What is so different about NGSS? – Chemistry PD

Activate Learning

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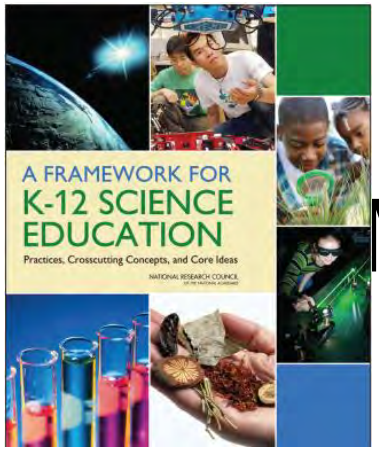
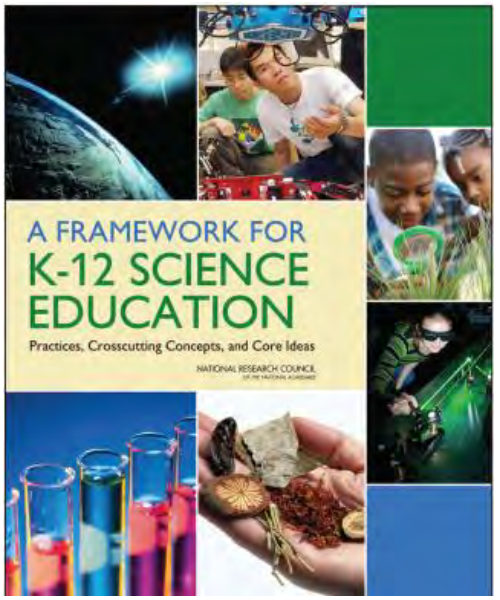


NEXT GENERATION SCIENCE STANDARDS
For States, By States

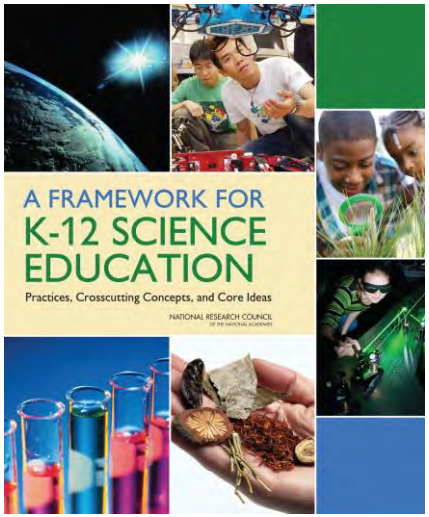
What will we do today?

- Learn a bit more about 3-Dimensiional learning
- Experience 3-Dimensional Learning
- Build understanding of Coherence
- Engage in doing a bit of science

NEXT GENERATION SCIENCE STANDARDS
For States, By States



What's new in the Framework and NGSS?



NEXT GENERATION SCIENCE STANDARDS

1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning
    1. Organized around disciplinary core explanatory ideas
    2. Central role of scientific and engineering practices
    3. Use of crosscutting concepts
3. Instructions builds towards performance expectations
4. Coherence: building and applying ideas across time

What is three 3-Dimensional Learning Learning

- Three-dimensional learning shifts the focus of the science classroom to environments where students use disciplinary core ideas, crosscutting concepts with scientific practices to **explore, examine,** and **explain** how and why phenomena occur and to **design solutions** to problems

Overview of EQuIP

I. Alignment to the NGSS	II. Instructional Supports	III. Monitoring student progress
1. Three dimensional: Supports students in three dimensional learning to make sense of phenomena or design solutions	Supports learning for all students through meaningful scenarios, supporting practices, supports phenomena and representations	Assessments evaluate three-dimensional learning; include formative; are accessible and unbiased
2. Coherence: Lessons fit together coherently, develops connections	Provides guidance for teachers to build coherence across the unit	Pre, formative, and summative aligned to three-dimensional learning

What should we look for in designing or deciding on materials?

The lesson/unit aligns with the conceptual shifts of the NGSS:

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

How do we move further? How do I support students in reaching a PE?

Performance Expectation

What performance expectation are we building towards?

MS.Chemical Reactions

Students who demonstrate understanding can:

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with HCl.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education

Scientific and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings.

Disciplinary Core Idea

PS1.A: Structure and Properties of Matter

- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.

