# Next-Generation Science Standards (NGSS) Facts

**Kentucky and the Next-Generation Science Standards**

- Kentucky was a lead state --one of 26 states that partnered in developing the new standards as part of a collaborative state-led process. Kentucky became involved in part to answer the call for new, aligned and more rigorous academic standards mandated in Senate Bill 1 (2009).

- No federal funds or incentives were used to create the NGSS and there are none to encourage adoption. The development of the NGSS was primarily supported by the Carnegie Corporation of New York.

- About 40 Kentuckians, including P-12 science teachers, state science and policy staff, higher education faculty, scientists, and engineers were involved in the development of the NGSS.

- During the public comment periods on the draft standards, Kentuckians registered a lot of support for the new standards and provided much input, much of which was incorporated in the final version.

- The final version of the standards did not change structurally from draft versions, however, they are noticeably different from the second draft of the standards. Based on public input, there are significantly fewer student performance expectations (assessable components) eliminating those that were narrowly focused or redundant. Student performance expectations that were part of a learning progression or that support big ideas were preserved.

- The new science standards integrate core ideas, key practices and concepts that apply to many areas of science. For example, the disciplinary core ideas of science and engineering are integrated rather than taught separately. However, the engineering design process is included as a separate topic with distinct Performance Expectations in grades K-2, 3-5, middle school and high school. The standards reflect the interconnected nature of science as it is practiced and experienced.

- There have been shifts of specific concepts to new grade levels. Some examples include:
  - Waves as a mechanism for energy transfer appears for the first time in elementary rather than in middle or high.
  - Light and sound has moved downward to first grade.
  - Earth's surface processes are introduced two years earlier than before.

- Not all concepts are taught at all grade levels in a continuous progression, but concepts build coherently. There has been very little negative feedback from either the field or Kentucky's lead state team regarding the shifts in concepts. More feedback has focused on the non-continuous nature of some concepts.

- Because the new standards are considerably different than the old standards, the state does not intend to complete a crosswalk with the old standards and would discourage others from doing this.

- The NGSS, based on the National Research Council's Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, are internationally benchmarked, rigorous, research-based and aligned with expectations for college and careers. They provide for deeper understanding of content and application.

- The standards are aligned with and explicitly make connections to the Kentucky Core Academic Standards for mathematics and English/language arts.

- The NGSS do not define a particular curriculum -- that will be up to schools and districts to develop. The Kentucky Department of Education will be providing support for implementation of the NGSS which will include strategies and ideas for curriculum development at the local level.

- The NGSS are designed to:
  - provide the foundation for rigorous science learning for every student at every school
  - develop 21st-century skills (critical thinking and problem solving, communication, collaboration, and creativity and innovation) that apply to all careers as well as everyday life
  - prepare every student for the workplace and ensure he/she is globally competitive
  - support the creation of science, technology and engineering jobs in the economy
  - equip all students for living in a society that demands an increasing level of science, mathematics and technology literacy

- Kentucky Timetable:
  - The standards will move through the normal regulatory process. The standards are not final until this process is complete which we hope will be by October.
  - Over the summer there were several introductory learning opportunities for schools and districts
  - Science Content Leadership Networks will be formed this fall and include a team of teachers from each district. There will be six regional meetings during the school year 2013-14 with virtual meetings in between.
  - A variety of training options will be available in the summer of 2014
  - The science standards are scheduled for implementation in school year 2014-15
  - The first anticipated assessments of the new standards are planned for spring 2015.

- The NGSS will made available through CIITS – the Continuous Instructional Improvement Technology System. After that, instructional resources and item banks will be made available as well.

**Evolution**

- Evolution is described conceptually in the standards.

- Biological change (commonly known as evolution) does not appear in the NGSS until middle school. It is addressed as one of the seven Big Ideas as early as Primary in the current standards.

- In Kentucky, public schools may provide instruction about religion, such as a comparative religion course. Courses may provide information about different viewpoints related to the creation of the world. It is not permissible for teachers, administrators or school staff to lead students in prayer, to teach preference of one religious denomination over another or to evangelize to students during the school day.

- Since college and career readiness is our goal for all students, we would be doing them a disservice by denying them the opportunity to learn science concepts required to be successful in college or their chosen careers. Evolutionary theory is one of the foundational components of modern biology, and it most certainly plays a significant part in college biology coursework.

