SC DEPARTMENT OF EDUCATION

Bundling Guide for Grade 6 Science

Office of Assessment and Standards

Purpose and Use

This document is intended to be a guide to provide examples of ways Performance Expectations (PEs) could be bundled. For this purpose, a bundle as defined by Pruit (2014), is, "a set of PEs that provide students with coherent connections among concepts within and across disciplines." This document is not intended to be read from cover to cover, but to be used, when needed, to support teacher professional learning and curriculum decisions. This is not intended for student use, and thus is not written in student-friendly language. This is not a curriculum or a means to limit instruction in the classroom. The bundles presented in this guide are not ordered for instruction. Although each PE states a dedicated Science and Engineering Practice (SEP) and Crosscutting Concept (CCC), students will need to use the whole range of SEPs and CCCs to achieve success by the end of instruction.

The bundles in this document do not represent the only way the PEs can be bundled. PEs bundled together may change depending upon the selected anchoring phenomenon that students are working to explain. The bundles presented in this guide were developed using an iterative process informed by the work of Krajick and colleagues (2014). This process is summarized in the steps below:

1. Review bundles that already exist.
2. Build bundles around an anchoring phenomenon.
    a. The "Example anchoring phenomena to support 3D instruction" provided in this resource is just that, an example. There are myriad phenomena to support 3D instruction, and different phenomena may be more appropriate for different learning contexts.
3. Explore and look for unexpected relationships among the PEs, including bundling across disciplines (Earth and Space Science, Life Science, Physical Science) when appropriate. This can include identification of PEs that are only partially met in the bundle.
    a. PEs within a bundle marked with an asterisk (*) share an authentic connection with the bundle but may not fully met.
4. Make sure each PE in the grade/course is found in at least one bundle.

Energy and Matter

Matter and energy are the fundamental building blocks of the universe. Matter, defined as anything that has mass and occupies space, consists of particles in constant motion. Depending on the matter—whether it's solid, liquid, or gas—these particles move in different ways. There is always thermal energy present in matter that's above absolute zero temperature. Thermal energy makes those particles move, whether they are vibrating in a solid or bouncing around in a gas. When people use the term "heat" in everyday conversation, they might mean both the energy that makes particles move inside something and the way that energy moves from one thing to another, like when you feel warmth from a fire or a hot stove. But in science, "heat" specifically refers to how energy is exchanged between things that are at different temperatures. This movement of energy can cause changes in matter, like turning ice into water or water into steam. Understanding how heat works involves knowing about insulators and conductors. Insulators, like barriers, slow down the movement of heat energy, while conductors help heat energy move more easily. These concepts help scientists and engineers design solutions such as better building materials or more efficient appliances to meet the needs of society.

PEs aligned to this bundle:

- 6-PS1-4. Develop and use a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- 6-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- 6-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- 6-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.*

Example anchoring phenomena to support 3D instruction:

- Insulating device
- Solar cooker
- Non-powered ways to keep a house cool

Earth's Weather and Climate

Water moves constantly through a cycle, circulating between the land, ocean, and atmosphere through processes such as transpiration, evaporation, condensation, and precipitation, as well as downhill flows on land. The way water moves in the atmosphere, influenced by winds, land shapes, and ocean temperatures, plays a big role in local weather patterns. Weather and climate, in general, are shaped by complex interactions involving sunlight, the ocean, the air, ice, landforms, and living things. These factors change depending on latitude, altitude, and the local geography, all impacting the flow patterns of the ocean and atmosphere. Due to the Earth's tilted axis, some parts of the planet get more direct sunlight at certain times of the year (unequal heating), which is why there are seasons and different climates around the globe.

