Illinois Learning Standards for Science: Quick Start Guide

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The **Illinois Learning Standards for Science** (taken verbatim from the Next Generation Science Standards) were officially adopted in 2014. Based on the NRC Document *A Framework for K-12 Science Education,* these standards are intended to engage students in science and engineering practices to explain natural phenomena and solve problems, much like real world scientists and engineers.

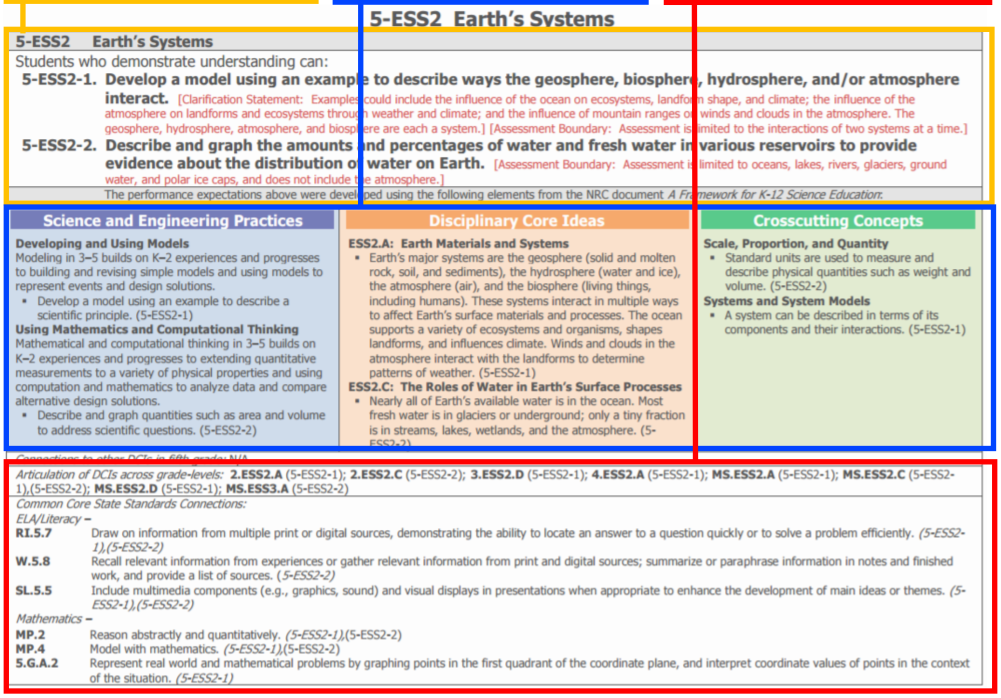
With the adoption of new standards comes a shift in the roles of teachers and students, and this quick start guide is intended to give you a brief familiarity with the standards as you begin to implement them in your classroom. For more information visit: www.ilclassroomsinaction.org

Standards Architecture

Performance Expectations are the assessable component

Foundation Boxes contain the supporting SEPs, DCIs and CCCs

Connections to Math and ELA standards are found here



5-ESS2 Earth's Systems

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Students who demonstrate understanding can:

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ▪ Develop a model using an example to describe a scientific principle. (5-ESS2-1) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ▪ Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)	**ESS2.A: Earth Materials and Systems** ▪ Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** ▪ Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2)	**Scale, Proportion, and Quantity** ▪ Standard units are used to measure and describe physical quantities such as weight and volume. (5-ESS2-2) **Systems and System Models** ▪ A system can be described in terms of its components and their interactions. (5-ESS2-1)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels: **2.ESS2.A** (5-ESS2-1); **2.ESS2.C** (5-ESS2-2); **3.ESS2.D** (5-ESS2-1); **4.ESS2.A** (5-ESS2-1); **MS.ESS2.A** (5-ESS2-1); **MS.ESS2.C** (5-ESS2-1),(5-ESS2-2); **MS.ESS2.D** (5-ESS2-1); **MS.ESS3.A** (5-ESS2-2)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. *(5-ESS2-1),(5-ESS2-2)*

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. *(5-ESS2-2)*

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. *(5-ESS2-1),(5-ESS2-2)*

Mathematics –

MP.2 Reason abstractly and quantitatively. *(5-ESS2-1)*,(5-ESS2-2)

MP.4 Model with mathematics. *(5-ESS2-1)*,(5-ESS2-2)

5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. *(5-ESS2-1)*

The Seven Shifts of the Illinois Learning Standards for Science

1. The standards reflect the interconnected nature of science
2. The standards are performances, not curriculum
3. The standards build coherently from K-12
4. The standards focus on deeper understanding of content and its application
5. The standards integrate science and engineering
6. The standards are focused on College and Career Readiness
7. The standards are aligned to Math and ELA standards across grades

Science and Engineering Practices

1. Asking questions and defining problems
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 and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating and communicating information

Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, Quantity and Proportion
4. System and System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

What is Three Dimensional Learning?

