Association Is Not Causation

Students distinguish association from causation, recognize coincidence and lurking variables, explain why a strong correlation does not show cause, and describe how a randomized experiment does.

TIME	40 minutes (one student with a parent or tutor, or a small group)
WHO	Math 1 (algebra readiness), about age 12. Follows Unit 10, Lesson 4. Closes Unit 10.
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson, pencil
PRIOR KNOWLEDGE	Scatter plots, association, and r (Lesson 1).
STANDARDS	NC.M1.S-ID.9, NC.M1.S-ID.8.
KEEP OUT	Formal experimental design vocabulary (control group, placebo, blinding). Statistical significance.

Learning goals

1. Define association, correlation, and causation, and tell them apart.
2. Explain a pattern as coincidence or name a plausible lurking variable.
3. Explain why a strong r does not prove cause.
4. Describe how a designed experiment with random groups can show cause, and defend a real causal pair.

Vocabulary: say both, every time

The rule for the whole lesson: whenever the adult or the student says a math word, they follow it with the plain-English version. Proper term first, plain English second, until the student does it without being asked.

TERM	LOOKS LIKE	PLAIN ENGLISH
Association	a pattern	They move together.
Causation	one makes the other happen	A bigger claim.
Lurking variable	a hidden third quantity	Drives both.
Coincidence	chance	No real link.
Experiment	random groups	The way to show cause.

> THE ONE SENTENCE TO SAY OUT LOUD
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> Association is not causation. A pattern is not a reason. Ask what else could be driving both.

Lesson timeline (40 minutes)

0:00 to 0:05	Warm-up: a silly claim. Longer Spelling Bee words go with more spider deaths. Should the Spelling Bee use shorter words to save lives? Let the student explain why not.
0:05 to 0:15	Mini-lesson: three words. Association, correlation, causation. Coincidence. Then lurking variables: Larry and the cars, ice cream and sunburns, shoe size and reading. The four questions to ask.
0:15 to 0:20	How cause is shown. A designed experiment: random groups, one change. Why random groups deal with lurking variables.
0:20 to 0:34	Sort and practice. The cause-or-just-connected sort, reading each explanation, then the practice problems or Worksheet Parts B to D. Same buttons: Hint, Show next step, Reveal answer, Hide help.
0:34 to 0:40	Defend your pair and exit ticket. The student names a real causal pair and defends it (Worksheet Part E), then Part F. Success looks like a clear mechanism, a way to test it, and naming sunny weather as the lurking variable.

Misconceptions to listen for

- **A strong r proves cause.** It shows a pattern only.
- **If it is not a coincidence, it is a cause.** A lurking variable is a third possibility.
- **Association never means causation.** Sometimes there is a cause; you need a reason and evidence.
- **The cause runs the way you first thought.** It could run the other way.
- **Bigger studies fix it.** More data does not remove a lurking variable; random groups do.

Support and stretch

Support

Draw a triangle for each story: the two quantities at the bottom and the possible lurking variable at the top with arrows down to both. Have the student fill in the top.

Stretch

Ask the student to find or invent a headline that confuses association with causation and rewrite it honestly. Ask how they would design an experiment to test whether music helps studying.

Where this goes next

Unit 11: midpoint and distance on a coordinate plane. The grid comes back for geometry: the middle of a segment and the length between two points, using the slope from Unit 3 and the parallel and perpendicular work from Unit 4.

> THE HABIT TO BUILD
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> When two things move together, ask: coincidence, a lurking variable, or a real reason? And how would you test it?