

How Graphs Help Us - Grade One

Ohio Standards Connection

Data Analysis & Probability Standard

Benchmark C

Represent data using objects, picture graphs and bar graphs.

Indicator 4

Read and interpret charts, picture graphs and bar graphs as sources of information to identify main ideas, draw conclusions, and make predictions.

Related Benchmarks

Benchmark A

Pose questions and gather data about everyday situations and familiar objects.

Indicator 5

Construct a question that can be answered by using information from a graph.

Benchmark B

Sort and classify objects by attributes, and organize data into categories in a simple table or chart.

Indicator 7

Answer questions about the number of objects represented in a picture graph, bar graph or table graph; e.g., category with most, how many more in a category compared to another, how many altogether in two categories.

Lesson Summary:

In this lesson, students learn why graphs are important tools in understanding and solving problem situations. Students analyze the kinds of shoes they are wearing. They answer questions posed by the teacher about the shoes when the shoes are scattered randomly and conclude it may be easier to answer the questions if the shoes were organized. The teacher introduces a graph to the students as a mathematical tool that organizes data and helps the user answer questions about the data.

Estimated Duration: 90 minutes (two 45-minute class sessions)

Commentary:

Students see the need for graphs when they understand it helps them answer questions that are not easily identifiable. Students should be encouraged to investigate their world by posing questions, organizing responses and creating representations of the data. Using data and graphing skills can expand students understanding in other areas. The visualization of such data allows diverse learners to have access to the information and a clearer understanding of their world.

Pre-Assessment:

The purpose of the pre-assessment is to determine students' prior knowledge of sorting objects as a prerequisite to understanding categories of data.

- Distribute to each student a collection of six to 10 objects in a re-sealable bag. Make the collections so that the objects can be sorted into two to four groups. Objects such as pattern blocks, colored paper clips, attribute blocks or coins are suggested. Use a variety of collections to allow opportunities for multiple sorting experiences.
- Have students observe the objects and sort them into groups. Observe students as they work and ask individuals to explain how they sorted the objects. Use a checklist or notes for anecdotal records of student understanding.
- Each student exchanges with another student who has a different collection of objects. Continue to observe the students as they sort, asking questions and recording information on student performance

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Mathematical Processes

Benchmarks

- A. Use a variety of strategies to understand problem situations; e.g., discussing with peers, stating problems in own words, modeling problems with diagrams or physical materials, identifying a pattern.
- I. Communicate mathematical thinking by using everyday language and appropriate mathematical language.

- Students sit in a circle on the carpet or floor. Ask several students to explain how they sorted the objects.
- Scatter a collection of 30 to 40 pattern blocks on the floor in the middle of the circle. Direct the students to look at the pattern blocks. Ask questions to gather information about the pattern blocks. Have students discuss each question with partners. Observe the methods students use to find the answers, such as counting. Sample questions may include:
 1. How would you sort the pattern blocks?
 2. Which shape do you see most often? (Answers will vary based on the collection.)
 3. How many more yellow shapes than green shapes are there? (Answers will vary based on the collection.)
 4. How did you find the answers to the questions? (Count.)
 5. Can you think of a way that may make it easier for us to answer these questions without having to count the blocks every time? (Students may suggest sorting the shapes into piles by color or writing down the number of each kind of shape.)
- Write anecdotal notes while listening to partner discussions. Suggestions for notes include methods for solving, use of appropriate vocabulary such as “graph” and students who demonstrate inadequate understanding of sorting a set of objects according to one or multiple characteristics.

Instructional Tip:

For students who suggest stacking or lining the blocks up to organize them, ask why they used that method. Ask them if they know what a graph is and have them explain how a graph would help them answer questions about the blocks. Students may say that graphs organize or separate information (“things”) and make it easier to answer questions about the information. If students do not sort or organize the blocks by a characteristic, guide them to the idea of sorting blocks into like groups. Explore different ways that blocks can be sorted (color, size, with or without leaf).

