



Dynamic Learning Maps Science Dimensions for Grades 3–5

This document includes tables that show how the science dimensions are applied in the Dynamic Learning Maps® (DLM®) Essential Elements for science in Grades 3–5. 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).

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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 3–5. The third column in the table lists which Essential Elements include each SEP; those with links are [tested Essential Elements](#). 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 3–5 Expectations	Essential Elements That Use This SEP
Asking Questions and Defining Problems 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.	- Develop questions that can help determine cause-and-effect relationships. - Ask questions about how a simple design solution is used.	SCI.EE.5.LS.EcoHlth-2 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.Impact-1
Developing and Using Models 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 and compare models to represent amounts, relationships, and patterns in the natural world.	SCI.EE.5.ESS.SolSys-2 SCI.EE.5.ESS.Earth-1

Science and Engineering Practice	Grade 3–5 Expectations	Essential Elements That Use This SEP
Planning and Carrying Out Investigations 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 record data using tools to determine and support an explanation of a phenomenon. • Use observations and measurements to determine and describe cause-and-effect relationships.	SCI.EE.5.ESS.Earth-3 SCI.EE.5.PS.Matter-1 SCI.EE.5.PS.Forces-1 SCI.EE.5.PS.Forces-3 SCI.EE.5.PS.Energy-1
Analyzing and Interpreting Data 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.	• Represent and interpret data in tables or graphs to determine and identify patterns that indicate relationships. • Use data as evidence for constructing and supporting claims about cause-and-effect relationships.	SCI.EE.5.LS.Plant-1 SCI.EE.5.LS.Ecosys-1 SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.ESS.SolSys-1 SCI.EE.5.ESS.SolSys-3 SCI.EE.5.ESS.Weath-1 SCI.EE.5.PS.Matter-1 SCI.EE.5.PS.Matter-2 SCI.EE.5.PS.Forces-2

Science and Engineering Practice	Grade 3–5 Expectations	Essential Elements That Use This SEP
Using Mathematics and Computational Thinking 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.	• Use simple data tables and graphs to determine and describe relationships in the natural world. • Use measurements and simple mathematical representations to describe characteristics of the natural world.	SCI.EE.5.ESS.SolSys-3 SCI.EE.5.ESS.Earth-1 SCI.EE.5.PS.Forces-1
Constructing Explanations and Designing Solutions 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.	• Identify observations, information, data, or models to describe and explain processes or relationships in the natural world. • Use information to determine and explain cause-and-effect relationships in the designed world.	SCI.EE.5.LS.Org-1 SCI.EE.5.LS.Trait-1 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.SolSys-2 SCI.EE.5.ESS.Earth-3 SCI.EE.5.ESS.Impact-1 SCI.EE.5.PS.Forces-1

Science and Engineering Practice	Grade 3–5 Expectations	Essential Elements That Use This SEP
Engaging in Argument from Evidence 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.	• Identify relevant evidence to support a claim. • Use observations, information, data, or a model to support cause-and-effect claims.	SCI.EE.5.LS.Plant-1 SCI.EE.5.LS.Ecosys-1 SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.LS.Group-1 SCI.EE.5.ESS.SolSys-1 SCI.EE.5.ESS.Weath-1 SCI.EE.5.PS.Matter-2 SCI.EE.5.PS.Forces-2 SCI.EE.5.PS.Forces-3 SCI.EE.5.PS.Energy-1
Obtaining, Evaluating, and Communicating Information 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.	• Use observations, images, simple texts, and other media to understand problems and determine how the natural world works. • Use information (e.g., observations, images, graphs, maps) to answer questions and support scientific ideas.	SCI.EE.5.LS.Org-1 SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.LS.EcoHlth-2 SCI.EE.5.LS.Group-1 SCI.EE.5.LS.Trait-1 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.Earth-2

