# Dynamic Learning Maps Science Dimensions for Grades K–2

This document includes tables that show how the science dimensions are applied in the Dynamic Learning Maps® (DLM®) Essential Elements for science in Grades K–2. Use this information as you plan science instruction for your students who may qualify in later grades for the alternate assessment, or for students who need additional support. The information is useful for defining science content and for illuminating foundational science learning expectations. This table of contents provides links to the sections corresponding to each dimension, and directly to each of the eight science and engineering practices (SEPs), the 14 "families" for disciplinary core ideas (DCI), and the seven crosscutting concepts (CCCs).

## Contents

## Science and Engineering Practices


The table below provides examples of the ways that each of the eight science and engineering practices (SEPs), which were adapted for use in the DLM Essential Elements for science, can be applied in Grades K–2. The third column in the table lists which Essential Elements include each SEP. With this information, you can understand the grade-band expectations related to each SEP and use them for your instructional needs.

| Science and Engineering Practice | Grade K–2 Expectations | Essential Elements That Use This SEP |
|---|---|---|
| **Asking Questions and Defining Problems**<br><br>A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works. Students with significant cognitive disabilities can engage in this practice by exploring the natural and designed world, beginning with making observations and identifying questions, and later developing and using questions to define problems that lead to investigating and understanding scientific principles. | • In exploring how the natural world works, ask questions that lead to observations, descriptions, and explanations. | SCI.EE.2.LS.Plant-1<br><br>SCI.EE.2.LS.Ecosys-1<br><br>SCI.EE.2.ESS.Impact-1<br><br>SCI.EE.2.PS.Matter-1<br><br>SCI.EE.2.PS.Forces-1 |
| **Developing and Using Models**<br><br>A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. Examples of these tools could include drawings, graphs, physical replicas, and dramatizations. Students with significant cognitive disabilities can engage in this practice beginning with using models that represent concrete events and later developing and using models to represent more abstract relationships, events, and systems in the natural and designed world. | • Use models to describe and classify amounts, relationships, and patterns. | *There are no Essential Elements that use this SEP in this grade band.* |

| Science and Engineering Practice | Grade K–2 Expectations | Essential Elements That Use This SEP |
|---|---|---|
| **Planning and Carrying Out Investigations**<br><br>Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Students with significant cognitive disabilities can engage in this practice beginning with collecting and using simple observations and later using tools to gather data to serve as evidence in an investigation. | • Collect and compare observations to determine and describe relationships in the natural world. | SCI.EE.2.LS.Plant-1<br>SCI.EE.2.ESS.SolSys-1<br>SCI.EE.2.ESS.Earth-2<br>SCI.EE.2.PS.Forces-1<br>SCI.EE.2.PS.Energy-1 |
| **Analyzing and Interpreting Data**<br><br>Scientific investigations produce data that must be analyzed to derive meaning. Students with significant cognitive disabilities can engage in this practice beginning with identifying and describing patterns and later interpreting, analyzing, and evaluating data in relation to explanations and solutions to problems in the natural and designed world. | • Identify and describe patterns in observations and measurements.<br>• Make classifications and comparisons based on observations and measurements. | SCI.EE.2.LS.Plant-1<br>SCI.EE.2.LS.Trait-1<br>SCI.EE.2.ESS.SolSys-1<br>SCI.EE.2.ESS.Weath-1<br>SCI.EE.2.PS.Matter-1<br>SCI.EE.2.PS.Forces-1 |
| **Using Mathematics and Computational Thinking**<br><br>In both science and engineering, mathematical and computational thinking are fundamental for representing physical variables and their relationships. They are used for a range of tasks, which can include recognizing, expressing, and applying quantitative relationships. Students with significant cognitive disabilities can engage in this practice beginning with simple mathematical representations and later applying and interpreting data as well as using mathematical reasoning to construct meaning about systems in the natural and designed world. | • Recognize numbers as representations of quantity.<br>• Recognize simple patterns. | *There are no Essential Elements that use this SEP in this grade band.* |