PEs aligned to this bundle:

- 6-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- 6-ESS2-5. Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- 6-ESS2-6. Develop and use models to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- 6-PS1-4. Develop and use a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.*
- 6-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.*
- 6-ESS3-2. Analyze and interpret data on natural hazards to identify patterns, which help forecast future catastrophic events and inform the development of technologies to mitigate their effects.*

Example anchoring phenomena to support 3D instruction:

- Surprise South Carolina, SNOW! (November 1, 2014)
- Atmospheric River storms (connection to 6-ESS3-2)

Natural Hazards

Some natural disasters, like volcanic eruptions and severe weather, often show warning signs before they occur, making them somewhat predictable. However, others, such as earthquakes, can happen suddenly without any warning, which currently makes them hard to predict. By studying past events and understanding the geological forces at work in the Earth, scientists can make predictions about where and when future disasters might happen. Waves, whether they are electromagnetic or mechanical, share common traits. A basic wave has a repeating pattern characterized by its wavelength, frequency, and amplitude. Geologists study the reflection, refraction, and speed of seismic waves to monitor earthquake activity.

PEs aligned to this bundle:

- 6-ESS3-2. Analyze and interpret data on natural hazards to identify patterns, which help forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- 6-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.*
- 6-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.*
- 6-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.*

Example anchoring phenomena to support 3D instruction:

- Any natural hazard and how it in monitored/forecasted/mitigated

Changes to Earth Over Time

Earth processes are driven by the flow of energy and cycling of matter within and between Earth's systems. This energy mainly comes from the Sun and Earth's internal heat. Energy flows and matter cycles, causing changes in Earth's materials and living things. These processes occur on different scales, from tiny to global, and over different time frames, from split seconds to billions of years. These interactions have shaped Earth's past and will continue to shape its future. Plate tectonics is the main theory that explains both past and present movements of land masses and rocks on Earth's surface, providing a framework for understanding Earth's geological history. The geologic time scale, built from studying the fossil record and rock layers, helps organize Earth's history. However, it's important to remember that while geologists can figure out the order of events using rock layers and fossils, they cannot pinpoint exact dates.

PEs aligned to this bundle:

- 6-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- 6-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- 6-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- 6-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
- 6-ESS3-2. Analyze and interpret data on natural hazards to identify patterns, which help forecast future catastrophic events and inform the development of technologies to mitigate their effects.*

Example anchoring phenomena to support 3D instruction:

- Supercontinents (e.g., Pangea, Laurasia, Gondwanaland, Tethys)
- Peach Tree Rock

Sensing Light and/or Sound

When light interacts with an object, it can either bounce off (reflect), be taken in (absorbed), or pass through (transmitted), depending on the object's material and the color of the light. Light typically travels in straight lines, but when it moves between different transparent materials (like air and water, or air and glass), its path bends. This bending is what makes lenses and prisms work. Waves, whether electromagnetic or mechanical (sound, water), share common traits. A basic wave has a repeating pattern characterized by its wavelength, frequency, and amplitude. Our senses have receptors that respond to different types of input, like light or sound, sending signals through nerve cells to the brain. The brain then processes these signals, leading to immediate reactions or memories.

PEs aligned to this bundle:

- 6-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.*
- 6-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.*

Example anchoring phenomena to support 3D instruction:

- Why do we see lightening before we hear thunder?
- Adolescent noise-induced hearing loss (sound focused)
- One-way mirror (light focused)

Cells and Living Systems

Cells are the smallest unit of life and all living things are made of cells. An organism can be made of just one cell (unicellular) or many cells with different functions (multicellular). Inside cells, there are specialized structures that have specific functions. In complex organisms made of many cells, the body works as a system with different interacting subsystems. These subsystems are groups of cells that work together to form specialized tissues and organs. Sense receptors (external and/or internal) react to different stimuli (electromagnetic, mechanical, chemical), sending them as messages along nerve cells to the brain. In the brain, these messages are processed, leading to quick responses or memories.

PEs aligned to this bundle:

- 6-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- 6-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.
- 6-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- 6-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.*

Example anchoring phenomena to support 3D instruction:

- Brumation
- Infectious disease (especially viral)
- Climbing plants

References

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