CCSSO 2015 Symposium: Future of Science Assessment

Lei Liu, Kathleen Scalise, Madeleine Keehner and Cindy Ziker

Examples and demonstrations from the new U.S. National Assessment for Educational Progress (NAEP): Virtual science lab; scenario-based tasks; domain modeling; and process data in hands-on and virtual objects tasks.
CCSSO 2015 Symposium: Future of Science Assessment

Accessible, engaging assessment for all students in the NAEP science and engineering scenario-based tasks

Kathleen Scalise
Director, NAEP Science, ETS
6/22/15
Innovation is a central component for the future of educational assessment. New claims about student reasoning, behavior, and mental processes in context, along with new data sources, new scoring methods, and new performance assessment tasks are driving the next generation of science, mathematics, engineering and technology assessments.
Two Types Assessment Technology Innovations

Information Technology Innovations

• NAEP Pilot 2015 employs science “scenarios” and simulators in rich tasks.
• NAEP also uses “hybridized” hands-on science tasks, and blocks of discretes (single) items.
• The tasks offer tools and animations to elicit what students know and can do through virtual and hands-on investigations.
• U.S. National Assessment of Educational Progress
Simulations: TEL Wells Task

Task: Community water well in a rural village. Students investigate problems, query avatars, explore data, and provide explanations (Carr, 2013).

In many parts of the world, people rely on water wells to provide a source of water. Water wells are an inexpensive, sustainable source of clean drinking water. However, they must be carefully maintained.
National Assessment Governing Board, May 2014

• NCES shared information from students and school staff after the 2014 TEL administration, including discussion of three positive themes that emerged:
  • High levels of student engagement in TEL tasks ("now I think I might like to be an engineer");
  • High levels of student completion of TEL additional supplemental block;
  • Supportive reactions to TEL administration and to task types in schools from school staff.
TEL Wells task is about *process* –
All students will (eventually) fix the pump.

We are interested in whether the *process* is:

- **Efficient**: solves problem without unnecessary steps.
- **Systematic**: solves problem methodically, with a logical sequence of steps.

Source: NCES, Sept. 2013
We capture *process data*:

- **What** is clicked (decisions/selections)
- **Order** of clicks (sequences)
- **Number** of clicks (frequencies)
- **Timing** of clicks (timestamps)

Provides a *trail of actions* so we can:

- **Reconstruct** problem-solving process
- **Characterize** different strategies
- **Infer** underlying cognition

Source: NCES, Sept. 2013
Characterizing “Efficient Actions”

What does an “efficient” pattern look like?

- WHICH choices you make

Source: NCES, Sept. 2013
Characterizing “Systematic Actions”

What does a “systematic” pattern look like?

- HOW you order your choices

Source: NCES, Sept. 2013
Games-based Assessment

Source: GlassLab, May 2015
Conversation-based Assessment

Source: J. Gorin, CERA, Dec. 2014
Collaborative Tasks

Use the volcano map to place the seismometers that you consider necessary.

You can select up to four seismometers.

Click on New Seismometer to get a new seismometer and click again to place it on the volcano map.

Source: J. Gorin, CERA, Dec. 2014
Multimodal Assessment: Live Performance

Source: J. Gorin, CERA, Dec. 2014
• Adaptivity is one example of measurement technology innovation from NAEP.
• In NAEP multistage adaptive tests (MST), the test adaptation occurs based on student cumulative performance on a block of items. Multistage testing (MST) can be highly suitable because it can help better meet the needs of all students.
• Also, NAEP doing a special study on the use of adaptivity within the simulation tasks – “responsive” scenario-based tasks (RSBTs).
Measurement Technology Innovation

Source: ETS, Nov. 2014
Examples of UDL tools available

• Available Only in Discrete (Single) Items
  1. Elimination Tool (multiple-choice questions only)
  2. Highlighter Tool
  3. Zoom
  4. Word Definition (some items only)

• Available in Discrete Items and SBTs (and Survey Questions)
  5. Text to Speech (TTS)
  6. Hide/Show Timer
• **TEL Discrete Items**: Text-to-Speech (TTS) use ranged from about 6% to 30%.

• **TEL Scenario-based Tasks (SBTs)**: In SBTs, TTS use ranged from 16% to 50% per task.

• At the student level, 53% of students used TTS at least once (either discrete or SBT).
Wrap-Up: Potential new directions for Science assessments

- **Tasks**: Open-ended, more free-form
  - Authentically reflect *real science and engineering practices*

- **Evidence**: Includes rich process data, assistive tools
  - Pathways, sequences, timing of actions, tool choices

- **Reporting**: Beyond scaled scores
  - Insights into process, strategy, cognition

We have more research to do, but what we are learning can contribute to the development of more authentic, rich, and informative approaches to STEM assessment and reporting.

Source: NCES, Sept. 2013
NRC report describes that a “system” of assessment is needed:

1. Assessment tasks should allow students to engage in science practices in the context of disciplinary core ideas and crosscutting concepts.

2. Multi-component tasks that make use of a variety of response formats will be best suited for this.

3. Selected-response questions, short and extended constructed response questions, and performance tasks can all be used, but should be carefully designed to ensure that they measure the intended construct and support the intended inference.

4. Students will need multiple and varied assessment opportunities to demonstrate their proficiencies with the NGSS performance expectations.
Discussion & Questions: Future of Science Assessment

Accessible, engaging assessment for all students in the NAEP science and engineering scenario-based tasks

Contact Kathleen Scalise, 6/22/15
kscalise@ets.org,
What is NAEP?

U.S. National Assessment of Educational Progress:

• Largest nationally representative and continuing assessment of what America's students know and can do in various subjects.

• Provides the U.S. national and state “Report Cards” and trend assessments, as well as many publications, products, and data tools, see http://nces.ed.gov/nationsreportcard/