1:4 Analyzing Weather Data

Teacher Notes

Central math concepts

Students' data work in the primary grades involves representing and interpreting categorical data, which is data that arises from classifying or sorting into categories.[†] In a chart like the one shown in task 1:4, the tally marks are the individual data points. Interpreting such a chart involves grasping the correspondence between the tally marks and the facts they represent. It is a significant act of the imagination to look at a tally mark in the first column and see in that mark a historical record of a recent sunny day.

From the individual data points (the tally marks), students can use counting to determine the number of data points in each category (5, 7, and 9) and the total count, 21. These counts are numerical summaries of the data. The counts can then be used to analyze the data—to ask and answer questions about the data.

In this way, students' analysis of categorical data connects directly to their uses of addition and subtraction to solve problems in context. In grade 1 specifically, when students "ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another" (CCSS 1.MD.C.4), they are using "addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions" (CCSS 1.OA.A.1). More generally, there are close connections in every elementary grade between students' data work and their expanding use of numbers and operations in context; see Table 1, p. 4 of the *Progression* document for a list of these connections in grades K–5.

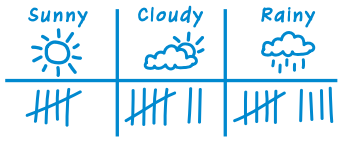
As the *Guidelines for Assessment and Instruction in Statistics Education Report* notes, "data are not just numbers, they are numbers with a context. In mathematics, context obscures structure. In data analysis, context provides meaning."[‡] Thus as the *Progression* document notes, "students should work with data in the context of science, social science, health, and other subjects, always interpreting data plots in terms of the context they represent" (p. 3).

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: cardinal counting; skip-counting; comparing numbers; adding and subtracting single-digit numbers; subitizing groups of 5; and using addition and subtraction to solve problems in context.

1:4

Our class watched the weather for 21 days. On a chart, we marked each day as one of three kinds: sunny, cloudy, or rainy.



(1) Count all the tally marks. Does your answer make sense?

(2) How many days were not rainy?

(3) Now create your own question by circling one word. Use the data to answer your question.

How many more cloudy/rainy days were
(circle one word)
there than sunny days?

Answer

(1) There are 21 tally marks. That makes sense because the class made one tally mark every day for 21 days. **(2)** 12 days were not rainy. **(3)** Possible questions/answers: "How many more cloudy days were there than sunny days?"—There were 2 more cloudy days than sunny days. "How many more rainy days were there than sunny days?"—There were 4 more rainy days than sunny days.

Click here for a student-facing version of the task.

Refer to the Standards

1.MD.C.4; MP.1, MP.2, MP.4. Standards codes refer to www.corestandards.org. One purpose of the codes is that they may allow a task to shed light on the Standards cited for that task. Conversely, reading the cited Standards may suggest opportunities to extend a task or draw out its implications. Finally, Standards codes may also assist with locating relevant sections in curriculum materials, including materials aligned to comparable standards.

Aspect(s) of rigor

Application

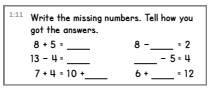
Extending the task

How might students drive the conversation further?

- Students could ask additional questions about the data, such as which kind of day was most common and which kind of day was least common.
- Students could ask questions similar to those in the task to analyze another set of data they have collected in the classroom.

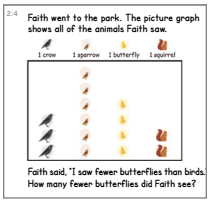
Related Math Milestones tasks

1:11



Task **1:11 Using Properties and Relationships** involves sums of single-digit numbers that cross ten, as task 1:4 does.

2:4



Task **2:4 Animals in the Park** combines situation types "Put Together with Total Unknown" and "Compare with Difference Unknown" in a context involving a picture graph display of categorical data.

K:14

In earlier grades, task **K:14 Animals from Land and Sea** involves a comparison based on classifying into categories.

See the Map of Addition and Subtraction Situations in K–2 Math Milestones to find tasks in grades K, 1, and 2 that cover the various addition and subtraction situation types.

Additional notes on the design of the task

- The situation types involved in the task are "Put Together with Total Unknown" and "Compare with Difference Unknown."
- The tally marks can be used to relate the analysis of the data to place value and properties of operations. For example, suppose we ask how many days weren't sunny. This number is visible on the chart as two groups of 5, a group of 2, and a group of 4. The total, 16, can be arrived at by adding (5 + 2) + (5 + 4), which corresponds to the sum 7 + 9, or it could be arrived at by (5 + 5) + (2 + 4), which corresponds to the sum 10 + 6. The equivalence of (5 + 2) + (5 + 4) and (5 + 5) + (2 + 4) illustrates the 'any which way' principle (a combination of the commutative and associative properties of addition). And the equation 7 + 9 = 10 + 6 records the 'making ten' process for 7 + 9.
- The option to circle words allows the task to involve student-created questions. Alternatively, the possible combinations/questions could be generated in advance, and students could choose which ones to solve.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like 1:4? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to 1:4? In what specific ways do they differ from 1:4?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 1:4 help students converge toward grade-level thinking about the important mathematics in the task? What factors would you consider in choosing when to use such a task in the unit?*

† Common Core Standards Writing Team. (2011, June 20). *Progressions for the Common Core State Standards in Mathematics (draft): K–3, Categorical Data; Grades 2–5, Measurement Data.* Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

‡ The Guidelines for Assessment and Instruction in Statistics Education Report was published in 2007 by the American Statistical Association, http://www.amstat.org/education/gaise.

* Math Milestones™ tasks are not designed for summative assessment. Used formatively, the tasks can reveal and promote student thinking.

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Teacher Notes

Math Milestones™

Anticipating and responding to student thinking about the task

Imagine how students might think about the task, and what you might see and hear while they work.

On this page, you can write your thoughts on the following questions.

Solution Paths

- What solution paths might you expect to see?
- What representations might you see? What correspondences between those representations might be noticed by students (or be worth pointing out to students) and discussed by them?
- What misconceptions or partial understandings might be revealed as students work on the task? How could you respond to these positively and productively?

Language

- What might you expect to hear from students engaged with the task? What does that language reveal about their mathematical thinking, and how might you respond to different ways of thinking?
- If students are using early English or using multiple languages in an integrated communication system, how might you help their classmates see those mathematical ideas as valuable?
- Even when using nascent language, students are thinking and communicating their thinking. What might it look like to respond positively and productively to the mathematics in their thinking before giving feedback on the language used?

Identity, Agency, and Belonging

- How can you engage students' interests, experiences, or funds of knowledge?
- How can you build students' self-confidence as learners, thinkers, and doers of mathematics?
- What choices are there for a student to make in the task? How can you build students' agency to the point where they notice and make these choices to solve problems?
- How might one use feedback to build student agency? Where might there be opportunities to build students' self-confidence?