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 3–5. 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); those with links are [tested Essential Elements](#). 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 3–5 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 3–5 Expectations	Essential Elements in This DCI Family
Organisms: Structure and Function, Growth and Development (Org)	<u>Internal and external structures</u> : Plants and animals have both internal and external structures that are essential for their growth, survival, and behavior. These structures enable organisms to interact with their environment and perform functions necessary for life. <u>Life cycles and reproduction</u> : Organisms have unique and diverse life cycles. The reproduction stage is crucial for the survival of species.	SCI.EE.5.LS.Org-1
Plants: Cycling of Matter and Flow of Energy (Plant)	<u>Matter sources for plants</u> : Plants acquire materials from the environment for growth and repair. These materials come primarily from the air and water. <u>Energy sources for plants</u> : Plants use and store energy from sunlight for growth, repair, and other functions.	SCI.EE.5.LS.Plant-1

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Ecosystem: Cycling of Matter and Flow of Energy (Ecosys)	<u>Animal use of matter and energy:</u> Animals obtain matter and energy from eating other organisms. Some animals eat plants, while others consume animals that eat plants. Animals live in places where they can find enough food. Food provides animals with materials needed for body repair, growth, warmth, and motion. Food also stores energy for animal functions, supporting the overall survival of animals.	SCI.EE.5.LS.Ecosys-1
Ecosystem Health (EcoHlth)	<u>Healthy ecosystems:</u> In healthy ecosystems, there is a diversity of plants and animals. Organisms can find enough food, water, space, and a place to grow and increase their populations. Two examples of the interaction of plants and animals in ecosystems are pollination and seed dispersal, which are facilitated by wind, water, and animals. Both processes ensure that plants can reproduce and thrive. <u>Relationships between living things and habitats:</u> Different organisms live in habitats that provide the resources and conditions for their survival needs, including food, water, reproduction, and space. Living things can impact the physical characteristics of their habitats. In addition, changes in habitats affect the populations that live there. These impacts can be positive or negative.	SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.LS.EcoHlth-2

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Group Survival Behavior (Group)	<u>Light and sound use in animals:</u> Animals, including humans, use their senses to explore the world around them, guiding their actions and behaviors. They receive light and sound from the environment. Sound can cause matter to vibrate, and vibrating matter can produce sound (e.g., the strings of a guitar). Objects become visible when light reflects off their surfaces and enters the eyes. Animal brains process light and sound to interpret the environment and respond with survival behaviors. These sensory inputs are crucial for animals to navigate their environments, find food, avoid predators, and engage in other essential activities. <u>Communication among animals:</u> Animals rely on their senses to share information with group members. Through visual cues, sounds, and other sensory signals, animals convey messages that are vital for their survival and social interactions. For example, animals might use sounds to alert others to danger or visual signals to indicate the presence of food.	SCI.EE.5.LS.Group-1
Traits of Organisms (Trait)	<u>Trait inheritance:</u> Offspring inherit a combination of traits from their biological parents, resulting in organisms that look similar to their parents. However, individuals of the same kind (e.g., siblings) exhibit unique characteristics because they inherited a different set of genetic information. Therefore, plants and animals display variations in their traits (this is also called a phenotype), which contribute to diversity within a species and support adaptation and survival in their environments.	SCI.EE.5.LS.Trait-1

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Human Impacts on Ecosystems (Human)	<u>Humans are members of ecosystems:</u> Humans live in diverse ecosystems, each providing essential resources like food, water, and shelter. Human activities have a profound impact on ecosystems, both positive and negative. The use of natural resources for energy and fuels affects the environment, and changes in habitats can significantly affect the organisms living there. <u>Solving human-caused problems:</u> By understanding environmental problems through asking questions, making observations, and gathering information, individuals can identify ways to reduce negative impacts and enhance positive ones. This allows for the development of strategies to protect and modify ecosystems, ensuring their health and sustainability.	SCI.EE.5.LS.Human-1



