

Instructor Notes

The Frog Experiment

This activity presents a nonsense correlation, which is an apparent relationship between two or more variables that is obviously absurd. One classic example of the nonsense correlation is the observation that the stork population and human birth rate in Europe have both been declining for the last 50 years. Do these two trends mean that storks bring babies? No; the trends are, of course, unrelated. (Actually, both trends may be related to the effects of prosperity and high population density, but they do not have a causal relationship.)

The Frog Experiment story gets participants thinking about cause-and-effect relationships. According to the story, a mad scientist experiments with a frog, cutting off its legs one by one and commanding the frog to jump, which the frog does until, legless, it can't jump at all. The scientist then concludes that the lack of legs causes deafness in frogs, a nonsense correlation.

National Science Education Standards for Grades 5–12

Science as Inquiry

- Abilities Necessary to Do Scientific Inquiry
 - Formulate and revise scientific explanations using logic and evidence. Based on logic, students recognize the absurdity of the mad scientist's explanation for the frog's behavior during the Frog Experiment.*
 - Recognize and analyze alternative explanations. Students identify the mad scientist's faulty assumptions and propose alternative investigations to refute his conclusions.*
- Understanding about Scientific Inquiry
 - Scientific explanations must adhere to specific criteria. Students use the Frog Experiment to discuss the difference between correlation and cause-and-effect when formulating scientific explanations.*

History and Nature of Science

- Nature of Scientific Knowledge
 - Scientific explanations must meet certain criteria based on the nature of scientific knowledge. Students discover that the mad scientist's explanation of the Frog Experiment was not consistent with prior experimental and observational evidence about nature and the scientist did not make accurate predictions about motor and auditory systems of the frog.*

Procedure Notes and Outcomes

Give participants the Frog Experiment handout to read and show the data on the overhead to the class. As a class, discuss the story and the scientist's conclusion. Although the story was originally written as a joke, use this opportunity to discuss the criteria that are essential to scientific explanations. Be sure the discussion includes the faulty assumptions the mad scientist made and experiments that could be done to refute the mad scientist's conclusion. Also discuss the difference between correlation and cause-and-effect. You may also want to include a discussion of when, why, and how animals are actually used in drug testing.

Overhead

The Frog Experiment

Trial	Condition of Frog	Jump Length (meters)
1	normal	1.2
2	minus 1 leg	0.5
3	minus 2 legs	0.1
4	minus 3 legs	0.01
5	minus 4 legs	0

NOTE: The scientist conducted each of these trials by starting the frog at the same line, yelling “jump,” and measuring the length of the frog’s jump in meters.

Handout

The Frog Experiment

There once was a mad scientist. One day, being curious of the nature of frogs, he propped a frog up on his desk, opened his notebook, and carefully observed the animal. After staring at it for a considerable amount of time, the scientist finally said, "Jump!" The frog leapt.

The scientist then quickly jotted down in his notebook, "Frogs will jump when told to do so." The scientist also recorded the length of the frog's jump.

The following day, the mad scientist entered his lab, checked his notebook, put the frog up on the table, and again stared at it. Finally, he took out a scalpel, removed one of the frog's legs, and said, "Jump!" The frog leapt.

The scientist quickly added to his notebook, "Three-legged frogs will jump when told to do so." The scientist also recorded the length of the frog's jump.

The next day the scientist, upon entering his lab, went through the same routine, cutting off another of the frog's legs. As he was staring at the wretched animal that was now missing two legs, he said, "Jump!" The frog leapt.

The scientist then added to his previous observations, "Two-legged frogs will jump when told to do so." The scientist also recorded the length of the frog's jump.

On the fourth day, the scientist behaved according to his habits and removed a third leg from the frog. He then expectantly said, "Jump!" The frog leapt.

Well, by now, the scientist was quite excited about all of this. He wrote down in his notebook, "One-legged frogs will jump when told to do so." The scientist also recorded the length of the frog's jump.

Finally, on the fifth day, the scientist entered his lab already thrilled by what new discoveries he might make. As usual, he checked his notebook, placed the frog on the table, stared at what was left of the animal, reached for his scalpel, and removed the last of the frog's legs. He then said, "Jump!" But, alas, the frog did not leap.

"Jump!" yelled the scientist again. Still the frog did not leap.

"Jump! Jump!" exclaimed the scientist. But the frog did not leap.

The scientist, quite disappointed, finally wrote down in his notebook, "Frogs, when deprived of all legs, become deaf."