Graphs Galore – Grade Four

**Ohio Standards Connection**

**Data Analysis and Probability**

**Benchmark B**
Read and interpret tables, charts, graphs, (bar, picture, line, and line plot), and timelines as source of information, identify main idea, draw conclusions and make predictions.

**Indicators:**
2. Represent and interpret data using tables, bar graphs, line plots and line graphs.
5. Propose and explain interpretation and predictions based on data displayed in tables, charts and graphs.

**Mathematical Processes**

**Benchmarks**
G. Use reasoning skills to determine and explain the reasonableness of a solution with respect to the problem situation.
H. Recognize basic valid and invalid arguments, and use examples and counter examples, models, number relationships, and logic to support or refute.

**Lesson Summary:**
In this lesson, students conduct surveys to collect data. They analyze and interpret the data, then determine which type of graph is appropriate for the data. Students use the data to make predictions, discover patterns and draw conclusions about the survey.

**Estimated Duration:** Three or four hours

**Commentary:**
Being able to construct and analyze graphs are equally important. As students construct graphs, make sure they are not confusing the use of scale in one type of graph for another. For example, when making picture graphs, providing a key is necessary. When constructing a bar graph, however, the horizontal or vertical scale provided should be adequate for reading the length of the bars. When constructing bar graphs and line graphs, make sure students understand appropriate intervals and how to label and use the axes.

**Pre-Assessment:**
- Have students do Graph Pre-Assessment, Attachment A, in small groups. Students first match data tables to graphs and then identify the type of graph (bar, line, line plot or pictograph).
- Conduct a class discussion. During the class discussion, make sure students have an understanding of graphs. For example, discuss the purpose of each type of graph and the needed vocabulary.
  a. Why would you use a graph to display the data in the table? (It is easier and quicker to compare data in a graph.)
  b. Can you think of why you would use one type of graph instead of another?

**Scoring Guidelines:**
Informally assess students by observing students’ ability to connect data presented in a table to a graph. The ability to match graphs by using features of the data is an important skill. Provide intervention for students who seem to have no strategies for matching graphs to data. The identification of the type of graph (bar, line graph, etc.) is measuring a student’s ability to recall vocabulary. Review the names for types of graphs, but focus the discussion more on strategies for matching graphs and data.
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I. Represent problem situations in a variety of forms (physical model, diagram, in words or symbols), and recognize when some ways of representing a problem may be more helpful than others.
J. Read, interpret, discuss and write about mathematical ideas and concepts using both everyday and mathematical language.
K. Use mathematical language to explain and justify mathematical ideas, strategies and solutions.

**Post-Assessment:**

Distribute *A Yummy Candy Bar Worksheet*, Attachment B, which displays information about the cost of a “Yummy” candy bar from 2000 to the present. Students create two different graphs for the data and predict the price of a “Yummy” bar in the future.

**Scoring Guidelines**

Look to see that each graph was created accurately. Check that the following were included: a title, descriptive labels for the vertical and horizontal axes and a key describing the symbols used if using a picture graph or a scale suitable for representing the data for other types of graphs. The prediction of the cost in the future is the same for all graphs. Check the accuracy of the predictions and the students’ rationales for making the predictions.

**Instructional Procedures:**

**Part One**

1. Administer the pre-assessment.
2. Divide students into small groups. Have each group select a survey topic and survey the class. Some suggested survey topics are:
   - Height of students
   - Favorite ice cream flavors
   - Number of book/genre’ checked from the library or pages read by students
   - Hours of sleep in a week
   - Kinds of vehicles used
   - Preferred pizza toppings
3. Appoint each group two different types of graphs to construct using their survey data. Make sure at least one of the appointed types is appropriate for the group’s data. For this exercise, assigning some groups inappropriate graphs for the data is also desirable. For example, if a group collects data about kinds of vehicles used, assigning a line graph would be asking the group to represent categorical data as continuous data. Discussing the appropriateness of selected graph types is part of the lesson, thus having some inappropriate graphs to discuss is necessary.
4. Provide each group with chart paper, markers, crayons and pencils.
5. Give the students time to construct their graphs.
**Instructional Tip:**
Have students develop a checklist on the board to assist in completing the graphs. This list might include a title, descriptive labels for both the vertical and horizontal axes, a key describing the symbols used if using a picture graph, and a scale suitable for representing the data (counting by ones, twos, fives, tens, etc.).

