

ANALYZING SCALED GRAPHS

3.DS.A.1,2

CONTENTS

The types of documents contained in the unit are listed below. Throughout the unit, the documents are arranged by lesson.

LEARNING MAP INFORMATION	An overview of the standards, the learning map section, and the nodes addressed in this unit
TEACHER NOTES	A brief discussion describing the progression depicted in the learning map section with research-based recommendations for focusing instruction to foster student learning and an introduction to the unit's lessons
OVERVIEW OF INSTRUCTIONAL ACTIVITIES	A table highlighting the lesson goals and nodes addressed in each lesson of this unit
INSTRUCTIONAL ACTIVITY	A detailed walkthrough of the unit
INSTRUCTIONAL ACTIVITY STUDENT HANDOUT	A handout for the guided activity, intended to be paired with the Instructional Activity
INSTRUCTIONAL ACTIVITY SUPPLEMENT	A collection of materials or activities related to the Instructional Activity
STUDENT ACTIVITY	A work-alone activity for students
STUDENT ACTIVITY SOLUTION GUIDE	A solution guide for the work-alone activity with example errors, misconceptions, and links to the learning map section

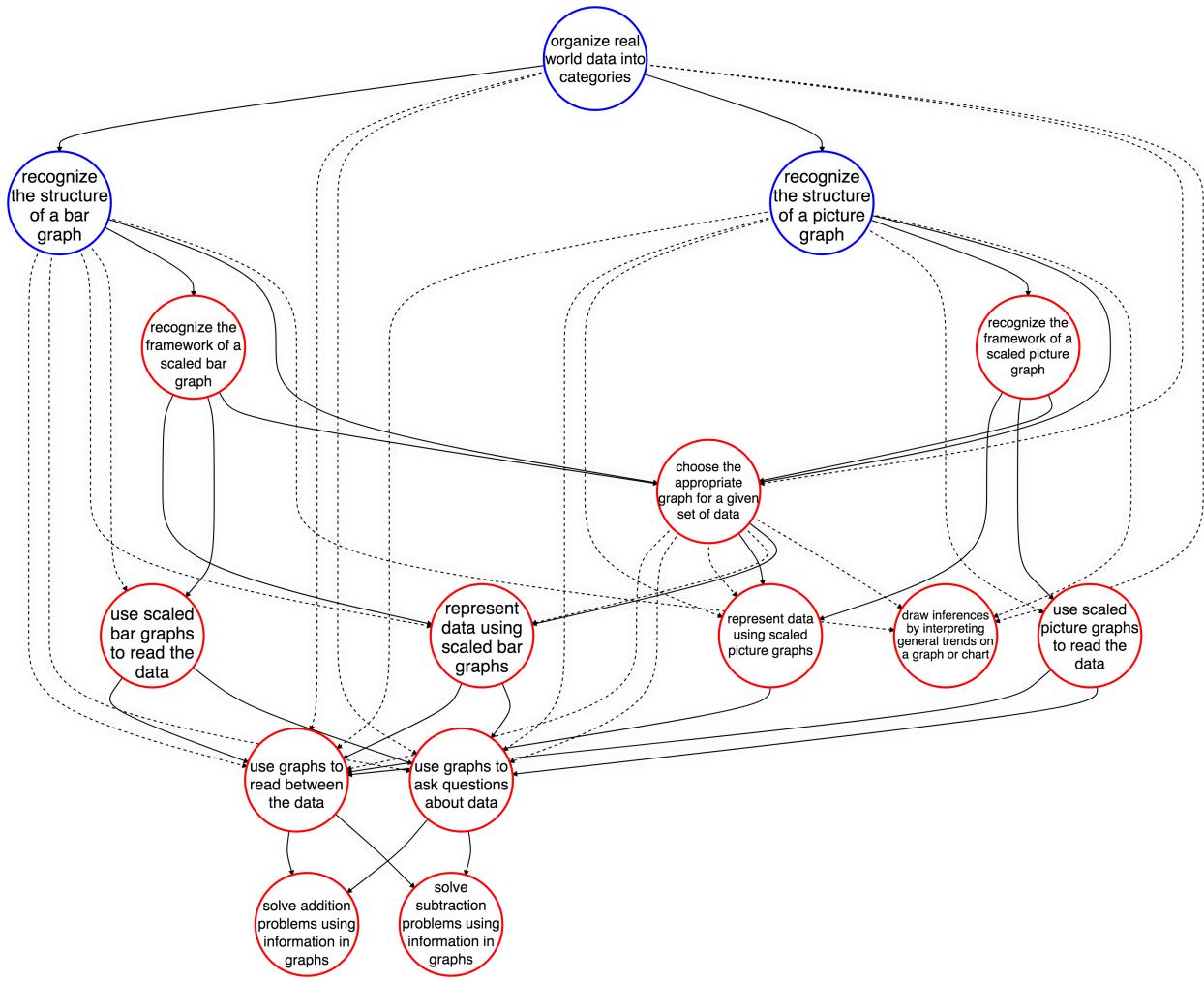
ANALYZING SCALED GRAPHS

LEARNING MAP INFORMATION

STANDARDS

3.DS.A.1 Create frequency tables, scaled picture graphs and bar graphs to represent a data set with several categories.

3.DS.A.2 Solve one- and two-step problems using information presented in bar and/or picture graphs.



*Learning map model of 3.MD.3

Node Name	Node Description
CHOOSE THE APPROPRIATE GRAPH FOR A GIVEN SET OF DATA	Choose the appropriate graph for a given set of data (e.g., bar graph, pie chart, line graph, etc.).
DRAW INFERENCES BY INTERPRETING GENERAL TRENDS ON A GRAPH OR CHART	Make conclusions by analyzing and evaluating data as it is represented in a graph or a chart.
ORGANIZE REAL-WORLD DATA INTO CATEGORIES	Make decisions about how to categorize real-world data based on attributes of the data and organize the data into identified categories.
RECOGNIZE THE FRAMEWORK OF A SCALED BAR GRAPH	Make known your understanding that a bar graph is used to display discontinuous data such as eye color or shoe size with a scale other than one.
RECOGNIZE THE FRAMEWORK OF A SCALED PICTURE GRAPH	Make known your understanding that a scaled picture graph is used to display data by a picture or a symbol with a scale other than one.
RECOGNIZE THE STRUCTURE OF A BAR GRAPH	Recognize the framework, specifiers, and labels of a bar graph to understand how information is presented in a display. The framework of a graph—including axes, scales, grids, and reference markings—provides information about how data is being measured. Specifiers, such as bars on a bar graph, are used to represent the data values. Labels denote the naming for the data represented on the x -axis and y -axis as well as the title of the graph.
RECOGNIZE THE STRUCTURE OF A PICTURE GRAPH	Recognize the framework, specifiers, and labels of a picture graph to understand how information is presented in a display. The framework of a graph—including axes, scales, grids, and reference markings—provides information about how data is being measured. Specifiers, such as pictures in a picture graph, are used to represent the data values. Labels denote the naming for the data represented on the x -axis and y -axis as well as the title of the graph.
REPRESENT DATA USING SCALED BAR GRAPHS	Create a scaled bar graph for a given set of data.
REPRESENT DATA USING SCALED PICTURE GRAPHS	Create a scaled picture graph for a given set of data.
SOLVE ADDITION PROBLEMS USING INFORMATION IN GRAPHS	Use graphs to solve addition word problems.
SOLVE SUBTRACTION PROBLEMS USING INFORMATION IN GRAPHS	Use graphs to solve subtraction word problems.
USE GRAPHS TO ASK QUESTIONS ABOUT DATA	Use graphs to answer questions that require interpretation and integration of information presented in a graph.
USE GRAPHS TO READ BETWEEN THE DATA	Answer questions that require interpretation and integration of information presented in a graph.
USE SCALED BAR GRAPHS TO READ THE DATA	Read a scaled bar graph to gather information about data.
USE SCALED PICTURE GRAPHS TO READ THE DATA	Read a scaled picture graph to gather information about data.

ANALYZING SCALED GRAPHS

TEACHER NOTES

This unit includes the following documents:

- ▶ Learning Map Information
- ▶ Instructional Activity (three lessons)
- ▶ Instructional Activity Student Handout (for Lesson 2)
- ▶ Instructional Activity Supplement (for Lesson 1)
- ▶ Student Activity
- ▶ Student Activity Solution Guide

In this unit, students will read, analyze, and create scaled bar graphs and scaled pictographs.