<table>
<tr><th>Science and Engineering Practice</th><th>Grade K–2 Expectations</th><th>Essential Elements That Use This SEP</th></tr>
<tr><td>Constructing Explanations and Designing Solutions<br><br>The products of science are explanations, and the products of engineering are solutions. Students with significant cognitive disabilities can engage in this practice beginning with describing and explaining relationships and later constructing and evaluating design solutions as well as explanations about processes and relationships in the natural and designed world.</td><td>• Make observations to identify patterns or compare relationships in the natural world.</td><td>There are no Essential Elements that use this SEP in this grade band.</td></tr>
<tr><td>Engaging in Argument from Evidence<br><br>Argumentation is the process by which explanations and solutions are reached. Students with significant cognitive disabilities can engage in this practice beginning with identifying information as evidence to support claims and later evaluating information to construct arguments about the natural and designed world.</td><td>• Understand that observations and data can be used as evidence.</td><td>SCI.EE.2.LS.Ecosys-1</td></tr>
<tr><td>Obtaining, Evaluating, and Communicating Information<br><br>Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical activity. Students with significant cognitive disabilities can engage in this practice beginning with using and describing observations to identify scientific ideas and later comparing and combining sources of information to communicate and evaluate scientific claims and ideas.</td><td>• Use observations, images, and other media to understand problems and determine how the natural world works.<br>• Use information (e.g., observations, images, maps) to answer questions and identify scientific ideas.</td><td>SCI.EE.2.LS.Org-1<br>SCI.EE.2.LS.Ecosys-1<br>SCI.EE.2.LS.EcoHlth-1<br>SCI.EE.2.LS.Group-1<br>SCI.EE.2.ESS.Earth-1<br>SCI.EE.2.ESS.Impact-1<br>SCI.EE.2.PS.Matter-1</td></tr>
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## Disciplinary Core Ideas

The tables below summarize key topics for each of the 14 “families” formed to organize and adapt the disciplinary core ideas (DCIs) for use in the DLM Essential Elements for science in Grades K–2. These tables show how scientific ideas relate to each other within a DCI family, and which Essential Elements are part of each DCI family (in the third column). With this information, you can understand the grade-band expectations related to each DCI family and use them for your instructional needs.

Note that the DCI family names are shortened for use in the Essential Element content codes (e.g., the Essential Element for Grades K–2 in the DCI family Organisms: Structure and Function, Growth and Development is SCI.EE.LS.2.Org-1); these shortened names are listed in parentheses after each DCI family name in the following tables for ease of correspondence to the list of Essential Elements.

### Life Science

| Disciplinary Core Idea (DCI) Family | Grade K–2 Expectations | Essential Elements in This DCI Family |
|---|---|---|
| **Organisms: Structure and Function, Growth and Development (Org)** | <u>Organism diversity</u>: Plants and animals (including humans) are living organisms that contribute to the diversity of life.<br><br><u>Plant structures</u>: Plants have various parts like roots, stems, leaves, flowers, and fruits that support their survival, growth, and reproduction.<br><br><u>Animal structures</u>: Animals have body parts that perform essential functions. Their external parts help them interact with the environment (for example, to feed, move, and protect themselves). | SCI.EE.2.LS.Org-1 |
| **Plants: Cycling of Matter and Flow of Energy (Plant)** | <u>Resources for plant growth</u>: Plants need resources such as water and light to support their growth and development. Plants that receive adequate amounts of water and light can grow and develop, which is evidenced by changes in their size, height, and form. | SCI.EE.2.LS.Plant-1 |

