

## Lesson 11: Gone in 30 seconds

### Goals

- Compare and contrast (orally) representations of bivariate data, including scatter plots, two-way tables, compound bar graphs, and relative frequency tables.
- Describe (orally and in writing) associations in bivariate data using different representations of the same data. Association is used here as correlation has not yet been formally defined.

### Learning Targets

- I can collect data and analyse it for associations using scatter plots, two-way tables, and compound bar graphs.

### Lesson Narrative

In this optional culminating lesson, students collect, represent, and analyse quantitative bivariate data. Then they group the quantitative data to create two categories, and look for evidence of an association in the resulting categorical data. This lesson allows students the opportunity to carry out the entire process of data analysis beginning with data collections and ending with an analysis of graphical representations to determine whether there is an association between two variables in the data. Students attempt to describe their reaction times by using the various techniques from the unit to model their data.

### Addressing

- Investigate patterns of association in bivariate data.

### Instructional Routines

- Discussion Supports

### Required Materials

#### Stopwatches

### Required Preparation

Students will work in groups of 4. Each group will need one stopwatch.

### Student Learning Goals

Let's gather and analyse some timing data.

## 11.1 Measuring 30 Seconds

### Optional: 45 minutes

To close the unit, students practise using the methods they have learned. Students begin by collecting data in small groups and then analysing the data for the entire class. They create

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a scatter plot and two-way tables to look for patterns in the data. Although it is expected there is a very weak, if any, association in the data, the discussion asks students to think about what it would mean if there were a positive or negative association in context.

### Instructional Routines

- Discussion Supports

### Launch

Arrange students in groups of 4. Select one student from each group to submit the data from the group when they finish recording their data. Prepare a table for all to see that is large enough to include the data from all of the students in the class.

Tell students that the same data is treated as both numerical and categorical data at different times within this activity. This is sometimes done when there is a threshold that makes sense for the context. In this case, it makes sense to look at data for which the second time is greater or less than the first time. Although the actual values may be lost when viewing the data as categorical, it can provide a different type of insight. In this example, we can more easily see if there was an improvement in reaction time for the second attempt.

*Engagement: Internalise Self-Regulation.* Provide a project checklist that chunks the various steps of the project into a set of manageable tasks.

*Supports accessibility for: Organisation; Attention Representing, Conversing: Discussion Supports.* Demonstrate the process for one round of the experiment, in which a group of students and staff play an example round while the rest of the class observes. This will help invite more student participation, conversations, and meta-awareness of language involving collecting and analysing the data.

*Design Principle(s): Support sense-making; Maximise meta-awareness.*

### Student Task Statement

In this activity, you'll get two chances to guess at how long 30 seconds is, then look for an association between the two guesses of all students.

1. Work with a partner. Follow the instructions listed here to gather your data.
  - One of you will hold a stopwatch where the other person cannot see it.
  - The person holding the stopwatch says “go” and starts the timer.
  - The other person says “stop” when they think 30 seconds have passed.
  - The person holding the stopwatch will stop the timer, then report and record the time to the nearest second.
  - The person holding the stopwatch will give a second chance, repeating the experiment.

- After *both* times are recorded, switch roles.

2. Record the group data in this table. When you finish, a group member should give the data to the teacher.

name	time 1	time 2

3. Look at your data. Comparing Time 1 to Time 2, do you think there is a positive association, a negative association, or no association? Discuss your thinking with your group.
4. What are some ways you could organise and represent the entire class's data?
5. Make a scatter plot of the entire class's data and look for patterns. Identify any outliers and the type of any association you observe.



6. Draw two lines on your scatter plot: a vertical line and a horizontal line, each representing 30 seconds for one trial. Use the table for the class's data to complete this two-way table.

	time 2 < 30 sec	time 2 = 30 sec	time 2 > 30 sec	total
time 1 < 30 sec				
time 1 = 30 sec				
time 1 > 30 sec				
total				