Earth and Space Science

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Earth in the Solar System (SolSys)	<u>Characteristics of The Sun:</u> The Sun is a star, which gives off light and transfers energy to Earth, making it the largest and brightest star visible in the sky due to its proximity. While the Sun is one of many stars that can be seen, other stars appear dimmer because they are farther away. The Sun provides light during the daytime, and its apparent movement across the sky, rising in the morning and setting in the evening, is a daily pattern observed from Earth. <u>Patterns in daylight and nighttime:</u> Earth rotates on its axis, an imaginary line across the planet, resulting in the cycle of daytime and nighttime. This rotation completes one full spin every 24 hours, creating the 24-hour cycle. The part of Earth facing the Sun experiences daylight, while the part facing away experiences darkness. Additionally, the number of daylight hours varies throughout the year, leading to seasonal patterns, such as longer daylight hours in summer and shorter ones in winter.	SCI.EE.5.ESS.SolSys-1 SCI.EE.5.ESS.SolSys-2 SCI.EE.5.ESS.SolSys-3

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Earth Systems (Earth)	<u>Earth’s water distribution:</u> Water is distributed across Earth in various forms and locations. Nearly all of Earth’s water is found in the ocean as salt water, while the amount of fresh water is limited and primarily located in streams, lakes, wetlands, and glaciers. Depending on temperature, water exists in different states—solid, liquid, or gas—and can be found almost everywhere, including as vapor in the air, droplets in clouds or flowing over land, and ice or snow sitting on the surface. <u>Weathering processes:</u> Water, along with ice, wind, organisms, and gravity, plays a significant role in weathering and erosion. These forces break rocks, soil, and sediments into smaller particles and move them around, leading to changes in the landscape. Examples of these processes include the formation of sand dunes, potholes, gullies, creeks, terracing, mudslides, and rivers carving out canyons.	SCI.EE.5.ESS.Earth-1 SCI.EE.5.ESS.Earth-2 SCI.EE.5.ESS.Earth-3
Weather and Climate (Weath)	<u>Predictions on local weather:</u> Weather consists of local events in the atmosphere, including wind, sunlight, precipitation, and temperature. By observing and measuring these conditions, daily patterns can be identified, which help in making and supporting predictions about future weather.	SCI.EE.5.ESS.Weath-1
Reducing Impacts of Severe Weather (Impact)	<u>Severe weather hazard mitigation:</u> Severe weather can cause harmful effects like unpassable roads, building damage, and restricted power and communication systems. Natural hazards such as floods, tornadoes, blizzards, and mudslides cannot be prevented, but humans can take steps to mitigate their impacts. To address these hazards, it is essential to approach them as problems to be solved through engineering. Understanding the problem involves asking questions, making observations, and gathering information. Solutions can include lightning rods, wind-resistant roofs, advanced warning systems, and community emergency plans.	SCI.EE.5.ESS.Impact-1

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Matter and Chemical Reactions (Matter)	<u>Properties of substances and phase change</u>: Observations and measurements of properties such as mass, volume, size, and temperature can be used to describe matter and characterize physical changes (i.e., a change that does not alter the composition of the particles of matter.) One example is phase change (also named change of state), in which a material changes from one state to another. When heat is added, a solid melts or a liquid boils. When heat is removed from a liquid substance, it can solidify. <u>Particle nature of matter</u>: Matter has mass, takes up space, and is composed of particles too small to be seen. Matter is observed as solid, liquid, and gas. We can indirectly observe the particle nature of matter in different phenomena; for instance, the way a closed syringe will not compress all the way, the increase of pressure in an inflating balloon, or even in the creation of bubbles. <u>Conservation of matter</u>: Matter can change in different ways, for example, in a phase change (when heat is added or removed) or when two or more substances are mixed. Regardless of the change, matter is never created or destroyed—it is always conserved—even if it seems to appear or disappear.	SCI.EE.5.PS.Matter-1 SCI.EE.5.PS.Matter-2