- The NGSS have been developed based on a vision for science education established by the *Framework for K-12 Science Education* published by the National Research Council in 2011. An 18-member committee – including nationally and internationally known practicing scientists, science education researchers and science education standards and policy experts, appointed by the National Research Council of the National Academies of Sciences – developed the framework. It underwent revisions based on a rigorous peer-review process as well as public scrutiny and feedback before it was finalized and released in July 2011.

- The vision of the framework is that all students, over multiple years of school, actively engage in science and engineering practices and apply concepts that cover many areas to deepen their understanding of the core ideas in these fields. The framework represents the first comprehensive document in more than 16 years that addresses the needs of science and engineering education.

**Why new standards are needed?**

- During the seven years since our current standards were developed, there have been major advances in the world of science and in our understanding of how students learn science effectively.

- Expanding our country's ability to compete in science and technology is critical to our ability to compete and lead in a global economy. We can only do this if American students get a solid science education that prepares them for college, careers, and opportunities in science-related fields.

- Life after high school or college is no longer about competing with people in the same town. Today, American students need to be able to compete with peers from Japan, China, and India. All our students need the knowledge and skills in science that equip them in a demanding global economy.

- Students who are proficient in science will be prepared to enter and succeed in rapidly growing fields in the national economy, such as medicine and health care, engineering, and technology.

- To be ready for college and careers, students need to have studied a rigorous curriculum. This means mastering the basics like English and math, but also some of the knowledge and skills colleges and employers value most, like science and technology.

- Science is central to the lives of all Americans, so it only makes sense that students in our public schools get the education in science they need to prepare them to be informed citizens and knowledgeable about how science and technology impacts everyday life.

- The standards are internationally benchmarked against countries whose students typically perform well on the Programme for International Student Assessment (PISA) or Trends in International Math and Science Study (TIMSS).

**Mechanics of the Next Generation Science Standards**

- The new standards are based on the *Framework for K-12 Science Education* released in July 2011 and developed by the National Research Council of the National Academy of Sciences.

- The framework consisits of the three dimensions described below. According to the authors, these dimensions should not be taught separately from one another; rather, they shoud be integrated in standards, assessment, curricula and instuction.

| Science and Engineering Practices | Disciplinary Core Ideas |
|---|---|
| 1. Asking questions (for science) and defining problems (for engineering)<br>2. Developing and using models<br>3. Planning and carrying out investigations<br>4. Analyzing and interpreting data<br>5. Using mathematics and computational thinking<br>6. Constructing explanations (for science) and designing solutions (for engineering)<br>7. Engaging in argument from evidence<br>8. Obtaining, evaluating, and communicating information | <u>Physical Sciences</u><br>PS 1: Matter and its interactions<br>PS 2: Motion and stability: Forces and interactions<br>PS 3: Energy<br>PS 4: Waves and their applications in technologies for information transfer<br><u>Life Sciences</u><br>LS 1: From molecules to organisms: Structures and processes<br>LS 2: Ecosystems: Interactions, energy and dynamics<br>LS 3: Heredity: Inheritance and variation of traits<br>LS 4: Biological evolution: Unity and diversity |
| **Crosscutting Concepts**<br>*These concepts apply to the study and practice of many areas of science.*<br>1. Patterns<br>2. Cause and effect<br>3. Scale, proportion and quanity<br>4. Systems and system models<br>5. Energy and matter<br>6. Structure and function<br>7. Stability and change | <u>Earth and Space Sciences</u><br>ESS 1: Earth's place in the universe<br>ESS 2: Earth's systems<br>ESS 3: Earth and human activity<br><u>Engineering, Technology and the Applications of Science</u><br>ETS 1: Engineering design<br>ETS 2: Links among engineering, technology, science and society |

- Each student performance expectation is a blend of the three dimensions of the framework: Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

- Many performance expectations will include Assessment Boundary statements that provide information on how deeply that expectation is to be assessed.

- To provide guidance and clarification to all NGSS users, the writers have created a system architecture that highlights the standards as well as each of the three integral dimensions and connections to other grade bands and subjects. The standards are organized in a table with three main sections:
  - performance expectations
  - the foundation boxes
  - the connection boxes