RESEARCH

Everyday life is inundated with graphs and statistics; they appear in advertisements, polls, societal trends, information on health and wellness, and even in the classroom as student progress and achievement (Van de Walle, Karp, Lovin, Bay-Williams, 2014). Graphing provides a meaningful opportunity for students to represent and communicate important mathematical relationships (Larson & Whitin, 2010). Students begin their exploration of data analysis early in elementary school using basic graphs, such as bar graphs and pictographs, and then advance to creating and analyzing data gathered themselves in later grades. The use of basic graphs initially allows students to analyze data between categories and then eventually extends into analyzing different data sets. Additionally, students need to understand that data can be gathered with respect to particular contexts or situations and then can be used to answer questions about the context or situation (Franklin, Kader, Mewborn, Moreno, Peck, Perry, & Schaeffer, 2007). The study of statistics and data moves mathematics beyond just arithmetic and numbers to information and data about the world. Students in grades three through five are also becoming more aware of the world beyond themselves and are ready to address some questions that have the potential to influence further-reaching decisions (NCTM, 2000).

While statistics and mathematics both involve the use of numbers, graphs, and charts, they are not the same field and require different processes and reasoning (Van de Walle, et al., 2014). According to Van de Walle and colleagues (2014), statistics is about more than just numbers: it is about numbers in context (i.e. data), and the context is central to answering statistical questions and using statistical reasoning (i.e. statistical literacy). The goal of data analysis is to contribute to statistical literacy among individuals and create an ability to use, analyze, transform, and create data. As our world changes and becomes more interconnected, today's students will have more data available at the touch of a button than in the past. Statistical literacy is essential in our personal lives as consumers, citizens, and professionals (Franklin, et al., 2007). To help students develop statistical literacy, an education in data analysis should begin in the early elementary grades and continue throughout the remainder of a student's educational career, as they strengthen and expand on their critical thinking and problem-solving skills (Franklin, et al., 2007). Students will progress from analyzing a single data set, where they might be most interested in their individual answers, to analyzing differences

between data sets to make decisions and answer questions.

There are four steps in the general process for doing statistics: formulating questions, data collection, data analysis, and interpreting results (Van de Walle, et al., 2014). Because statistics is considering numbers in relation to a specific context, the first step is developing questions in order to create the context for the numbers or data that will be collected.

Once questions have been generated and established, students can begin collecting data, the second step in the statistics process. There are two different types of data: categorical and numerical. The following figure details the difference between the two types of data.

AN EXAMPLE

According NCTM (2000), by the sixth grade students should be able to sort these two types of data. Therefore, Van de Walle and Colleagues (2014) point out, grades three through five are important for establishing the foundational understanding of the two types of data.

Type of Data	Definition	Types of Questions (Context)
Categorical data	Information collected on things that can be grouped by labels	<ul style="list-style-type: none"> ▶ Favorite food ▶ Most popular pet name ▶ Types of shoes in a classroom
Numerical data	Information counted or measured on a continuous scale	<ul style="list-style-type: none"> ▶ Distance traveled to get to school ▶ Amount of plant growth over the course of a month ▶ Height of students in a class

When students collect data they should be aware of three factors: (1) how the data will be organized so they do not ask some people more than once and others not at all, (2) that they gather data from other classes so they have enough data for a representative sample, and (3) that they take into consideration variability, which means that if they ask a group of kindergarteners and a group of third graders what their favorite book is, the answers will vary significantly (Van de Walle, et al., 2014).

The third step of the statistics process is analyzing the data that has been collected. The initial part of analyzing data is classification, which means deciding how the data will be categorized. Once the data has been categorized, it can then be represented graphically. Discuss with students why different graphical representations are better for some data sets than others. Likewise, be aware that if students are creating the graphs, some graphical representations—such as line graphs and circle graphs—are better suited for students in intermediate and higher grade levels; however, this does not mean that students in elementary grades

should not be exposed to these graphical representations or taught how to read and analyze them.

The fourth and final step in the statistic process is interpreting the results, which is when students are asked questions about their data and they must think statistically about what their data represents. Van de Walle, et al. (2014) provides a collection of questions from different researchers designed to promote statistical thinking (p. 391):

- ▶ What do the numbers (symbols) tell us about our class (or other population)?
- ▶ If we asked another class (population), how would the data look? What if we asked a larger group, how would the data look?
- ▶ How do the numbers in this graph (population) *compare* to this graph (population)?
- ▶ Where are the data “clustering”? Where are the data that are not in the cluster? About what percent is or is not in the cluster?
- ▶ Would the results be different if [change of sample, population, or setting]?
- ▶ What does the graph *not* tell us?
- ▶ What new questions arise from these data?
- ▶ What is the maker of the graph trying to tell us?

Questions such as these should be incorporated both during and after instruction on the creation of the graphical representations.

LEARNING MAP INFORMATION

The learning map section for this sequence of activities begins with organizing data into categories and then recognizing the structure of bar graphs and pictographs. Following an understanding of the basic graphs, the nodes advance to recognizing the framework of scaled bar graphs and pictographs. A solid understanding of the basic graphs provides a foundation for the further development of using scaled intervals to describe data sets. Students can then use the scaled graphs to read data from the graph or represent data using a scaled graph.

Scaled bar graphs and scaled pictographs can then be used to analyze data. Students should be able to ask questions about the data and read between the data as part of their analysis. Students will also be expected to solve addition and subtraction problems using the information in the graphs as they read between the data. While these two types of scaled graphs are only some of the data displays students will encounter in their education, they are common graphs to be learned.

INSTRUCTIONAL ACTIVITIES

The activities in this unit are designed to allow students to read and analyze scaled bar graphs and scaled pictographs. First, students are given graphs to read and analyze. Next, students are given two different data sets and asked to create appropriate graphs for each data set. Students will then read and analyze those graphs. Finally, students will gather their own data to create scaled bar graphs and pictographs with other students to create a multi-value graph to read and analyze.

REFERENCES

- Franklin, C., Kader, G., Mewborn, D., Moreno, J., Peck, R., Perry, M., Scheaffer, R. (2007). *Guidelines for assessment and instruction in statistics education (GAISE) report: A pre-K-12 curriculum framework*. Alexandria, VA: American Statistical Association.
- Larson, M. J., & Whitin, D. J. (2010). Young children use graphs to build mathematical reasoning. *Dimensions of early childhood*, 38(3), 15-22.
- National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Van de Walle, J., Karp, K., Lovin, L., Bay-Williams, J. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades 3-5* (2nd ed.). Upper Saddle River, NJ: Pearson.

ANALYZING SCALED GRAPHS

OVERVIEW OF INSTRUCTIONAL ACTIVITIES

Lesson	Learning Goal	Nodes Addressed
Lesson 1	Students will read and analyze scaled pictographs and bar graphs.	<ul style="list-style-type: none"> ▶ RECOGNIZE THE FRAMEWORK OF A SCALED BAR GRAPH ▶ USE SCALED BAR GRAPHS TO READ THE DATA ▶ USE GRAPHS TO READ BETWEEN THE DATA ▶ RECOGNIZE THE FRAMEWORK OF A SCALED PICTOGRAPH ▶ USE SCALED PICTOGRAPHS TO READ THE DATA
Lesson 2	Students will create, read, and analyze scaled pictographs and bar graphs.	<ul style="list-style-type: none"> ▶ REPRESENT DATA USING SCALED BAR GRAPHS ▶ REPRESENT DATA USING SCALED PICTOGRAPHS ▶ USE SCALED BAR GRAPHS TO READ THE DATA ▶ USE GRAPHS TO READ BETWEEN THE DATA ▶ USE GRAPHS TO ASK QUESTIONS ABOUT THE DATA ▶ USE SCALED PICTOGRAPHS TO READ THE DATA
Lesson 3	Students will create a scaled graph from data that they collect. Students will then read and analyze the data using the created graph.	<ul style="list-style-type: none"> ▶ CHOOSE THE APPROPRIATE GRAPH FOR A GIVEN SET OF DATA ▶ REPRESENT DATA USING SCALED PICTOGRAPHS ▶ REPRESENT DATA USING SCALED BAR GRAPHS ▶ USE GRAPHS TO READ BETWEEN THE DATA

ANALYZING SCALED GRAPHS

INSTRUCTIONAL ACTIVITY

Lesson 1

LEARNING GOAL

Students will read and analyze scaled bar graphs and pictographs.

PRIMARY ACTIVITY

Students will be given a scaled bar graph and scaled pictograph to read and analyze. Using the graphs, students will answer questions comparing the data. Students will also be asked to compare and contrast the two different types of displays.

OTHER VOCABULARY

Students will need to know the meaning of the following terms:

- ▶ Scaled bar graph
 - ▶ Scaled pictograph
 - ▶ Horizontal axis
 - ▶ Vertical axis
 - ▶ Title
 - ▶ Scale
 - ▶ Interval
 - ▶ Key
-

MATERIALS

- ▶ **INSTRUCTIONAL ACTIVITY SUPPLEMENT** (Recommend one copy for every group of three to four students.)
- ▶ Two sticky notes, or small slips of paper, per student

IMPLEMENTATION

Students will be working in groups of three or four for this activity, and they need to be seated near their group members to allow for discussion.