Disciplinary Core Idea (DCI) Family	Grade 3–5 Expectations	Essential Elements in This DCI Family
Interacting Forces (Forces)	<u>Balanced and unbalanced forces:</u> Forces can act on an object from multiple directions and strengths, such as when objects in contact exert forces (push or pull) on each other. When forces are balanced, there is no change in an object’s motion, whether at rest or moving at a constant speed. Unbalanced forces can change an object's motion by speeding it up, slowing it down, stopping it, or changing its direction. Balanced and unbalanced forces can affect the movement of an object (e.g., its speed and direction). <u>Noncontact forces:</u> Some forces (electric, magnetic, and gravitational forces) act on objects without direct contact. These forces can pull objects together (“attraction”) or push them apart (“repulsion”). Gravitational force (gravity) pulls all objects on Earth's surface downward toward the center of the planet. Gravity influences the movement and behavior of objects and maintains the stability of Earth's environment.	SCI.EE.5.PS.Forces-1 SCI.EE.5.PS.Forces-2 SCI.EE.5.PS.Forces-3
Energy (Energy)	<u>Energy attributes and perception:</u> Energy can be defined as the ability to do work, enabling things to change, grow, and move. It exists in various forms, such as moving objects, sound, light, and heat. In such cases, energy is transferred from one place (or object) to another. The amount of energy transferred can be inferred from how much sound is heard, light is seen, heat is felt, and how an object moves. Sound can make matter vibrate (e.g., in a musical instrument) and louder sounds possess more energy than softer sounds. Light travels in a straight path from its source, with brighter light having more energy than dimmer light. Heat flows from warmer objects to cooler ones, with hot objects having more heat energy than cold ones.	SCI.EE.5.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 3–5. The third column in the table lists which DLM Essential Elements for science include each CCC; those with links are [tested Essential Elements](#). 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 3–5 Expectations	Essential Elements That Use This CCC
Patterns Observed patterns in nature guide organization and classification, and prompt questions about relationships and causes underlying them.	- Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products. - Patterns of change can be used to make predictions. - Patterns can be used as evidence to support explanation.	SCI.EE.5.LS.Trait-1 SCI.EE.5.ESS.SolSys-2 SCI.EE.5.ESS.SolSys-3 SCI.EE.5.ESS.Weath-1 SCI.EE.5.PS.Forces-1 SCI.EE.5.PS.Forces-2 SCI.EE.5.PS.Forces-3

Crosscutting Concept (CCC)	Grade 3–5 Expectations	Essential Elements That Use This CCC
Cause and Effect: Mechanism and Explanation 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.	• Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship.	SCI.EE.5.LS.Plant-1 SCI.EE.5.LS.Ecosys-1 SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.LS.EcoHlth-2 SCI.EE.5.LS.Group-1 SCI.EE.5.LS.Trait-1 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.SolSys-1 SCI.EE.5.ESS.SolSys-2 SCI.EE.5.ESS.Earth-3 SCI.EE.5.ESS.Weath-1 SCI.EE.5.ESS.Impact-1 SCI.EE.5.PS.Forces-1 SCI.EE.5.PS.Forces-2 SCI.EE.5.PS.Forces-3
Scale, Proportion, and Quantity 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.	• Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods. • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.	SCI.EE.5.ESS.SolSys-1 SCI.EE.5.ESS.ESS-Earth-1 SCI.EE.5.PS.Forces-1

Crosscutting Concept (CCC)	Grade 3–5 Expectations	Essential Elements That Use This CCC
Systems and System Models A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.	• A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.	SCI.EE.5.LS.EcoHlth-1 SCI.EE.5.LS.EcoHlth-2 SCI.EE.5.LS.Group-1 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.SolSys-2
Energy and Matter: Flows, Cycles, and Conservation Tracking energy and matter flows into, out of, and within systems helps one understand their system’s behavior.	• Matter is made of particles. • Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems. • Energy can be transferred in various ways and between objects.	SCI.EE.5.LS.Plant-1 SCI.EE.5.LS.Ecosys-1 SCI.EE.5.ESS.Earth-2 SCI.EE.5.PS.Matter-1 SCI.EE.5.PS.Matter-2 SCI.EE.5.PS.Energy-1
Structure and Function The way an object is shaped or structured determines many of its properties and functions.	• Different materials have different substructures, which can sometimes be observed. • Substructures have shapes and parts that serve functions.	SCI.EE.5.LS.Org-1
Stability and Change For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.	• Change is measured in terms of differences over time and may occur at different rates. • Some systems appear stable, but over long periods of time will eventually change.	SCI.EE.5.LS.EcoHlth-2 SCI.EE.5.LS.Human-1 SCI.EE.5.ESS.Earth-3 SCI.EE.5.ESS.Impact-1 SCI.EE.5.PS.Matter-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>