PS1.B: Chemical Reactions

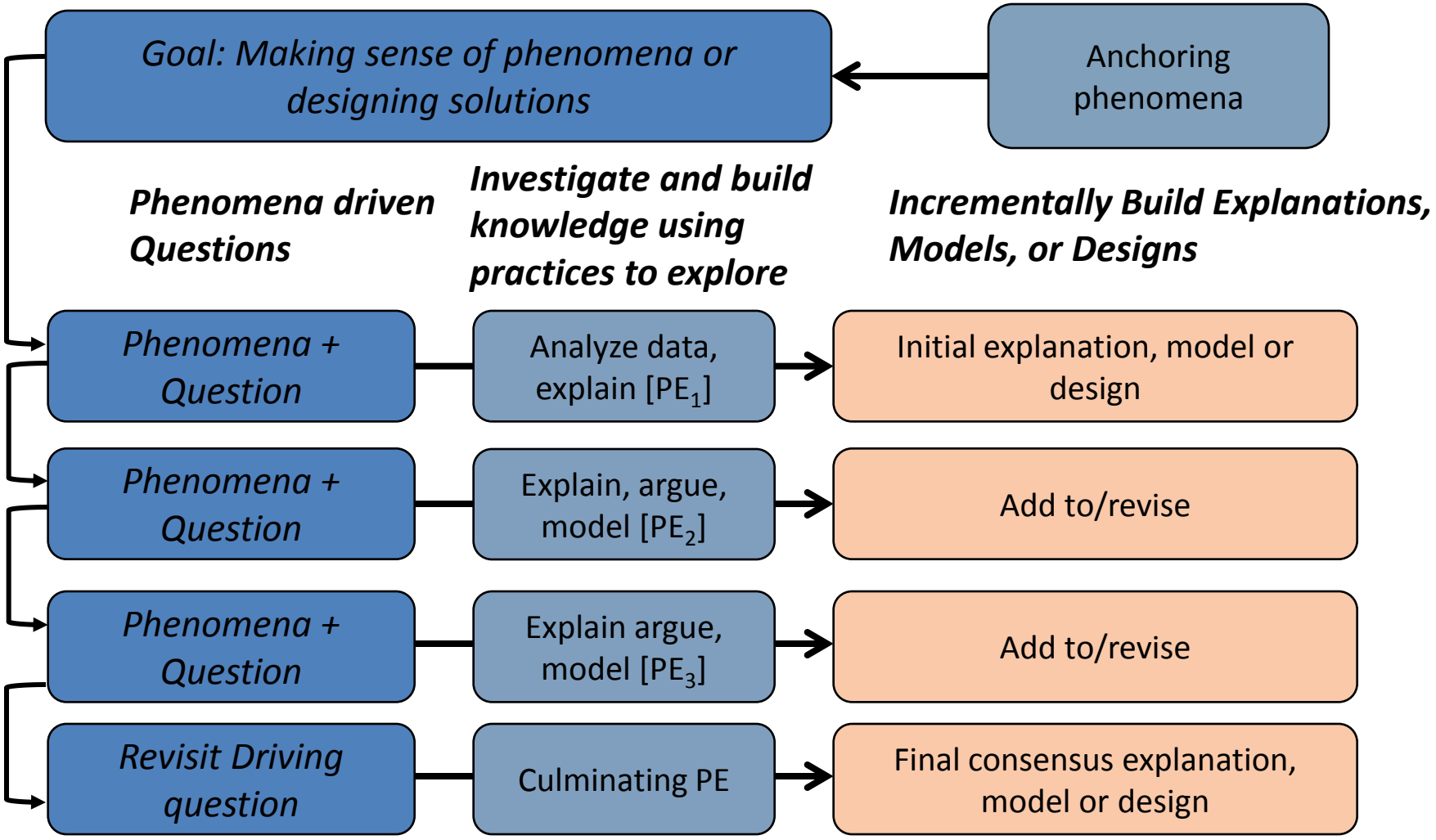
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.