Begin with a **review** of bar graphs, as necessary. Students should be familiar with the parts of a bar graph such as title, axis, and scale. Students should discuss with their group what they know and understand of bar graphs.

Present the bar graph titled “Most Popular Categories of Books Checked Out by Mr. Arbuckle’s Class” from the **INSTRUCTIONAL ACTIVITY SUPPLEMENT**. **Use** a Think-Pair-Group-Share cooperative learning strategy to discuss the graph.

First, **give** students time to independently read and analyze the graph.

Next, **ask** students to discuss with a partner what information they can read from the graph. Then **ask** groups to discuss the graph.

Finally, **invite** groups to share their analysis and information from the graph. **Probe** students’ thinking about the data set that was used for this bar graph. **Ask** questions allowing students to consider what changes would be needed for the bar graph if the data set included much larger values.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ Why was a bar graph chosen for this data?
- ▶ Do you think a bar graph is a good data display for this data? Why or why not?
- ▶ What other data display could be used to share this same data set?
- ▶ How would this bar graph change if more data values were collected (for example, book checkout totals for the entire school)?
- ▶ What limits are placed on data values in a bar graph like this?

Next, **present** the scaled bar graph titled “Most Popular Categories of Books Checked Out at Garfield Elementary in September” from the **INSTRUCTIONAL ACTIVITY SUPPLEMENT**. **Use** a Think-Pair-Group-Share cooperative learning strategy to discuss the graph.

First, **give** students time to read and analyze the graph independently.

Next, **ask** students to discuss with a partner what information they can read from the graph. Then **ask** groups to discuss the graph.

Finally, **invite** groups to share their analysis and information from the graph. **Draw** students' attention to the differences in this data compared to the non-scaled bar graph, if students don't notice the differences on their own.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ Why was a bar graph chosen for this data?
- ▶ Do you think a bar graph is a good data display for this data? Why or why not?
- ▶ What other data display could be used to share this same data set?
- ▶ How is this bar graph different from the first bar graph presented?
- ▶ How could this bar graph be made just like the first?
- ▶ How are the data values in this bar graph different from the data values in the first bar graph?

Determine if the student can **RECOGNIZE THE FRAMEWORK OF A SCALED BAR GRAPH:**

- ▶ What information does this bar graph display?
- ▶ What information does the height of the bars display?
- ▶ How can you use the height of the bars to compare the data categories?
- ▶ What is the scale of the bar graph?
- ▶ Why was this scale chosen for this data set?
- ▶ How would a different scale affect the bar graph?
- ▶ Without the scale, what information can you still read from the graph? What information would you not be able to read?

Determine if the student can **USE SCALED BAR GRAPHS TO READ THE DATA:**

- ▶ Can you identify the number of books checked out for each category?

Determine if the student can **USE GRAPHS TO READ BETWEEN THE DATA:**

- ▶ Can you rank the book categories from most popular to least popular?
- ▶ How many more fantasy books were checked out than biographies?
- ▶ How many more sports books were checked out than art books?
- ▶ How many more animal books were checked out than fantasy books?
- ▶ How many more books were checked out in the most popular category compared to the second most popular category?
- ▶ How many fewer art books were checked out than sports books?
- ▶ How many fewer fantasy books were checked out than sports books?
- ▶ How many fewer books were checked out in the two least popular categories than in the most popular two categories?
- ▶ How many fewer books were checked out in the least popular category than in the most popular category?

After discussing and analyzing scaled bar graphs, students will explore scaled pictographs.

Begin with a **review** of pictographs, as necessary. Students should be familiar with the parts of a pictograph such as title, category labels, symbols, and key. **Require** students to discuss with their group what they know and understand about pictographs.

Present the pictograph titled “Wacky Weekend Fishing Tournament Leaders Saturday Morning Totals” from the [INSTRUCTIONAL ACTIVITY SUPPLEMENT](#).

Use a Think-Pair-Group-Share cooperative learning strategy to discuss the graph.

First, **give** students time to read and analyze the graph independently.

Next, **ask** students to discuss with a partner what information they can read from the graph. Then **ask** groups to discuss the graph.

Finally, **invite** groups to share their analysis and information from the graph. **Probe** students’ thinking about the data set that was used for this pictograph. **Ask** questions allowing students to consider what changes would be needed for the pictograph if the data set included much larger values.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ Why was a pictograph chosen for this data?
- ▶ Do you think a pictograph is a good data display for this data? Why or why not?
- ▶ What other data display could be used to share this same data set?
- ▶ How would this pictograph change if more data values were collected (for example, fish totals for the entire weekend tournament)?
- ▶ What limits are placed on data values in a pictograph like this?

Next, **present** the scaled pictograph titled “Wacky Weekend Fishing Tournament Leaders Tournament Totals” from the [INSTRUCTIONAL ACTIVITY SUPPLEMENT](#).

Use a Think-Pair-Group-Share cooperative learning strategy to discuss the graph.

First, **give** students time to read and analyze the graph independently.

Next, **ask** students to discuss with a partner what information they can read from the graph. Then **ask** groups to discuss the graph.

Finally, **invite** groups to share their analysis and information from the graph. **Draw** students' attention to the differences in this data compared to the non-scaled pictograph, if students don't notice the differences on their own.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ Why was a pictograph chosen for this data?
- ▶ Do you think a pictograph is a good data display for this data? Why or why not?
- ▶ What other data display could be used to share this same data set?
- ▶ How is this pictograph different from the first pictograph presented?
- ▶ How are the data values in this pictograph different from the data values in the first pictograph?

Determine if the student can **RECOGNIZE THE FRAMEWORK OF A SCALED PICTOGRAPH:**

- ▶ What information does this pictograph display?
- ▶ What is the scale of the pictograph?
- ▶ Why was this scale chosen for this data set?
- ▶ How would a different scale affect the pictograph?
- ▶ Without the scale, what information can you still read from the graph?

Determine if the student can **USE SCALED PICTOGRAPHS TO READ THE DATA:**

- ▶ Identify the number of fish caught by each contestant.

Determine if the student can **USE GRAPHS TO READ BETWEEN THE DATA:**

- ▶ Rank the contestants from most fish caught to least fish caught.
- ▶ How many more fish did Kevin catch compared to Landen?
- ▶ How many more fish did Elaine catch compared to Joe?
- ▶ How many more fish did the winner catch compared to the fifth-place contestant?
- ▶ How many more fish did the fourth-place contestant catch compared to the fifth-place contestant?
- ▶ How many fewer fish did Elaine catch compared to Tara?
- ▶ How many fewer fish did Joe catch compared to Landen?
- ▶ How many fewer fish did the second-place contestant catch compared to the winner?
- ▶ How many fewer fish did the two females catch compared to the three males?

After students have analyzed both the scaled bar graph and the scaled pictograph, **ask** students to compare and contrast the scaled bar graph and scaled pictograph.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ In what ways are scaled bar graphs similar to scaled pictographs?
- ▶ How are scaled bar graphs and scaled pictographs different?
- ▶ How do both bar graphs and pictographs display data values?
- ▶ How does the scale affect the visual display of the scaled bar graph and scaled pictograph?
- ▶ Does the scale on a bar graph work the same as the scale on a pictograph?
- ▶ What happens if the graphs are not scaled?

Students should be required to describe their understanding of the use of scale in a bar graph and in a pictograph. Students should be able to describe how using a different scale would affect the appearance of a scaled bar graph or pictograph.

At the end of the activity, **give** each student two sticky notes. On one sticky note, students will complete the following statement:

Eureka! I now understand _____ about scaled bar graphs and pictographs.

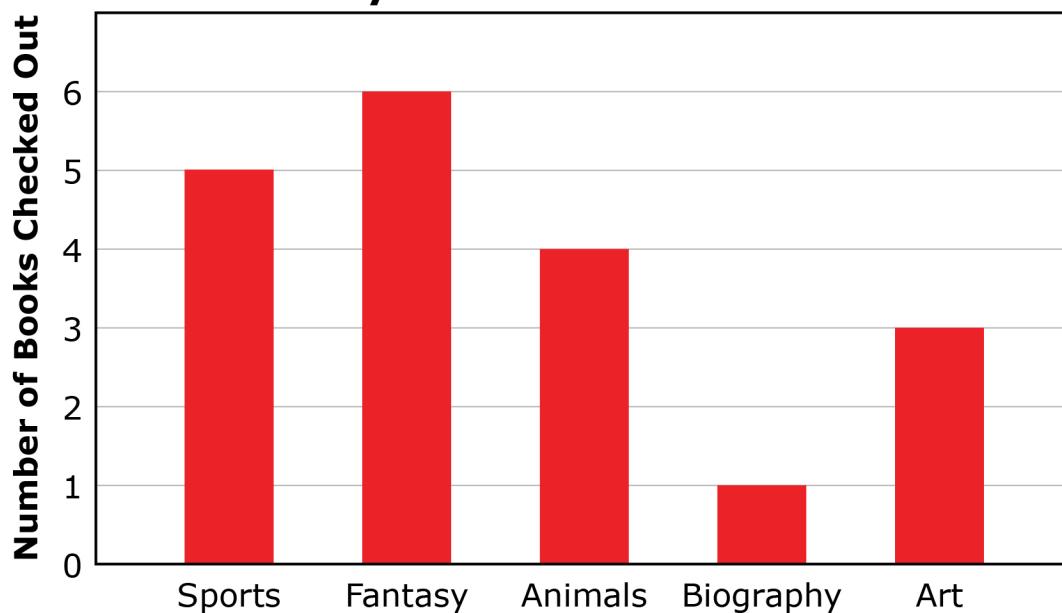
On the other sticky note, students will complete the following statement:

I am still wondering about _____ with scaled bar graphs and pictographs.

