The students had become interested in the question of whether more families had cars with two doors or four doors. As they planned, the students had to decide if trucks should be included. What about vans with four doors or station wagons with five doors? After the class had settled on common categories, different groups of students kept track of the data in different ways. One group put cubes in different cups that represented the different categories. Another group recorded the data using tallies. A third group of students made a list of families with cars with two doors and those with cars with four doors without attempting to organize the information or agree on the results of their data collection. The teacher used the students’ work for a class discussion about which groups were able to answer the question they had posed.

Students’ representations should be discussed, shared with classmates, and valued because they reflect the students’ understandings. These representations afford teachers opportunities to assess students’ understandings and to initiate class discussions about important issues related to representing data. Misconceptions that arise because of students’ representations of data offer situations for new learning and instruction. A teacher asked first-grade students to fold a piece of paper in half and cut out a heart (adapted from University of North Carolina Mathematics and Science Education Network [1997, p. 19]). When the students sorted their hearts into three columns according to size (see fig. 4.23a), some of them stated that the large hearts represented the most popular choice because that column was the tallest. A teacher could use a class discussion of the differences between the sizes and the numbers of hearts as an early experience with scale and as an opportunity for the students to plan how to revise the graph to convey the data more accurately. By pasting their hearts on equal-sized pieces of paper, the students could create a new graph, shown in figure 4.23b.

![Fig. 4.23.](image)

**What Size Heart Did You Make?**

- **Small**
- **Medium**
- **Large**

(a) Students' original data display

(b) Students' revised data display
Select and use appropriate statistical methods to analyze data

Through their data investigations, young students should develop the idea that data, charts, and graphs give information. When data are displayed in an organized manner, class discussions should focus on what the graph or other representation conveys and whether the data help answer the specific questions that were posed. Teachers should encourage students to compare parts of the data (“The same number of children have dogs as have cats”) and make statements about the data as a whole (“Most students in the class have lost only two teeth”).

By the end of grade 2, students should begin to question inappropriate statements about data, as illustrated in this classroom conversation: Two students, interested in how many of their classmates watched a particular television show, surveyed only their friends and reported their results to the class. “You didn’t ask me and I watched it!” one girl complained. Another student said, “Wait a minute, you didn’t ask me and I didn’t watch it. I bet most kids didn’t watch it."

Data investigations can encourage students to wrestle with counting issues that are fundamental to all data collection: Whom do I count? How can I be certain I have counted each piece of data once and only once?

The concept of sample is difficult for young students. Most of their data gathering is for full populations, such as their own class. With guidance, students can begin to recognize when conclusions about one population cannot be applied to another, as demonstrated in the following hypothetical example: A teacher reads a book about whistling to a first-grade class. The students decide to survey the class and discover that eight students can whistle and nineteen cannot. When the teacher asks the class to title the chart they have created, the students agree that...
Teachers should address the beginnings of probability through informal activities.

an appropriate title would be “Most Children Cannot Whistle.” The teacher then asks, “What do you think would happen if we asked the fourth graders?” The students repeat the survey and discover that almost every fourth grader can whistle, so they decide to retitle the graph “Number of Students in Our Class Who Can Whistle.”

Develop and evaluate inferences and predictions that are based on data

Inference and prediction are more-advanced aspects of this Standard. The development of these concepts requires work with sampling that begins in the next grade band. As appropriate beginnings for these concepts, however, teachers should encourage informal discussions about whether or not students in other classes would reach a similar conclusion.

Understand and apply basic concepts of probability

At this level, probability experiences should be informal and often take the form of answering questions about the likelihood of events, using such vocabulary as more likely or less likely. Young students enjoy thinking about impossible events and often encounter them in the books they are learning to read. Questions about more and less likely events should come from the students’ experiences, and the answers will often depend on the community and its location. During the winter, the question “Is it likely to snow tomorrow?” has quite different answers in Toronto and San Diego.

Teachers should address the beginnings of probability through informal activities with spinners or number cubes that reinforce conceptions in other Standards, primarily number. For example, as students repeatedly toss two dice or number cubes and add the results of each toss, they may begin to keep track of the results. They will realize that a sum of 1 is impossible, that a sum of 2 or 12 is rare, and that the sums 6, 7, and 8 are fairly common. Through discussion, they may realize that their observations have something to do with the number of ways to get a particular sum from two dice, but the exact calculation of the probabilities should occur in higher grades.