Crosscutting Concepts

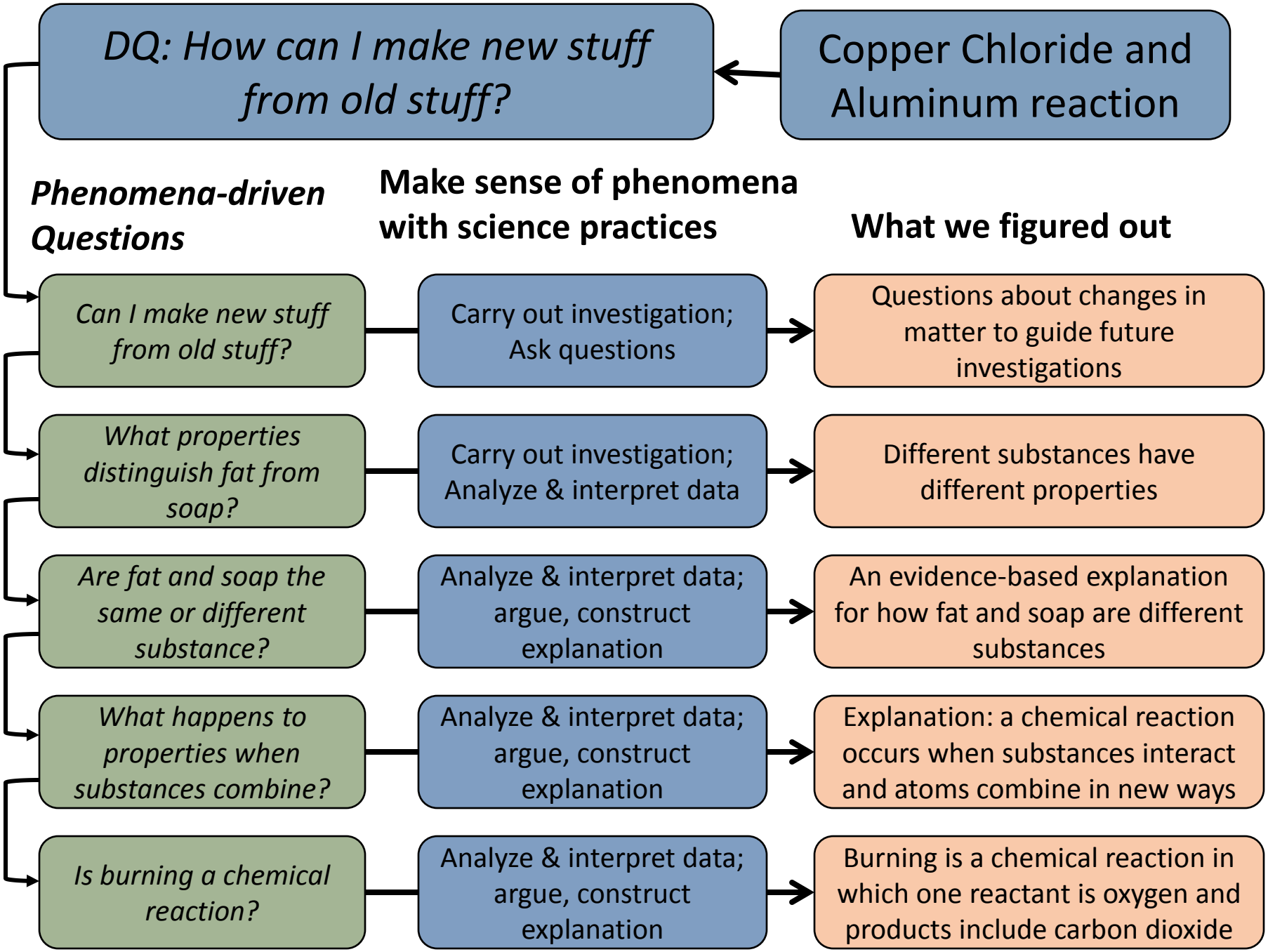
Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

Storyline: Question and phenomena motivate each step in building a disciplinary core idea



Thanks to Brian Reiser and Michael Novak


DQ: How can I make new stuff from old stuff?
Copper Chloride and Aluminum reaction
Phenomena-driven Questions
Make sense of phenomena with science practices
What we figured out
Can I make new stuff from old stuff?
Carry out investigation; Ask questions
Questions about changes in matter to guide future investigations
What properties distinguish fat from soap?
Carry out investigation; Analyze & interpret data
Different substances have different properties
Are fat and soap the same or different substance?
Analyze & interpret data; argue, construct explanation
An evidence-based explanation for how fat and soap are different substances
What happens to properties when substances combine?
Analyze & interpret data; argue, construct explanation
Explanation: a chemical reaction occurs when substances interact and atoms combine in new ways
Is burning a chemical reaction?
Analyze & interpret data; argue, construct explanation
Burning is a chemical reaction in which one reactant is oxygen and products include carbon dioxide

Let’s look at phenomena

- When you mix substances together, how would you know whether new substances are formed?

What we have figured out so far

- Matter is composed of atoms & molecules in constant motion.
- Substances can exist in solid, liquid, and gaseous states.
- Substances have characteristic properties that help identify substances and distinguish them from one another.
- Solubility, density, and melting point are properties of substances.

What we will do?

Substance	Observations	Solubility
Road Salt		
Baking Soda		
Water		XXXXX
Substances Combine		

<u>Scientific Explanation</u>: Write a **scientific explanation** that states whether new substances were formed after combining the baking soda, powdered sugar, road salt, and water.