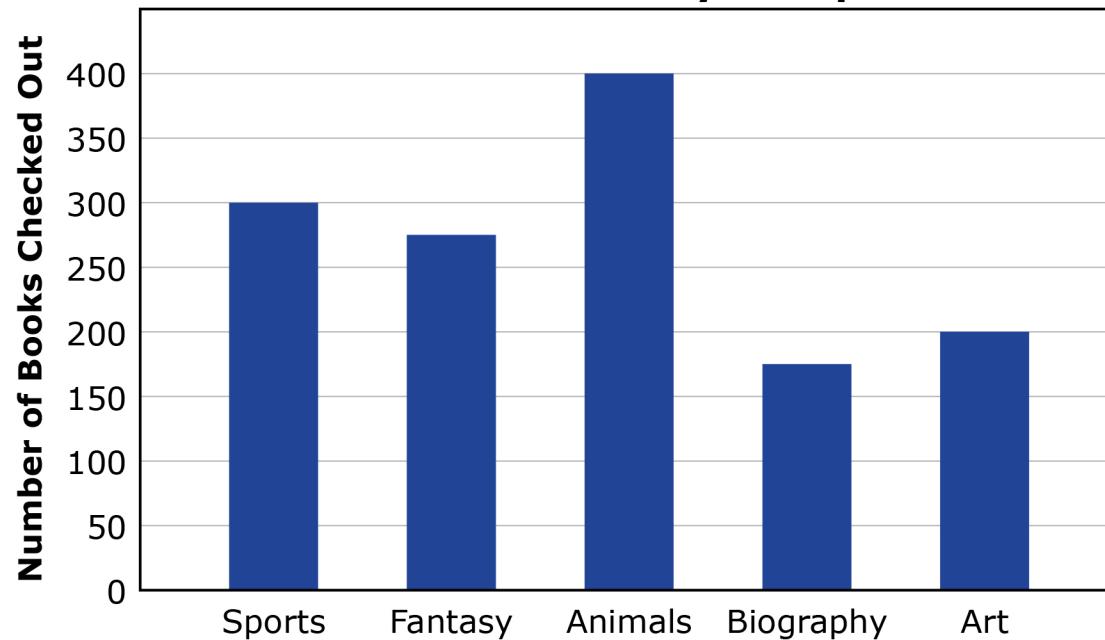
ANALYZING SCALED GRAPHS
INSTRUCTIONAL ACTIVITY SUPPLEMENT

Lesson 1

**Most Popular Categories of Books Checked Out
by Mr. Arbuckle's Class**



Most Popular Categories of Books Checked Out at Garfield Elementary in September



Wacky Weekend Fishing Tournament Leaders Saturday Morning Totals

Joe	
Tara	
Landen	
Kevin	
Elaine	

Key



= one fish caught

Wacky Weekend Fishing Tournament

Tournament Totals

Joe	
Tara	
Landen	
Kevin	
Elaine	

Key

 = three fish caught

ANALYZING SCALED GRAPHS

INSTRUCTIONAL ACTIVITY

Lesson 2

LEARNING GOAL

Students will create, read, and analyze scaled bar graphs and pictographs.

PRIMARY ACTIVITY

Students will be given two data sets to create a scaled bar graph and scaled pictograph. Students will then read and analyze the graphs. Using the graphs created, students will answer questions comparing the data.

OTHER VOCABULARY

Students will need to know the meaning of the following terms:

- ▶ Scaled bar graph
 - ▶ Scaled pictograph
 - ▶ Horizontal axis
 - ▶ Vertical axis
 - ▶ Title
 - ▶ Scale
 - ▶ Interval
 - ▶ Key
-

MATERIALS

- ▶ INSTRUCTIONAL ACTIVITY STUDENT HANDOUT
-

IMPLEMENTATION

Students may work in pairs or alone on this activity.

Review the characteristics of a scaled bar graph and a scaled pictograph by recalling the discussion in [LESSON 1](#) when students compared and contrasted the two types of data displays.

Using those recalled characteristics, **lead** students in a discussion about the types of data sets that would fit best with the use of a scaled bar graph versus a scaled pictograph. Students should realize that a scaled bar graph may be used for either large or small data values, depending on the scale chosen. A large scale can be used to accommodate data values that range from small to large. A smaller scale would be used for overall smaller data values. Students should also realize the limitations on a scaled pictograph due to the images used in the display. A scaled pictograph may need to use fractional parts of the image to represent the data values; this limits the scale used to ensure that the fractional pieces are easily recognizable. Additionally, a pictograph of any sort that has many data values is difficult to understand if the images are too numerous to count easily. These limitations limit the data values that are well suited for a pictograph display.

Distribute the [INSTRUCTIONAL ACTIVITY STUDENT HANDOUT](#) to each student.

Students will analyze the two given data sets to determine which type of data display is the most appropriate for each data set. Then, students will create each data display using the given template. Students are free to choose whichever of the two scaled graphs (bar graphs or pictographs) for the data set. However, students must be able to justify their choice for each graph. The [INSTRUCTIONAL ACTIVITY STUDENT HANDOUT](#) is designed for students to choose one data set to be displayed as a scaled bar graph and the other as a scaled pictograph.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ How is each data set different from the other?
- ▶ What type of information is given in each data set?
- ▶ How would you want to see the data displayed to best understand and analyze the data?
- ▶ What type of scale fits each data set?
- ▶ Do scaled bar graphs or pictographs use a larger scale?
- ▶ Can both a scaled bar graph and a scaled pictograph be used for the same data?

Determine if the student can **REPRESENT DATA USING SCALED BAR GRAPHS:**

- ▶ What scale best fits the data? Explain your thinking.
- ▶ Is it necessary to provide a key for this graph? Why or why not?
- ▶ What will be the height of each bar?
- ▶ How would you determine the height of each bar using the shaved ice data?
- ▶ How does the scale chosen affect the height of each bar?
- ▶ What information will be read from your bar graph?
- ▶ What label will be used on the horizontal axis?
- ▶ What label will be used on the vertical axis?

Determine if the student can **REPRESENT DATA USING SCALED PICTOGRAPHS:**

- ▶ What scale fits the data? Explain your thinking.
- ▶ Is a key for your data display? Why or why not?
- ▶ How will the key be used to explain the pictures?
- ▶ How do you determine the number of pictures to use for each dog?
- ▶ How can the pictures be divided according to the scale in order to accurately represent data that is not divisible by the scale chosen? (For example, if the scale for each picture is two biscuits, how would 15 biscuits be represented? Or, if the scale for each picture is three biscuits, how would 10 biscuits be represented?)
- ▶ How does the scale chosen affect the number of pictures needed for each dog?
- ▶ What information will be read from your pictograph?

After students create the scaled bar graph and pictograph, students should analyze the data.

Ask students questions requiring them to read and analyze the data displays.

Students should also create questions to ask each other and to answer using the data displays.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ What do you know about this data?
- ▶ What does this data represent?
- ▶ How can you communicate with others about this data?

Determine if the student can **USE SCALED BAR GRAPHS TO READ THE DATA:**

- ▶ How many shaved ices of each flavor were ordered?

Determine if the students can **USE GRAPHS TO READ BETWEEN THE DATA:**

- ▶ Rank the flavors from greatest ordered to least ordered.
- ▶ How many more grape shaved ices were ordered than coconut?
- ▶ How many more rainbow mix shaved ices were ordered than lime?
- ▶ How many more of the most popular shaved ices were ordered compared to the least popular?
- ▶ How many more cherry and blue raspberry shaved ices were ordered than lime and coconut?
- ▶ How many fewer grape shaved ices were ordered than blue raspberry?
- ▶ How many fewer cherry shaved ices were ordered than rainbow mix?
- ▶ How many fewer shaved ices did the least popular flavor have ordered compared to the most popular flavor?
- ▶ How many fewer shaved ices did the two least popular flavors have ordered compared to the two most popular flavors?