6. Have students respond in their journals to the following prompt: *Explain whether both types of graphs are suitable for the given data. Is either type of graph inappropriate for the data? Why?*

7. Have each group discuss within the group their graphs, interpret the results, make predictions and draw conclusions. Suggestions for questions to support student thinking:
   - Did any of the data surprise you and did you see any patterns?
   - Do any types of graphs make patterns easier to see?
   - What are the benefits and drawbacks of the different types of graphs?
   - What predictions can you make about the future for your data using your graph?
   - Do you know of any outside factors that affect the data?
   - Why did you pick the graph over another kind of graph?
   - What does this graph tell you about the data?
   - What patterns in the data does this graph display?

8. Have the groups share their graphs and discussions about the graphs with the class. Ask each group to display their graphs Discuss any trends evident in the graph. Ask students to make predictions that require extending their graphs. For example, if the graph shows trends of consumer spending from 2000 to 2004, ask students to predict the spending for 2005. Other similar questions could be
   - What kind of pet would you expect a new student to have and why?
   - What do you predict the attendance will look like……
   - Will the same trend continue in ……
   - Was this an appropriate graph choice to display your data and why?
   - Why would you use this graph to display the data?
   - Can you predict the most popular……

9. Have students record on exit cards two things they learned about interpreting graphs.

**Part Two:**
10. Display *Extra Graph Practice,* Attachment A on the overhead. Question the students to stimulate their reasoning skills.
   - What information does the graph provide?
   - Did the graph make you think one food choice was better than others and why do you think so?
   - Predict what you think would be our classes favorite foods.
   - Did you discover any unique qualities or discover interesting information as you analyze the graphs?
   - Predict how many cats and dogs are owned by our classmates?
   - If a new student enrolled, what do you think they would have a cat, dog or both?
   - By looking at the line graph, predict the temperature over the next three days?
What do you think the line plot of another class would look like?
Using a pictograph, would it look the same for this 4th grade class?
Why was this type of graph useful for this type of information?
What other types of graphs might be more useful for this kind of information?

11. Provide students with the following problem:
The newspaper editor needed to convince the city maintenance department to repair the sidewalk in front of the school. The editor had the following data handy: 64 students ride the bus, 42 are driven by their parents, and 23 walk. How could the editor present and use this information to help the school with the sidewalk?

a. Have students work alone on the problem and then share their solution and solution method with a partner.
b. Discuss different solution methods as a class. Discuss the reasonableness of answers and the efficiency of solution methods.

12. Provide students with newspapers, magazines, and other resources. Have them collect graphs and attach the graphs to their journals. Give students the following prompt:
What type of graph is this? What is the graph about? What patterns in the data does this graph display? Use this graph to make a prediction about future trends.

13. Have students share their journal responses in pairs. Select several pairs to display their collected graphs and have the class discuss predictions made from the graphs.

Differentiated Instructional Support:
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- Pair students showing evidence of exceeding the standard and have them collect new data, create more complex types of graphs and share with friends.
  For example, they may compare the most popular brand names of clothes for boy and sold in the United States using a double bar graph.
- Give graphs with guiding questions. For example, which one has the most or least?
- Divide a journal page into 4 sections. At the top, have the student write the following headings: bar graphs, line graphs, picture graphs and line plots. Under each heading, have the students record what they have learned. During conferences with the students, help them add additional information.

Extensions:
- Distribute Attachment C, Extra Graph Practice. Have students make predictions based on the attendance data provided, then have students collect similar data for the school.
- Provide story problems in which students solve a mystery using the data presented in the problem. For example:
  In the school library, the following number of book genres’ were checked out last week: nonfiction 90, mystery 33, survival 25, fantasy 62. The library has $500 dollars to spend but all the money must be spent on the same genre. On which genre should the library spend the money and why?
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- Pass out various books of world facts and other almanacs. Have the students work in pairs to find graphs and talk about what they mean. Have the groups share with the class their findings.

**Home Connections:**
Have students record the number of pages they read each night for a week. Then have them create an appropriate graph for the data.

