Department of Education

Changes and Highlights to the 2025 Standards

On May 8, 2025, the Iowa State Board of Education approved a revised version of the Iowa Academic Standards for Science. This document worked to clarify many of the previous standards adopted in 2015.

This document is designed to assist districts in transitioning from the previous version of the Iowa Standards for Science (2015) to the newly adopted Iowa Academic Standards for Science (2025). Educators should refer to the actual standards document for requirements. The following information highlights what has changed significantly or has been added to the document in the 2025 adoption. This document is not comprehensive, as it does not discuss every altered phrasing or verbiage. Instead, it is intended to provide a broad overview for districts as they read the Iowa Academic Standards for Science document, as well as offer a few sample resources for further study.

When reading this document, it is important to remember that standards represent the ***minimum expectations for all students.*** This theme is fundamentally important in all contexts found in the document. For clarity, here are important reminders when using the provided information:

- ***Minimum Expectations:*** Recall that standards serve as a floor, not a ceiling. Teachers are free—and expected—to teach supplemental content or deeper cognitive loads than what is outlined in the document.
- ***Standards vs. Curriculum:*** Standards are distinct from curriculum. They set the minimum expectations for what students should know and be able to do, rather than dictating how students engage with curricular materials. Curriculum decisions are made at the district and classroom level.
- ***All Standards for All Students:*** The standards set expectations for all students at all grade levels. This includes every elementary grade and every standard in the high school sequence.

Front Matter

The Iowa Academic Standards for Science document includes new front matter that was not present in the previous version of the standards. The 2015 version was simply the performance expectations from the Next Generation Science Standards, with no explanation or elaboration on the shifts in instruction and assessment required to teach science in a three-dimensional way. The front matter in the 2025 Iowa Academic Standards for Science highlights instructional shifts, including a focus on sensemaking and coherence from a student's perspective. The following table illustrates what these shifts may look like in a classroom.

Classroom activities look less like:	Classroom activities look more like:
Students have infrequent exposure to science instruction or related activities	Students engage with science concepts as a core part of instruction and are encouraged to connect lessons to their own experiences.
Students memorize the definition of matter.	Students determine how matter changes form, weight, and properties as droplets form on the outside of a soda can.
Students draw a picture of the solar system, labelling the planets.	Students plan and conduct an experiment to determine how the sun's movement through the sky determines time, day and night, and the seasons.
Students learn what the symbols are on a weather map.	Students model how hail is formed.
Students balance chemical equations.	Students model how energy is conserved when an explosion causes a piston to expand.
Students create a model of an atom using Styrofoam.	Students explain why an onion makes you cry using molecular models.
Students use trial and error to build a bridge out of popsicle sticks.	Students research various bridge designs, select a design that best aligns with their scientific understanding of forces, and then test their chosen design.

Sensemaking

Perhaps the most significant shift from traditional science instruction is the move towards active student sensemaking of relevant phenomena. Student-centered science classrooms empower students with the agency to authentically contribute to determining the lesson's trajectory and figuring out how the world works, allowing students to author their understanding of natural phenomena.

For more information on sensemaking or coherence from a student perspective, see:

- Qualities of a Good Anchor Phenomenon for a Coherent Sequence of Science Lessons
- Shifting Traditional Science Instruction to Interactive Student Sensemaking
- Sensemaking from NSTA
- Making Sense of Sensemaking- Smithsonian
- Coherence from the Students' Perspective
- Iowa Science Phenomena

Three-Dimensional Teaching and Learning

The front matter devotes considerable time to defining and discussing the three dimensions of science standards, instruction and assessment. These three dimensions, Science and Engineering Practices (SEP), Disciplinary Core Ideas (DCI) and Crosscutting Concepts (CCC), are fundamental to teaching and learning science using the Iowa Academic Standards for Science.

