Integrating Science Practices Into Assessment Tasks

The Next Generation Science Standards call for the development of "three-dimensional science proficiency," that is, students' integrated understanding of disciplinary core ideas, science and engineering practices, and crosscutting concepts. Assess three-dimensional science proficiency requires *multicomponent tasks* (National Research Council, 2014). These are a set of prompts linked by a common scenario, phenomenon, or engineering design challenge.

Developing three-dimensional science assessments is challenging. Most current assessments focus on testing students' knowledge of science facts. Few focus on having students apply their understanding of disciplinary core ideas in the context of engaging in a science or engineering practice. Fewer still make connections to crosscutting concepts.

The "task format" templates included in this document are tools to help teachers and district leaders design three-dimensional assessment tasks. They are based on the language of *A Framework for K-12 Science Education* and the NGSS Evidence Statements, focusing on all eight science practices and two engineering practices. These task formats represent different ways that assessment tasks can be written to engage students in science practice. They do not specify precisely which disciplinary core ideas are to be integrated into tasks, which would be determined by the team designing the assessments.

The different formats get at different aspects of a given science and engineering practice. Some formats are likely to be more demanding cognitively for students than others. The idea of presenting multiple formats is to give task developers a sense of the range of tasks that can be written. A good "test" of a student's grasp of a particular practice, in the context of a disciplinary core idea and crosscutting concept, would be comprised of multiple tasks and draw on multiple formats.

How to Read a Template Task

Scenario presented to students

Format	Task Requirements for Students
1	Present students with a textual description of an investigation of an observable phenomenon, *then* Ask students to formulate a scientific question relevant to Investigating that phenomenon.

Task(s) for students to complete

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Potential Task Formats: Constructing Explanations (Science)

Relevant definitions

- "Scientific explanations are accounts that link scientific theory with specific observations or phenomena... Very often the theory is first represented by a specific model for the situation in question, and then a model-based explanation is developed." (NRC Framework, 2012).

Format	Task Requirements for Students
1	Present students with a question about how a phenomenon works and related observations (firsthand or from a variety of media sources), *then* Ask students to interpret the observations in order to answer the question, *and* Answer the question by producing an explanation (using words and/or drawings), *and* Give reasons for how the observations support their answer to the question.
2	Describe a phenomenon to students along with some related qualitative or quantitative data/ observations, *then* Ask students produce an explanation about the causal mechanism for the phenomena—at their level of scientific knowledge, *and* Show how their interpretation of the data is evidence for their explanation.
3	Describe a phenomenon to students along with a related set of evidence and an explanation that includes multiple scientific principles, *then* Ask students to say which pieces of evidences support or contradict particular components of the explanation.
4	Present students with a model or representation of an observable scientific process or system, *then* Ask students to write a model-based explanation for a relevant phenomenon.
5	Describe a phenomenon and present students with a causal explanation of it, *then* Ask students to identify gaps or weaknesses in how it scientifically explains the phenomenon based on their level of scientific understanding.
6	Present students with data from independent and dependent variables in an investigation, *then* Ask them to construct a quantitative and/or qualitative claim about how the independent variables relate to the dependent variables.
7	Describe a phenomenon and present students with a range of evidence obtained from a variety of sources (empirical investigations, models, theories, simulations, peer review), *then* Ask students to construct a causal explanation for the phenomena, *and* Describe how the evidence relates to the mechanisms or principles they have included.
8	Present students with an initial explanation for a phenomenon and new data or a model that would require a revision of the initial explanation, *then* Ask students to revise the explanation for the phenomenon, *and* Describe how their revised explanation accounts for the new data or model.