- **Claim:** (Write a statement that responds to the original question.)
- **Evidence:** (Provide scientific data to support your claim. Use appropriate and and sufficient data.)
- **Reasoning:** (In your reasoning statement, connect your claim and evidence to show how your data link to your claim. Also, tell why your data count as evidence to support your claim by using scientific principles. Remember, reasoning is the process where you apply your science knowledge to answer the question.)
- **What New Questions do you have?**

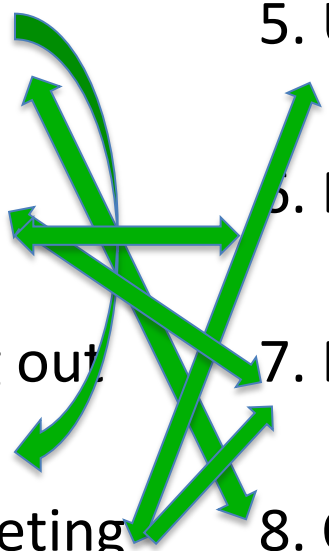
- Share and critique explanations.

What are Scientific and Engineering Practices?

The multiple ways of knowing and doing that scientists and engineers use to study the natural world and design world.

The practices work together – they are not separated!

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



What performance expectation are we building towards?

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Scientific and Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts
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Why Use Crosscutting Concepts?

Ideas that cut across and are important to all the science disciplines

Provide different lenses to examine phenomena

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

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.
   a. Provides opportunities to use specific elements of the scientific or engineering practices(s) to make

Do the materials clearly point out how students use elements of the practice to make sense of phenomena or design solutions?

Poll
- Yes
- No

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

   b. Provides opportunities to construct and use specific elements of the disciplinary core idea(s) to

Do the materials clearly point out how students use elements of the DCIs to make sense of phenomena or design solutions?

Poll

- Yes
- No

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

   c. Provides opportunities to construct and use specific elements of the crosscutting concept(s) to

Do the materials clearly point out how students use elements of the crosscutting concepts to make sense of phenomena or design solutions?

Poll

- Yes
- No

Summary: Evaluating the focus on 3-dimensional learning

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

Poll
- Yes
- No

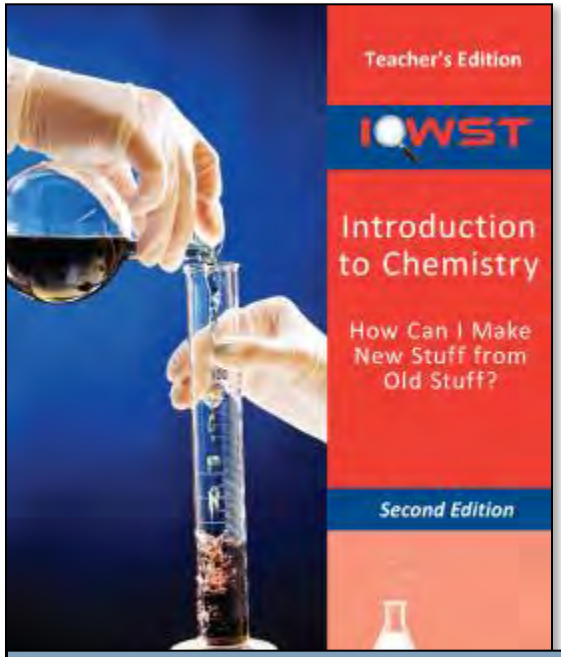
A concluding message

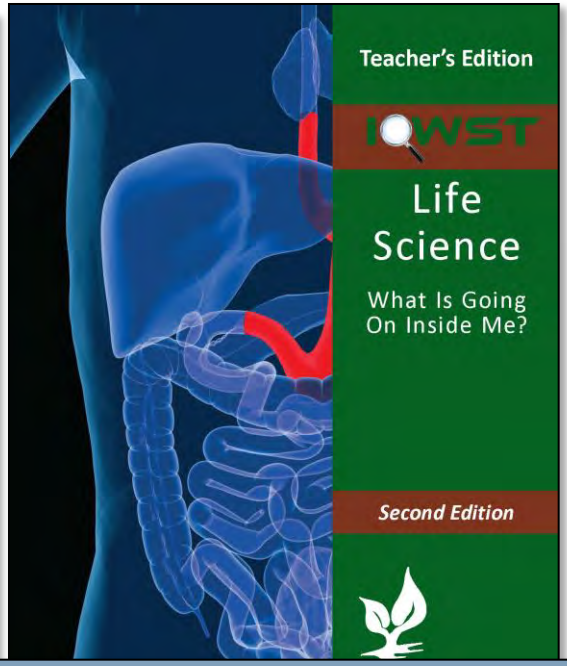
- By focusing on core ideas integrating with practices and crosscutting concepts, classrooms become learning environments where teachers and students have time to engage in science by designing and carrying-out investigations and making and debating claims supported by evidence and reasoning.

- Business is not the same!
- NGSS is different!
- Revolution and not evolution

Thanks to!

Activate Learning





Middle school curriculum materials supporting students using science practices to construct and apply disciplinary core ideas

IQWST: Investigating and Questioning our World through Science and Technology (Krajcik, Reiser, Sutherland, & Fortus, 2013)