LINCOLN CURRICULUM STANDARDS FOR

Science

Grade 2

The Role of Science Standards in Michigan

According to the dictionary, a standard is “something considered by an authority or by general consent as a basis of comparison.” Today’s world is replete with standards documents such as standards of care, standards of quality, and even standard operating procedures. These various sets of standards serve to outline agreed-upon expectations, rules, or actions, which guide practice and provide a platform for evaluating or comparing these practices.

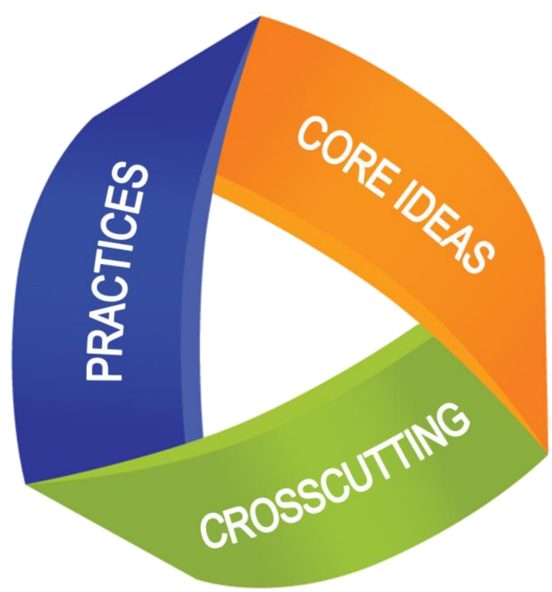
One such set of standards is the academic standards that a governing body may have for the expected outcomes of students. In Michigan, these standards, are used to outline learning expectations for Michigan’s students, and are intended to guide local curriculum development and assessment of student progress. The Michigan Science Standards are performance expectations for students. They are not curriculum and they do not specify classroom instruction. Standards should be used by schools as a framework for curriculum development with the curriculum itself prescribing instructional resources, methods, progressions, and additional knowledge valued by the local community. Since Michigan is a “local control” state, local school districts and public school academies can use these standards in this manner to make decisions about curriculum, instruction, and assessment.

At the state level, these standards provide a platform for state assessments, which are used to measure how well schools are providing opportunities for all students to learn the content outlined by the standards. The standards also impact other statewide policies, such as considerations for teacher certification and credentials, school improvement, and accountability, to name a few.

The standards in this document identify the student performance outcomes for students in topics of science and engineering. These standards replace the Michigan Science Standards adopted in 2006, which were published as the Grade Level Content Expectations and High School Content Expectations for science.

Why These Standards?

There is no question that students need to be prepared to apply basic scientific knowledge to their lives and to their careers, regardless of whether they are planning STEM based careers or not. In 2011, the National Research Council released *A Framework for K-12 Science Education*,[1] which set forth guidance for science standards development based on the research on how students learn best. This extensive body of research suggests students need to be engaged in **doing science** by engaging the same practices used by scientists and engineers.



1 A New Conceptual Framework." *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Washington, DC: The National Academies Press, 2012.

Furthermore, students should engage in science and engineering practices in the context of **core ideas** that become ever more sophisticated as students move through school. Students also need to see the connections of these disciplinary-based core ideas to the bigger **science concepts that cross disciplinary lines**. The proposed Michigan standards are built on this research-based framework. The framework was used in the development of the Next Generation Science Standards, for which Michigan was a lead partner. The Michigan Science Standards are derived from this effort, utilizing the student performance expectations and their relevant coding (for reference purposes). These standards are intended to guide local curricular design, leaving room for parents, teachers, and schools to surround the standards with local decisions about curriculum and instruction. Similarly, because these standards are performance expectations, they will be used to guide state assessment development.

