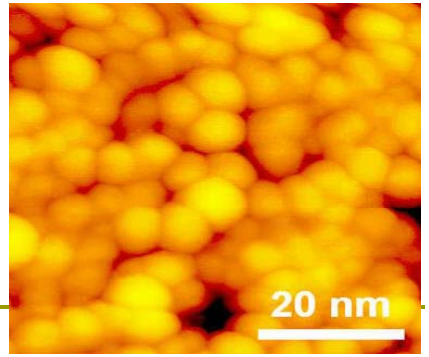


NGSS

Dennis Sunal

A Framework for K-12 Science Education:

Practices, Crosscutting Concepts, and Core Ideas (2011)

National Research Council
The National Academies Press

Common Core Framework URL
http://www.nap.edu/catalog.php?record_id=13165

A New Framework for K-12 Science Education & Common Core Standards

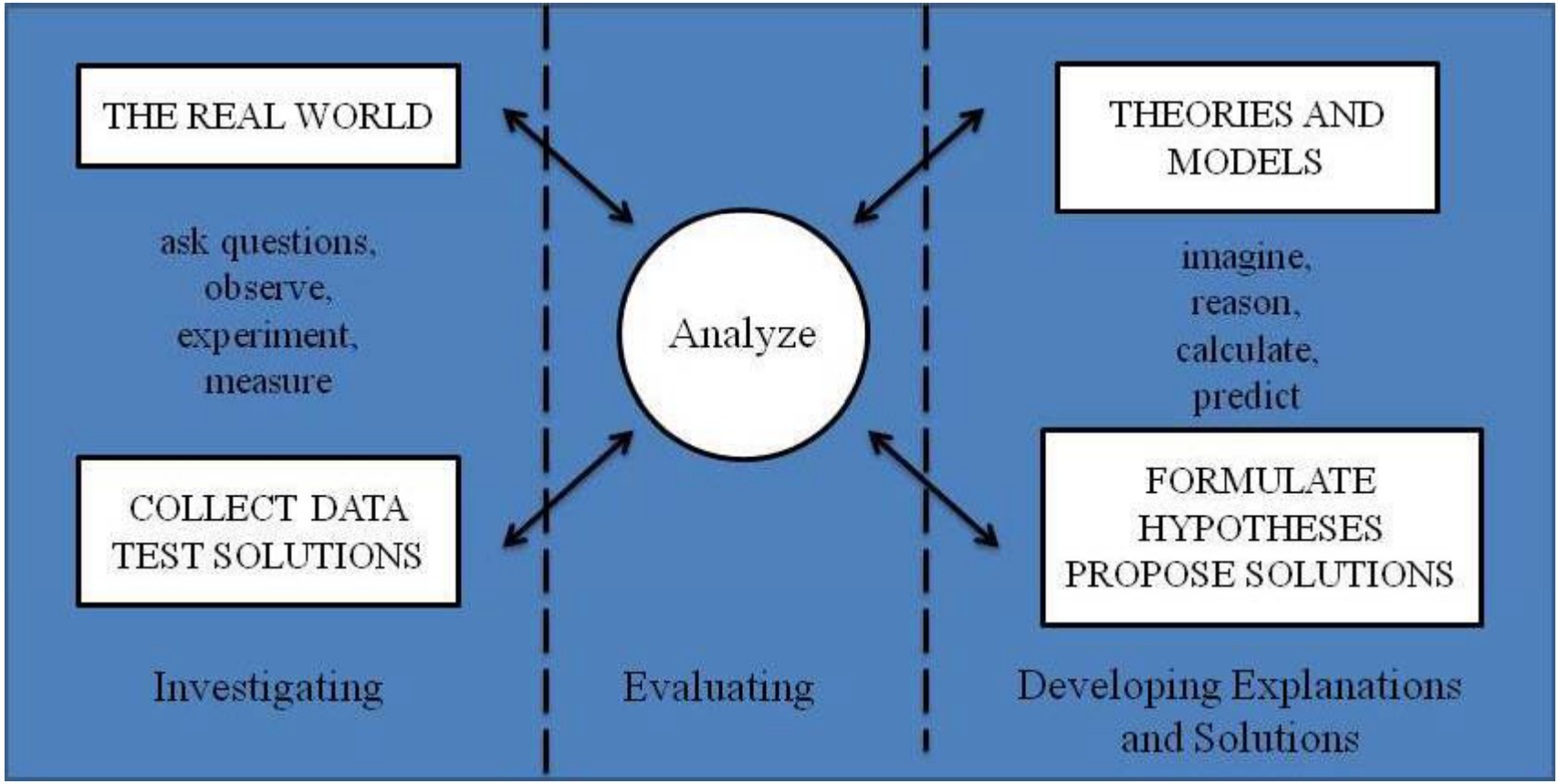
- **The *Framework for K-12 science standards: Practices, crosscutting concepts, and core ideas* was released in July, 2011 by the National research Council (NRC). The NRC was responsible for developing the NSES in 1996. PDF available from http://www.nap.edu/catalog.php?record_id=13165**
- **These new core standards are designed to strengthen the National Science Education Standards and gradually replace them.**
- **The Common Core has already been developed in English-Language Arts and Mathematics.**

A New Framework for K-12 Science Education & Common Core: Next Generation Science Standards

The Framework is designed to provide a vision (organize and direct) and define the aspects of what students should learn in K-12 science.