Scoring Guidelines:

This activity informally assesses student’s ability to sort objects according to one characteristic. Use anecdotal notes to record conceptions and misconceptions of sorting a set of objects, *Pre-Assessment Checklist*, Attachment A. Students who demonstrate an inadequate understanding of sorting by randomly grouping the objects will require intervention strategies.



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Post-Assessment:

- Distribute *Pizza Graph*, Attachment B, to each student.
- Read the directions and have students fill in the bar graph according to the information given.
- Read the four questions and ask students to answer them orally, by drawing pictures or in writing.
- Instruct students to create questions about the graph and then have them ask the questions orally or in writing.

Scoring Guidelines:

Use the four-point rubric, *Post-Assessment Rubric*, Attachment C, to assess student understanding and to determine appropriate intervention.

Instructional Procedures:

Part One

1. Have students sit on the floor in a circle. They remove one of their shoes and place it in the middle of the circle.
2. Ask students questions about the shoes. Questions may include:
 - What kind of shoes do you see?
 - How many shoes are there?
 - What kind of shoe did more students wear to school today?Explain that the types of shoes they named are called *categories* (tennis shoes, dress shoes, sandals, slip-on). Write the word “categories” on a sentence strip or board for students to see. Have students say the word.
3. Ask students how they can answer more questions about the shoes? (This reinforces the idea addressed in the pre-assessment of sorting objects into categories based on one characteristic.) Tell them that grouping the shoes makes it easier to distinguish their characteristics.
4. Make a physical model of a graph. Line up the shoes in columns and place a sheet of paper with the name of the category under the column. Tell students that the paper names the type of shoes or categories of shoes. Place sheets of paper with the numbers 1 to 10 (more if needed) in a column to the left of the shoes. Explain that the numbers tell how many shoes there are in a category.

Instructional Tip:

A large floor graph can be used to place the shoes and labels (categories and numbers). The floor graph can be made using chart or roll paper. Use self-adhesive notes to label the categories and numbers.

5. Ask students questions about the number of shoes in each category. Questions may include:
 - How many dress shoes are there?
 - How many sandals are there?
6. Ask questions that compare the categories. Questions may include:
 - Which kind of shoes are there more of? How do you know?
 - How many more tennis shoes than sandals are there? How do you know?

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- Are there more dress shoes than sandals? How do you know?
 - Which kind of shoes are there more of than slip-ons? How do you know?
7. Ask questions that combine categories. Questions may include:
 - How many tennis shoes and dress shoes are there? How will you find your answer?
 - How many shoes are there? How did you find your answer?
 8. Model for students how to make a bar graph of the shoes on chart paper or the board. Have the students complete the bar graph. Use *Blank Graph*, Attachment D. If more than four categories are needed, create a blank graph for the number of categories. Observe students as they shade in the bars. Assist students who shade in too many or not enough boxes.
 9. Tell the students that the information about shoes on the graph is called *data*. Show the students the word *data* on a sentence strip or chalkboard. Have the students say the word. Tell students that *data* is information that helps answer a question. Refer to the questions in step three.
 - What kind of shoes do you see?
 - How many shoes are there?
 - What kind of shoe did more students wear to school today?

Tell students they can answer these questions now using the data in the graph. Allow partners to discuss and answer the questions. Listen to the discussions to determine students' understanding.

10. To close the lesson, review the vocabulary and ask students to answer the following questions with partners. Ask students to share their responses with the class.
 - How do graphs help us?
 - What is data?
 - What categories did we use to sort the shoes?
 - Are there other categories we could use to sort the shoes and make a graph?

Write a summary of student responses on the chalkboard or chart paper. An example of a summary follows:

Graphs help answer questions. They sort data and show how many objects are in a category.

Part Two

Instructional Tip:

Prepare a collection of objects for each pair of students. Draw a bar graph representing the objects in the bag and make copies for each student. Use four categories. Items that may be used are coins, colored candies or cereal, construction paper shapes or pattern blocks. This part of the lesson may take two days.

