Assessing Three-Dimensional Performance: Phenomena and Problems

SCENARIOS | EQUITY | SENSE-MAKING

Phenomena and problems have become central to conversations about science teaching, learning, and instructional materials, but the role of phenomena and problems in assessment has been less clear. Are they a "nice-to-have" engagement hook, or a "must have" feature? If they are part of three-dimensional assessments, what sets a good assessment phenomenon apart from one that might be less effective? As teachers, administrators, and researchers evaluated a wide range of assessment tasks for the Task Annotation Project in Science (TAPS), it became clear that phenomena and problems are not only important, but perhaps the **most critical predictor of whether a task can meaningfully elicit three-dimensional performances from all students.**

What we've learned about phenomena and problems in science assessments:

✓ Relevance and engagement are more important than ever.

It is essential that we make sure our assessments are as connected to the culture, lives, and ideas of our students as possible. Phenomena and problems in assessment should be compelling: presented in a way that helps students clearly know why what they are figuring out is important and relevant. Assessing three-dimensional learning requires more complex tasks and sustained attention, and eliciting student responses to these tasks requires that they are engaged and motivated throughout.

✓ Phenomena and problems are vital to 3D assessments.

If our goal for student learning is preparing students to make sense of the world around them and address problems, we need assessments that allow us to observe students doing just that: make sense of phenomena and address problems. **This is a non-negotiable aspect of new science assessments.**

✓ The way phenomena and problems are presented matters.

The information provided to students about the phenomenon or problem —the data, images, contextual language, etc.—plays a direct role in which science ideas and practices, and at what level of sophistication, students need to demonstrate (e.g., if we want to know whether students can use the three dimensions at a high-school level of sophistication, we must give them the messy data, discordant observations, data from multiple scales, etc. to make sense of).

✓ Uncertainty distinguishes powerful phenomena for assessments .

Good phenomena-based scenarios problematize the phenomenon—in other words, high-quality scenarios are compelling because they present students with some kind of uncertainty, and help students understand what they are supposed to be addressing and why it matters. Ideally, the sense-making provoked by this uncertainty requires students to use the three dimensions to address.

If we want assessments to truly reveal what students know and can do, students have to be motivated to engage in tasks. To support all learners, phenomena and problems need to be rich and compelling to the students who are seeing the task.

Implications for educators and developers:

Educators should make sure that the assessments students see are grounded in making sense of phenomena and solving problems that are relevant, compelling, and accessible to the students engaging with the assessment. In the classroom, we can pay attention to the specific values, ideas, and backgrounds of our specific students, and build assessments that value and respect what students bring to the table.

Developers should pay close attention to developing the right phenomena- or problem-driven scenario, since this will play a big role in determining the quality of the assessment. Both classroom and externally developed assessments can and should attend to research about what matters to diverse learners, opportunity to learn considerations, and ensure that assessments focus on asking students to make their thinking visible as they address phenomena and problems that matter to them.

Phenomena and problems can be used to support equitable science assessments.

Phenomena and problems that support a wide range of diverse learners prioritize some features:

	Assessment scenarios should look less like...	Assessment scenarios should look more like...
CENTRAL	A context that is used as a "hook" for students, but is not central to student sense-making.	Making sense of the phenomenon or problem is the actual point of the task—the task can't be completed without engaging with the scenario and figuring out some aspect of the phenomenon or problem.
SPECIFIC	Generic observations, ideas, or science topics (e.g., ecosystems, "students were doing an experiment", "volcanoes are...").	A specific set of observations—or questions and problems grounded in a specific set of observations—about a real-world instance or occurrence.
RELEVANT	Contexts that are presented in a way that is disconnected from the students engaging with them.	Authentic contexts that are presented in a way that intentionally provide opportunities for students to understand and meaningfully connect to the scenarios, emphasizing why students should find the assessment context meaningful.
COMPELLING	Descriptions of ideas or phenomena that students already understand (e.g., confirming a claim or explanation) or are not interested in figuring out.	Contexts that make the authentic uncertainty of a situation—what students need to figure out—clear to students, both giving students something puzzling/intriguing to wonder about and helping to cue them toward which ideas and practices they might want to use.
COMPREHENSIBLE	Blocks of text that are confusing or overwhelming to students are the primary way of presenting the phenomenon.	Multiple modalities (text, diagrams, simulations, data tables, infographics, etc.) used to convey complex information in a coherent way.

Engaging, relevant, and compelling scenarios in assessment tasks...

- ✓ Present students with **real-world** observations.
- ✓ Are based around at least one **specific instance**, not a topic or generally observed occurrence.
- ✓ Are presented to students as **puzzling or intriguing**.
- ✓ Provide, as part of the scenario, a **compelling question or observation that needs to be explained**—in other words, scenarios clearly point out to students what aspect of the scenario is uncertain, and why figuring that uncertainty out matters to someone.
- ✓ Are **explainable using the grade-appropriate DCIs, SEPs, and CCCs**—and not ideas that are outside what is described by each dimension, or parts of the dimensions that are below or above grade-level.
- ✓ **Effectively use at least 2 modalities** (e.g., text-based descriptions, images, video, etc) to present information.
- ✓ Present **real or well-crafted, grade-appropriate data**, if data are being used.
- ✓ **Use as many words as needed** to convey the relevant and compelling features of the phenomena, **but no more.**
- ✓ Are **sufficiently rich to drive the task at hand**—they provide students with enough information to engage in the whole task without including unnecessary information that might distract or confuse students. Note that whether a task is "rich enough" depends on the length and purpose of the task.