Elementary Principals: Are You Ready for the Next Generation Science Standards?

FEA/NJPSA/NJASCD Fall Conference: Imagine!
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Purpose:

The purposes of this session is to introduce principals to the Next Generation Science Standards (NGSS) and provide a general overview of the key instructional and conceptual shifts required by the NGSS.
What are the NGSS?

The Next Generation Science Standards (NGSS) are K–12 science content standards. Standards set the expectations for what students should know and be able to do. The NGSS were developed by states to improve science education for all students.

A goal for developing the NGSS was to create a set of research-based, up-to-date K–12 science standards. These standards give local educators the flexibility to design classroom learning experiences that stimulate students’ interests in science and prepares them for college, careers, and citizenship.
THE THREE DIMENSIONS OF SCIENCE LEARNING

Within the Next Generation Science Standards (NGSS), there are three distinct and equally important dimensions to learning science. These dimensions are combined to form each standard—or performance expectation—and each dimension works with the other two to help students build a cohesive understanding of science over time.
NGSS: Three Dimensions

- Four Disciplinary Core Ideas:
  - Life Science,
  - Physical Science
  - Earth and Space Science
  - Engineering

- Seven Crosscutting Concepts
  - Patterns
  - Cause and effect
  - Scale, proportion, and quantity
  - Systems and system models
  - Energy and matter: Flows, cycles, and conservation
  - Structure and function
  - Stability and change

- Eight Science and Engineering Practices
  - Asking questions (science) and defining problems (engineering)
  - Developing and using models
  - Planning and carrying out investigations
  - Analyzing and interpreting data
  - Using mathematics and computational thinking
  - Constructing explanations (science) and designing solutions (engineering)
  - Engaging in argument from evidence
  - Obtaining, evaluating, and communicating information
3-D Learning

Through 3-D learning, the NGSS emphasize that science is not just a series of isolated facts. This awareness enables students to view science more as an interrelated world of inquiry and phenomena rather than a static set of science disciplines.

The NGSS represent a fundamental shift in science education and require a different approach to teaching science than has been done in the past. Looking ahead, teachers can use a range of strategies to engage students and create opportunities to demonstrate their thinking and learning.
How To Read The Standards

VIDEO
Performance Expectations

Performance expectations are the assessable statements of what students should know and be able to do. Some states consider these performance expectations alone to be “the standards,” while other states also include the content of the three foundation boxes and connections to be included in “the standard.” The writing team is neutral on that issue. The essential point is that all students should be held accountable for demonstrating their achievement of all PEs, which are written to allow for multiple means of assessment.
Science and Engineering Practices describe what scientists do to investigate the natural world and what engineers do to design and build systems. The practices better explain and extend what is meant by “inquiry” in science and the range of cognitive, social, and physical practices that it requires. Students engage in practices to build, deepen, and apply their knowledge of core ideas and crosscutting concepts.
CROSSCUTTING CONCEPTS

Crosscutting Concepts help students explore connections across the four domains of science, including Physical Science, Life Science, Earth and Space Science, and Engineering Design.

When these concepts, such as “cause and effect”, are made explicit for students, they can help students develop a coherent and scientifically-based view of the world around them.

VIDEO
DISCIPLINARY CORE IDEAS

Disciplinary Core Ideas (DCIs) are the key ideas in science that have broad importance within or across multiple science or engineering disciplines. These core ideas build on each other as students progress through grade levels and are grouped into the following four domains: Physical Science, Life Science, Earth and Space Science, and Engineering.
Math

M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning

M4: Model with mathematics

S1: Ask questions and define problems
S2: Develop & use models
S5: Use mathematics & computational thinking

E2: Build a strong base of knowledge through content-rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others

ELA

E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations

Science

S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions

S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose

Commonalities
Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek elli.stanford.edu
How will science education change with the NGSS?

Science education will involve less:
1. Learning of ideas disconnected from questions about phenomena
2. Teachers providing information to the whole class
3. Teachers posing questions with only one right answer
4. Student reading textbooks and answering questions at the end of each chapter
5. Worksheets
6. Oversimplification of activities for students who are perceived to be “less able” to do science and engineering

Science education will involve more:
1. Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
2. Students conducting investigations, solving problems, and engaging in discussions with teacher guidance
3. Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
4. Students reading multiple sources and developing summaries of information
5. Student writing of journals, reports, posters, and media presentations that offer explanations and arguments
6. Provision of supports so that all students can engage in sophisticated science and engineering practices

What can principals do to support implementation?

• Focus on what the students are doing first and then think about what the teacher has designed to make that happen;

• Know the standards enough to identify and provide feedback on aspects of the three dimensions during classroom visits

• Engage teachers on how the three dimensions are incorporated into lessons.
Great Sites To Help With Implementation

**All logos are links to their website**
Other Great Sites

**All logos are links to their website**

- [CRASH COURSE](#)
- [Alan Alda Center for Communicating Science](#)
- [BIG HISTORY PROJECT](#)
- [THE ARGUMENTATION TOOLKIT](#)
- [Project 2061](#)
- [Mystery Science](#)
Resources

- NGSS Overview for Principals
- Inside the NGSS Box
- How to Read the NGSS
- NGSS Glossary
- Adapting Curriculum Materials to Align with NGSS Grades K-5 - Brian J. Reiser
- Rethinking and Redesigning Science Education - Barbara Mammen