Organization and Structure of the Performance Expectations

Michigan's science standards are organized by grade level K-5, and then by grade span in middle school and high school. The K-5 grade level organization reflects the developmental nature of learning for elementary students in a manner that attends to the important learning progressions toward basic foundational understandings. By the time students reach traditional middle school grades (6-8), they can begin to build on this foundation to develop more sophisticated understandings of science concepts within and across disciplines. This structure also allows schools to design local courses and pathways that make sense for their students and available instructional resources.

Michigan's prior standards for science were organized by grade level through 7th grade. Because these standards are not a revision, but were newly designed in their entirety, it was decided that the use of the grade level designations in the traditional middle grades (6-8) would be overly inhibiting to apply universally to all schools in Michigan. Such decisions do not specifically restrict local school districts from collaborating at a local or regional level to standardize instruction at these levels. Therefore, it is recommended that each school, district, or region utilize assessment oriented grade bands (K-2, 3-5, 6-8, 9-12) to organize curriculum and instruction around the standards. MDE will provide guidance on appropriate strategies or organization for such efforts to be applied locally in each school district or public school academy.

Within each grade level/span the performance expectations are organized around topics. While each topical cluster of performance expectations addresses the topic, the wording of each performance expectation reflects the three-dimensions of science learning outlined in *A Framework for K-12 Science Education*: cross-cutting concepts, disciplinary core ideas, and science and engineering practices.

Cross Cutting Concepts (CCC)

The seven Crosscutting Concepts outlined by the *Framework for K-12 Science Education* are the overarching and enduring understandings that provide an organizational framework under which students can connect the core ideas from the various disciplines into a "cumulative, coherent, and usable understanding of science and engineering" (*Framework,* pg. 83).

These crosscutting concepts are…

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

Disciplinary Core Ideas (DCI)

The crosscutting concepts cross disciplines. However within each discipline are core ideas that are developed across grade spans, increasing in sophistication and depth of understanding. Each performance expectation (PE) is coded to a DCI. A list of DCIs and their codes can be found on the MDE website and in the MDE Guidance Documents.

Science and Engineering Practices

In addition to the Crosscutting Concepts and Disciplinary Core Ideas, the National Research Council has outlined 8 practices for K-12 science classrooms that describe ways students should be engaged in the classroom as a reflection of the practices of actual scientists and engineers. When students "do" science, the learning of the content becomes more meaningful. Lessons should be carefully designed so that students have opportunities to not only learn the essential science content, but to practice being a scientist or engineer. These opportunities set the stage for students to transition to college or directly into STEM careers.

Coding Hierarchy

Based upon the Framework and development of the Next Generation Science Standards effort, each performance expectation of the Michigan Science Standards is identified with a reference code. Each performance expectation (PE) code starts out with the grade level, followed by the disciplinary core idea (DCI) code, and ending with the sequence number of the PE within the DCI. So for example, K-PS3-2 is a kindergarten PE, linked to the 3rd physical science DCI (i.e., Energy), and is the second in sequence of kindergarten PEs linked to the PS3. These codes are used in MSS and NGSS Science Resources to identify relevant connections for standards.

Listed below are the Science and Engineering Practices from the *Framework:*

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

Implementation

It is extremely important to remember that the research calls for instruction and assessments to blend the three dimensions (CCC, DCI, and Practices). It is this working together of the three dimensions that will allow all children to explain scientific phenomena, design solutions to problems, and build a foundation upon which they can continue to learn and be able to apply science knowledge and skills within and outside the K-12 education arena. While each PE incorporates these three dimensions into its wording, this alone does not drive student outcomes. Ultimately, student learning depends on how the standards are integrated in instructional practices in the classroom. There are several resources based on the National Research Council's *A Framework for K-12 Science Education* that were developed for educators to utilize in planning curriculum, instruction, and professional development. These include resources developed by Michigan K-12 and higher education educators, with plans to develop more guided by the needs of the field as implementation moves forward. This includes assessment guidance for the Michigan Department of Education, local districts, and educators.