Determine if the students are ready to **USE GRAPHS TO ASK QUESTIONS ABOUT THE DATA:**

- ▶ What questions could you ask from the bar graph?

Determine if the student can **USE SCALED PICTOGRAPHS TO READ THE DATA:**

- ▶ How many dog biscuits did each dog receive?

Determine if the students can **USE GRAPHS TO READ BETWEEN THE DATA:**

- ▶ Rank the dogs from greatest number of dog biscuits received to least number of dog biscuits received.
- ▶ How many more dog biscuits did Prince receive than Bucky did?
- ▶ How many more dog biscuits did Duchess receive than Gloria did?
- ▶ How many more dog biscuits was the highest total compared to the lowest total?
- ▶ How many more dog biscuits did Prince and Duchess receive than Gloria and Steve did?
- ▶ How many fewer dog biscuits did Steve receive than Duchess did?
- ▶ How many fewer dog biscuits was the least total compared to the second highest total?
- ▶ How many fewer dog biscuits did the lowest two dogs receive compared to the highest two dogs?
- ▶ How many fewer dog biscuits did the lowest three dogs receive compared to the highest two dogs?

Determine if the students are ready to **USE GRAPHS TO ASK QUESTIONS ABOUT THE DATA:**

- ▶ What questions could you ask from the pictograph?

Students should be required to choose an appropriate display for a given set of data and create that scaled graph. Students should then be able to read and analyze the data set using the scaled graph.

At the end of the activity, have students write three different questions, with answers, for each data display created. The questions and answers can be used to understand students' comprehension of the scaled bar graphs and pictographs.

ANALYZING SCALED GRAPHS

Lesson 2

Data Set 1: The Humane Society tracked the number of dog biscuits given to six of its dogs over a two-week period.



Dog	Number of Treats
Bucky	
Prince	
Gloria	
Steve	
Duchess	
Leo	

Data Set 2: Shaved ice was a popular treat at the school carnival. The data table below shows the six types and numbers of shaved ice served.



Flavor	Number Served
Cherry	72
Blue Raspberry	80
Grape	60
Lime	70
Tropical Punch	95
Coconut	50

Name _____

Scaled Bar Graph: I chose data set _____ because

Name _____

Scaled Pictograph: I chose data set _____ because

ANALYZING SCALED GRAPHS

INSTRUCTIONAL ACTIVITY

Lesson 3

LEARNING GOAL

Students will create a scaled graph from data that they collect. Students will then read and analyze the data using the created graph.

PRIMARY ACTIVITY

Students will collect data by clapping for 15 seconds and recording the number of claps completed. Students will then decide whether a scaled bar graph or pictograph would best represent the data they collected. Groups of students will then share and compare their individual graphs before combining their data and graphs to create a group graph. Using the group graphs, students will read and analyze the data using the created graph. Finally, students will think about how they could change the collection of data to get a data set that would better fit the scaled graph not chosen (either a bar graph or a pictograph).

OTHER VOCABULARY

Students will need to know the meaning of the following terms:

- ▶ Scaled bar graph
 - ▶ Scaled pictograph
 - ▶ Horizontal axis
 - ▶ Vertical axis
 - ▶ Title
 - ▶ Scale
 - ▶ Interval
 - ▶ Key
-

MATERIALS

- ▶ Paper and pencil
 - ▶ Timer or stopwatch to measure 15 seconds
 - ▶ Graph paper (optional)
-

IMPLEMENTATION

Students may be partnered or work independently at first.

Set a timer for 15 seconds.

Instruct students to clap for 15 seconds.

Student should then record their total number of claps.

Ask students to consider the number of claps recorded and how best to make a visual display that clearly shows the total number of claps.

Using their data, students will begin to create a scaled data display. Students may be given graph paper to use when creating their scaled graphs. This data display will have only one category for the individual student but will allow students to start to analyze their data and consider a larger data set with more categories.

Most students will have a significant numbers of claps and therefore will choose to use a scaled bar graph.

Some students may have a smaller number of claps and will choose to use a scaled pictograph.

Either graph could be chosen, but some students may find it cumbersome to use pictures for a large total, making a pictograph less desirable. Additionally, a scaled bar graph could be used for either a large or small data set with an adjusted scale. Students can choose whichever scaled graph they wish, but they need to justify their choice.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ What is your estimate of the number of claps you will complete in 15 seconds?
- ▶ How can you organize your data to visually display it?
- ▶ How do you think your number will compare to your classmates?
- ▶ How can you organize your data to compare it with your classmates?

Determine if the student can **CHOOSE THE APPROPRIATE GRAPH FOR A GIVEN SET OF DATA:**

- ▶ What is the highest number you need for your scale?
- ▶ Based on your total number of claps, what scale would be appropriate to use when displaying your data?
- ▶ Using your chosen scale, is a scaled bar graph or a scaled pictograph more appropriate?
- ▶ Could either scaled graph successfully be used?

Determine if the student is ready to **REPRESENT DATA USING SCALED PICTOGRAPHS:**

- ▶ What information will the horizontal axis display?
- ▶ What information will the vertical axis display?
- ▶ What labels will your graph include?
- ▶ What title describes your data and graph?
- ▶ What key is needed to label your graph?
- ▶ How many pictures will you need to display your total number of claps?

Determine if the student is ready to **REPRESENT DATA USING SCALED BAR GRAPHS:**

- ▶ What information will the horizontal axis display?
- ▶ What information will the vertical axis display?
- ▶ What labels will your graph include?
- ▶ What title describes your data and graph?
- ▶ How tall will your bar be to represent your total number of claps?

After creating their individual graphs, **group** together four to five students who have the same type of scaled graph.

As groups, students will combine their individual data and graphs to create a multi-value graph with a category representing each student in the group. Students who chose a scaled bar graph will have a bar representing each student in the group. Students who chose a scaled pictograph will have a row with images for each student. Again, graph paper may be used to create the group scaled graph.

Students will then be able to compare data and analyze the information.

GUIDING QUESTIONS

Determine if the student is ready to [USE GRAPHS TO READ BETWEEN THE DATA](#):

- ▶ What is a typical number of claps for a 15-second timeframe?
- ▶ How much greater is the largest total of claps compared to the smallest total?
- ▶ What is the difference between your clap total and the largest total for your group?
- ▶ What is the difference between your clap total and the smallest total for your group?
- ▶ How does your group graph compare to other groups' graphs?

Students should be required to collect data and use it to create a scaled graph. Students should also be able to describe and analyze their data.

At the end of the activity, teachers should ask students to consider their individual data and the graph they created. Given their 15-second clap count, students chose either a scale bar graph or a scaled pictograph to create. Students should write a short reflection describing what changes in their data would have caused them to choose the other type of scaled graph (either a bar graph or pictograph).

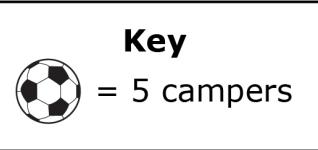
ANALYZING SCALED GRAPHS

Lessons 1 – 3

1. Pete's soccer camp is trying to decide on a camp mascot. The results of a camper survey are shown in the pictograph.

What Should Be The Camp Mascot?

Penguin	
Dinosaur	
Sparrow	
Horse	

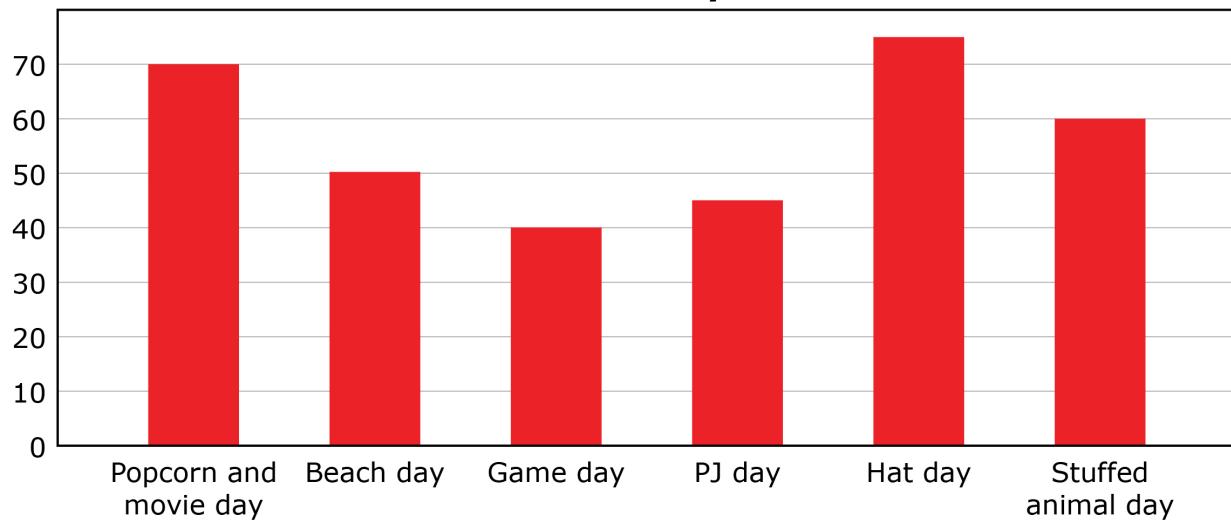


- 1.a. How many campers answered the survey?
- 1.b. Which mascot choice is the most popular? Explain your answer.

