CONNECTICUT NEXT GENERATION SCIENCE STANDARDS (NGSS-CT)

NEXT GENERATION SCIENCE STANDARDS
For States, By States

A TOOLKIT FOR PARENTS AND FAMILIES

A New Vision for Science Education

Children are naturally curious about the world. While many adults recall learning science by reading about it in a textbook or listening to a teacher's explanation, we now know how to engage learners in more meaningful, lasting and exciting science learning.

By dramatically changing the way science is taught and learned, the Next Generation Science Standards (NGSS), adopted by Connecticut in November 2015, are designed to raise interest, participation and achievement for all students. This introductory video explains the design principles and key features of NGSS. This fact sheet summarizes the need for and development of NGSS.

Like learning to ride a bike or play a musical instrument, the experience of doing science is far more important than just reading about it in a book. Based on years of research about how people learn science, the NGSS promote a new way of teaching and learning that allows students to actively do science in a meaningful way, not just learn about it from a textbook or a lecture. For students, next generation science means more "figuring out" and less just "learning about" science ideas. In this way, knowledge is retained and built upon for a lifetime.

Decades of research have led to recommended improvements to science education. Among these is a more authentic approach to scientific inquiry, the discovery process practiced by scientists that is more flexible and iterative than the scientific method traditionally taught in schools. This poster highlights new NGSS approaches that aim to involve all students in figuring out explanations based on critical analysis of evidence. To summarize, an NGSS learning approach teaches students to think on their own and in collaboration with others.

NGSS are aligned with contemporary expectations for college-level science courses. Beginning in 2012, the College Board redesigned Advanced Placement exams in STEM subjects (e.g., biology, chemistry, physics, computer science) to emphasize the use of science practices to reason with evidence (see summary of AP STEM advances). To help states and districts reform their science programs to better prepare more students for success in college-level science, the College Board in 2009 published College Board Standards for College Success: Science for grades 6–12.

By making science learning more like the way scientists work, more relevant to the real world and to students' experiences, the NGSS can better inspire and prepare many more students for advanced studies, careers and citizenship.

Striving for Excellence and Equity

NGSS will compel school districts to make many systemic improvements to curriculum design, teaching and assessment practices, and instructional materials. These changes will take considerable time, commitment and resources. The reward for sustained and coordinated reform is that by the end of 12th grade, many more Connecticut students will:

- appreciate the creative and dynamic **nature of scientific discovery**;
- be **critical consumers of scientific and technological information** related to their everyday lives;
- learn to **think critically**, **analyze information** and apply knowledge to **solve complex problems**;
- be inspired and enabled to **continue to learn about science outside school**; and
- have the **skills to enter careers** of their choice, including (but not limited to) careers in science, engineering, and technology.

Innovative Changes

Perhaps the most significant change in NGSS is that students are expected to show evidence of their learning by using science and engineering practices to gradually piece together explanations from evidence. Simply knowing facts is not sufficient. See example below that contrasts student expectations in a current NGSS Performance Expectation with a previous Connecticut science standard:

2004 Connecticut Science Standards	2015 Next Generation Science Standards
Describe the effects of the strengths of pushes and pulls on the motion of objects.	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Major features of NGSS:

- Three-dimensional learning: Students use all three dimensions of science — the science and engineering practices, crosscutting concepts and disciplinary core ideas — to make sense of phenomena they experience in their lives and/or to design solutions to authentic problems. In other words, science knowledge is learned and demonstrated through science and engineering practices and applied in a context that is relevant and interesting to students.
- Real-world context: NGSS shifts the outcome of instruction from explaining science to using science to explain real world phenomena. Students use knowledge they develop over time to (a) explain an observable event or situation; and (b) to engineer solutions to problems. For example, instead of simply learning about the topics of photosynthesis and mitosis, students are engaged in building evidence-based explanatory ideas that help them figure out the phenomenon of how a tree grows. In this video, a leading NGSS contributor explains how phenomena shift the focus of science learning to making sense of observable events. This STEM teaching tool explains the central role of phenomena in NGSS teaching and learning.
- Engineering design is integrated within K–12 science curriculum for all students at all grades.
- Complements Connecticut Core Standards for English language arts and mathematics. NGSS make explicit interdisciplinary connections among the sciences, language arts and mathematics. Among the NGSS science and engineering practices are those that call for reading, writing, speaking, listening, computing and analyzing data. These present exciting opportunities for students to use reading, writing and mathematics skills to support their science investigations.

