



ACTIVITY 3

Questioning Causation

INVESTIGATION

What is the cause of
the broken window?





3 : QUESTIONING CAUSATION

GUIDING QUESTION

How do people consider if one event caused another?

INTRODUCTION

People use causal reasoning every day when they ask why and how something occurred. Asking a series of questions is one way to examine potential evidence for or against a cause-and-effect relationship. Three helpful questions that focus on indicators of causation are:

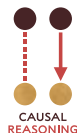
- 1 Do changes in the two variables tend to happen together?
- 2 Does the possible cause usually happen before the possible effect?
- 3 Is there a likely way the possible cause could lead to the possible effect?

As you explored in Activity 2, a fourth question can help evaluate a claim about causation:

- 4 Is another explanation for the result likely?

In this activity, you will explore how to use these questions in everyday thinking about well-being.

CONCEPTUAL
TOOLS



MATERIALS LIST

FOR EACH GROUP
OF FOUR STUDENTS

STUDENT SHEET 3.1
"Causation Cartoons"

STUDENT SHEET 3.2
"Reevaluating
Salas High School
Forum Posts"



What caused the paint to spill?

PROCEDURE

PART A: RECOGNIZING CHARACTERISTICS OF CAUSATION

- 1 Causal reasoning involves analyzing if, when, and how changes happen. A claim about causation can be investigated by asking four basic questions about a possible cause-and-effect relationship where X is the cause, and Y is the effect.

Using the four questions listed in Table 3.1, follow your teacher's instruction to review the example claim and reevaluate the image of the cat and spilled paint.

TABLE 3.1

Four Questions to Determine Cause-and-Effect Relationships

CLAIM It must have rained because there are dark clouds in the sky, and the ground is wet.

QUESTION	DEFINITION	EXAMPLE
How often do X and Y happen together?	association is changes in two variables that tend to happen together	Dark clouds and rain often occur together.
Does X happen before Y?	timing is the order of events in time, where the possible cause comes before the effect	Dark clouds appear before it begins to rain.
How could a change in X lead to a change in Y?	mechanism is a reasonable idea for how the possible cause could have led to an effect based on logic and knowledge	Droplets of water in the sky condense to form clouds. When clouds become very heavy with water, they release the water as rain.
Given the evidence, how likely was the change in Y caused by something other than X?	An <i>alternative explanation</i> is another possible explanation for a result, such as an unnoticed variable or random chance	A sprinkler can release droplets of water and make the ground wet, even if the clouds are not producing rain.

- 2 With your group members, read Cartoon 1, Panel A, on Student Sheet 3.1, “Causation Cartoons,” or in Figure 3.1. Identify the claim about cause and effect being made by the person in Panel A.

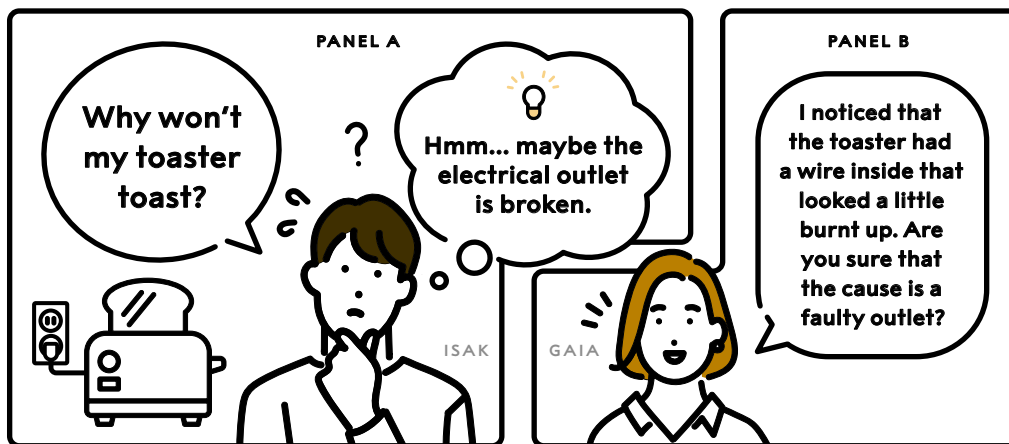


FIGURE 3.1
Cartoon 1

- 3 On Student Sheet 3.1, have one group member draw a circle around the supposed cause, draw a box around the supposed effect, and draw an arrow pointing from the cause to the effect.
- 4 As a group, read Cartoon 1, Panel B. Which kind of question about causation is the person in Panel B bringing up? Have the same group member record the type of question (association, timing, mechanism, or alternative explanation) in the box next to Panel B on the student sheet.
- 5 Does the information in Panel B strengthen or weaken the cause-and-effect claim in Panel A? Circle “Strengthens Claim” if it supports the claim and “Weakens Claim” if it weakens the claim.
- 6 Repeat Steps 2–5 for Cartoons 2, 3, and 4. For each cartoon, have a different group member record the information on the student sheet. Be ready to review your answers as a class.

