

## The NGSS Science and Engineering Practices—An “8-point booster shot” for Inquiry!

Jo Anne Vasquez

Recently in a workshop I was presenting, Susan, a third grade teacher, lamented, “I just learned to teach in an inquiry-oriented way and now you’re telling me it is gone?” Visibly upset, she tried to explain how hard she has worked to become an inquiry-oriented teacher, using hands-on, inquiry-based materials. She thought she was all set, and now with the roll-out of the Next Generation Science Standards (NGSS) Susan cannot find inquiry anywhere. So, where did it go?

When the National Science Education Standards (NSES) were developed in 1996, they used the term inquiry to describe the activities students engaged in to develop knowledge and understanding of scientific ideas. This description led to various interpretations of what inquiry should and shouldn’t be in the classroom. Since there were different interpretations of the term, a companion book, *Inquiry and the National Science Education Standards* was written to clarify its meaning and to give guidance to inquiry teaching and learning. Then in 2011 the National Research Council (NRC) committee that developed *A Framework for K–12 Science Education* decided not to use the term inquiry since its meaning was still unclear. What we have all come to call inquiry is in the NGSS, but it is more precisely defined in terms of practices.

We know that students learn science best by engaging in the practices of science. The term practices may be confused with the colloquial sense of “a practice” or “to practice,” which is a repetitive performance of activities or skills. We need to now consider “practices” as what scientists and engineers do as they work, through a coordination of both knowledge and skills. As teachers, we can engage students in these practices and help them learn how scientific knowledge is developed and applied.

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For us to better understand the shift required from just thinking of inquiry as defined in the NSES, let's take a look at the similarities between inquiry abilities, as they were called in 1996, and the newer conception of practices in the NGSS.

Inquiry Abilities from the NSES (Grades K–5)	Science and Engineering Practices from the NGSS
Identify questions that can be answered through investigations	Asking questions and defining problems
Develop descriptions, explanations, predictions, and models using evidence	Developing and using models
Plan and conduct a simple investigation	Planning and carrying out investigations
Use data to construct a reasonable explanation	Analyzing and interpreting data
Use mathematics in all aspects of inquiry	Using mathematics and computational thinking
Recognize and analyze alternative explanations and predictions	Constructing explanations and designing solutions
Think critically and logically to make relationships between explanations and evidence	Engaging in arguments from evidence
Communicate investigations and explanations	Obtaining, evaluating, and communicating information

In the NSES, inquiry abilities were specified in grade spans, K–4, 5–8, and 9–12. They have been adapted and some combined here to give you a clearer overview of how, as you are making the shift to the NGSS, you can consider the similarities between the inquiry abilities and the science and engineering practices.

By now you are probably thinking this is all very difficult to understand, but let's take a look at a performance expectation from the NGSS that second grade students should be able to accomplish.

Here is how you might prepare your students to be able to do this. Each group of students is given a paper plate that has a piece of chocolate bar and an ice cube on it. They discuss and record the properties of each. They are asked to find a way to change the shape of the ice cube and the chocolate. Once the groups have agreed upon the way and changed the shape of the ice cube and the chocolate, they will then share their findings by responding to some guiding questions from the teacher:

- x What did you do to change the shape of the ice cube and chocolate?
- x What was left afterward?
- x What could you do to restore it to its former shape?

Seems easy enough don't you think? And probably not terribly different from any inquiry lesson that you've taught before.

For a while we will have to find ourselves changing the way we talk about inquiry, for some educators will insist it has gone away. On the contrary, inquiry is the heart of science. To inquire is to ask questions and our students have many questions. They then can investigate their questions