Student Learning in an NGSS Classroom

This chart highlights some of the key differences between a traditional science classroom and an NGSS classroom. Students in elementary NGSS classrooms will use one or more of these science and engineering practices daily to gradually construct their own scientific explanations of phenomena. Secondary students will build on elementary school foundations and expand their daily use of one or more of these science and engineering practices for grades 6–12.

High-quality curriculum materials and daily lessons will involve students in using the full range of practices to develop, use and refine their ideas, and not simply explain the science to the students.

Helpful Parent Guides

Grade Band Parent Guides explain the questions your child might be investigating in grades K–2, grades 3–5, grades 6–8 and grades 9–12, and how the learning process will look different from a traditional classroom.

Key Messages for Parents and Families

- NGSS transition is a major undertaking that will take years to realize. School districts will need to plan coordinated efforts to transform curriculum, teaching practices, instructional materials and assessments. Ask to see your district's long-term transition plan that describes how teams of educators, administrators and external partners will lead science improvement efforts.
- Communicate to district leaders your hopes for how the district's science education program can help your child achieve life goals.
- Support a district budget that allocates spending for NGSS professional learning, curriculum-writing and obtaining appropriate science equipment, supplies and learning space.
- Expect that your child will have frequent, productive opportunities to learn NGSS science beginning in kindergarten and coherently progressing each year by building on and deepening knowledge and skills gained in previous grades.
- Expect your child to be well prepared for college-level science courses by ensuring he or she experiences a coherent K–12 science curriculum that reflects the integration of science content with practices. A strong foundation in NGSS scientific reasoning aligns with the practices and reasoning skills adopted by the College Board for Advanced Placement (AP) courses and tests.

What Parents and Families Can Do to Encourage Children's Science Learning

The success of next generation science reform relies on partnerships among teachers, administrators, parents, students, and community members. Below are some things parents and families can do to support their children's science learning:

- This parent guide will help you get familiar with the innovations in NGSS, why they are important, and how they will influence science teaching, learning and assessment in your child's school.
- NGSS are ambitious learning goals designed to raise interest and achievement for diverse learners. Parents can expect to see teachers using strategies shown to be successful in making NGSS-style science learning accessible to learners with varied needs and interests.
- OBSERVE TOGETHER — Encourage children to be curious observers of their surroundings. Let them know you are also curious. Pay attention to things in your environment and talk about what you notice and wonder. For example, with young children you might say, "I notice that when the wind blows, the trees move. I wonder what causes that?" With older children, you might discuss inherited traits that seem to run in your family.

- THINK TOGETHER — Even very young children come up with their own explanations of natural events such as thunder, sunrise or a volcanic eruption. Ask them for their explanation and ask why they think that.
- VISIT TOGETHER — go to parks, bodies of water, fields or any open spaces, and pay attention to your surroundings. For more formal learning opportunities, visit science museums, nature centers, zoos, farms and farmers' markets, planetariums, aquariums and libraries.
- TINKER TOGETHER — Encourage children to figure out how things work and to invent solutions to fill needs. With safety in mind, let children figure out how to assemble toys, replace batteries or bulbs. Work together to repair a bike or build your own riding toy.
- TALK with your child about what they're learning about in science. TALK with your child's teacher and ask some of these 10 Questions Your Kid's Science Teacher Wishes You Would Ask.
- ENCOURAGE your children to participate in extracurricular opportunities focused on science, technology, engineering, and math (STEM), such as clubs, field trips, after-school programs, vacation camps, and science research competitions.
- BE POSITIVE — Science should be fun, not scary, for you and your child. Be positive about the creativity, fascination and importance of NGSS-style science learning. Read more in Tips for Busy Parents.
- INSPIRE children by learning about diverse careers in STEM fields. Many rewarding jobs are accessible to students who earn a certificate or a two-year associate degree.
- PARTICIPATE in citizen science activities such as Big Butterfly Count, Lost Ladybug Project, or Project Feederwatch.

Links to Detailed Information

- Next Generation Science Standards
- Framework for K–12 Science Education
- College Board Standards for College Success: Science
- Connecticut Core Standards for English language arts and mathematics