**Science workshop plan**

Consultant: Keeping in mind the NGSS standards, specifically the cross-cutting concepts and the engineering principles, learners mastering content is a happy secondary effect of Standards Based Learning, not the focus.

Awesome science teacher: What do you mean?

Consultant: The era of the teacher being the steward of knowledge, the sage on the stage, and the keeper of facts is extinct. I know as many facts as you about science because I have a smart phone in my pocket.

Awesome science teacher: Oh no, that is scary. I know so many things and took so many science classes and the kids need to know this stuff.

Consultant: I understand that feeling. Most teachers feel the same way. In which of your education classes or from which directive by your administration does it say to teach the kids lots of content?

Awesome science teacher: Umm, not sure. That is just the way teaching has always been done.

Consultant: Just because we have always done it that way doesn’t mean it is the best way for student learning. When we know better, we do better.

Awesome science teacher: So what are you saying? That I don’t teach content?

Consultant: When people ask me what I teach, I reply, “Students.” While this might seem flippant and sarcastic, it is not. We teach children, not *To Kill a Mockingbird* or photosynthesis or multiplying fractions or the American civil war.

Awesome science teacher: Yes, but there are tests in my class and standardized tests and curriculum.

Consultant: True. What is your first unit of the school year for your 7th grade science class?

Awesome science teacher: Cells and knowing the different parts and what those parts do.

Consultant: Awesome. And your summative is having kids make a diagram of all the parts of a cell?

Awesome science teacher: Yes. How did you know?...Well, I guess that is what we all do.

Consultant: Ha ha. What are you assessing when you have learners make that model?

Awesome science teacher: I am seeing if kids know all the parts of a cell.

Consultant: However, we said that content is secondary. Very important, but secondary. I would even argue that you really don’t want kids to memorize all of the cell parts after leaving your class. What do you really want kids to be able to do when they leave your class that you are having them do when they make a model of a cell?

Awesome science teacher: I want them to leave my class being able to understand different systems and constructs of science and be able to explain them in a model. I want them to understand how parts contribute to a whole in science.

Consultant: One of the NGSS cross-cutting concepts talks about systems and models and explains that “A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.” Specifically for 7th grade, it asks learners to understand that “Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems” and that “Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems” and that “Models are limited in that they only represent certain aspects of the system under study.” What if you created a standard in kid-friendly language that said something like, “I can use a model to understand a system”? Then, this was the only standard that you used to assess the cell diagram project that you already do in your class?

Awesome science teacher: But how will I know if they know the content?

Consultant: If a learner is proficient in “using a model to understand a system,” what will happen almost “accidentally”?

Awesome science teacher: They will understand the content that I want them to know. So, I am not technically having them memorize facts and giving them a test on this content, but instead practicing making models to understand systems and then helping them discover the different parts of cells and then having them create a model that explain how a cell works?

Consultant: Exactly. In that way, you are exposing the learners to the content but focusing your assessment attention and energy on what matters most to you and what will be most valuable for the learner as a science-minded problem-solver in the future. Also, even though I know as many facts as you about cells, I cannot make a model of one to understand the system of cell life as well as you.

Awesome science teacher: Well that isn’t that hard. I can do that.

Consultant: Heck yes you can!

*Enthusiastic high fives are exchanged*

**Practices and Crosscutting concepts are recursive and “standards” to assess.**

**Core Ideas are more of a curriculum guide to make the recursive magic happen.**

**PRACTICES FOR K-12 SCIENCE CLASSROOMS**

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

**SEVEN CROSSCUTTING CONCEPTS OF THE FRAMEWORK**

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

2. *Cause and effect: Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. *Scale, proportion, and quantity.* In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.

4. *Systems and system models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineerin**g**.

5. *Energy and matter: Flows, cycles, and conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems’ possibilities and limitations.

6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

7. *Stability and change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

**Three Disciplinary Core Ideas**

*Physical Sciences*

PS1: Matter and its interactions

PS2: Motion and stability: Forces and interactions

PS3: Energy

PS4: Waves and their applications in technologies for information transfer

*Life Sciences*

LS1: From molecules to organisms: Structures and processes

LS2: Ecosystems: Interactions, energy, and dynamics

LS3: Heredity: Inheritance and variation of traits

LS4: Biological evolution: Unity and diversity

*Earth and Space Sciences*

ESS1: Earth’s place in the universe

ESS2: Earth’s systems

ESS3: Earth and human activity

*Engineering, Technology, and Applications of Science*

ETS1: Engineering design

ETS2: Links among engineering, technology, science, and society

**https://www.nextgenscience.org/three-dimensions**