| **Disciplinary Core Idea (DCI) Family** | **Grade K–2 Expectations** | **Essential Elements in This DCI Family** |
|---|---|---|
| **Ecosystem: Cycling of Matter and Flow of Energy (Ecosys)** | Animal food sources: Animals grow and change throughout their lives, requiring food to support their growth, development, and survival. They obtain food by eating plants or other animals, ensuring they have the energy and materials needed for growth and daily functions. | SCI.EE.2.LS.Ecosys-1 |
| **Ecosystem Health (EcoHlth)** | Environmental conditions for living things: Living things are diverse and inhabit diverse places, which support their specific needs. A particular place provides the necessary habitat conditions for an organism to thrive. Living things require essential resources such as water, air, and land to grow, reproduce, and survive. | SCI.EE.2.LS.EcoHlth-1 |
| **Group Survival Behavior (Group)** | Animal learned behaviors: Animals rely on their senses to gather information from the environment. Learned behaviors, such as protecting, nesting, feeding, hunting, cleaning, grooming, and migrating, are vital for the offspring's survival.<br><br>Animals have offspring, who learn essential behaviors from their parents, other family members, and community members, as well as through their own experiences. These behaviors are often reinforced by the parents' actions to ensure their young thrive. | SCI.EE.2.LS.Group-1 |
| **Traits of Organisms (Trait)** | Trait resemblance: Plants and animals often resemble their biological parents but are not identical, displaying both similarities and differences. These variations in characteristics among individuals of the same kind contribute to the diversity within a species. | SCI.EE.2.LS.Trait-1 |
| **Human Impacts on Ecosystems (Human)** | *There are no Essential Elements in this grade band for this DCI family.* | *There are no Essential Elements in this DCI family in this grade band.* |

## Earth and Space Science

| Disciplinary Core Idea (DCI) Family | Grade K–2 Expectations | Essential Elements in This DCI Family |
|---|---|---|
| **Earth in the Solar System (SolSys)** | <u>Daily patterns in celestial objects</u>: Humans live on Earth, a planet from which we can observe various celestial objects such as the Sun, other stars, and the Moon. The Sun, a star, provides light to the Earth during the daytime and appears to rise in the morning and set in the evening. While the Sun is visible during the day, other stars and the Moon are mainly seen at night, with the Moon often appearing distinct from the stars. | SCI.EE.2.ESS.SolSys-1 |
| **Earth Systems (Earth)** | <u>Earth's water sources</u>: Water is distributed across Earth in various forms and locations, including oceans, rivers, lakes, ponds, and glaciers. It can be found as solid ice and liquid water, playing a crucial role in Earth's ecosystems and climate.<br><br><u>Water and wind effects on Earth's surface</u>: Water transports soil and rocks, and wind carries soil and erodes rocks. These processes can lead to rapid or gradual changes in landforms, continuously transforming the planet's surface. As a result, they shape the Earth's surface. | SCI.EE.2.ESS.Earth-1<br><br>SCI.EE.2.ESS.Earth-2 |
| **Weather and Climate (Weath)** | <u>Local weather characterization</u>: Weather within a localized area is determined by the combination of sunlight, wind, precipitation, and temperature in a specific region at a particular time. Observations and recorded measurements of these conditions can reveal patterns over various time scales, including daily, monthly, seasonal, and yearly trends. | SCI.EE.2.ESS.Weath-1 |
| **Reducing Impacts of Severe Weather (Impact)** | <u>Problems related to severe weather</u>: Forecasting severe weather allows people to prepare and respond effectively, since severe weather can cause significant harm, including loss of shelter, access to food, and power. To address such situations, it is crucial to clearly understand a severe weather-related problem by asking questions, making observations, and gathering information. | SCI.EE.2.ESS.Impact-1 |

## Physical Science

| Disciplinary Core Idea (DCI) Family | Grade K–2 Expectations | Essential Elements in This DCI Family |
|---|---|---|
| **Matter and Chemical Reactions (Matter)** | Matter classification: There are different kinds of matter, such as wood, metal, and water. Matter can change between solid and liquid states depending on temperature (e.g., butter, water). Matter is described and classified by its observable properties (e.g., color, texture), which help distinguish different substances based on their characteristics. | SCI.EE.2.PS.Matter-1 |
| **Interacting Forces (Forces)** | Pushes and pulls affecting movement (contact forces): The motion of objects is influenced by forces like pushes and pulls. These forces can vary in strength and direction and together can change an object's speed or direction, start or stop its movement, and keep it in place. Stronger pushes or pulls make objects move faster, and when objects collide, they exert forces on each other. | SCI.EE.2.PS.Forces-1 |
| **Energy (Energy)** | Evidence of energy: Energy manifests in various forms, such as moving objects, sound, light, and heat. Pushes and pulls with different strengths and directions provide evidence of energy. Energy manifests in daily life examples like a rolling marble, hearing or feeling a sound, feeling warmth from the Sun or a light source, and seeing light from a bulb or flame. | SCI.EE.2.PS.Energy-1 |