**Materials and Resources:**
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

*For the teacher:* chalk, overhead projector, transparencies, prepared worksheets

*For the student:* chart paper, markers, pencil, straight edge, if necessary calculators, glue, crayons, decorative die shapes (for pictograph), if desired

**Vocabulary:**
- chart
- data
- interval
- line graph
- line plot
- scale
- table
- Venn diagram

**Technology Connections:**
- Allow time for students to use the computer to make graphs and analyze the results with partners.
- Working with a partner on the computer, have the partner use the same data in a different type of graph and compare results.
- Ask the students to use the library or Internet resources to find the historical development of graphs and make a presentation to the class.

**Research Connections:**

**Attachments:**
Attachment A, *Graph Pre-Assessment*
Attachment B, *A Yummy Candy Bar Graph Worksheet*
Attachment C, *Extra Graph Practice*
Attachment D, *Vocabulary for Data*
1. Match the chart or table to the correct graph. The graphs are on the second page of the attachment.

2. Label each graph by stating the type of graph presented.

### Number of Wolves

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Wolves in Small Town</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>2</td>
</tr>
<tr>
<td>1990</td>
<td>5</td>
</tr>
<tr>
<td>1995</td>
<td>12</td>
</tr>
<tr>
<td>2000</td>
<td>18</td>
</tr>
<tr>
<td>2005</td>
<td>30</td>
</tr>
</tbody>
</table>

### How Many Siblings

<table>
<thead>
<tr>
<th>Number of Siblings</th>
<th>Number of Students with this many siblings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

### Summer Book Club

<table>
<thead>
<tr>
<th>Name</th>
<th>Ben</th>
<th>Ellen</th>
<th>Emily</th>
<th>Evan</th>
<th>Jamie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Books Read in summer</td>
<td>6</td>
<td>3</td>
<td>15</td>
<td>9</td>
<td>21</td>
</tr>
</tbody>
</table>

### Age and Height

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (inches)</td>
<td>28.5</td>
<td>38</td>
<td>41</td>
<td>47.5</td>
<td>52</td>
</tr>
</tbody>
</table>
### Graph Pre-Assessment

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ben</td>
<td>📚 📚</td>
</tr>
<tr>
<td>Ellen</td>
<td>📚</td>
</tr>
<tr>
<td>Emily</td>
<td>📚 📚 📚 📚 📚</td>
</tr>
<tr>
<td>Evan</td>
<td>📚 📚 📚 📚</td>
</tr>
<tr>
<td>Jamie</td>
<td>📚 📚 📚 📚 📚 📚 📚 📚 📚 📚 📚</td>
</tr>
</tbody>
</table>

= 3 Books

![Graph 1](image1.png)

![Graph 2](image2.png)

![Graph 3](image3.png)
Directions: The prices for the Yummy bar, a delicious candy bar, are given in the table for 6 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Yummy bar (in cents)</td>
<td>49</td>
<td>55</td>
<td>59</td>
<td>65</td>
<td>69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Make two different types of graphs to represent the Yummy bar data. Choose a bar graph, picture graph, line graph or line plot. Include appropriate labels for the graphs.

First graph type ___________________                           Second graph type_________________


4. What trends do you notice in the data. Use one of your graphs to support your answer.

5. Which of your graphs represents the data better and why?
Directions: Use the table to answer the questions.

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>22</td>
<td>22</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>15</td>
<td>17</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>41</td>
<td>24</td>
<td>19</td>
<td>22</td>
<td>32</td>
</tr>
<tr>
<td>27</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What was the students’ favorite day to be absent?

2. On which day of the week were fewer students absent?

3. What day of the week might the principal choose for a fire safety assembly and why?

4. What day of the week might he principal choose for an entertainment assembly and why?

5. The principal has decided to give the students a day off school. What day of the week would you choose for the day off? How would you display the attendance data to convince the principal to select that day?
A bar graph compares groups and the data is usually represented by the length of the bar.

In a picture graph, the data is represented by pictures, objects or symbols. A key is used to show the value of each picture, object or symbol.

A line graph uses a line to show how something changes over a period of time.

A line plot shows data along a vertical number line.

A table or chart is used to organize data into rows and columns.

Data is defined as the collected information that will be shown on the graph.

An interval is the distance between any two numbers on the scale.

A scale is a series of numbers placed at fixed distances on the side of a graph.

A Venn diagram is a visual comparison of the similarities and differences of two or more groups of data.