Science Preparation for Elementary School Students

There are many ways that elementary teachers can prepare their students for the science they will be studying in middle school and high school. These are just suggestions that will help them to avoid learning misconceptions and misuse of terms and concepts that would get in the way of understanding at higher levels.

First, it doesn’t hurt for them to be introduced to aspects of the nature of science (NOS). There are several NOS lessons on the ENSI site that will help with this. Elementary teachers should go to the NGSS (Next Generation Science Standards) Appendix H. They should read it carefully, and especially notice, on the two tables on pp. 5 and 6, the appropriate grade level column on those two pages. Listed there are the Learning Outcomes (LOs) expected in science for those grade levels. Teachers should incorporate interactive experiences in their lessons that will help their students to learn about those LOs. Again, several of the ENSI NOS lessons will help do this.

It’s never too early to begin helping students to understand some of the important elements of science, as long as these experiences are age-related and as long as the information is not distorted in the efforts to simplify. Here are some suggestions that should help:

Seriously consider avoiding the use of the word “hypothesis” at this level. The word is often misused (by texts and teachers). There’s nothing wrong with predicting (based on logic or previous experience), or even just guessing what might happen in an experiment (with their more limited experience), but this should be called a “prediction” or “expectation”—NOT a hypothesis! As properly used, a hypothesis is usually a tentative, testable, natural explanation for why something is the way it is, or happens the way it does. It’s not just an “educated guess.” A good hypothesis should be the basis or reason for expecting or predicting the likely outcome of any test of that hypothesis (experiment or planned observation), but usually not the prediction itself. Consider using “model” instead of hypothesis, idea, or theory in its casual sense.

If you must use the word “hypothesis,” avoid defining it as the widely used “an educated guess” or any kind of guess. This is much too vague. A “guess” could be about anything, but “hypothesis” should just apply to a possible explanation or answer to a question about some natural event or condition. Use the definition as given above, and try to limit its use to tentative explanations.” Students begin picking up that “educated guess” definition somewhere early in life, and it becomes another of the many misconceptions that they (and their later teachers) have to deal with. This may seem like a minor distinction, but it’s one that can be confusing later on. Consider using “model” instead of hypothesis.

Another term often used incorrectly is the word theory. This term, too, should be avoided in the elementary years. It’s better to use “idea” or “model” for the vernacular use of theory (as it’s commonly used by people). “Theory,” if used at all, should be clearly reserved only for use as a “scientific theory”: a well-established, highly supported explanation of natural phenomena. Read the treatment of “theory” in the Science Surprises booklet, or this teaching guide.

Here are some very important skills to develop during their elementary years: 1) Focusing on careful observations using all their senses, 2) writing precise, detailed and critical descriptions (so they can compare with others and possibly call it a “scientific fact”), and 3) distinguishing between what they observe with their senses, and what they think or infer from those observations. You can do a lot of this in the context of exploring many of the science standards content. More formal or abstract aspects (like developing and working with hypotheses) can wait until middle school.

Guiding those inferences, by the way, into discussions about how observations (data) can lead to deeper understanding, or meaningful insights not directly gained by observing—such things as the possible reasons why they observed what they observed, and predictions about what they might expect to happen if they change something in what they do or look for. This gets into some analyses and other kinds of deeper thinking, but it can be fun to do, and gives kids a real taste of the power of logical analysis derived from what is observed. And you don’t have to get into any of the formal terminology for this, either, something that can be confusing, or, even worse, misused. And the habit of doing that can be hard to change later.
Keep in mind that the essential goal of the *Science Surprises* unit is for students to recognize **common misconceptions** about the **nature of science**, including the myth that there is only one “Scientific Method.” They should be aware of ways that science is done other than experimentation, e.g., how they study the distant past (historical science), and how they describe living organisms. They should also recognize the key features of the nature of science.

**For studying living things**, be sure that students get familiar with the great **diversity** and many **examples** of plant and animal life (as well as bacteria), and **why** we call them "plants" or "animals." In other words, what are the **features** usually associated with "plants," and likewise with "animals?" You might even help them to recognize the features that distinguish the major groups of vertebrates (fishes, amphibians, reptiles, birds, and mammals) and even some of the more common invertebrates, e.g., insects, spiders, crustaceans (crabs, shrimp, barnacles, etc), molluscs (clams, octopi, snails, etc.), echinoderms (sea stars, urchins, etc), and annelid worms. This will lay the groundwork for learning more about **classification** and how that provides clues to biological relationships (their phylogeny) later on.

**More Misconceptions to Avoid**: Get familiar with a few of the key misconceptions about **evolution**. Avoid phrases and terminology that facilitate those misconceptions. These include the misuse of terms like organisms vs populations and species, adaptation vs acclimation, and cause vs purpose. For details about this, [CLICK HERE](#) to read them on the ENSI site. Misusing these terms can cause greater difficulties later in MS, HS and college, so be alert to their misuse by yourself and your students, making corrections when they arise.