The Common Core being developed explicit standards and performance expectations for various grade levels specified in the Framework.

Three Spheres of Activity for Scientists and Engineers



Framework for K-12 Science Education

The new focus of the Framework* involves integration of content, teaching/learning strategies, and crosscutting concepts

Three Framework Dimensions are titled

1. **Practices (word replaces "inquiry practices")**
2. **Crosscutting Concepts**
3. **Core Ideas**

*Common Core Framework URL
http://www.nap.edu/catalog.php?record_id=13165

Three Dimensions for Common Core

1. **Practices:** ***Scientific and engineering (inquiry) practices***
2. **Crosscutting Concepts:** ***Unify the study of science and engineering through their common application across fields***
3. **Core Ideas:** ***in four disciplinary areas a) physical sciences, b) life sciences, c) earth and space sciences, d) engineering, technology, and applications of science***

Scientific and Engineering Practices

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**

Crosscutting Concepts

1) **Patterns**
2) **Cause and Effect:** Mechanism and explanation
3) **Scale, proportion, quantity**
4) **Systems and models**
5) **Energy and matter:** Flows, cycles, and conservation
6) **Structure and function**
7) **Stability and change**

Disciplinary Core Ideas

1. Physical Sciences

PS 1: Matter and its interactions

PS 2: Motion and stability: Forces and interactions

PS 3: Energy

PS 4: Waves and their applications in technologies for information transfer

Disciplinary Core Ideas

2. 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

Disciplinary Core Ideas

3. Earth and Space Sciences

ESS1: Earth's Place in the Universe

ESS2: Earth's Systems

ESS3: Earth and Human Activity

Disciplinary Core Ideas

4. Engineering, Technology, and Applications of Science

ETS1: Engineering Design

ETS2: Links Among Engineering, Technology, Science, and Society

Common Core Ideas in the Framework

For each Common Core idea in the Framework

- **Practices are explained**
- **Goals are listed**
- **The learning progression is described**

You can find this Framework free online

Common Core Ideas in the Framework: Physical Sciences

PS1:Matter and its interactions

PS1A: Structure and properties of matter

PS1B:Chemical reactions

PS1C: Nuclear processes

PS2: Motion and stability: Forces and interactions

PS2A: Forces and motion

PS2B: Types of intyeraction

PS2C: Stability and instability in physical systems

PS3: Energy

PS3A: Definitions of energy

PS3B: Conservation of energy and energy transfer

PS3C: Relationship between energy and forces

PS3D: Energy in chemical processes and everyday life

PS4: Waves and their applications

PS4A: Wave properties

PS4B: Electromagnetic radiation

PS4C: Information technologies and instrumentation

Framework Recommendations

1: Standards should set rigorous learning goals that represent a common expectation for all students.

2: Standards should be scientifically accurate yet also clear, concise, and comprehensible to science educators.

3: Standards should be limited in number.

4: Standards should emphasize all three dimensions articulated in the framework—not only crosscutting concepts and disciplinary core ideas but also scientific and engineering practices.

5: Standards should include performance expectations and criteria that integrate the scientific and engineering practices with the crosscutting concepts and disciplinary core ideas. (ability to use and apply knowledge).

6: Standards should incorporate boundary statements. (include guidance about what needs to be taught but also what does *not need to be taught)*

7: Standards should be organized as sequences that support students' learning over multiple grades. (learning spiral)

8: The progressions in standards should be informed by existing research on learning and teaching.

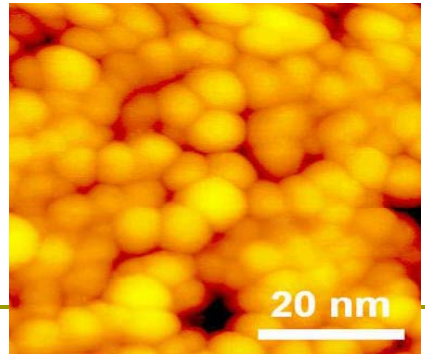
9: Developing grade band standards as an overarching common set.

10: Grade-by-grade standards, if written, should be designed to provide a coherent progression within each grade band.

11: Any assumptions about the resources, time, and teacher expertise needed for students to achieve particular standards should be made explicit

12: The standards for the sciences and engineering should align coherently with those for other K-12 subjects.

13: In designing standards and performance expectations, issues related to diversity and equity need to be taken into account. In particular, performance expectations should provide students with multiple ways of demonstrating competence in science.



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