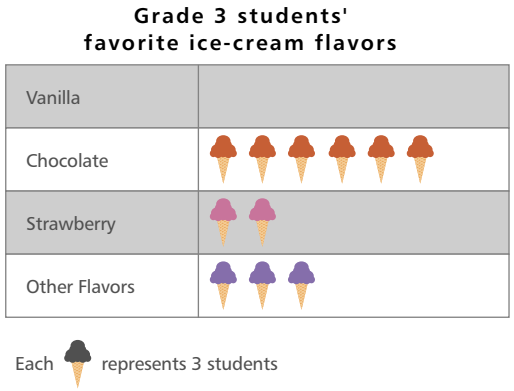
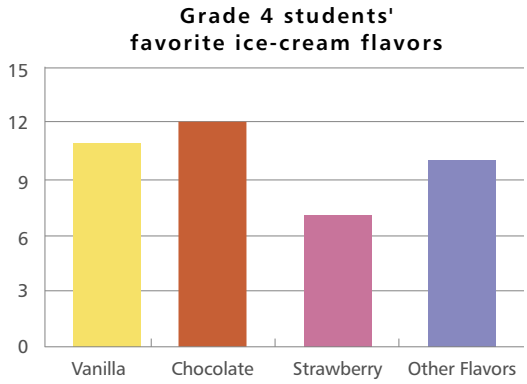
Diving deeper into data





Our society is inundated with representations of data on a daily basis. Advertising, news sources, and work-related presentations are a few examples of attempts to persuade or influence our way of thinking with graphic or pictorial data.

To answer questions about the data being presented, students examine and analyze a bar graph and pictograph in this problem scenario.

Problem scenario

I have a friend who teaches math to students in grades 3 and 4 at another school. Her students were taking surveys and making graphs about their favorite ice-cream flavors. The third-grade classes represented the results of their survey using one type of graph. The fourth-grade classes used a different type of graph to represent their survey results. I would like you to answer some questions about both graphs.

For the questions, see the **activity sheet** on **page 459**.

Classroom setup

Before presenting the problem to your students, gather the following materials:

- The activity page with the graphs and questions for each pair or group of students to record their solutions
- Pens or markers
- A digital camera or a smartphone or tablet with a camera

Present the problem scenario, then distribute the activity page. Provoke some initial thinking by asking such questions as these:

- What type of graph did the students in grade 3 use?
- What is a pictograph?
- What type of graph did the fourth-grade students use?

With your students, read through the questions for the grade 3 pictograph and the grade 4 bar graph to ensure that the class understands the questions. Do not accept possible solutions at this time. Organize students in pairs or triads to solve the problem.

As students are working, walk around the classroom and observe the strategies they use to answer the questions. You may want to take some pictures with a digital camera, a smartphone, or a tablet to help gather evidence of student thinking during the solution process. Try not to tell students how to do the math, but use questions to stimulate their thinking:

- How many third-grade students voted for strawberry? How do you know?
- How many students does each ice-cream cone represent?
- Is the bar closer to 9 or to 12? How does the answer help you figure out how many students voted for strawberry?
- What number would be exactly halfway between 9 and 12?

After students have answered the questions, select solutions that employed different strategies to share with the whole class. For example, in answering question 1 of the grade 3 pictograph, students may have started with different rows on the pictograph, resulting in various addends when determining the total number of students who have voted. Other students may have added the total number of ice-cream cones and multiplied by three. To answer the grade 4 bar graph questions, students may have used different strategies to determine the exact number of students who have voted, such as adding numbers to the vertical axis between the existing numbers. As you display multiple solutions, you could ask questions of the class to prompt discussion:

- What do you think this group did to solve the problem?
- Do you have questions about this solution?
- How did these students determine how many ice-cream cones should go beside vanilla in grade 3?
- How did this group figure out exactly how many fourth graders voted for strawberry?
- Could one of the bars on the graph be exactly halfway between the 9 and 12? Why or why not?
- Why didn't the grade 3 students use one ice-cream cone to represent each student?
- What is the same about the two graphs?
- What is different about the two graphs?
- Why did students use one ice-cream cone to represent three students? Why not five or ten cones?

As students share ideas, start a list on the board or on chart paper to record student thinking.

Extensions and modifications

You may want to provide an extra challenge for anyone who finishes early:

- What if we combined the data from the grade 3 and grade 4 surveys?
- Choose a type of graph and represent the combined data from the grade 3 and grade 4 graphs.

If you feel that the task may overwhelm some students, provide a pictograph and bar graph that use one-to-one data representation. Calculating the total amounts mentally or by hand may be appropriate for most students; however, some may need to use a calculator.

Where's the math?

This problem requires students to read, interpret, and analyze a pictograph and a bar graph. To answer the pictograph question, students must determine the total number of existing votes, remembering that each ice-cream cone represents three votes. Some students may use repeated addition of threes to total each row and then proceed to add the rows together; other students may total the number of all the cones and then multiply by three.