More information on the three dimensions in science education:

- Framework for K-12 Science Education
- Practices should not stand alone: How to sequence practices in a cascade to support student investigations
- Overview of three dimensions from NSTA

Bundling

The front matter also discusses ways to enhance unit planning using the standards, especially around bundling standards. Educators should not teach one standard in isolation. If a classroom revolves around student sensemaking of phenomena, students should be able to move fluidly in and out of different practices, framing their thinking through various crosscutting concepts, all within the context of the content they are engaging with. When a small number of standards are bundled, the different dimensions break apart into distinct dimensions that teachers should use when planning their lessons and assessments. In this respect, the actual standards should be viewed as an example of how the dimensions can be combined into a unit, rather than being taught in isolation.

For example, a biology class may bundle the following two standards together, giving them access to the following 3-dimensional elements:

HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

- SEP: Developing & Using Models
- DCI: Multicellular organisms are organized in a hierarchical structure where one system is made up of numerous parts that work together to build the organism
- CCC: Systems and Systems Models

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

- SEP: Planning & Carrying Out Investigations
- DCI: Living systems strive to maintain stable internal conditions. Feedback mechanisms exist to help living things remain alive and functional even as external conditions change.
- CCC: Stability and Change of Systems

When teaching and assessing this bundle, it may be more effective to rearrange the three-dimensional elements to make the chosen phenomena more coherent. Perhaps a teacher may choose to use the following sequence in their lessons and assessments:

Students investigate why a runner sweats and how excessive water loss can be harmful to the body.

- SEP: Developing & Using Models
- DCI: Living systems strive to maintain stable internal conditions. Feedback mechanisms exist to help living things remain alive and functional even as external conditions change.
- CCC: Systems and System Models

Students expand on the runner's problem by investigating how kidneys work as a runner takes in excess water after his run.

- SEP: Planning & Carrying Out Investigations & SEP: Developing & Using Models
- DCI: Multicellular organisms are organized in a hierarchical structure where one system is made up of numerous parts that work together to build the organism
- CCC: Systems and Systems Models & CCC: Stability and Change of Systems

In this way, the three-dimensional original standard is broken down into its components, which are rearranged to teach in a manner that is coherent to the student within the context of the phenomena being studied.

Learn more about bundling standards and see example bundles for elementary, middle and high school.

Connections

A new addition to the Iowa Academic Standards for science is the inclusion of supplemental connections to many of the standards. These connections, located at the bottom of many standards, are designed to provide teachers with ideas on how to make the content more relevant and connected to other disciplines and careers in their classroom. These specific connections are not required for every student, but are simply there to help teachers in planning.

- Iowa Science Phenomena (IowaPBS)

Elementary Science

The largest emphasis in elementary science is set on the intentional teaching of science in elementary schedules. There is a strong emphasis, even in the front matter, on the intentional building of ideas, practices, and conceptual frames over time. For later grades to meet the rigor expected in the standards, it is essential that students have a valuable science experience in primary grades. There are several reasons why this is important.

1. Science (and social studies and the arts) provides the context for student work in literacy. Science involves reading, writing, speaking, listening, modeling, and collaboration in a way that makes literacy instruction meaningful.
    a. Kim et al. (2023, Harvard Graduate School of Education) conducted a longitudinal evaluation of the Model of Reading Engagement (MORE), a K-3 integrated science and social studies literacy curriculum. Nearly 3,000 students in 30 schools showed improved reading comprehension across science, history, and literature as a result of a schema-rich science instruction.
    b. Guthrie et al. (1993–2021) developed CORI, a model that combines science themes with strategic literacy instruction. The program significantly boosted both science inquiry skills and overall text comprehension compared to either science-only or literacy-only approaches.
    c. Duke, Ward & Pearson (2021) discuss how integrating domain knowledge, vocabulary, and motivation into literacy instruction fosters deeper reading comprehension, often aligning with science-rich content.
2. Science provides background experiences that students can draw from when they read or write. Experiences making sense of the world around them make reading and writing easier because they have built a more complex cognitive framework of prior understanding from which to assimilate new information.
3. Science provides experiences that foster curiosity and joy. Curiosity leads to a motivation to learn, which is essential for any learning to happen.
4. Science exposes students to possible career pathways. It has been shown that students who lack a strong elementary science experience tend to self-select themselves out of STEM opportunities in later grades. This trend is even greater for students in populations that are typically underrepresented in the science fields.

