Assessing the Three Dimensions of the Next Generation Science Standards

HIGH SCHOOL SCIENCE
Career & College Readiness Conferences
Summer 2014

To what extent have you interacted with this document?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. Huh?

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How about this one?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. No clue
Or this one?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. It's the first time I've seen it.

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Outcomes

- Review the process of developing NGSS
- Discuss the implications of teaching and assessing in the three Dimensions of NGSS
- Explore teaching and assessing through Science and Engineering Practices
- Identify opportunities for formative assessment during instruction
- Examine student activities for assessment tasks
- Discuss the potential structure of an assessment system for science

Developing Assessments for the Next Generation Science Standards

Committee on the Assessment of K-12 Science Proficiency

Board on Testing and Assessment and Board on Science Education National Academy of Sciences
Topics Addressed

- The challenges of assessing three-dimensional science learning
- Principles for developing assessment tasks
- Developing classroom assessments
- Developing monitoring assessments
- Developing assessment systems
- Implementing the system

Three-Dimensional Science Learning

- New types of assessment are needed
- NGSS assessment should start with the needs of classroom teaching and learning
- State monitoring assessments must move beyond traditional forms
- States must create coherent systems of assessment that can support both classroom learning and policy monitoring functions
What should assessment look like?

Focus on Formative Assessment

Assessment Designed to Guide Instruction

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they
• use multiple practices in developing a particular core idea and
• apply each practice in the context of multiple core ideas.
The NGSS describe specific goals for science learning in the form of performance expectations, statements
about what students should know and be able to do at each grade level or grade band,
that emphasize the importance of the connections among scientific concepts, and
that incorporate all three dimensions.

Assessment Challenge

It will not be feasible to assess all of the performance expectations for a given grade band during a single assessment occasion.

Multiple assessments

Students will need multiple—and varied—assessment opportunities to demonstrate their competence on the performance expectations for a given grade level.
To adequately cover the three dimensions, specific components may focus on individual practices, core ideas, or crosscutting concepts. Assessment tasks will need to contain multiple components, i.e., a set of interrelated questions.

- Individual and/or group investigation
- Observations in tables and/or graphs
- Constructed responses
- Selected responses
- Electronic drag and drop, ordering, etc.

Utilize the Practices

- Student activities that reflect such learning include the Practices of:
  - Developing and refining models
  - Generating, discussing and analyzing data
  - Engaging in both spoken and written explanations and argumentation

Challenges and Opportunities

- Instruction that is aligned with the Framework will naturally provide many opportunities for teachers to observe and record evidence of student learning.
- Incorporate teacher and student reflection into the process
Opportunity

- Use a set or cluster of interrelated questions to generate evidence of NGSS knowledge
- Specific questions may focus on Practices, Disciplinary Core Ideas and/or Crosscutting Concepts
- The parts need to support students’ three-dimensional science learning as described in a specific Performance Expectation

Antarctica’s Pine Island Glacier: A “Climate Canary”?
Using atmospheric and oceanic processes and the poles to teach the climate system

Students analyze geoscience data to:
- Describe variations in the flow of energy in a system
- Collect evidence that a glacier is melting
- Determine the role of glaciers and the global ocean in the climate system

Three Dimensional Assessment

- [Image of Three Dimensional Assessment]
- [Text and figures related to the assessment]
Performance Expectation

Students who demonstrate understanding can:

**HS-ESS3-5**
Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

[Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]

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ID the Assessment Opportunities in the 5E Learning Cycle

- Engage (Step 1)
- Explore (Steps 2-3)
- Explain (Step 4)
- Elaborate (Step 5)
- Evaluate

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Assessment Opportunities?

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<tr>
<th>5E</th>
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Assessment System

- Performance assessment tasks developed within the classroom
- Portfolio of classroom work samples with tasks specified by district and/or state
- Units (curriculum materials and assessments) developed outside of the classroom (district and/or state)
- Item banks of NGSS-aligned tasks, developed outside of the classroom, from which schools and teachers select

Assessment System Challenges

- A single, external large-scale assessment cannot cover the full breadth and depth of NGSS
- Performance Expectations with suitable assessment tasks take time to administer and several will be required to adequately sample NGSS PE’s
- Some practices are difficult to assess, e.g., carry out an investigation, using conventional formats of external, on-demand assessments

NGSS Main Messages

- New types of assessment are needed
- State monitoring assessments must move beyond traditional forms
- NGSS assessment should start with the needs of classroom teaching and learning
- States must create coherent systems of assessment that can support both classroom learning and policy monitoring functions
Reviewed the process of developing NGSS.
Discussed the implications of teaching and assessing in the three Dimensions of NGSS.
Explored teaching and assessing through Science and Engineering Practices.
Identified opportunities for formative assessment during instruction.
Discussed the structure of an assessment system for science.

Outcomes

Resources
http://www.nap.edu/catalog.php?record_id=13165
Developing Assessments for the Next Generation Science Standards
http://www.nap.edu/download.php?record_id=18409
NSTA
http://ngss.nsta.org/access-standards/
NAEP Released Items
TIMSS Released Items
http://nces.ed.gov/timss/educators.asp
PISA Released Items
http://nces.ed.gov/surveys/pisa/educators.asp

Exit Slip
Write two statements that describe the implications for assessing student understanding in YOUR classroom.
1) Ah-ha! statement
2) Action(s) statement
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