Then students must find the difference between the existing number of votes and the total number of third-grade students to determine how many students voted for vanilla. They will partition that difference into groups of three to determine the number of cones that would represent the votes for vanilla.

To answer the bar graph questions, students must use the vertical axis scale and quantitative reasoning to determine the exact number of votes for such flavors as vanilla and strawberry. Through class discussions, students can explore the structures of the two graphs and the reason for scaling them. They could also begin to explore the impact that different scales have on the appearance of the data.

Show off your students!

Each month, the Problem Solvers department features a challenging mathematics problem for you to try with your students. Take notes as your students tackle the problem, and then share with us any insights you gain from observing their efforts. Department editors compile teacher reflections and student results, which appear in the Problem Solvers: Solutions section of a subsequent issue of the journal.

Sharing your students' work makes a valuable contribution to the journal, and it is fun to see your input in print. Details about how to contribute appear under the heading **Share your students' work** in the Problem Solvers: Problem section of each issue.

Share your students' work

Try this problem in your classroom. We are interested in how your students responded to the problem, what problem-solving strategies they used, and how they explained or justified their reasoning. Send your thoughts and reflections—including information about how you posed the problem, samples of students' work, and photographs showing your problem solvers in action—by **May 20, 2015**, to Problem Solvers department editor Ed Enns, Waterloo Region District School Board, Learning Services, 51 Ardelt Avenue, Kitchener, ON N2C 2R5; or email him at **ed_enns@wrdsb.on.ca**. Selected submissions will be published in a subsequent issue of *TCM* and acknowledged by name, grade level, and school name unless you indicate otherwise.

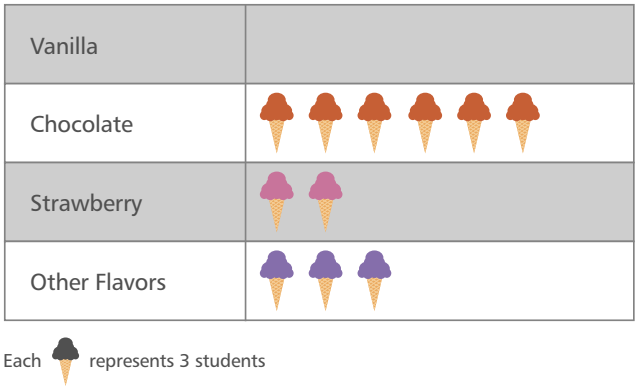
Edited by **Ed Enns**, an elementary school learning services consultant with the Waterloo Region District School Board in Kitchener, Ontario, Canada. Each month, this section of the Problem Solvers department features a new challenge for students. Readers are encouraged to submit problems to be considered for future columns. Receipt of problems will not be acknowledged; however, those selected for publication will be credited to the author. Find submission guidelines for all departments at **www.nctm.org/tcmdepartments**.

Name_____

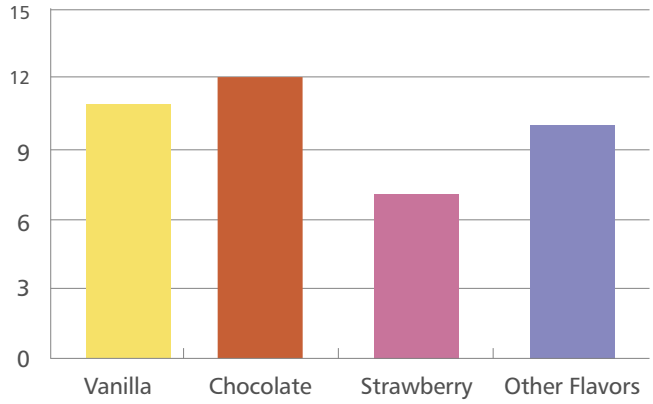
Grade 3's Favorite Ice-Cream Flavors

I have a friend who teaches math to students in grades 3 and 4 at another school. Her students were taking surveys and making graphs about their favorite ice-cream flavors. The third-grade classes represented the results of their survey using one type of graph. The fourth-grade classes used a different type of graph to represent their survey results. I would like you to answer some questions about both graphs.

Grade 3 students' favorite ice-cream flavors



Grade 4 students' favorite ice-cream flavors



1. a. If 45 students are in grade 3, how many third graders voted for vanilla?

   b. How many ice-cream cones should you put on the graph to represent the students who voted for vanilla? Show your thinking. Add cones to the pictograph to represent the number of grade 3 students who voted for vanilla.

2. How many fourth-grade students voted in total?

3. If 2 students changed their vote from other flavors to strawberry, how many votes would strawberry have? How many votes would other flavors have?

From the April 2015 issue of teaching children mathematics