11. Give each pair of students a collection of objects in a re-sealable bag.
12. Ask students what they would like to know about their collection of objects. Tell them to write questions with a partner. (It is not important to answer the questions at this time.) They should not open the bag, but just observe the objects inside. Model a question aloud, such as:
 - What categories can I use?
 - How many squares are in the bag?
 - Are there more pennies than nickels in the bag?

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Walk around the room and listen to partners as they make up questions. Assist students whose make questions are not relevant to their collections of objects.

13. Have students bring their collections and sit in a circle on the floor. Ask students to share their questions with the class and record the questions on chart paper or the chalkboard.
14. Choose a question to answer about the objects. Show students the bar graph of the objects. Ask them to identify it.
15. Give half of the class a bar graph representing the collection. Allow the other half to open the bag of objects and use them to answer questions. Use the questions created by the students about the collection. Announce who answered the question first, someone using the bar graph or counting the objects. Students should realize that a bar graph makes it easier to answer the questions.
16. Give all students the bar graph for the collection. In partners, have students ask each other questions about the information in the graph. Observe partners and listen to questions.
17. Ask students for questions about other students in the class. For example, how many siblings or pets students have? What is their favorite ice cream flavor? Select one of the questions, ask each student to answer and record the data on the board. Have students create a bar graph, *Bar Graph Template*, Attachment D, using the data.
18. Complete an outline to summarize information about bar graphs. Complete the outline together as a class. If students lack writing skills, put the outline on chart paper to post in the class. Use *How Graphs Help Us*, Attachment E. For example,

I learned about	<u>bar graphs.</u>
I learned that	<u>they help us.</u>
Details	<u>organize or sort things into groups</u>
	<u>tell how many of each group</u>
	<u>easier to answer questions than counting</u>

Students can use the outline to write sentences about the bar graph and information they have learned.
19. Conduct the post-assessment activity, *Pizza Graph*, Attachment B.

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).

- Differentiated instructional techniques are embedded within the lesson. Students' movement to and from the circle benefit the kinesthetic learners. Graphing activities use models and representations for visual learners. Discussion opportunities and teacher modeling aloud assist auditory learners.
- Students are paired with other students throughout the lesson. Pairings maybe random or purposeful when combining students of various performance levels in the pre-assessment.
- Allow students to respond orally or in writing on the post-assessment depending upon their writing skills.

Extensions:

- For students interested in nature, sorting and graphing items found on a nature hike around the school could be graphed (kinds of animals or plants).



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- Have the students create their own graphs using eye color, hair color, shirt color or any appropriate category that they choose. *Blank Graph*, Attachment D, is included to help with further graphing projects.

Home Connections:

- Using *Blank Graph*, Attachment D, students can sort objects in their toy box or closet and create graphs with parent assistance.
- Families read their favorite children's story and draw a picture representing that story on a square of paper. When these return to the classroom the teacher, assists students in putting the information into a graph to display in the hallway. The categories for the graph are determined by the information the students bring with them or the literary skill being studied in reading class. The teacher may graph the data by author, title, topic, fiction or nonfiction, etc. There may be more than one way to sort the data which makes for an interesting discussion with students.

Interdisciplinary Connections:

English Language Arts

Research

Benchmark A: Generate questions for investigation and gather information from a variety of sources.

Indicator 1: Discuss ideas for investigation about a topic or area of personal interest.

Writing Process

Benchmark C: Use organizers to clarify ideas for writing assignments.

Indicator 4: Use organizational strategies (e.g., brainstorming, lists, webs and Venn diagrams) to plan writing.

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: re-sealable bags and collections of objects, sheets of paper or self-adhesive notes for floor graph, chart paper and markers

For the student: re-sealable bags with collections of objects

Vocabulary:

- category
- data
- graph



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- information
- label
- sort

Technology Connections:

- Make graphs from photos taken with a digital camera. Have students take the photos themselves and determine the topic for a class or project graph.
- Use computer software to access sample graphs and analyze the data. Software programs can provide intervention for students who need additional practice with this concept.

Research Connections:

Marzano, Robert J., Jane E. Pollock and Debra Pickering. *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement*, Alexandria, Va: Association for Supervision and Curriculum Development, 2001.

