Science Instruction in Lumberton

This document will describe:

- What is different about the new Next Generation Science Standards
- How instruction in Lumberton is adjusting to meet the new expectations

Why NGSS?

Timeline for the new Science standards

- The state requires that the curriculum for middle school must be revised to align to the new standards for the 2016-2017 school year.
- The state requirements for grades K-5 are that the curriculum must be revised to align to the new standards for the 2017-2018 school year.
- Lumberton is following the state timeline.

The new standards represent a shift from knowing information to application of scientific knowledge, reasoning, and critical thinking.

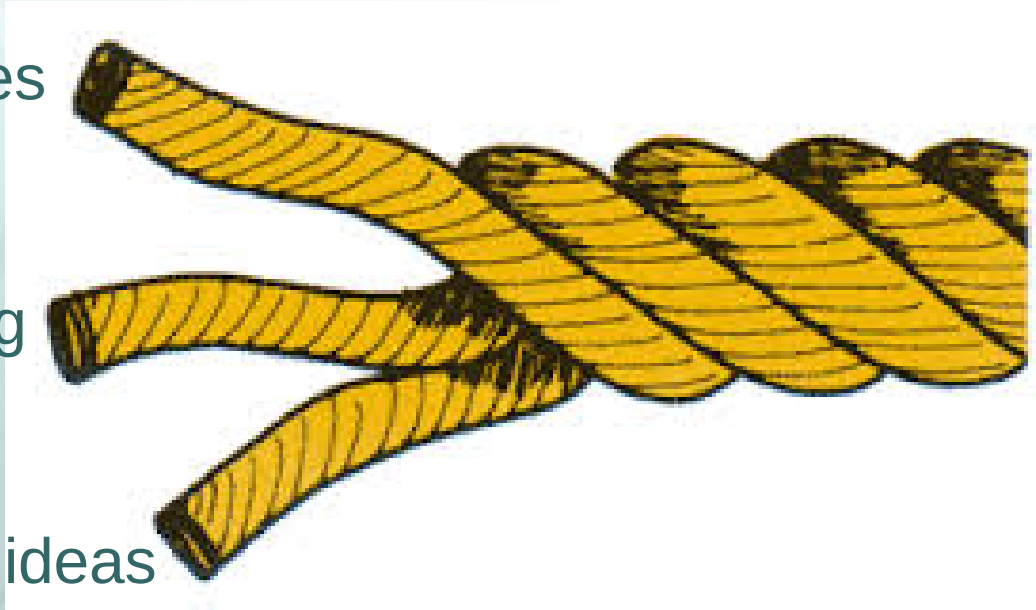
Next Generation Science Standards Overview

The standards include three equally important, intertwined dimensions

Practices

Crosscutting concepts

Core ideas



Dimension 1:
Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematical and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Some good news

With the new standards in Language Arts, Math, and Science, there is a great deal of cohesion.

In math, there are a list of math practices that should weave through the students' learning, and many are similar to the Science and Engineering Practices.

In language arts, there is an emphasis on skills that are also very similar to the practices in Science and in Math, including using evidence for claims and being able to communicate ideas.

This supports the development of important skills and attitudes that span across various subjects.

Dimension 2: Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

These concepts apply in different ways in all areas of science. In the new standards, a focus on the cross-cutting concepts is based on these ideas:

- Making these concepts explicit facilitates understanding of a coherent and scientific view of the world
- These concepts are tools for constructing explanations of natural phenomena

Dimension 3: Disciplinary Core ideas

These are the part that are most similar to the previous standards

And yet different because they….

- They focus on a small set of ideas in each area (Physical Science, Life Science, Earth & Space Science, Engineering).
- They focus on deep exploration of ideas over the course of many years.
- They are intended to avoid coverage of numerous disconnected topics.
- They take into consideration that “facts” are readily available through our electronic devices and instead focus on thinking critically about the facts and evaluating the reliability of sources.