- 1.c. How many more votes did the most popular choice receive than the least popular choice?
- 1.d. Did the two least popular choices receive more votes together than the most popular choice? Explain your answer.

-
2. The students at Southern Elementary School earned a reward day. They voted on how to celebrate their day. The results are shown in the following bar graph.

How Should Reward Day Be Celebrated?



Name_____

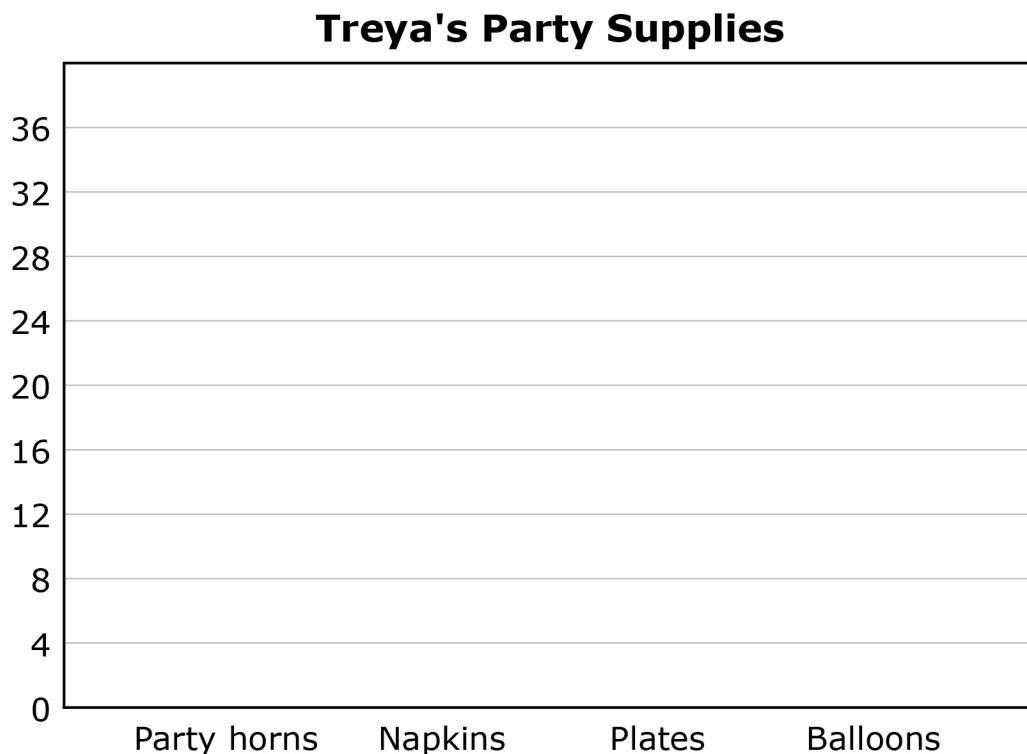
2.a. How many students voted?

2.b. Rank the Reward Day options in order from most popular to least popular.

2.c. How many more students voted for Hat Day than PJ Day?

2.d. How many more students voted for the top 3 choices than the bottom 3 choices?

3. Treya bought 2 party packs for her birthday party. Each pack includes 8 party horns, 16 napkins, 10 plates, and 5 balloons.
- 3.a. Create a bar graph to show how many of each party item Treya has.



3.b. How many party supplies does Treya have in total?

3.c. Which party item does Treya have the most of?

3.d. Which party item does Treya have the fewest of?

3.e. How many more of the most numerous item does Treya have compared to the least numerous item?

3.f. Treya invited 20 people. Does she have enough party horns for everyone? If not, how many more does Treya need?

4. The students in Miss King's class voted on their favorite superhero. Their vote results are shown in the following table.

Superhero	Batman	Superman	Wonder Woman	Spider-Man
Number of Votes	18	16	14	15

- 4.a. Create a pictograph for the vote results.



Key

- 4.b. How many students voted?

4.c. Which two superheroes were the most popular?

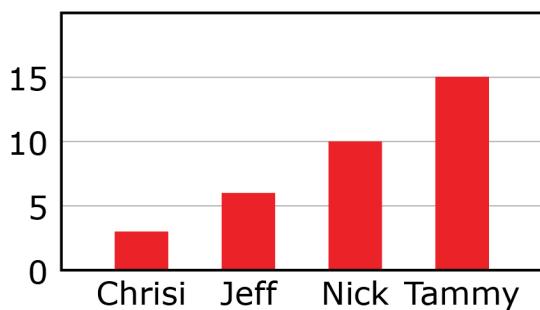
4.d. Some students wanted to vote for the Joker, but the class decided that he was not a superhero. 12 students fewer than the combined total for Batman and Superman would have voted for the Joker. How many students wanted to vote for the Joker?

4.e. Some of the students were disappointed that Wonder Woman was not the most popular superhero. How many more votes did Wonder Woman need to become the most popular superhero choice?

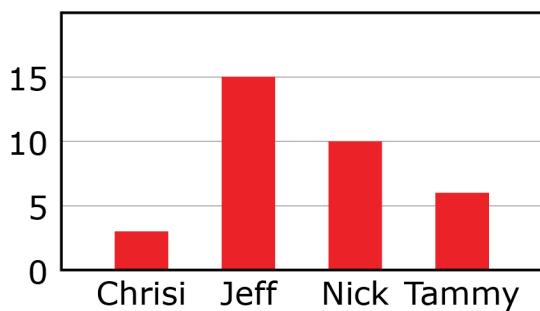
5. Which of the following bar graphs correctly displays the data in the table? Explain your choice.

Name of Student	Chrisi	Jeff	Nick	Tammy
Number of Cousins	6	10	15	3

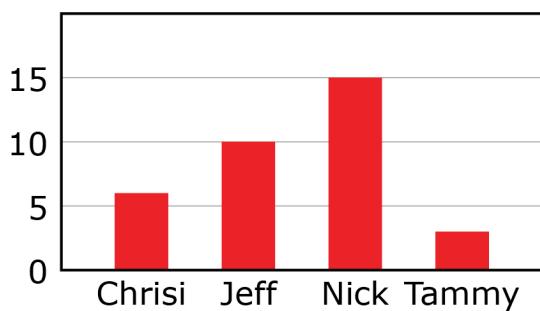
A)

Number of Cousins

B)

Number of Cousins

C)

Number of Cousins

6. Drew has 8 video games, Justin has 6 video games, Tori has 4 video games, and Kelsi has 10 video games. Which pictograph correctly shows the data about video games? Explain your choice.

A) Number of Video Games

Drew	
Justin	
Tori	
Kelsi	

Key

 = 4 video games

B) Number of Video Games

Drew	
Justin	
Tori	
Kelsi	

Key

 = 4 video games

C) Number of Video Games

Drew	
Justin	
Tori	
Kelsi	

Key

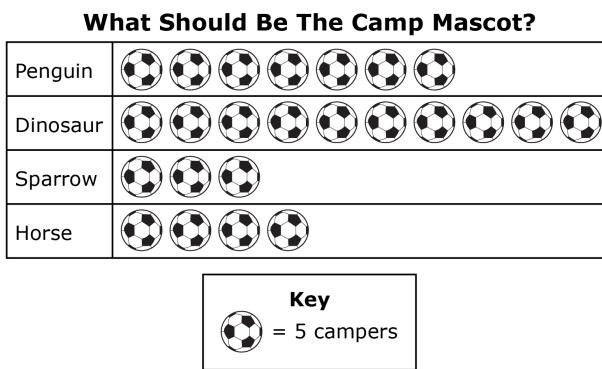
 = 4 video games

ANALYZING SCALED GRAPHS

STUDENT ACTIVITY SOLUTION GUIDE

Lessons 1 – 3

1. Pete's soccer camp is trying to decide on a camp mascot. The results of a camper survey are shown in the following pictograph.



- 1.a. How many campers answered the survey?

