TASK TEMPLATE STRUCTURE

After <u>Science and Engineering Practice 1 (to obtain/generate/synthesize information)</u> **about a phenomenon,** <u>Science and Engineering Practice 2 (produce something with the info)</u> **to explain the phenomenon** *using the Cross-Cutting Concept (CCC) as the sense-making lens*.

The task template structure includes the pairing of two science and engineering practices to show the role of the science and engineering practice both ***to process*** and ***to produce*** in order to make sense of scientific phenomena and demonstrate understanding. Highlighting the ***CCC as the sense-making lens*** is intended to ensure the essential role of this dimension in the resulting task. Thus, the task template structure provides intentional focus for 3 dimensional task design: *How do I want students to make sense of a phenomenon (or move their thinking along a sense-making continuum)? What will they process, produce, and what conceptual lens will help them understand a deeper structure for sense- making?*

While the CCCs are incredibly useful for developing understanding of the mechanisms that explain any particular scientific phenomenon, it is a deep understanding of *how the CCC is used for sense-making* that is *transferable* across scientific thinking. Using the science and engineering practice to process data and to produce artifacts useful for explaining scientific phenomena while focused through the lens of a CCC reveals the deep structure of scientific sense-making. The skills and conceptual thinking developed through experiences requiring this focus will be transferable across various scientific disciplines and scientific phenomena. Providing these 3 dimensional experiences in appropriately increasing sophistication throughout the K-12 experience will result in the critical thinkers and problem solvers our economy requires.

In order to ensure that the task is grade level appropriate in all 3 dimensions, it is essential to use resources that provide insight into the learning progressions for the 3 dimensions along the K-12 continuum in designing the task. This will also be essential in developing success criteria for the task. These resources include: *A Framework for K-12 Science Education*, Appendices E, F, & G of the NGSS, and the *Evidence Statement Templates* created by the NGSS writers used to develop the PE Evidence Statements through the lens of the SEP.

Example: Suppose I want to evaluate my middle school students' ability to explore the factors that affect the growth of organisms, specifically plants (LS1.B). Near the beginning of my instructional sequence, I might use a task template such as this:

After analyzing and interpreting data **about the varying height of Red Oak trees for 3 different climate regions in the US**, develop investigable questions *that might identify causal relationships that would influence* the **variance of average tree** height *based on patterns in the data.*

After analyzing and interpreting data	This first science and engineering practice is used to process information that should provide stimulus for engagement with science and engineering practice 2. Details for how students will engage with this science and engineering practice should be defined in the task based on grade band learning progressions for the science and engineering practices.
Varying height of Red Oak trees for 3 different climate regions in the US	This phenomenon has the DCI embedded. Although not explicitly stated, DCIs that I want my students to use are factors that affect the growth of plants, components required for photosynthesis, and variations in climate due to geographical location. Depending on my students' experiences, I may have to provide more or less support for these DCIs.
Develop investigable questions	This second science and engineering practice is used to produce something that will lead to making sense of the phenomenon. Details for how students will engage in this practice should be defined in the task based on grade band learning progressions for the science and engineering practices.
That might identify causal relationships that would influence…based on patterns in the data.	At this grade level, students use patterns to identify potential causal relationships according to Appendix G of the NGSS; this template is hardwired to use the CCC of patterns appropriately for sense-making.

Many details about the task are not defined at this point; however, the role of the task template is not to completely define the task, but to provide a structure to focus thinking toward a 3-dimensional experience. I feel I have a good understanding of next steps in developing the task, as well as a tool to keep me focused on creating an experience that requires 3 dimensional sense- making of this phenomenon.

Later in my instructional sequence, I might use a task template such as this:

After <u>obtaining and evaluating information</u> **about the factors that affect the height of mature Red Oak trees**, <u>develop an argument for the cause</u> **of the variance of average tree height for the 3 climate regions**, *using a system model to show the role of the transfer of matter and energy in tree growth and the impact that different climate regions have on the inputs to the model* <u>as support for your argument</u>.

After <u>obtaining and evaluating information</u>	This first science and engineering practice is used to process information that should provide stimulus for engagement with science and engineering practice 2, the phenomenon, and the CCC. Details for how students will engage with the science and engineering practice should be defined in the task based on grade band learning progressions for the science and engineering practice.
Factors that affect the height of mature Red Oak trees for the 3 climate regions	The phenomenon has the DCI embedded. Although not explicitly stated, DCIs that I want my students to use are factors that affect the growth of plants, components required for photosynthesis, and variations in climate due to geographical location. Aspects of these DCIs may be obtained through science and engineering practice 1 in this task.
<u>Develop an argument for the cause</u>	This second science and engineering practice is used to produce something that will demonstrate understanding of the phenomenon by developing an argument for why the phenomenon occurs as it does. Details for how students will engage with this science and engineering practice should be defined in the

	task based on grade band learning progressions for the science and engineering practice
using a system model to show the role of the transfer of matter and energy in tree growth and the impact that different climate regions have on the inputs to the model	At this grade level, students use system models to evaluate what happens within the system based on inputs and outputs of matter and energy. This template is hardwired to use the CCC of systems thinking through modeling appropriately for sense-making within the task.

Similar to the first example, all details about the task are not defined, but the desired intent of the task, its 3 dimensionality, and a path forward for developing the task seems clear. This second example also shows how different sense-making tools are used to explore the same phenomenon. This task is requires higher order thinking than the first task, and in fleshing out this task I may find that other SEPs or CCCs might be used for sense-making. Nevertheless, my intent at this point in task development is a focus on 3 dimensional thinking expressed by the task template as written.