The Core Ideas …

- Are the content EVERY student should know.
- Are the content that provides the power for students to explain various scientific principles and phenomena.
- Take into consideration students' abilities and science needs at different grade levels.
- Develop across time and grades.

So… students are moving from learning a lot of scientific facts to learning big ideas in science and applying them in a variety of ways.

A new addition to the standards: Engineering

As students learn scientific ideas and principles, they will be engaged in an engineering activity in which they try to solve a problem that relates to the content they have learned.

Steps of the Engineering Process

1. Define what the problem is.
2. Develop and test solutions. (This may require building something but may not.)
3. Test the solutions
4. Make changes to optimize the solutions.

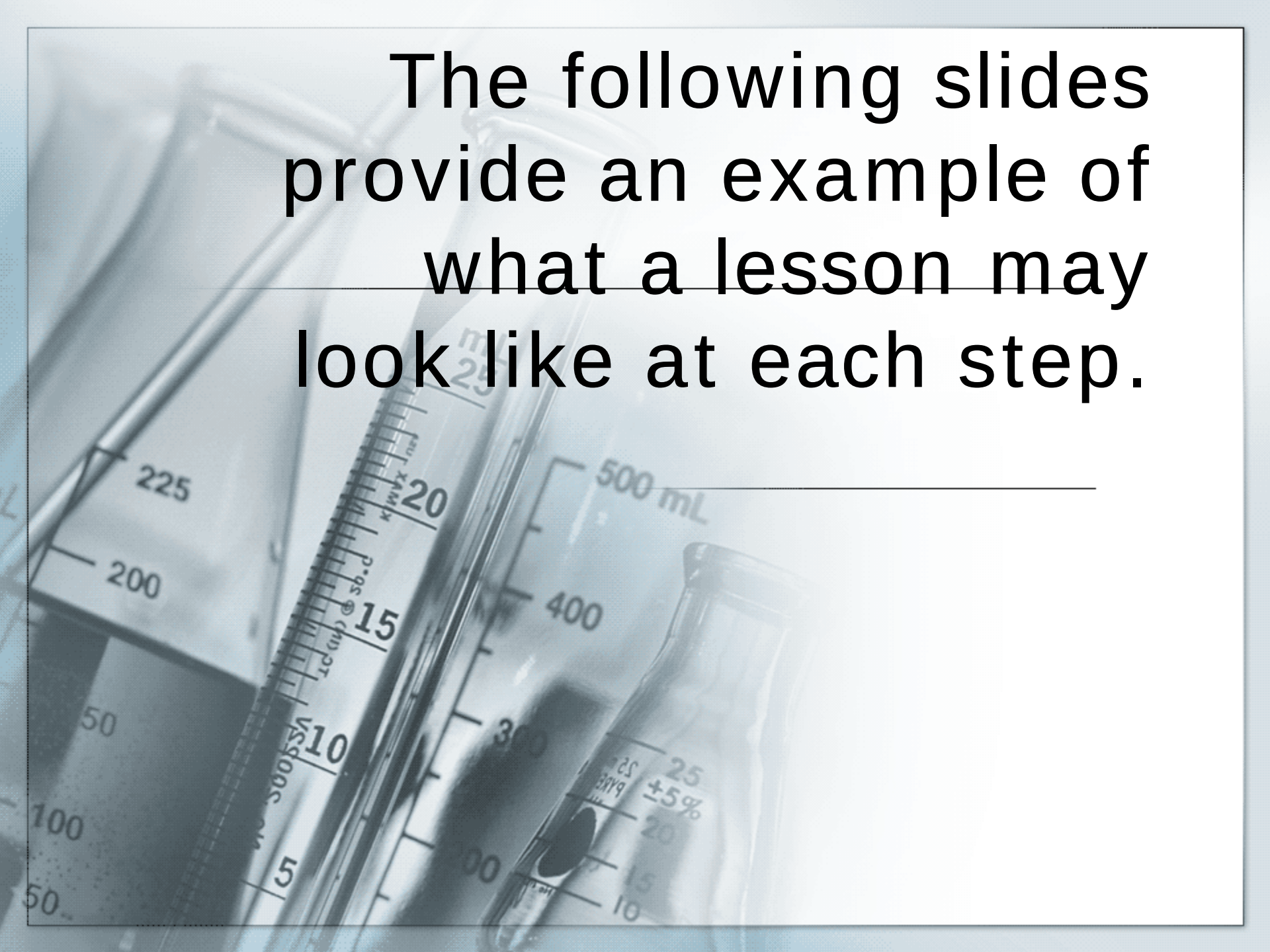
Sample Engineering Task:

Your family has a deck where you like to sit for dinner every evening, but there are a lot of bees in your yard, and you are allergic to bee stings. How can you enjoy your deck without worrying about bees? Your solution should be environmentally friendly and safe for everyone.

What a NGSS Lesson Looks Like

1. Students observe a phenomenon or discuss a phenomenon that is already familiar to them (e.g. Leaves turn brown in Autumn).
2. Students pose questions related to the phenomenon and then consider which ones can be investigated.
3. Students design an investigation to research their questions.
4. Students discuss their findings.

*Notice that the students are designing their own investigations rather than following directions for a lab that have been written out and given to them.



The following slides provide an example of what a lesson may look like at each step.

1. Students observe a phenomenon or discuss a familiar one

- The teacher fills a cylinder with water.
- The teacher places an index card over the top of the cylinder and inverts it.
- The teacher removes his hand from index card and, although the cylinder is upside down, the index card remains in place over the opening (now at the bottom) and water remains in the cylinder.
- Students observe closely and make notes on their observations.

2. Students pose questions and then consider which can be investigated

Some questions that might be asked in small groups or as a whole class are…

- Does the size or shape of the container make any difference?
- Will the same thing happen with a material other than an index card?
- Does changing the volume of water in the cylinder yield a different outcome?
- Does the temperature of the water make a difference?
- What if the liquid in the cylinder were something other than water?
- What happens if you shake the cylinder while it is inverted?

3. Students design an investigation to research their questions

- In small groups, students discuss procedures they can design to investigate their questions.
- Students use a variety of materials, such as other containers, water pitchers, other materials to cover the opening, etc. to perform their investigation and take careful notes on their findings.

4. Students discuss their findings

- Students discuss within their own groups what their findings were and what those findings make them think.
- They write a description or draw a model to explain the phenomenon.
- They may share their ideas with other students.
- The whole class discusses theories using “accountable talk”
  - “I agree with _____ because…”
  - “What is your evidence to support that?”
  - “I disagree because…”
  - “I can add on to that idea….”
  - “Please say more about that….”
  - “But what about/what if..?”
  - “How does that idea fit with…?”

This lesson within the context of a unit

- The previous example is not the only kind of lesson that will be taking place.
- This type of lesson can be used to introduce a new unit/topic, getting students curious and engaged.
- This would be followed by learning of content through reading, lecture, investigation, etc.
- Students don't have much prior knowledge for this lesson, but that is okay. The idea is stimulating thinking and curiosity, not arriving at the right answer.
- At the end of the unit, the teacher may circle back to this kind of activity in order to assess student growth in understanding and application of concepts.

The revised LMS Science Curriculum

We are excited to share that the middle school is adopting the IQWST (Investigating and Questioning our World through Science and Technology) program! There are many reasons that, after partnering with Rider University and conducting an exhaustive search of available materials, we made this selection.

- The creators of the program were also authors of the Next Generation Science Standards.
- It was developed by science education, literacy, and learning science specialists from several universities & Weizmann Institute of Science and therefore combines solid understandings of science and effective instructional practices.
- The program is completely digital. All of the materials will be accessed online, and student work will be submitted online.
- Its format is engaging for students.
- It was developed through grant funding from the National Science Foundation and completely aligns to the new standards.

Stay tuned for information about the upcoming revisions for Grades K-5