CORRECT ANSWER

120 campers answered the survey.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
24 campers answered the survey.	did not use the scale to relate the number of images to the actual number of campers who answered the survey.	USE SCALED PICTURE GRAPHS TO READ THE DATA
5 campers answered the survey.	only used the information in the key to answer the question.	USE SCALED PICTURE GRAPHS TO READ THE DATA
48 campers answered the survey.	used an incorrect scale to relate the number of images to the actual number of campers who answered the survey.	USE SCALED PICTURE GRAPHS TO READ THE DATA

- 1.b. Which mascot choice is the most popular? Explain your answer.

CORRECT ANSWER

Dinosaur was the most popular choice for mascot because 50 campers voted for dinosaur, which is more than any other option.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Sparrow was the most popular choice for mascot because the greatest number of campers voted for this option.	chose the least popular option instead of the most popular option.	USE SCALED PICTURE GRAPHS TO READ THE DATA
Penguin was the most popular choice for mascot because the greatest number of campers voted for this option.	did not chose the most popular option but instead chose the second most popular option.	USE SCALED PICTURE GRAPHS TO READ THE DATA

1.c. How many more votes did the most popular choice receive than the least popular choice?

CORRECT ANSWER

The most popular choice received 35 more votes than the least popular choice.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The most popular choice received 15 more votes than the least popular.	compared the most popular choice to the second most popular choice instead of the least popular choice.	USE GRAPHS TO READ BETWEEN THE DATA
The most popular choice received 5 more votes than the least popular.	compared the second to least popular choice to the least popular choice.	USE GRAPHS TO READ BETWEEN THE DATA

1.d. Did the two least popular choices receive more votes together than the most popular choice? Explain your answer.

CORRECT ANSWER

No, the 2 least popular choices only received 35 votes together, but the most popular choice received 50 votes.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
No, the least 2 popular choices only received 7 votes together, but the most popular choice received 10 votes.	did not use the scale to relate the number of images to the actual number of votes received by the choices.	USE GRAPHS TO READ BETWEEN THE DATA
Yes, the least 2 popular choices received 35 votes together, but the most popular choice only received 10 votes.	did not use the scale to correctly find the number of votes received for each of the options.	USE GRAPHS TO READ BETWEEN THE DATA

-
2. The students at Southern Elementary School earned a reward day. They voted on how to celebrate their day. The results of the vote are shown in the following bar graph.



- 2.a. How many students voted?

CORRECT ANSWER

340 students voted.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
300 students voted.	did not add all of the values for each category.	USE SCALED BAR GRAPHS TO READ THE DATA
34 students voted.	did not use the scale to find the values for each category, but instead used a scale of 1.	USE SCALED BAR GRAPHS TO READ THE DATA

2.b. Rank the options in order from most popular to least popular.

CORRECT ANSWER

Hat Day was most popular, followed by Popcorn and Movie Day, Stuffed Animal Day, Beach Day, PJ Day, and Game Day.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Game Day was most popular, followed by PJ Day, Beach Day, Stuffed Animal Day, Popcorn and Movie Day, and Hat Day.	ordered the options from least popular to most popular.	USE SCALED BAR GRAPHS TO READ THE DATA
Hat Day was most popular, followed by Popcorn and Movie Day, Stuffed Animal Day, Beach Day, Game Day, and PJ Day.	incorrectly ordered some of the least popular options.	USE SCALED BAR GRAPHS TO READ THE DATA
Popcorn and Movie Day was most popular, folloeo by Beach Day, Game Day, PJ Day, Hat Day, and Stuffed Animal Day.	did not order the categories, but instead read the listing of categories from right to left on the horizontal axis.	USE SCALED BAR GRAPHS TO READ THE DATA

2.c. How many more students voted for Hat Day than PJ Day?

CORRECT ANSWER

30 more students voted for Hat Day than PJ Day.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
3 more students voted for Hat Day than PJ Day.	counted the bars as 1 vote instead of 10 votes.	USE GRAPHS TO READ BETWEEN THE DATA
40 more students voted for Hat Day than PJ Day.	incorrectly subtracted the difference between 75 votes and 45 votes.	USE GRAPHS TO READ BETWEEN THE DATA
75 more students voted for Hat Day than PJ Day.	did not subtract the number of votes for PJ Day but instead simply read the number of votes for Hat Day.	USE GRAPHS TO READ BETWEEN THE DATA

2.d. How many more students voted for the top 3 choices than the bottom 3 choices?

CORRECT ANSWER

70 more students voted for the top three choices than the bottom three choices.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

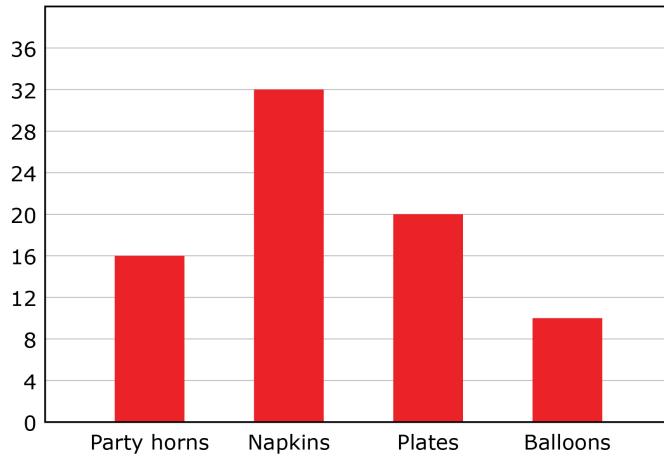
Example Error	Misconception	Missing Knowledge
35 more students voted for the top three choices than the bottom three choices.	found the difference between the top and bottom choice, not the top three and bottom three choices.	USE GRAPHS TO READ BETWEEN THE DATA
205 more students voted for the top three choices than the bottom three choices.	did not subtract the number of votes for the bottom three choices from the number of votes for the top three choices, but instead simply found the number of votes for the top three choices.	USE GRAPHS TO READ BETWEEN THE DATA
20 more students voted for the top three choices than the bottom three choices.	did not correctly identify and total the top three and bottom three choices, but instead calculated the first three choices on the left compared to the last three choices on the right.	USE GRAPHS TO READ BETWEEN THE DATA

-
3. Treya bought 2 party packs for her birthday party. Each pack includes 8 party horns, 16 napkins, 10 plates, and 5 balloons.

3.a. Create a bar graph to show how many of each party item Treya has.

CORRECT ANSWER

Treya's Party Supplies



ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
8 party horns 16 napkins 10 plates 5 balloons	did not calculate using the given fact that Treya bought two party packs and instead recorded values for a single party pack.	REPRESENT DATA USING SCALED BAR GRAPHS
2 party horns 2 napkins 2 plates 2 balloons	recorded two of each item instead of the total for each item in two packs.	REPRESENT DATA USING SCALED BAR GRAPHS
8 party horns 8 napkins 8 plates 8 balloons	recorded the value of party horns for all items instead of calculating the different value for each item.	REPRESENT DATA USING SCALED BAR GRAPHS

3.b. How many party supplies does Treya have in total?

CORRECT ANSWER

Treya has 88 party supplies in total.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Treya has four party supplies.	counted the number of types of party supplies instead of the actual number of party supplies.	RECOGNIZE THE STRUCTURE OF A BAR GRAPH and/or USE SCALED BAR GRAPHS TO READ THE DATA
Treya has 44 party supplies.	calculated the number of party supplies in a single pack instead of two packs.	USE SCALED BAR GRAPHS TO READ THE DATA
Treya has 90 party supplies.	incorrectly calculated the total of all party supplies.	USE GRAPHS TO READ BETWEEN THE DATA

3.c. What party item does Treya have the most of?

CORRECT ANSWER

Napkins are the party item that Treya has the most of.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Plates are the party item that Treya has the most of.	chose the party supply with the second highest total.	USE SCALED BAR GRAPHS TO READ THE DATA
Balloons are the party item that Treya has the most of.	chose the party supply with the lowest total.	USE SCALED BAR GRAPHS TO READ THE DATA

3.d. What party item does Treya have the fewest of?

CORRECT ANSWER

Balloons are the party item that Treya has the fewest of.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Party horns are the party item that Treya has the most of.	chose the party supply with the second lowest total.	USE SCALED BAR GRAPHS TO READ THE DATA
Napkins are the party item that Treya has the most of.	chose the party supply with the highest total.	USE SCALED BAR GRAPHS TO READ THE DATA

3.e. How many more of the most numerous item does Treya have compared to the least numerous item?

CORRECT ANSWER

Treya has 22 more napkins than balloons.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Treya has 32 more napkins than balloons.	did not calculate the difference between the most numerous item and least, instead used the highest value.	USE GRAPHS TO READ BETWEEN THE DATA
Treya has 12 more napkins than plates.	calculated the difference between the highest and second highest values.	USE GRAPHS TO READ BETWEEN THE DATA
Treya has 10 more plates than balloons.	calculated the difference between the second lowest and lowest values.	USE GRAPHS TO READ BETWEEN THE DATA

3.f. Treya invited 20 people. Does she have enough party horns for everyone? If not, how many more does Treya need?

