What are the major shifts in the Framework and NGSS?

1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning
   1. Organized around disciplinary core explanatory ideas
   2. Central role of scientific and engineering practices
   3. Use of crosscutting concepts
3. Coherence: building and applying ideas across time
How NGSS impacts design and development of assessment tasks

• Standards expressed as performance expectations – integration of practices, core ideas, and crosscutting concepts into a single statement of what is to be assessed

• Requires students to demonstrate knowledge-in-use/evidence of three dimensional learning

• Performance Expectations are not instructional strategies or objectives for a lesson

• Provide a guiding vision of how student should be able to use knowledge at the end of instruction
## Overview of EQuIP

<table>
<thead>
<tr>
<th>I. Alignment to the NGSS</th>
<th>II. Instructional Supports</th>
<th>for teachers to</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Three dimensional:</strong> Supports students in three dimensional learning to make sense of phenomena or design solutions</td>
<td>Supports learning for all students through meaningful scenarios, supporting practices, supports phenomena and representations</td>
<td>Provide guidance</td>
</tr>
</tbody>
</table>
III. Monitoring student progress

Assessments evaluate three-dimensional learning; include formative; are accessible and unbiased.

Pre, formative, and summative aligned.
Designing Assessments for 3-Dimensional Learning

Challenges:

• How do we use performance expectations in order to construct tasks that can be used during instruction?

• How do we design tasks that provide evidence of 3-dimensional learning?

• How do we make these tasks formative so that they can be used during instruction to help teachers gauge students’ progress toward achieving performance expectations?
Our Design Approach

Three distinct phases:

Unpacking

Developing learning performances (LP)

Creating tasks and rubrics
Our Assessment Guidelines

• What claims do we want to be able to make about what students know and can do?

• What kinds of evidence will students need to provide to demonstrate proficiency?

• What kinds of tasks / task features will elicit the desired evidence?
Learning Performances

What are Learning performances?

- Builds toward understanding of Performance Expectations
- Combine practices, core ideas and crosscutting concepts at a smaller grain size than the PE (lesson level)

Why use Learning Performances?

- Specifies “knowledge in use”
- Using “know” or “understand” is too vague
- We conceptualize understanding as embedded in practice and not as memorizing static facts
- Assessable in a task
Constructing a Learning Performance

- Identify key aspect(s) of disciplinary knowledge from the disciplinary core unpacking
- Identify key aspect(s) from the practices unpacking
- Identify key aspect(s) from the CCC unpacking
- Construct a statement or “claim” of what a student should be able to do
Constructing a Learning Performance

Core idea: Chemical Reactions
Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-5)

Practice: Constructing explanations

Learning Performance: Students should be able to construct an explanation about how they determine that substances are the same based upon characteristic properties.

Crosscutting Concept: Patterns
From a Performance Expectation to Learning Performances

**MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

- **LP C-01**: Students should be able to analyze and interpret data to claim that substances are the same or different.

- **LP C-02**: Students should be able to construct an explanation about how they determine that substances are the same based upon characteristic properties.

- **LP C-05**: Students should be able to analyze and interpret data to determine whether a reaction has occurred using properties of substances before and after the substances interact.

- **LP C-06**: Students should be able to construct an explanation about how they determine that a chemical reaction has occurred based on properties of substances before and after substances interact.
Explanation Assessment Task

Maria found four different bottles filled with unknown pure liquids. She measured the properties of each liquid. The measurements are displayed in the data table below. Maria wonders if any of the liquids are the same substance.

<table>
<thead>
<tr>
<th>Liquid</th>
<th>Density</th>
<th>Color</th>
<th>Volume</th>
<th>Boiling Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0 g/cm³</td>
<td>Clear</td>
<td>6.1 cm³</td>
<td>100 C°</td>
</tr>
<tr>
<td>2</td>
<td>0.89 g/cm³</td>
<td>Clear</td>
<td>6.1 cm³</td>
<td>211 C°</td>
</tr>
<tr>
<td>3</td>
<td>0.92 g/cm³</td>
<td>Clear</td>
<td>10.2 cm³</td>
<td>298 C°</td>
</tr>
<tr>
<td>4</td>
<td>0.89 g/cm³</td>
<td>Clear</td>
<td>10.2 cm³</td>
<td>211 C°</td>
</tr>
</tbody>
</table>

Use the data in the table to:
1) Write a claim stating whether any of the liquids are the same substance.
2) Provide at least two pieces of evidence to support your claim.
3) Provide reason(s) that justify why the evidence supports your claim.

Task Features
- Focus on density and boiling point
- Learning Performance: Understanding the properties of characteristic substances
- Tasks provide a setting that can provide various levels of support characteristic action has properties.
Student 1:
I think that Sample 2 and Sample 4 are the same substance. I think this because they have the same density, 0.89g/cm^3. They also have the same boiling point, of 211º C. Having the same density and boiling point provides evidence that Sample 2 and Sample 4 are the same substance because these two pieces of evidence are properties. Properties are unique characteristics that help to identify and distinguish substances, and they do not change based on amount. The same substances have the same properties, so since Sample 2 and Sample 4 have the same properties, it is very likely that they are the same substance. Volume is not a property, because it changes based on amount (it is amount) and so although they have different volumes, it does not matter in terms of being the same substance.
Student 2

None of the samples in the table could be the same substance. Density, volume, and boiling point are all properties of a substance. Properties are unique characteristics of a substance. For two samples to be the same, they have to have the same properties. None of the samples shown in the table have the same properties.
Modeling assessment task

Watch the video clip. Construct a model to explain why the M&M behaved differently in cold, room temperature, and hot water. Your model should include both pictures and words to explain the behavior of M&M particles in the water at different temperatures.

<table>
<thead>
<tr>
<th>Cold Water (5°C)</th>
<th>Room Temperature Water (20°C)</th>
<th>Hot Water (80°C)</th>
</tr>
</thead>
</table>

Task Features

- **Performance Evidence**: Students are in the process of developing a model that explains how particle motion changes when thermal energy is added or removed in each state of matter.
- **Motivating Context**: Tasks provide a motivating context.
Student response 3 (M&M item)

Key:
- green particles: m & m particles
- orange particles: hot water particles
- Red particles: room temperature particles
- Blue particles: cold water particles
- Arrows: movement

The m&m particles get more energy in the hot water so they move faster, hit each other harder, and spread farther apart. In the colder water the m&m particles move slower and don't spread apart very far.
M&Ms are put in water and the particles are spreading out more when they are in hot water, and less when they are in colder water.
Our Next Steps

What questions do we have?

• Do the tasks support teachers in integrating practices, crosscutting concepts and core ideas in their instruction?

• How does using assessment tasks in formative ways inform instructional decisions?

Investigating these question will help us design the support for teachers using the items
The Value of our Approach

A systematic process to facilitate the design of 3-dimensional assessments that can be used formatively.

Benefits

- Develop a broadly accessible vision of how to design NGSS assessments
- Document principled design decisions
- Create well-aligned formative tasks that are usable across varied classroom environments
- Generalize to other core ideas, crosscutting concepts, and practices

Next Generation Science Assessment

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