Attachments:

Attachment A, *Pre-Assessment Checklist*

Attachment B, *Pizza Graph*

Attachment C, *Post-Assessment Scoring Guideline*

Attachment D, *Blank Graph*

Attachment E, *How Graphs Help Us*



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Attachment B Pizza Graph

Directions: Read the story. Fill in the graph.

The school cafeteria wants to know which pizza kids like best. Fill in the graph with the information to find out what they learned.

- Six kids like Supreme pizza the best. Color that bar blue.
- Twelve kids chose Sausage. Color that bar green.
- Two fewer kids chose Cheese than Supreme. Color that bar red.
- Four more kids chose Pepperoni than Cheese. Color that bar yellow.

Pizza Orders

12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				
	Cheese	Pepperoni	Sausage	Supreme

Toppings



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Attachment B (continued) Pizza Graph

1. Which type of pizza was chosen the most?

2. How many fewer kids chose Pepperoni than Sausage?

3. Which two toppings had the same number?

4. Write your own question that could be answered using the graph.

Bonus question:

If we were to order pizzas for our class, what kinds should we get? Why?
Be sure to use the information on the graph.

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Attachment C Post-Assessment Scoring Guideline

Score	Description of Performance
4	<p>The response shows understanding of creating and reading graphs, developing questions using information from a graph and drawing conclusions based on the information in a graph.</p> <ul style="list-style-type: none"> • Bar graph is completed accurately. <ol style="list-style-type: none"> 1. Cheese – 4 2. Pepperoni – 8 3. Sausage – 12 4. Supreme - 6 • Three or four responses to the questions are correct. <ol style="list-style-type: none"> 1. pepperoni 2. 4 3. 10 4. Sausage should be ordered, because more students chose it. The response may include pepperoni as the second most popular choice. • An appropriate question for the information is given. (Answers may vary.)
3	<p>The response shows adequate understanding of creating and reading graphs, developing questions using information from a graph or drawing conclusions based on the information in a graph.</p> <ul style="list-style-type: none"> • Bar graph is completed with no or minor errors. The errors may occur because student miscalculates or misinterprets directions C and/or D. If the wrong calculation is graphed correctly, consider this a minor error. • Answers three to four of the questions based on the information in the graph. If calculation errors are evident, accept responses based on the errors. • An appropriate question for the information is given (answers may vary).
2	<p>The response shows basic understanding of creating and reading graphs, developing questions using information from a graph or drawing conclusions based on the information in a graph.</p> <ul style="list-style-type: none"> • Bar graph is completed with a few minor errors. The errors may occur because student miscalculates or misinterprets directions C and D OR shaded bars are off by one box for one or two bars. • Answers two of the questions based on the information in the graph. If calculation errors are evident, accept responses based on the errors. • An appropriate question for the information is attempted but not completed. (Answers may vary.)

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Attachment C (continued) Post-Assessment Scoring Guideline

<i>1</i>	<p>The response shows limited understanding of creating and reading graphs, developing questions using information from a graph or drawing conclusions based on the information in a graph.</p> <ul style="list-style-type: none"> • Bar graph is completed with several major and minor errors. The errors may occur because student miscalculates or misinterprets directions C and D OR shaded bars are off by more than one box for one or two bars. • Answers one to two of the questions based on the information in the graph. If calculation errors are evident, accept responses based on the errors. • A question for the information is not given or is not related to the data in the graph. (Answers may vary.)
<i>0</i>	<p>The response shows inadequate understanding of creating and reading graphs, developing questions using information from a graph or drawing conclusions based on the information in a graph.</p> <ul style="list-style-type: none"> • Bar graph is completed with no correct shaded bars. • Answers zero to one of the questions based on the information in the graph. • A question for the information is not given or is not related to the data in the graph. (Answers may vary.)

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Attachment D Bar Graph Template

14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				



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Attachment E How Graphs Help Us

Name _____

I learned about _____

I learned that _____

Details _____
