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: Engaging in Argument from Evidence

Relevant definitions

- 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")
- A *pattern of evidence* from data is what the data say ("The population of white-colored moths disappeared in cities," or "The birds' tail feathers are whiter in the mountains than in the city")

Format	Task Requirements for Students
1	Describe a phenomenon and give two or more competing arguments with varying degrees of evidence or that account for variable amounts of gathered evidence, *then* Ask students to identify which arguments are more scientific and why.
2	Present students with a claim about a phenomenon, *then* Ask students to identify evidence that supports the claim, *and* Articulate the reasons for how scientific principle(s) connect each piece of evidence to the claim.
3	Describe a phenomenon to students, *then* Ask students to articulate (construct) a claim about that phenomenon, *and* Identify evidence that supports or contradicts the claim, *and* Articulate the reasons for how scientific principle(s) that connect each piece of evidence to the claim.
4a, 4b	Describe a scenario in which two or more explanations are offered for a phenomenon and associated evidence using text, images, video, and/or data, *then* Ask students to identify the different reasoning used in the explanations (easier), *or* Ask students to identify the differences in reasoning and the evidence that supports or contradicts each (harder).
5	Describe an engineering design problem, a proposed solution, a set of criteria, and a set of data collected during testing of the solution, *then* Ask students to interpret the data to identify quality scientific evidence, *and* Support a claim about how well the solution addresses the problem using the evidence.
6a, 6b	Present students with a claim, a list of data sources that are relevant to the claim (but not what the data say), *then* Ask students to identify (select from a list) a pattern of evidence from the data that would support the claim, *or* Ask students to identify (select from a list) what pattern of evidence from the data would refute the claim.
7a, 7b, 7c, 7d	Present students with a claim **and** a pattern of evidence with reasoning relevant to the claim, ***then*** Ask students to assess whether the evidence is logically consistent with the reasoning, *or* Ask students to assess whether the evidence is consistent with a scientific theory or model they have studied, *or* Ask students to generate ideas about additional evidence needed to support the claim, *or* Ask students to critique and refine the reasoning used to support the claim.

8	Describe a scenario in which two or more scientific arguments are offered for a phenomenon that is described using text, images, video, and/or data, *then* Ask students to evaluate the merits and coherence of each argument by analyzing its fit with currently accepted explanations and the claim, evidence, reasoning relationships, *and* Use their evaluation to draw a conclusion about which argument is better supported.
9	Describe a scenario in which two or more contradictory claims are offered for a phenomenon and partial data for evaluating the claim, *then* Ask students to identify additional information needed to draw a conclusion about which claim is accurate, *and* Justify the choice of additional information using reasoning based on a model or scientific principles.

Potential Task Formats: Obtaining, Evaluating, and Communicating Information

Relevant definitions

- A "scientific text" is any form of scientific communication including but not limited to prose, graphs, videos, posters, symbols, and mathematics.

Format	Task Requirements for Students
1	Present students with a scenario that describes a phenomenon and includes a set of resources including grade-appropriate texts, data displays, tables, diagrams, equations, graphs, and models, *then* Ask students to synthesize the information from across the resources and texts, *and/or* Ask students to compare and contrast information across the resources and texts to determine which are most relevant to explaining the phenomenon, *and* Ask students to communicate information from the resources with others in oral or written forms using models, drawings, writing, or numbers.
2	Present students with a scenario that describes a phenomenon and includes a set of at least three multimodal resources with qualitative and quantitative information in written text within visual or media displays, *then* Ask students to integrate information across the resources in order to explain, clarify, or ask questions about claims and findings made in the resources, *or* Ask students to evaluate and integrate information across the resources to address a scientific question or solve a problem.

3	Present students with a set of scientific literature (or grade-appropriate adaptations) and/or media reports related to a scientific phenomenon, *then* Ask students to analyze and write about the validity and reliability of the information in the text (e.g., data, hypotheses, conclusions) Ask students to evaluate the information presented and synthesize across and to address a scientific question or solve a problem and/or ask questions about the phenomenon based on information from relevant texts.
4	Present students with a scenario that describes a phenomenon or an investigation of a phenomenon using text, images, video, and/or data, *then* Ask students use multiple forms of scientific texts (e.g., abstracts, articles, posters, science journalism) and multiple ways to present information (e.g., graphically, mathematically) to communicate about the phenomenon to a given audience or an audience of their choosing.

This work was created as part of the Research + Practice Collaboratory project. The Research + Practice Collaboratory brings educators and researchers together to develop more equitable innovations for STEM teaching and learning. Learn more at researchandpractice.org.

We are constantly updating and evolving our tools in response to user feedback.