

Collaborative Tool: Planning for Engagement with Big Science Ideas

Note: Before using this tool, please read primer for *Planning for Engagement with Important Science Ideas*.



The series of prompts below will help you transform common topics found in textbooks, curricula, and Standards into big ideas worth teaching. The purpose of this is NOT for you to justify why you have started out with a particular topic. It is to help you *question* the topic's importance, to *learn more* about it, *compare* it against the Next Generation Science Standards (or your current state standards), and identify the *core ideas* you will teach.

Two important notes: (1) In using this tool you will quickly reach the “edge” of your science knowledge. You should take a break from working on it yourself (after Step 1 is a good time) and start *sharing your ideas and questions* about the subject matter with some colleagues. (2) This tool is *not linear*. You will likely go back to previous steps to revise what you had recorded there. This is expected and it is a productive way to develop an anchoring event based on big science ideas for your unit.

Step 1 Start by comparing your curriculum topics against the *Standards*

1.1 State below what your curriculum currently identifies as the main topic (just a word or phrase), then list between 8 and 10 of the most important curriculum sub-topics you also see. Topics at this stage can initially be expressed as a process or thing or theory or concept.

1.2 Now identify where the topics above topics fit with the *Next Generation Science Standards* (<http://www.nextgenscience.org/>) or your state standards. Copy and paste below all the possible disciplinary core ideas and performance expectations that relate to your topic (this is the *only* part of the tool where you should copy and paste from another source).

1.3 Which of the curriculum ideas fit with the NGSS? How might you re-cast your curriculum ideas to better address the Standards? The Standards *take precedence* over the curriculum topics, but it is possible to teach some curriculum ideas that are not mentioned directly in the Standards.

At this point you will need to talk with a collaborator before moving on...Where are you unsure? Need input about?

Step 2 Moving from topics and Standards toward “big ideas”

2.1 Which one of the ideas from the curriculum and Standards now seems the most central—meaning they might help explain other ideas you’ve listed and explain a wide range of natural phenomena? You must use more than a name to express your idea, *express it as a set of relationships*. Explain your choice clearly enough so a colleague could understand why you made the choice you did. To think about this, imagine filling these sentences in: *If my students could only understand how [core idea]_, then they could use that to understand most other ideas in the unit. And here’s why [give reasons for why your big ideas link to other ideas or have explanatory power]*.

If you have trouble, the text in the box may help you think about how to identify what the big idea is...

Does your current choice for a central idea have a more fundamental or underlying idea that should really be the target of instruction? For example, energy transfer is what “underlies” the idea of food webs; kinetic molecular motion “underlies” the Gas Laws; and, the idea of unbalanced forces “underlies” simple machines. ALTERNATIVELY: Your topic could be a smaller part of a *larger system of activity* that is really what is important to teach. For example, in earth science the tides should be taught within the larger context of the regular movement of bodies in space and the gravitational effects of these bodies.

2.2 What about the big idea would students see as relevant to their own lives? Think about what kinds of experiences and events students have had and how the science concepts might be meaningful (not just relevant) to students. Where students encounter such ideas/science phenomena?

Step 3 Learning more about your “big idea”

You will need to deepen your understanding of topics with which *you may think* you are very familiar. You don’t need college level textbooks, just use *Wikipedia*, *How Stuff Works*, the *National Digital Library* or other reputable source. Read with the expectation that you’ll have to generate a causal explanation (a “why-does-it-happen-this-way” story) for some phenomenon related to your topic.

3.1 Write below three *new facets* of the topic you’ve learned about and if new relationships between ideas have come to light—*what facts, concepts, connections did you not already understand?* Do not write definitions or formulas or trivial details; you need to UNPACK the meaning of a science idea in order to consider how to help students reconstruct the idea.

Do not copy and paste from any source.

Step 4 Coordinating an important phenomenon (Anchoring Event) with its explanatory model

Now we return to selecting an anchoring event or process (the observable world) and the underlying causal model for those events (the unobservable world). Answer these two sets of questions that help establish a relationship between the two.

4.1 What is an actual, observable event or set of events that students can come to a deep understanding of over a period of days? Explain why students will find this puzzling and not just an exercise found in a textbook. **DO NOT NAME A CONCEPT, NAME AN ACTUAL EVENT THAT UNFOLDS OVER TIME, EVEN IF IT IS A BRIEF AMOUNT OF TIME.**

4.2 Give the event some context. How can the phenomena be made into a context-rich case of something “local” or “personal” to students rather than being a generic science idea? Can earthquakes, for example, be about the case of the Nisqually Earthquake? Can food chains be about the case of the decline of the Orca populations in Puget Sound? Can cell division be about a case of wounds healing in an athlete?

4.3 Now outline a causal storyline for this phenomenon. Use the abstract or unobservable characters, events, properties to form the explanation. This should be a “gapless” explanation that is just beyond what you think students at your relevant grade level might be capable of.

4.4 *In addition* to the written explanation, create on a separate piece of paper a diagrammatic/pictorial template for the explanation that you’d ask students to draw into. You can break the model into “before, during and after” sections, or you can compare two events side-by-side. Below this template, include a list of key observable and unobservable features.

Step 5 What success looks like

In this final step, you should imagine what your students will be able to do if they are successful in understanding the big idea and engaging in scientific practices. Look at how the performance expectations are written in the NGSS—they require students to both use a scientific practice (or more than one practice) and also to understand a set of specific science concepts.

Write two performance expectations for your students that pair up one or more scientific practices with the understanding of key concepts. Because modeling, explanation and arguing with evidence are at the heart of authentic disciplinary work, your performance expectations should include these three, either individually, or in combination with one another in a performance expectation.

This is the end of the tool, you should now have enough of an understanding of your big idea to prepare you for planning instruction...but keep testing and comparing ideas with your colleagues—professionals are never “done” thinking about science ideas!