

Phenomena Based Instruction

The 3 Dimensions of the Next Generation Science Standards

Criteria for Selecting Useful Phenomena:

Scientific phenomena are occurrences in the natural and human-made world that can be observed and cause one to wonder and ask questions.

Phenomena-based instruction is a primary feature of the NGSS classroom. A three-dimensional learning approach requires students to use the [Science and Engineering Practices](#), [Crosscutting Concepts](#), and [Disciplinary Core Ideas](#) in concert to explore, investigate, and explain how and why phenomena occur. The complexity of a student explanation should be appropriate to the learning progression at the grade span.

Phenomena do not have to be phenomenal. Often simple events, when looking at them through a scientific eye, can elicit curiosity and questions in students and adults. Such wonderment is the beginning of engagement in which answers to questions are sought.

When choosing useful phenomenon for classroom use, the scale or size of phenomena is important. Determining the grain size of a phenomenon involves considering the length of instructional time required to teach it, the depth of student explanation possible, and the complexity of the phenomenon itself. In the same way a jigsaw puzzle can be broken down into individual pieces, larger phenomena can be broken down into smaller phenomena. By having students observe and explain smaller related phenomena first, they can then be challenged to explain the larger and more complicated larger phenomenon.

We call the larger phenomena *anchoring phenomena* and the smaller phenomena *investigative phenomena* which are defined below.

Anchoring Phenomena

Anchoring phenomena are the focus of an instructional unit and connect student learning across multiple weeks of instruction. They often require significant or in depth understanding of several science ideas as well as multiple lines of evidence and reasoning to adequately explain. Because of their size or scale, students may only be able to explain particular aspects of an anchoring phenomena.

Investigative Phenomena

Investigative phenomena are used in instructional sequences (across several lessons) to provide students personal experience with observable events where an evidence based explanation can be constructed. They often require understanding or use of a fewer number of connected science ideas to explain. By explaining investigative phenomena, students begin to explain aspects of an anchoring phenomena.

Use the following guiding questions and criteria to help determine if a phenomenon under consideration is useful or not:

- Can students **observe** and/or **investigate** the phenomenon either through firsthand experiences (e.g., directly in a classroom, lab, or outdoor environment) or through someone else's experiences (e.g., through video presentations, demonstrations, or analyzing patterns in data)?
- Do students have to understand and use **Core Ideas, Science and Engineering Practices,** and **Crosscutting Concepts** to explain how and why the phenomenon occurs?
- By making sense of the phenomenon, are students building understanding toward grade-level **performance expectations**?
- Would student explanations of the phenomenon be **grade-level appropriate**?
- Is the phenomenon **relevant** to real-world issues or the student's local environment?
- Will students find making sense of the phenomenon **interesting** and **important**?
- Does the potential student learning related to the phenomenon justify the **financial costs** and **classroom time** that will be used?

This tool is an adaptation of the following resources:

- [Qualities of a Good Anchor Phenomenon for a Coherent Sequence of Science Lessons](#) from William R. Penuel and Philip Bell, Research + Practice Collaboratory
- [Three-dimensional instruction: Using a new type of teaching in the science classroom](#) from Joe Krajcik, NSTA Science Teacher
- [Criteria for Evaluating Phenomena](#) from Ted Willard, NSTA
- [Using Phenomena in NGSS-Designed Lessons and Units](#) from Achieve