Michigan Specific Contexts

Because the student performance expectations were developed to align to a general context for all learners, the Michigan Department of Education (MDE) works with a variety of stakeholders to identify Michigan-specific versions of the standards for student performance expectations that address issues directly relevant to our state such as its unique location in the Great Lakes Basin, Michigan-specific flora and fauna, and our state's rich history and expertise in scientific research and engineering. These versions of the performance expectations allow for local, regional, and state-specific contexts for learning and assessment. In addition to the specific performance expectations that frame more general concepts and phenomena in a manner that is directly relevant to our state, there are also a number of performance expectations which allow for local, regional, or state-specific problems to be investigated by students, or for students to demonstrate understandings through more localized contexts. Both of these types of performance expectations are identified in the following standards, as well as in the accompanying guidance document, which also identifies both clarification statements and assessment boundaries. The Michigan specific performance expectations should be used by educators to frame local assessment efforts. State level assessments will specifically address the performance expectations with Michigan-specific contexts.

MDE is collaborating with multiple statewide partners to generate a list of support materials for the state standards that focuses on resources and potential strategies for introducing or exploring DCIs through a local, regional, or statewide lens to make the learning more engaging and authentic. These contextual connections are not included in the specific performance expectations, as educators should merely use these as recommendations for investigation with students, and assessment developers have the opportunity to use these to develop specific examples or scenarios from which students would demonstrate their general understanding. This approach provides the opportunity for educators to draw upon Michigan's natural environment and rich history and resources in engineering design and scientific research to support student learning.

Michigan Educator Guidance

The Michigan Science Standards within this document are the performance expectations for students in grades K-12 for science and engineering practices, cross cutting concepts, and disciplinary core ideas of science and engineering. In order to be able to develop and guide instruction to address the standards for all students, Michigan educators will need access to a range of guidance and resources that provide additional support for the teaching and learning of science. This guidance will be developed and shared with Michigan educators following the adoption of the proposed standards. The MDE provides additional guidance based upon educator needs and requests, and utilizes support from practicing Michigan educators and educational leaders to develop such guidance or tools to aid in the implementation of the standards.

Accompanying this standards document will be a range of resources provided to educators and assessment developers to help frame the learning context and instructional considerations of the performance expectations. Such guidance will include appropriate connections and references to the Science and Engineering Practices, the Disciplinary Core Ideas (DCI), and Cross Cutting Concepts (CCC) that frame each performance expectation. External partners, including the Michigan Mathematics and Science Center Network, Michigan Science Teachers Association, and National Science Teachers Association, and professional development providers in Michigan, will utilize the coding references of the standards to provide additional resources to Michigan educators.

The MDE will provide ongoing support to educators through guidance and professional learning resources, which will be updated regularly. Additional information and references can be found at http://michigan.gov/science.

Science – Grade 2

Structure and Properties of Matter

2-PS1-1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. *
2-PS1-3	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
2-PS1-4	Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Interdependent Relationships in Ecosystems

2-LS2-1	Plan and conduct an investigation to determine if plants need sunlight and water to grow. **
2-LS2-2	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. *
2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats. **

Earth's Systems: Processes that Shape the Earth

2-ESS1-1	Use information from several sources to provide evidence that Earth events can occur quickly or slowly. *
2-ESS2-1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. * **
2-ESS2-2	Develop a model to represent the shapes and kinds of land and bodies of water in an area. *2-ESS2-2 MI Develop a model to represent the state of Michigan and the Great Lakes, or a more local land area and water body.*
2-ESS2-3	Obtain information to identify where water is found on Earth and that it can be solid or liquid. ** *2-ESS2-3 MI Obtain information to identify where fresh water is found on Earth, including the Great Lakes and Great Lakes Basin.*

* - Integrates traditional science content with engineering. - Includes a Michigan specific performance expectation.
**- Allow for local, regional, or Michigan specific contexts or examples in teaching and assessment.

Science – Grade 2

Engineering Design	
K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.