The Next Generation Science Standards

For some time there has been a sense nationally that America’s prominence in science, engineering, and technology has been slipping, and at the same time an increasing recognition that something needs to be done to improve U.S. science education. Because science, engineering, and technology are so much a part of today’s world—and because they can address at least in part so many of the world’s greatest problems—there has been considerable international attention given to improving science education.

It is well accepted that students are no longer just competing with their peers in their state or even in other states, but with students from around the globe. Yet fewer than half our students were in the top two quartiles on the 2011 TIMSS assessment, with the U.S. posting an overall ranking of 10th. The Rising above the Gathering Storm report from the National Academy of Sciences highlighted the slippage of our STEM industry and education sectors, including the impact this has on the American economy.

One response to improve U.S. education has been the development of the Common Core math and ELA standards. Now there is an effort to develop new standards for science: the Next Generation Science Standards (NGSS).

Development of the NGSS

The NGSS are a major revision of the 1996 National Science Education Standards from the National Research Council (NRC). Previously, states used these standards and the Benchmarks for Science Literacy from the American Association for the Advancement of Science (AAAS) as guides or simply adopted one of them for their state science standards. While these two documents have proven to be both durable and of high quality, they are over 15 years old. Much more is now known about learning science and engineering than when they were written, and much in science has changed.

In 2010, with support from the Carnegie Corporation of New York, the NRC, Achieve, AAAS, and the National Science Teachers Association embarked on a two-step process to develop the NGSS. First, the NRC along with research and educational experts wrote the Framework for K–12 Science Education as guidance for writing the NGSS. This Framework is grounded in current research on learning science and identifies what all K–12 students should know in science and engineering. Second, a process was developed among 26 states that applied through the consent of their state board of education chair and chief state school officer to be “lead states” in the development of the NGSS. This process also included stakeholders from the science, science education, higher education, business, and industry communities.

What Is Different about the NGSS?

The NGSS website lists several ways the new science standards are distinct from prior ones:

1. The NGSS Embody the Idea that K–12 Science Education Should Reflect the Interconnected Nature of Science as It Is Practiced and Experienced in the Real World. Most current state and district standards include knowledge and skills as separate outcomes. The NGSS include scientific knowledge, how it is developed and applied, and the connections within the discipline in each student expectation. These are described as three dimensions: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas.

2. The Next Generation Science Standards Are Student Performance Expectations—NOT Curriculum. The three dimensions described above are included in each student performance expectation. The way they connect does not determine how they should be used in curriculum, units, or lessons. The details of all three dimensions are included to clarify the expectations for what students will know and be able to do by the end of the grade or grade band.

3. The Science Concepts in the NGSS Build Coherently from K–12. In the past, science has been taught as isolated and unconnected facts, concepts, and sub-disciplines. The NGSS focus on fewer disciplinary ideas while providing more coherence to the discipline as students increasingly learn more complex material.

4. The NGSS Focus on Deeper Understanding of Content as Well as Application of Content. The smaller set of disciplinary ideas focuses on the core foundations for learning, and this in turn helps students connect new ideas. Understanding these core ideas and engaging in scientific and engineering practices helps prepare students for both broader understanding and deeper levels of scientific and engineering investigation later on.
5. Science and Engineering Are Integrated throughout the NGSS. The integration of technology and engineering into science is not new, but in the past this has not received much attention in instruction. The NGSS raise engineering design to the same level as scientific inquiry.

6. The NGSS and Common Core State Standards (CCSS) Are Aligned. The NGSS overlap the CCSS in meaningful and substantive ways, providing greater opportunities for all students to learn science, math, and ELA together. The NGSS connect across other parts of the curriculum, as well. This integration of subject areas will strengthen science learning for all students, particularly traditionally underserved students. For example, students are expected to provide arguments from evidence, develop explanations, and evaluate and communicate information, building a context rich knowledge base across subject areas.

Issues to Consider

The NGSS are designed to provide a high-quality science education, connect with the CCSS, and meet the needs for college and career readiness. The experience with the CCSS tells us that alignment of policy, state statutes, and regulatory concerns are important issues in discussions of the NGSS. Here are some areas to consider.

**Timing:** With ongoing CCSS implementation and many other major reforms, educators at all levels have their hands full. The NGSS developers have said the NGSS should not be competing with the Common Core standards, but connecting with them—and that states should focus on getting CCSS right and not rush to implement the NGSS. States considering NGSS adoption and the subsequent implementation can ask such questions as:

- Is our CCSS implementation on track? Would moving to implement the NGSS right now enhance or overwhelm the state’s CCSS efforts?
- When are the state’s science standards due for renewal, and how does that match the release of the NGSS?
- Should the state develop a long-range, actionable plan for the adoption and implementation of the NGSS that does not take away from CCSS efforts or put too much pressure on districts and teachers to do too much at once?

**Alignment of State Resources and Initiatives:** An examination of existing policies, plans, and resources that might be affected by the adoption of NGSS is helpful. Questions include:

- What CCSS policies and implementation plans are in place, and how might the NGSS overlap, align with, and/or impede them?
- How do the NGSS fit with your state’s strategic plan?
- How do the NGSS fit with existing policies aligned with college- and career-readiness standards (if applicable)? If your state has a waiver, how will this impact implementation?
- How will your state educator accountability system measures align with these new standards?

**Building Educator Capacity:** The capacity of educators and administrators is an important consideration for determining timelines and expectations for them. The NGSS will require support. Here are some questions to consider:

- What overlap and economies of scale can you leverage from your work with the CCSS? For example, are science teachers attending CCSS workshops about literacy and writing in science and technical subjects?
- What professional development systems or procedures are in place that can benefit the implementation of the NGSS? For example, can CCSS learning opportunities be combined with the NGSS so they do not feel like “one more reform?”
- How are you currently financing professional learning for CSSS and what level of support will science teachers need?
- How will professional learning and digital policies be updated to accommodate the NGSS?

**Assessments:** To date no assessments have been developed—or are in the pipeline to be developed—that are aligned to the NGSS. The NAEP Science Framework was used in the development of the NGSS, so there is alignment with that national assessment. Some questions to consider include:

- What are other states thinking about science assessments (e.g., consortia)?
- If you are building your capacity to implement online and/or computer adaptive testing, how might you use this platform for science assessments?

**Resources**

NASBE’s Next Generation Science Standards Initiative will offer state boards of education abundant resources and other assistance to help them make informed decisions about the NGSS. These will include: 1) holding two regional forums for state board members on the NGSS; 2) conducting state policy audits of related issues such as graduation requirements, assessments, and teacher preparation to support the alignment of their state systems; 3) individualized assistance for developing state action plans for various issues, such as alignment of policies, and 4) making resources and materials easily accessible to address state boards’ communications concerns related to the NGSS.

The initiative’s regularly updated web page is at [www.nasbe.org/project/next-generation-science-standards](http://www.nasbe.org/project/next-generation-science-standards), or contact project director Francis Eberle at francise@nasbe.org for more information on how the initiative can assist you and your state.

The Next Generation Science Standards primary website is located at [www.nextgenscience.org](http://www.nextgenscience.org).