favorite. 5 people voted for ice cream.)