

Progression of Crosscutting Concepts in Grades K–5

Appendix F, Ca Science Framework, Adapted from the NGSS Appendix G by the California Science Project.

1. *Patterns.*

Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Grades K–2

Students recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Grades 3–5

Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.

2. *Cause and effect: Mechanism and explanation.*

Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

Grades K–2

Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.

Grades 3–5

Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity might or might not signify a cause and effect relationship.

3. *Scale, proportion, and quantity.*

In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

Grades K–2

Students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.

Grades 3–5

Students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

4. *Systems and system models.*

Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

Grades K–2

Students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.

Grades 3–5

Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.

5. Energy and matter: Flow, cycles and conservation.

Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Grades K-2

Students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.

Grades 3-5

Students learn matter is made of particles, and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.

6. Structure and function.

The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

Grades K-2

Students observe the shape and stability of structures of natural and designed objects are related to their function(s).

Grades 3-5

Students learn different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.

7. Stability and change.

For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Grades K-2

Students observe some things stay the same while other things change, and things may change slowly or rapidly.

Grades 3-5

Students measure change in terms of differences over time, and observe that change may occur at different rates. Students learn some systems appear stable, but over long periods of time they will eventually change.