Teacher Tune-up

Quick Content Refresher for Busy Professionals

What is a hypothesis and why is it so tricky to teach?

There's a lot of disagreement among science educators about how to introduce the idea of developing a hypothesis, but they largely agree that rigid definitions don't help. Also, experiments based on intentionally contrived situations (like many of the ones we include in these materials) should be considered EXERCISES to help students go on to develop more meaningful, purposeful, and phenomena-based hypotheses as they continue in science classes. As scaffolding for thinking through the development of a hypothesis for the first time in science class, SciGen offers the following frame.

When we construct a scientific hypothesis, two things are often included:

- a view that states what we think is true and
- a reason or cause that we can test with a measurement.

This isn't intended as a strict definition, but simply as a scaffold for developing useful hypotheses.

When developing a hypothesis, students should think about what they've already learned or observed that would allow them to state a testable hypothesis. Articulating a thoughtful hypothesis involves making a kind of commitment, but teachers also must make sure that students don't become overly attached to a hypothesis. It's okay to be wrong!

Many science teachers are eager for students to differentiate between independent and dependent variables when conducting experiments and also to include a cause and effect relationship in their hypothesis statement. Here is a sentence frame many New York City middle school teachers have their students use:

➡ If the *(INDEPENDENT VARIABLE)* changes, then the *(DEPENDENT VARIABLE)* changes because *(REASON)*.

The thing you plan to change in your experiment is called the INDEPENDENT variable. The thing you measure is called the DEPENDENT variable. For example, if you want to know how well plants grow with different amounts of water, you could take several potted plants and water them at different rates over the course of a month, measuring the growth of the plants over time. The amount of water given per day or week would be the INDEPENDENT variable because it is the thing you change. The size each plant grows to would be the DEPENDENT variable.

It's also important that you think about other variables for this to be a fair test. Are you using the same kind of plants, and are they the same size to start with? Are they growing in the same amount of soil? Are all the plants getting the same amount of light? Do you have several plants for each treatment to check whether variations in growth are just random?

For the plant growth experiment, you could frame a hypothesis this way:

➡ If the RATE OF WATERING increases, then the RATE OF PLANT GROWTH will increase, because plants need water to grow.

The result of the experiment might show that things are more complicated. Perhaps you would find that there is an optimum rate of watering, and that too much water is bad for plants. You could then refine your hypothesis, and perhaps devise new experiments to test other variables.