Adapting Lesson Plans into Storylines

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The **Next Generation Science Standards (NGSS)** promote a science education framework that forefronts the practice of science and uses three dimensions that ask students to assume a more autonomous role in their learning. Learning within this three-dimensional framework entails "making sense" of phenomena through asking driving questions such as, "Why does nail polish remover evaporate more quickly than water when I get it on my skin?"

The questions asked around phenomena form storylines. Storylines begin with phenomena, things that are observable in the natural world. Students figure out **Disciplinary Core Ideas (DCIs)** and **Crosscutting Concepts (CCCs)** by using **Science and Engineering Practices (SEPs)** to "make sense" of the phenomena. The sense-making process is kept on track by the storyline that maps out relevant **DCIs** and **CCCs**, possible student questions/lines of investigation and potential misconceptions.

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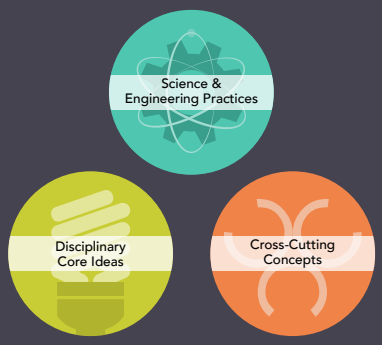
Story-lining is challenging because it is new to the science education community. Traditional science education draws heavily on a textbook as one of the drivers of instruction. It is ordinarily the repository of facts, or core disciplinary ideas, on which teachers design lessons to build student proficiency in chemistry, biology or physics. Proficiency typically means encouraging students to repeat facts learned from the book, or what was passed to them from the book via the teacher, onto paper during a quiz or test.



The NGSS Foundation: 3-Dimensional Instruction

In the non-NGSS model, the teacher may tell the students the reason and then subsequently have them do a laboratory activity meant to empirically validate that water and acetone evaporate at different rates when all other factors are controlled. Proponents of the **NGSS** argue, and research would suggest this is no longer an open question, that students gain a deeper understanding of the relevant disciplinary core ideas (the facts) by heading immediately into a hands-on laboratory experience to begin the process of understanding why acetone evaporates more readily than water. As they do this, students must think for themselves before the teacher presents them with the facts. They might be given some context, for example "looking at this with a microscope eye, what types of molecules are involved, how are they different and how are they moving?" and from there deduce that they should research and find out the properties of the

chemicals along with chemical structures. Some in the **NGSS** community refer to this as a shift from "…learning about to figuring out." This shift can be difficult. The process of figuring out the **DCIs** (facts) as opposed to learning about them is impeded by misconceptions and questions that touch on irrelevant **DCIs**. Storylines are helpful for dealing with these impediments because they map out potential paths students may take as the make sense of phenomena. They identify the impediments along the way and make plans for addressing them.

Next Steps

Perhaps you have a set of activities you have been doing for some time and you would like to adapt it to the **NGSS**. Or perhaps you are in the process of developing a new set of materials aligned to the **NGSS**. The first thing to acknowledge is that you will not feel completely comfortable at all times. The **NGSS** are pretty detailed, and people have different opinions on what implementation of the **NGSS** looks like.

> **a shift from "…learning about to figuring out."**

That said, most in the science education community seem to agree that if the practice of science is emphasized as the manner by which students gain familiarity with, and understanding of, the disciplinary core ideas, that is a good start. In otherwords if students can—by virtue of building models, analyzing data, asking questions and engaging in other science practices—identify and wrestle with disciplinary core ideas to explain phenomena under investigation, they will have engaged in three-dimensional learning.

Storyline Development

So, what should you try to do as you begin to build storylines for your students?

Think about the disciplinary core ideas you would like to "cover."

Find materials in your existing toolkit of lab activities that address those disciplinary core ideas.

Devise a question or phenomenon that cannot be answered with a simple "yes" or "no" that will be interesting to your students, and that in the course of answering, might conceivably make use of the lab activities previously identified—perhaps not directly, but with some modification.

Challenge yourself to make sense of the question or phenomenon before you present it to your students. This is extremely important because sense-making is not a prescriptive process and it is therefore hard to be predictive about the direction your students will take on the path to understanding. It is best to come to a fundamental understanding of the phenomenon yourself first so that you feel prepared to comfortably direct students to where they need to be.

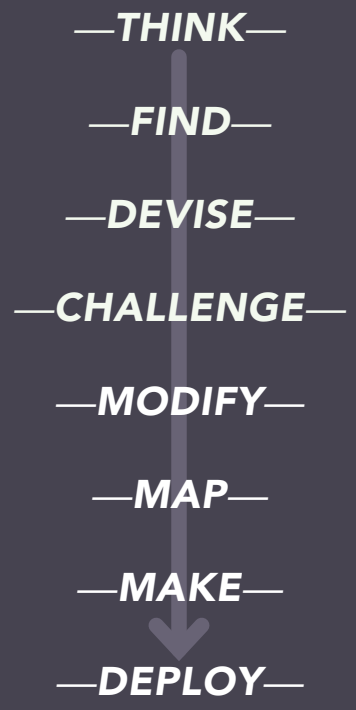
Modify the previously identified lab activities so that they provide an introduction to a relevant technique, but stop there. Do not tell students how to apply the technique to figure out the answer. For example, you can show students how to use a burette. They should come to determine that the burette might be a good tool to use to add precise volumes of acid to base to determine the concentration of one or the other. Also, be sure to caution your students against any laboratory activity or practice that might be unsafe. For example, if students propose reacting sodium metal with water in the course of a storyline, absolutely step in with guidance!

Map out the most likely sequence you think students will engage with modified laboratory activities as they make sense of the phenomenon, and map out questions they may ask as they go from point A (ignorance) to point B (understanding). Be prepared to answer expected questions.

Make a mental list of common misconceptions so that you can address them efficiently so they do not become distractions or lead to the teacher explaining the phenomena. Misconceptions can derail any planned activity. Effectively addressing them requires some thought by the teacher prior to introducing the leading question or phenomena so that the leading questions do not illicit answers based on misconceptions.

Deploy the storyline to your students. You can even introduce the phenomenon or question with a video or demonstration.

As you begin your NGSS journey, remember to have fun! It is impossible to predict the path you and your students will take as you make sense of phenomena. Let your students ask the questions that progress the learning, with you there at their side.



See NGSS Basic Terminology

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