CORRECT ANSWER

No, Treya needs four more party horns to have enough for all 20 guests.

 ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
No, Treya needs 12 more party horns to have enough for all 20 guests.	did not calculate the number of party horns in two party packs.	USE SCALED BAR GRAPHS TO READ THE DATA
Yes, Treya has enough party horns for all 20 guests.	incorrectly calculated the number of party horns in two party packs.	USE SCALED BAR GRAPHS TO READ THE DATA

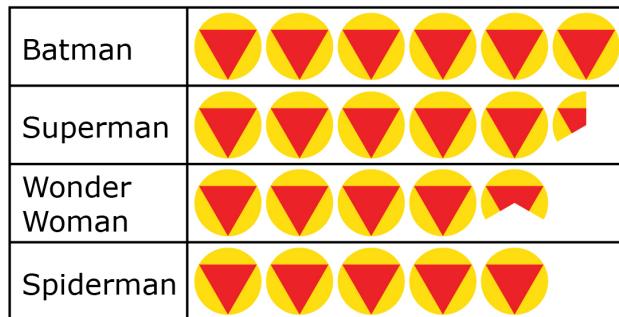
4. The students in Miss King's class voted on their favorite superhero. Their vote results are shown in the following table.

Superhero	Batman	Superman	Wonder Woman	Spiderman
Number of Votes	18	16	14	15

- 4.a. Create a pictograph for the vote results.

 CORRECT ANSWER

Favorite Superhero of Miss King's Classes



Key
 = 3 people

NOTE: A different symbol and scale may be chosen and correctly used by students in their scaled picture graphs.

 ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge								
Favorite Superhero of Miss King's Classes <table border="1" data-bbox="213 451 670 692"> <tbody> <tr> <td>Batman</td> <td></td> </tr> <tr> <td>Superman</td> <td></td> </tr> <tr> <td>Wonder Woman</td> <td></td> </tr> <tr> <td>Spiderman</td> <td></td> </tr> </tbody> </table> <div data-bbox="332 699 545 804" style="border: 1px solid black; padding: 5px; width: fit-content;"> Key  = 3 people </div>	Batman		Superman		Wonder Woman		Spiderman		<p>the corresponding number of votes is not correctly assigned to each superhero, instead the values are simply given in ascending order with no regard to the order of the names.</p>	REPRESENT DATA USING SCALED PICTURE GRAPHS
Batman										
Superman										
Wonder Woman										
Spiderman										
Favorite Superhero of Miss King's Classes <table border="1" data-bbox="213 889 605 1129"> <tbody> <tr> <td>Batman</td> <td></td> </tr> <tr> <td>Superman</td> <td></td> </tr> <tr> <td>Wonder Woman</td> <td></td> </tr> <tr> <td>Spiderman</td> <td></td> </tr> </tbody> </table> <div data-bbox="305 1148 507 1254" style="border: 1px solid black; padding: 5px; width: fit-content;"> Key  = 1 person </div>	Batman		Superman		Wonder Woman		Spiderman		<p>pictograph is not scaled, making it more difficult to read.</p>	REPRESENT DATA USING SCALED PICTURE GRAPHS
Batman										
Superman										
Wonder Woman										
Spiderman										

4.b. How many students voted?

 CORRECT ANSWER

63 students voted.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
22 students voted.	the scale of the pictograph was not used, instead individual images were counted for the total.	USE GRAPHS TO READ BETWEEN THE DATA
60 students voted.	the scale was used, but a miscalculation was made in transferring the images to total students.	USE GRAPHS TO READ BETWEEN THE DATA

4.c. Which two superheroes were the most popular?

CORRECT ANSWER

Batman and Superman were the two most popular superheroes.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Batman was the most popular superhero.	did not identify the two most popular superheroes.	USE GRAPHS TO READ BETWEEN THE DATA
Wonder Woman and Spiderman were the two most popular superheroes.	identified the two least popular superheroes.	USE GRAPHS TO READ BETWEEN THE DATA
Batman and Wonder Woman were the two most popular superheroes.	incorrectly identified the two most popular superheroes.	USE GRAPHS TO READ BETWEEN THE DATA

4.d. Some students wanted to vote for the Joker, but the class decided that he was not a superhero. 12 students fewer than the combined total for Batman and Superman would have voted for the Joker. How many students wanted to vote for the Joker?

CORRECT ANSWER

22 students wanted to vote for the Joker.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
34 students wanted to vote for the Joker.	found the combined total for Batman and Superman, but did not find 12 less than that combined total.	USE GRAPHS TO READ BETWEEN THE DATA
46 students wanted to votes for the Joker.	found the combined total for Batman and Superman, but then added 12 more.	USE GRAPHS TO READ BETWEEN THE DATA
20 students wanted to vote for the Joker.	incorrectly found 12 less than the combined total for Batman and Superman.	USE GRAPHS TO READ BETWEEN THE DATA

- 4.e. Some of the students were disappointed that Wonder Woman was not the most popular superhero.
How many more votes did Wonder Woman need to become the most popular superhero choice?
-

CORRECT ANSWER

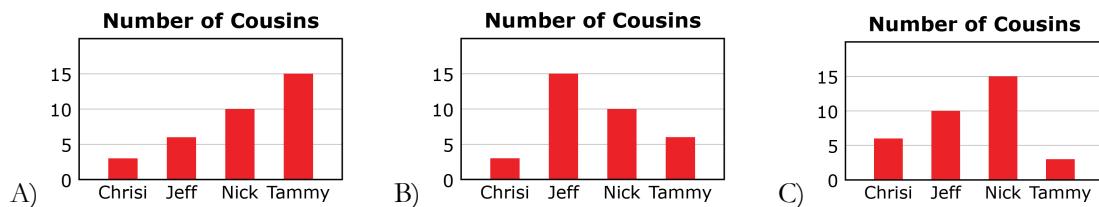
Wonder Woman needed five more votes or more to be the most popular superhero.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Wonder Woman needed four more votes to be the most popular superhero.	found the amount that would tie Wonder Woman for most popular.	USE GRAPHS TO READ BETWEEN THE DATA
None. Wonder Woman was already the most popular superhero.	incorrectly identified the least popular superhero as the most popular superhero.	USE GRAPHS TO READ BETWEEN THE DATA
Wonder Woman needed three more votes to be the most popular superhero.	incorrectly calculated the amount Wonder Woman would need to become the most popular superhero.	USE GRAPHS TO READ BETWEEN THE DATA

5. Which of the following bar graphs correctly displays the data in the table? Explain your choice.

Name of Student	Chrisi	Jeff	Nick	Tammy
Number of Cousins	6	10	15	3



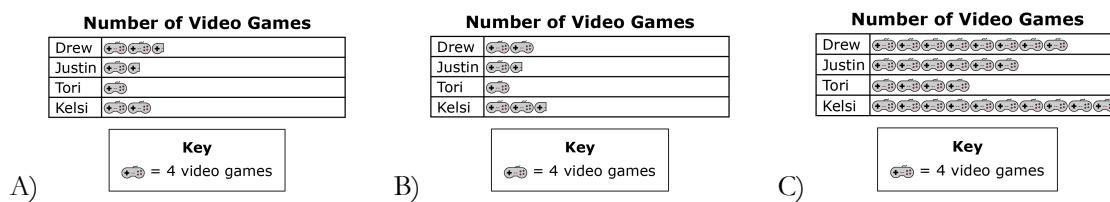
CORRECT ANSWER

Bar graph C is correct because it uses the scale on the vertical axis to correctly mark the bar height for the number of cousins each person has.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Bar graph A is correct because the bars grow in height, like the number of cousins grows from 3 to 15 cousins.	the corresponding number of cousins is not correctly assigned to each student, instead the values are simply given in ascending order with no regard to the order of the names.	REPRESENT DATA USING SCALED BAR GRAPHS
Bar graph B is correct because it uses the scale on the vertical axis to correctly mark the bar height for the number of cousins each person has.	the corresponding number of cousins is incorrectly assigned to the names.	REPRESENT DATA USING SCALED BAR GRAPHS

6. Drew has 8 video games, Justin has 6 video games, Tori has 4 video games, and Kelsi has 10 video games. Which pictograph correctly shows the data about video games? Explain your choice.



CORRECT ANSWER

Pictograph B is correct because it uses the scale to correctly display the number of video games each person has.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
Pictograph A is correct because it uses the scale to correctly display the number of video games each person has.	the corresponding number of video games is incorrectly assigned to each person.	REPRESENT DATA USING SCALED PICTURE GRAPHS
Pictograph C is correct because it uses the image to correctly represent the number of video games each person has.	the identified scale is not used to assign the number of video games to each person.	REPRESENT DATA USING SCALED PICTURE GRAPHS