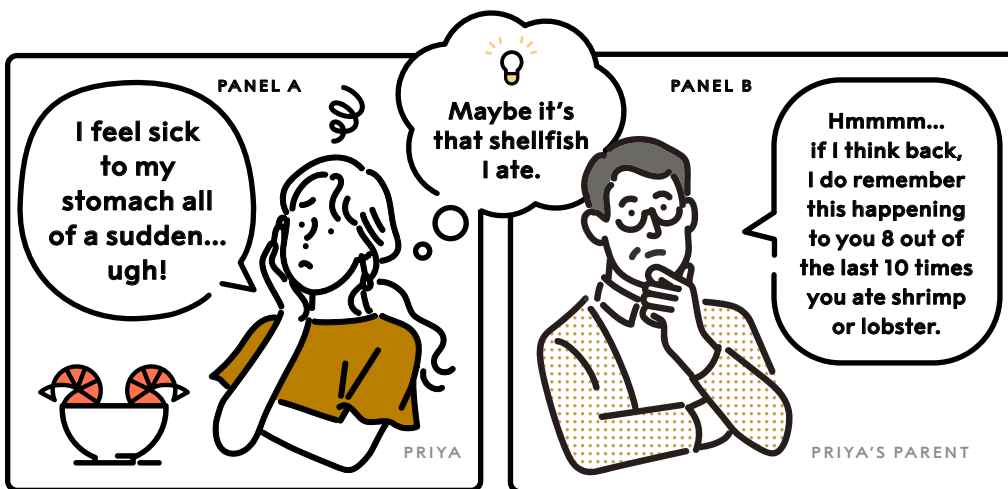


FIGURE 3.2
Cartoon 2



FIGURE 3.3
Cartoon 3

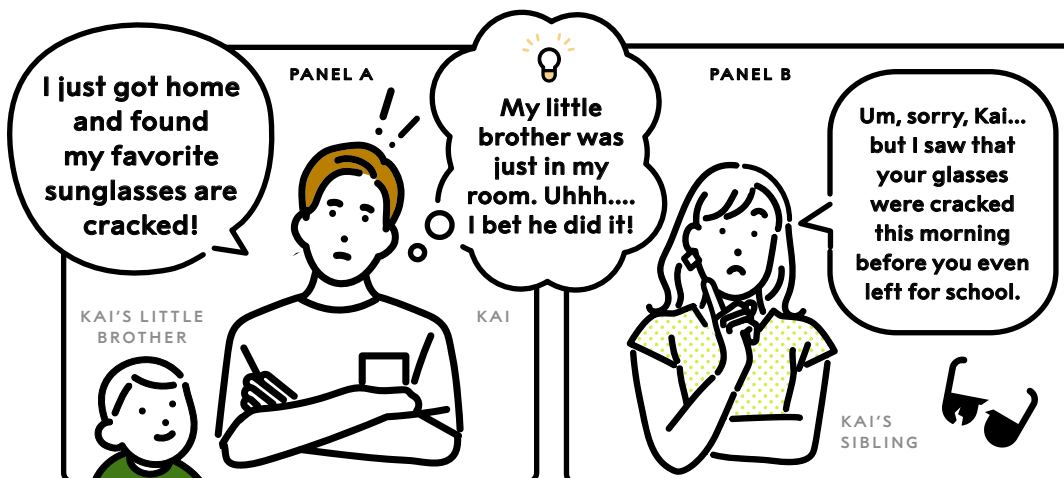


FIGURE 3.4
Cartoon 4

PART B: REEVALUATING SOCIAL MEDIA POSTS FOR WELL-BEING STRATEGIES

- 7 With your group, revisit the social media posts in Activity 1 and use the questions about causation to reanalyze the proposed solutions. Complete Student Sheet 3.2, “Reevaluating Salas High School Forum Posts.” For each post:
 - use the questions from Table 3.1 in Step 1 to decide if each indicator of causation (association, timing, and mechanism) is present or absent in each post. In the “Indicators of Causation” column on Student Sheet 3.2, make a check mark for each indicator that is present and make an X for each indicator that is absent.
 - discuss with your group whether you think there might be an alternative explanation for the effect. Record any possible alternative explanations in the last column on the student sheet.
- 8 With your group, reevaluate which of the six solutions you think would be most effective and which would be least effective in improving well-being. Compare it to your ideas from Activity 1. Record your reasoning in your science notebook.
- 9 As a class, discuss how your ideas about the proposed solutions have or have not changed since Activity 1.

BUILD UNDERSTANDING

- ① Jaime says, “I have three different kinds of evidence that this new supplement is improving my grades. **1)** I’ve been getting better grades since I started taking it six months ago. That’s timing. **2)** During the time I’ve been taking it, I’ve also been getting better grades. That’s an association. **3)** On the bottle, it says it works by increasing blood flow to the brain. That’s the mechanism. Since I have all three indicators for causation, the supplement must be improving my grades.”

Can Jaime be absolutely confident in their cause-and-effect claim? Why or why not?

- ② Suppose you want to convince your friends that exercise increases muscle strength. Explain how each of the three indicators of causation (timing, association, and mechanism) could be used to provide scientific evidence to support this cause-and-effect claim.

CONNECTIONS TO EVERYDAY LIFE

- ③ Imagine you are feeling stressed and see the following advertisement for a stress-relief pill. Would you spend money you've saved on the pill or not? Explain your reasoning, using the four questions about causation (association, timing, mechanism, and alternative explanations).



Fictional advertisement for stress-relief pill

- ④ Think about a well-being strategy you have recently tried.
- Describe if the strategy was or wasn't effective.
 - Based on what you learned in this activity about indicators of causation and alternative explanations, can you explain why the strategy did or didn't work?

KEY SCIENTIFIC TERMS

association
mechanism
timing