STEM TEACHING TOOL #30

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

BY KATIE VAN HORNE, WILLIAM R. PENUEL, AND PHILIP BELL | VERSION 2.0
MARCH 2016, UPDATED FEBRUARY 2018

Potential Task Formats: Planning and Carrying Out Investigations (Science)

Relevant definitions

- An *investigation plan* encompasses a description of data sources and measures to be used, procedures for observing and recording data, and, where relevant, a plan for how observations will be sampled.
- A *data source* refers to a type of data only ("We would need data on the size of the white-colored moth population" or "We would need data comparing the color of tail feathers in birds in the mountains and in the city").

Format	Task Requirements for Students
1a	Present students with a scenario that describes a phenomenon using text, images, video, and/or data to be explained, *then* Ask students to generate a research question to investigate the phenomenon with resources available in the classroom (or with a given list of resources), Ask students to evaluate different ways of observing or measuring a phenomenon to determine which will best answer the question asked, Ask students to identify the variables needed in the investigation to explain the phenomenon, Ask students to characterize each variable as dependent or independent and to explain any variables to be controlled and why, *and* Ask student to make observations/measurements to produce data.
1b	Present students with a scientific model to be tested, *then* Ask students to generate a research question to investigate the phenomenon with resources available in the classroom (or with a given list of resources), Ask students to evaluate different ways of observing or measuring a phenomenon to determine which will best answer the question asked, Ask students to identify the variables needed in the investigation to explain the phenomenon, Ask students to characterize each variable as dependent or independent and to explain any variables to be controlled and why, *and* Ask student to make observations/measurements to produce data.
2	Present students with a scenario that describes a phenomenon using text, images, video, and/or data, a scientific question, and an investigation plan, *then* Ask students to describe how the data will be collected precisely, *and* Ask students to how much data is needed to be reliable.
3a	Present students with a scenario that describes a phenomenon using text, images, video, and/or data to be explained and a scientific question, *then* Ask students to create an investigation plan to study the scientific phenomenon that includes independent and dependent variables and controls (when applicable), what tools will be used to gather data, and how observations/measurements will be recorded, Ask students to describe how the investigation will generate relevant evidence for answering the scientific question, *and/or* Ask students to conduct the investigation and collect data to serve as evidence to answer the scientific question.

3b	Present students with a scientific model, *then* Ask students to create an investigation plan to test the model that includes independent and dependent variables and controls, when applicable, what tools will be used to gather data, and how observations/measurements will be recorded, Ask students to describe how the investigation will generate relevant evidence for testing the model, Ask students to describe the pattern of evidence that would support the model, *and/or* Ask students to conduct the investigation and collect data to serve as evidence to evaluate the model.
4	Present students with a scenario that describes a phenomenon using text, images, video, and/or data and an engineering problem to be solved and a possible design solution, *then* Ask students to design an investigation to test the design solution that considers environmental, social, and personal impacts of the investigation.
5	Present students with a scenario that describes a phenomenon using text, images, video, and/or data to be explained a scientific question, and an investigation plan, *then* Ask students to consider possible confounding variables or effects and evaluate the investigation's design to ensure it will produce the necessary data, Ask student to revise the investigation to ensure it will produce the necessary data and in the revision include the types of data to be collected, how much data will be collected, and the accuracy of data needed to produce reliable measurements, *and/or* Ask students to conduct the investigation and write an explanation to answer the scientific question using data from the investigation as evidence.
6	Present students with a scenario that describes a phenomenon using text, images, video, and/or data to be explained a scientific question, and investigation plan, and data collected from the investigation, *then* Ask students analyze how well the data collected generated relevant evidence to answer the research question, *and* Ask students to revise the investigation plan to be more relevant and to generate more accurate and precise data.