## Crosscutting Concepts

The table below presents descriptions of the seven crosscutting concepts (CCCs) from *A Framework for K-12 Science Education* (National Research Council, 2012) and used in the Next Generation Science Standards (NGSS; NGSS Lead States, 2013) in Grades K–2. The third column in the table lists which DLM Essential Elements for science include each CCC. Note that these concepts have not been reduced in depth, breadth, and complexity from the general education standards for use in the DLM Essential Elements for science, because that reduction was accomplished through the other dimensions (SEPs and DCIs). The text within this table is quoted from the National Science Teachers Association (NSTA) Matrix of CCCs (NSTA, 2013), which was developed from *A Framework for K–12 Science Education* (National Research Council, 2012) and NGSS Appendix G (NGSS Lead States, 2013). Use the information as a guide for your instructional needs.

| Crosscutting Concept (CCC) | Grade K–2 Expectations | Essential Elements That Use This CCC |
|---|---|---|
| **Patterns**<br><br>Observed patterns in nature guide organization and classification, and prompt questions about relationships and causes underlying them. | • Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. | SCI.EE.2.LS.Plant-1<br>SCI.EE.2.LS.EcoHlth-1<br>SCI.EE.2.LS.Group-1<br>SCI.EE.2.LS.Trait-1<br>SCI.EE.2.ESS.SolSys-1<br>SCI.EE.2.ESS.Earth-1<br>SCI.EE.2.ESS.Weath-1<br>SCI.EE.2.ESS.Impact-1<br>SCI.EE.2.PS.Forces-1 |

| Crosscutting Concept (CCC) | Grade K–2 Expectations | Essential Elements That Use This CCC |
|---|---|---|
| **Cause and Effect: Mechanism and Explanation**<br>Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. | • Events have causes that generate observable patterns.<br>• Simple tests can be designed to gather evidence to support or refute student ideas about causes. | SCI.EE.2.LS.Plant-1<br>SCI.EE.2.LS.Ecosys-1<br>SCI.EE.2.LS.Group-1<br>SCI.EE.2.ESS.Earth-2<br>SCI.EE.2.ESS.Impact-1<br>SCI.EE.2.PS.Forces-1 |
| **Scale, Proportion, and Quantity**<br>In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. | • Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).<br>• Standard units are used to measure length. | SCI.EE.2.PS.Forces-1 |
| **Systems and System Models**<br>A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. | • Objects and organisms can be described in terms of their parts.<br>• Systems in the natural and designed world have parts that work together. | SCI.EE.2.LS.EcoHlth-1 |
| **Energy and Matter: Flows, Cycles, and Conservation**<br>Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior. | • Objects may break into smaller pieces, be put together into larger pieces, or change shapes. | SCI.EE.2.LS.Ecosys-1<br>SCI.EE.2.PS.Matter-1<br>SCI.EE.2.PS.Energy-1 |
| **Structure and Function**<br>The way an object is shaped or structured determines many of its properties and functions. | • The shape and stability of structures of natural and designed objects are related to their function(s). | SCI.EE.2.LS.Org-1<br>SCI.EE.2.PS.Matter-1 |
| **Stability and Change**<br>For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. | • Some things stay the same while other things change.<br>• Things may change slowly or rapidly. | SCI.EE.2.ESS.Earth-2<br>SCI.EE.2.ESS.Impact-1 |

# References


National Research Council. (2012). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press. https://doi.org/10.17226/13165

NGSS Lead States. (2013). *Next generation science standards: For states, by states*. National Academies Press. https://doi.org/10.17226/18290

NSTA. (2013). *Matrix of crosscutting concepts in NGSS*. Retrieved December 13, 2023, from http://static.nsta.org/ngss/MatrixOfCrosscuttingConcepts.pdf