Grades 3-5 NGSS CCCs[1]

PATTERNS In 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 use these patterns to make predictions.

- **Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1).**
- **Similarities and differences in patterns can be used to sort, and classify designed products. (4-PS4-3)**
- **Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. (4-PS4-1)**
- **Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2)**
- **Patterns of change can be used to make predictions (3-LS1-1), (3-ESS2-1), (3-ESS2-2), (3-PS2-2)**
- **Patterns can be used as evidence to support an explanation. (4-ESS1-1), (4-ESS2-2)**

CAUSE AND EFFECT In 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.

- **Cause and effect relations are routinely identified. (3-PS2-1), (4-PS4-2)**
- **Cause and effect relationships are routinely identified and used to explain change.**
- **(3-LS2-1), (3-LS3-2), (3-LS4-2), (3-LS4-3), (4-ESS3-1), (5-PS2-1)**
- **Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1), (3-PS2-3), (4-ESS2-1), (4-ESS3-2), (5-PS1-4)**
- **Events that occur together with regularity might or might not be a cause and effect relationship.**

SCALE, PROPORTION, AND QUANTITY In grades 3-5, students recognize that 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.

- **Natural objects exist from the very small to the immensely large. (5-PS1-1), (5-ESS1-1)**
- **Observable phenomena exist from very short to very long time periods. (3-LS4-1)**
- **Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-ESS2-2), (5-PS1-2), (5-PS1-3)**

[1] Items in grey have no citations in Grades 3-5 Performance Expectations.

SYSTEMS AND SYSTEM MODELS In grades 3-5, students understand that a system is a group of related parts that make up a whole and carry out functions its individual parts cannot. They can also describe a system in terms of its parts and their interactions.

- **A system can be described in terms of its components and their interactions. (3-LS4-4), (4-LS1-1), (4-LS1-2), (5-LS2-1), (5-ESS2-1), (5-ESS3-1)**
- **A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.**

ENERGY AND MATTER In grades 3-5, students learn matter is made of particles and that 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 by recognizing that the total weight of substances does not change.

- **Matter is transported into, out of, and within systems. (5-LS1-1)**
- **Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4), (5-PS3-1)**

STRUCTURE AND FUNCTION

STABILITY AND CHANGE

Dr. Art's Recommendations re Grade Span 3-5 CCCs

NOTE: Please read these grade span recommendations before reading the recommendations for a specific 3-5 grade.

The Grade 3-5 span features a sequenced transition away from the K-2 strong focus on the two CCCs of **Patterns** and **Cause and Effect**. Grade 3 retains the emphasis, but Grade 4 reduces it to about 50%. In Grade 5, less than 25% of the citations are on these two CCCs.

The main **Cause and Effect** CCC bullet in Grades 3-5 states: "Cause and effect relationships are routinely identified, tested, and used to explain change." One important Grade 3-5 **Cause and Effect** CCC bullet is not cited at all in the grade span. It states that "events that occur together with regularity might or might not be a cause and effect relationship." Grades 4 and 5 should include differentiating between causation and correlation. Sometimes events happen in the same time and/or same place, but neither of the events causes the other one. Their connection could be a complete coincidence or it could be that something else is causing both of them to happen. In those circumstances, we consider that the connection between the two events is a correlation, not a causation relationship.

Grades 4 and 5 extend the use of **Systems and System Models** to develop models that describe ways that ecosystems function (Grade 4) and Earth systems interact and function (Grade 5). This kind of system analysis is absolutely essential for analyzing and understanding environmental issues and local ecosystems.

Grades 4 and 5 provide multiple opportunities to combine the Science and Engineering Practice of developing and using models with the CCC of **Systems and System Models**. There is one important Grade 3-5 **Systems and System Models** CCC bullet that is not cited at all in the grade span. It states that "a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot." Grades 4 and 5 instruction and learning can include ecosystem examples and Earth System examples that illustrate how a system has functions and properties that none of its individual parts have.

Systems generally have properties that are qualitatively very different from the system's parts. Whole system properties help explain many diverse phenomena across all science contexts. For example, the function of a system is an example of a property of the whole system that none of its parts have. There are other significant whole system properties that are not system functions. Examples of such system properties include fuel efficiency of a car, the safety of a car, a person's body temperature, and the climate of a region.

Grade 4 introduced a strong focus (four citations) on energy transfers related to the CCC of **Energy and Matter**. Grade 5 has one citation with respect to energy transformations (uses of energy in animal food and its origin in plant capture of sunlight). Grade 5 also uses the contexts

of photosynthesis and food webs to focus on the flows of matter into, within and out of systems. These contexts provide important opportunities to connect the CCC of **Systems and System Models** with the CCC focused on the flows of **Energy and Matter**. Following the flows of energy and matter has the greatest value in combination with systems modeling. When students develop, modify and create their own system models, they can deepen their understanding of these flows. This experience will also increase their appreciation of the explanatory power of models in general, and specifically with respect to tracking the flows and transformations of matter/energy.

Grade 5 begins to provide a foundation for the CCC of **Scale, Proportion, and Quantity**. This CCC becomes increasingly important in middle school and high school. Many features of our universe exist across an unimaginably wide spectrum of magnitudes ranging from the practically invisible to the overwhelmingly immense. Upper elementary school is the appropriate starting point for this lifelong journey of understanding scale and its implications.

The CCCs and their bullet statements aim to provide important functions with respect to investigating and reasoning about phenomena. CCCs can function as powerful tools to guide investigations, analyses, and understanding. However, the number of CCCs and their bullet sentences do pose a danger of becoming names and factual statements that teachers and students repeat in communicating about the CCCs rather than actually using the CCCs as tools.

One potentially useful way to guide the use of CCCs as tools is to frequently ask oneself and others why we should care about using/citing a particular CCC or its bullet statement. Why do I care about how the energy is flowing or why did I choose a particular CCC in investigating a new phenomenon? If we can convincingly explain how the CCC helped, then we are probably using it effectively, and not just naming it and/or talking superficially about the CCC.