Throughout the elementary grades, individual front matter outlines key ideas and practices specific to each grade level. The grade-specific front matter discusses how leveraging student play as a means of developing science practices, content knowledge and crosscutting concepts can be effective.

Resources highlighting the importance of high-quality elementary science:

- Science and Engineering in Preschool through the Elementary Grades (National Academies)
- Rise and Thrive with Science (National Academies)

Middle School Science

According to the National Academies of Sciences, Engineering, and Medicine, most Americans learn the bulk of their science and engineering knowledge during middle and high school. That's why these years are a critical window to spark students' curiosity and build a strong STEM foundation. When students engage in science and engineering during this time, they begin to see and explore the world in new ways, ask meaningful questions, guide their learning, and develop key skills for the future.

- Finding Balance in Middle School Science (Smithsonian)

Middle School Sequence

One of the major changes to the previous standards was the realignment of the standards in grades six through eight. The following pages aim to clarify changes to the middle school sequence.

The following table indicates where standards have been moved. The list provided in the table is the current 2025 Iowa Academic Standards for Science. The color codes indicate where they existed in 2015. For example, 6-PS1-4 was in 6th grade in 2015 and will remain in 6th grade in 2025, while 6-PS3-3 was in 8th grade in 2015 but was moved to 6th grade in 2025.

6th Grade	7th Grade	8th Grade
6-PS1-4	7-PS2-1	8-PS1-1
6-PS1-6	7-PS2-2	8-PS1-2
6-PS3-3	7-PS2-3	8-PS1-3
6-PS4-1	7-PS2-4	8-PS1-5
6-PS4-2	7-PS2-5	8-LS1-5
6-PS4-3	7-PS3-1	8-LS1-6
6-LS1-1	7-PS3-2	8-LS1-7
6-LS1-2	7-PS3-4	8-LS3-1
6-LS1-3	7-PS3-5	8-LS3-2
6-LS1-8	7-LS1-4	8-LS4-1
6-ESS1-4	7-LS2-1	8-LS4-2
6-ESS2-1	7-LS2-2	8-LS4-3
6-ESS2-2	7-LS2-3	8-LS4-4
6-ESS2-3	7-LS2-4	8-LS4-5
6-ESS3-1	7-LS2-5	8-LS4-6
6-ESS3-2	7-ESS1-1	8-ESS2-5
6-ETS 1-1	7-ESS1-2	8-ESS2-6
6-ETS 1-2	7-ESS1-3	8-ESS3-3
6-ETS 1-3	7-ESS2-4	8-ESS3-4
6-ETS 1-4	7-ETS 1-1	8-ESS3-5
	7-ETS 1-2	8-ETS 1-1
	7-ETS 1-3	8-ETS 1-2
	7-ETS 1-4	8-ETS 1-3
		8-ETS 1-4

High School Science

High School Course Pathways

The high school science standards are grade-banded, meaning that there are multiple pathways that districts can develop to have all students engage with all of the standards. Districts should plan for the fact that the Iowa Academic Standards for Science are required for all students. That means that **all high school standards must be met within the three required years of science that students must complete for high school graduation.** Determining the three-year science sequence in a high school should take into consideration local factors such as staffing limitations, high-quality curriculum, and local contexts. The Iowa Academic Standards for Science document gives three examples of how the science standards could be placed in high school courses.

- Paths through Mathematics and Science (NAEP)
- Rethinking the High School Science Course Sequence (Activate Learning)

High School Electives

Iowa code requires three years of science as a minimum graduation requirement for students. After three years of required science, students often take electives. The Iowa Academic Standards for Science include two examples of elective courses that are frequently taught in Iowa. They are not required for all students. They simply serve as examples for other science electives that a district may want to provide. It is important to remember that three-dimensional instruction and assessment should be valued and expected in elective courses. It is hoped that other elective courses will follow suit and create their three-dimensional standards centered on active student sense-making of relevant phenomena.