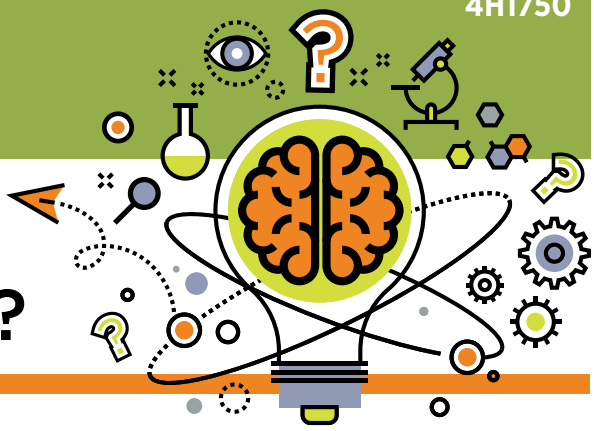
TEACHING SCIENCE

...when you don't know diddly-squat



Introduction: What is the answer? Who cares?

It's all about the questions! When youth ask questions you cannot answer, **you win**!

The goal of teaching inquiry-based science is to make the youth smarter than you. When they ask questions you cannot answer, it is not a failure.

The joy of science is the joy of discovery. Have you ever had a "light bulb moment" when you suddenly understand something you previously did not? How does that feel? You feel accomplished. The goal is not to impart your knowledge to others, but rather to let them discover it for themselves. When you simply spew forth information from your brain while attempting to teach a young person, you take away the accomplishment of that light bulb moment.

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What science is not:

Science is **not**:

- **Knowing all the answers.** Even if you don't know diddly-squat, you can teach science. The Wright brothers did not know how to build a working airplane when they started. They asked questions, which led to more questions. Some questions don't have an answer (yet).

Science is **not**:

- **A recipe.** A recipe is a set of instructions used to put things together and get an expected result. Science does not always have predictable results. It is about predicting what will happen, trying an experiment, and then figuring out why it did or did not work.

Science is **not**:

- **Magic.** Science isn't about making mysterious things happen and mystifying people. It is trying to understand the world around us.

Guidelines for Teaching Inquiry-Based Science:

1. Ask a question: *Why is the sky blue?*
2. Usually the youth will respond with: *I don't know.*
3. Ask the youth again: *What do you think? What do you think makes the sky blue?*
4. If the youth still don't respond, it may be that the fear of being wrong makes them uncomfortable. Give a totally outrageous (wrong) answer: The sky is blue because every night bats go out with crayons and color it blue. *Do you think that is what happens?* It sets up the idea that it is okay to be wrong. The humor also breaks the tension.
5. Keep asking more questions, especially ones you don't know the answer to.

Age-Level Characteristics:

Early Childhood (ages 3–8):

Youth in this age group tend to:

- Be naturally curious.
- Be more excited about doing an activity than completing it.
- Work better in small groups than large ones.
- Do better in activities that do not need fine motor skills.
- Do better in activities that have little or no wait time.
- Need guidance in developing a plan of action.
- Be concrete thinkers.

Middle Childhood (ages 9–11)

Youth in this age group tend to:

- Be eager to try new things.
- Have lots of energy.
- Work better in same-gender groups.
- Need some guidance in developing a plan of action.
- Respond to encouragement rather than comparison.
- Do better with multiple short small-group discussions sprinkled throughout rather than a larger wrap-up conversation.

Young Teens (ages 12–14)

Youth in this age group tend to:

- Develop their own opinions.
- Be self-critical. **(Emphasize it's okay to be wrong.)**
- Like to discover things for themselves rather than be taught.
- Begin to think abstractly and hypothetically.
- Be able to take responsibility in planning and evaluating their own work.
- Need thoughtful questions to help guide in developing a plan of action.

Teens (ages 15–18)

Youth in this age group tend to:

- Develop leadership capabilities.
- Be self-critical. **(Emphasize it's okay to be wrong.)**
- Be capable of abstract or hypothetical thinking.
- Need exposure to career opportunities to plan their future.

You do not need all the answers to teach science. You simply need an inquisitive mind and to be willing to carry out an investigation.

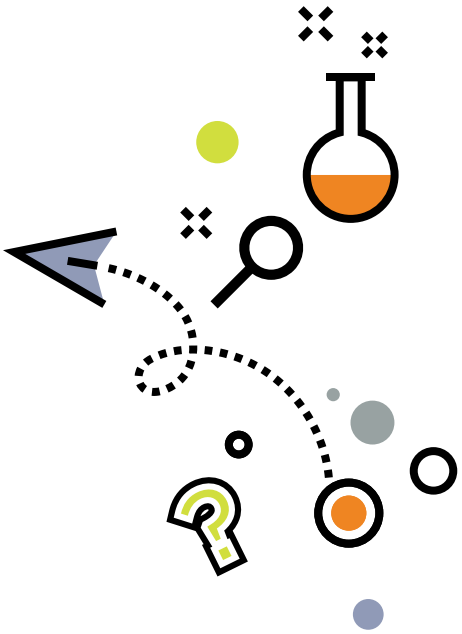
Science & Engineering Practices:

These eight Science and Engineering Practices come from *A Framework for K–12 Science Education* (National Research Council, 2012, p. 42). These research-based best practices for engaging youth in science are connected to in-school science standards that all children must meet. Not all lessons will include all eight of these practices. They also do not follow any order.

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Reference:

National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press.



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