The Next Generation Science Standards uses the phrase ***three-dimensional learning*** to describe the goals of instruction, but what does that mean? The *Framework* describes the need to integrate the practices of science and engineering with the content that is usually presented in isolation to better reflect the creativity and universality of science, ultimately developing scientifically literate citizens. When students use the science and engineering practices (**SEPs**) to explain phenomena or solve problems related to the core scientific concepts **(DCIs**), and use the crosscutting concepts (**CCCs**) to connect to other domains of knowledge, then they are experiencing three dimensional learning. This process is reflective of the true nature of scientific inquiry, and precisely the way to get our students thinking like scientists. The performance expectations are written to be three dimensional, so each one contains a practice, content target and crosscutting concepts; these are color coded on the NGSS website.

What are phenomena?

Phenomena are the reasons students are engaged in the sciences practices; interesting natural occurrences or problems that need solving drive student questions and investigations. Different from discrepant events or attention grabbers, these are rich, complex objects of study for students that allow them to engage with core scientific concepts through the process of scientific inquiry. Phenomena can be anchoring (drives a whole unit) or investigative (builds evidence for explanation).

What is coherence

Coherence is a foundational strand that runs through the standards, but how does that affect your classroom? Coherence means that students experience the practices, content and crosscutting concepts at increasing complexity from K-12; because the content builds progressively, students are not expected to require re-teaching. Within a unit, coherence means that the lessons are ***storylined*****,** sequenced in a way that allows for logical discovery and questioning from students that leads to explaining phenomena.

How does engineering fit?

Engineering in the Illinois Learning Standards for Science are no longer stand alone concepts, and are instead meant to be integrated into science instruction. Rather than just participate in an engineering project, the standards reinforce the engagement of students in *engineering design thinking*, the iterative design process used to solve problems. The engineering performance expectations are particularly useful in connecting to career readiness in classrooms.

What should I read?

The ***Next Generation Science Standards*** and the associate appendices are a necessary read, but for a more in depth understanding of why the standards are written as they are, have a look at ***The Framework for K-12 Science Education*****.** Additional quality reads include ***Writing Assessments for the NGSS***, ***Seeing Students Do Science*** and ***Taking Science to School***, available as free pdfs from the National Academies Press.

Resources

Lessons, Units and Other Instructional Materials

Illinois Classrooms in Action: A one stop resource for all things teaching courtesy of Illinois State University and ISBE. Professional learning, resources and more. *www.ilclassroomsinaction.org*

NGSS Hub @ NSTA: A collection of instructional materials vetted by NSTA Curators. Arranged by grade and content, with suggestions for full alignment. *www.ngss.nsta.org*

Next Gen Storylines: Northwestern University's fully aligned, storylined instructional units. Planned and piloted in Illinois classrooms. *www.nextgenstorylines.org*

Concord Consortium: A good collection of resources, particularly the NGSS Pathfinder that connects the SEPs, DCIs and CCCs to select instructional material. *www.concord.org/ngss/*

Strategies, Skills and Teaching Tips

Talk Moves: Created by The Inquiry Project, this resource on productive classroom talk will open up students to communicating their ideas to their peers. *https://inquiryproject.terc.edu*

STEM Teaching Tools: Tools for educators addressing specific issues in NGSS implementation. Videos and written materials. *www.stemteachingtools.org*

Ambitious Science Teaching: Tools and exemplars of ways to increase student engagement in science learning with an attention to equity. *www.ambitiousscienceteaching.org*

American Museum of Natural History's Tools for NGSS: A five part tool for planning NGSS instruction and assessment. *www.amnh.org*

Professional Learning

Illinois Science Teachers in Action: the science subsection of Classrooms in Action, this network hosts discussion forums, resources and professional learning opportunities hosted by the ISBE Science Content Specialists. *www.ilclassroomsinaction.org*

Science Foundational Services: A project of IARSS to support Illinois teachers. Though the trainings have ended, all the slides and resources are available for self-paced study. *www.iarss.org*

NGSX: The Next Generation Science Exemplar is a full fledged, multi-strand professional development built to immerse participants in the NGSS. *www.ngsx.org*

NSTA Professional Learning Series: professional learning videos and written materials for self-guided PD. *www.ngss.nsta.org*