COMMON MISCONCEPTIONS

• Students confuse the meaning of the picture or symbol on a scaled pictograph and believe that it represents a value of one.
  
  Begin working with pictographs that have a 1-to-1 correlation between the symbol and its value, and then move to intervals aligned with the skip-counting capabilities of students (2’s, 5’s, 10’s). Students should recognize that the key is an important part of a scaled pictograph, which tells them the number or value that one picture represents. Students may be confused by part of a picture or symbol on a pictograph—explain that we can use part of a picture to represent a number smaller than the scale unit.

• Students count each square or tick mark interval on a scaled bar graph as one unit.
  
  Begin working with bar graphs that have single-unit intervals, and then move to intervals aligned with the skip-counting capabilities of students (2’s, 5’s, 10’s). Have students include tick marks at each unit between intervals as they move from working with single-unit to scaled bar graphs. Help students to see that the same skip-counting and multiplication strategies that they use to problem solve with tape diagrams or number lines can be applied to problem solving with scaled bar graphs.

• Students are confused about which operations to use and in what order to answer “how many more” or “how many less” questions for a particular scaled graph.
  
  Solving one- and two-step problems using the data in scaled picture and bar graphs requires either addition or multiplication to first determine the quantities represented by either the number of pictures or the height of the bar for a particular category of data. Once the scale factor is correctly applied to the data, drawing comparisons between categories often involves tricky wording for students. Emphasize key words that indicate subtraction (“how many more”, “how many less”, “what is the difference between”) versus addition (“categories A and B combined”).

SCALED PICTOGRAPHS

When transitioning from working with single unit pictographs to scaled pictographs it is very important for students to recognize that each picture, image, or symbol represents more than one unit. Students need to learn to use the key to
identify what each picture represents and use this scale to multiply by the number of pictures, or to add up the symbols using the values, to interpret the values on the graph correctly. When teaching students how to construct a scaled pictograph, emphasize that the data can help them choose an appropriate scale. Be sure to instruct students that half or a smaller part of a picture can be used to represent a number smaller than the scale.

**SCALED BAR GRAPHS**

When transitioning from working with bar graphs with single unit intervals to scaled bar graphs it is very important for students to recognize that the interval between tick marks on the vertical axis is more than one unit. When reading and interpreting a scaled bar graph, the number of units in the interval between tick marks—the scale—helps students to determine the quantity represented by the each bar on the graph. Many students find it helpful to see that the same skip-counting and multiplication strategies that they use to problem solve with tape diagrams or number lines can be applied to problem solving with scaled bar graphs. Bar graphs can be drawn vertically or horizontally, depending on which axis the labels and tick marks go on, but the information is the same as long as the scales are the same.

**SOLVING SIMPLE ONE- AND TWO-STEP PROBLEMS WITH SCALED PICTOGRAPHS AND BAR GRAPHS**

Students have prior knowledge of using single-unit pictographs and bar graphs to solve simple put-together, take-apart, and compare problems about the data presented in a graph. This is now extended to include using scaled graphs to solve one- and two-step problems. Students will employ multiplication or skip-counting strategies as the first step in reading and interpreting the data on the graph. They will then learn to strategically perform the appropriate operations, such as subtraction and addition, to answer questions such as ‘how many more’ or ‘how many less’ and draw comparisons among different categories of data. 

**TEACHER TIPS**

In Grade 3 the most important development in data representation for categorical data is that students now draw pictographs in which each picture represents more than one object, and they draw bar graphs in which the height of a given bar in tick marks must be multiplied by the scale factor in order to yield the number of objects in a given category. These developments connect to the emphasis on multiplication in this grade.

Students require an understanding of the parts of pictographs and bar graphs before they can accurately construct, read, and use these tools. Provide several examples of different graphs with different data and different scales, and be sure to consistently point out the different parts of the graphs: title, horizontal and vertical axes, scale or key, and the bars or pictures that represent the data.

When interpreting graphs, start with simple tasks that involve interpreting the data in these graphs. Ask students to find the number represented by each bar on a bar graph or by the pictures for each category on a pictograph. Move into problems that ask students to compare different categories. Increase the complexity of the problems as the students improve at interpreting the data.

When drawing graphs, have students collect data and draw their own graphs. Have them practice giving their graph a title, drawing and labeling the axes, deciding on a scale, and graphing their data. Give students opportunities to present their scaled bar and pictographs and explain the data.