7. Use the two-way table to decide whether there is an association between Time 1 and Time 2. Explain how you know.

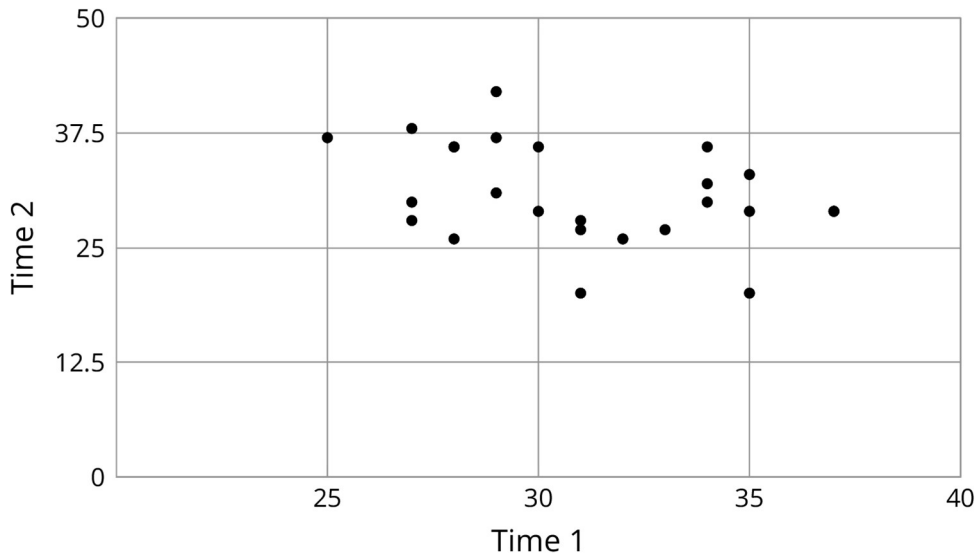
**Student Response**

Answers vary based on student data. Sample response:

1. No response necessary.

name	time 1	time 2
Jada	28	36
Lin	37	29
Diego	29	37
Andre	35	29

2. There appears to be a negative association. People who guessed too high the first time may have tried to stop sooner the second time, and people who guessed too low the first time may have waited longer to stop the second time.
3. We could show the class data as a scatter plot to show both times at once. We could find the difference of each time from exactly 30 seconds and show that with separate histograms, dot plots, or box plots.



4. There appears to be no association in the class data. There aren't any outliers, because all of the data was in a cluster around the point (30, 30).

- 5.

	time 2 < 30 sec	time 2 = 30 sec	time 2 > 30 sec
time 1 < 30 sec	2	1	9

time 1 = 30 sec	1	0	1
time 1 > 30 sec	2	1	9

6. There is no evidence of association, because the relative frequencies of one time greater and less than 30 seconds is about the same regardless of what the other time was.

### Activity Synthesis

The purpose of the discussion is to solidify understanding of the strategies and tools from the unit. Specifically, how to organise and analyse categorical data to determine if there is an association between two variables.

Some questions for discussion:

- “What representation (data table, scatter plot, two-way table, or something else) helped the most in determining any relationships between time 1 and time 2?”
- “If someone's time was slower on the second attempt, how would that appear on the scatter plot?” (The point would be above and to the left of the line  $y = x$ , since the value for the  $y$ -coordinate would be greater than the value for the  $x$ -coordinate like the point (1.2,1.4).)
- “If there was a positive association between the variables, what would that mean?” (In general, the slower the first time, the slower the second time. The faster the first time, the faster the second time as well.)
- “If there was a negative association between the variables, what would that mean?” (In general, the slower the first time, the faster the second time. The faster the first time, the slower the second time.)
- “If the class showed a tendency to overcompensate by going from a time that was longer than 30 seconds to one that was shorter or the other way around, how would that appear in the two-way table?” (The numbers in the table would be greatest on the bottom left and top right of the table with smaller numbers elsewhere.)

### Lesson Synthesis

The goal of this discussion is to help students reflect on collecting, representing, and analysing data with two linked variables. Display the data from the class for all to see while discussing these questions:

- “How is the data used in this unit different from data that would be displayed on a dot plot?” (In this unit we studied two variables for the same individuals while a dot plot would only show 1 variable.)
- “What are some ways we have graphically represent the data from this unit? Why might we choose one representation instead of another?” (We used tables and scatter plots with numerical data, like height and hand span. We used two-way tables and bar

graphs with categorical data, like if someone plays an instrument or has a mobile phone.)

- “How do we look for associations between variables?” (We look at trends in scatter plots when the data are numerical. We look for different relative frequencies when the data are categorical.)



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