Innovative Technology-Enhanced Assessments of Contemporary Science Standards: NAEP Digitally Based Assessments (DBA)

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U.S. National Assessment of Educational Progress (NAEP)

- Congressionally mandated project administered by the National Center for Education Statistics
- Common measure of student achievement across the country in a variety of subject areas since 1969
- A gold standard of large-scale assessments

Who Participates in NAEP?

NAEP Science Transition to DBA*

Science: 3 Components

Paper-Pencil Items to DBA

Science Interactive Computer Tasks

“Hybrid” Hands-On Tasks

*2D framework so all performance expectations cross content/practice, plus crosscutting concepts are in framework
New Items

- From small innovations to large innovations

Use the slider to view the nuclear reaction that occurs when a high-energy particle collides with a large nucleus.

What type of nuclear reaction occurs, and why?

A  Fusion, because more high-energy particles are produced.
B  Fusion, because a high-energy particle combines with a large nucleus.
C  Fission, because two smaller nuclei are produced.
D  Fission, because mass is neither created nor destroyed during the process.

Clear Answer
New Items

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Example of Items:
2009 Sample P&P, Science Grade 4

A student tried to connect an electrical circuit as shown above. The light bulb did not light up. What can the student do to make the light bulb light up?

A. Connect a second battery to the first battery.
B. Replace the wires with thicker wires.
C. Replace the steel nails with aluminum nails.
D. Connect the steel nails with a short piece of wire.
Opportunities for Enhancement

This functionality can be customized to create a variety of circuits.
Performance Task: TEL Wells (audio off)

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Look to the Future: Virtual Lab Study

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TEL Scenario-based Task (SBT):

- Explore growth in **Chicago**
- Create an ideal **iguana** habitat
- Design a safe **bike lane**
- Promote a teen **rec center**

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
Bike Lanes SBT

STEP 1  Learning About Design Criteria
Determine how lane width and speed limit affect road safety.

STEP 2  Explaining the Design Criteria
Explain trade-offs among design criteria.

STEP 3  Planning for a Safer Bike Route
Identify route modifications based on design criteria.

STEP 4  Redesigning the Route
Propose a design based on criteria and constraints.

STEP 5  Providing a Design Rationale
Explain trade-offs among criteria.

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
Bike Lanes: Design and Systems

Use the two sliders on the left to see how changing the car speed and car lane width affect the safety of a road.

Use the sliders to perform the following:
- Change the car’s speed limit to 25 mph by using the Speed Limit slider
- Select 14 feet of car lane width by using the Car Lane Width slider

When you are finished, click Submit.

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
Bike Lanes: Design and Systems

Design a different SAFE route connecting Pleasant Valley and Rolling Hills Park. Your route should include only minimal changes (if any) to existing streets.

Your safe route must be the following (in order of importance):
- FIRST: The least expensive route
- SECOND: The shortest route

NOTE: Changing the width of a street is a lot more expensive than changing its speed limit.

Click Next when you are finished. Click Tutorial to review directions for using the map tool.

<table>
<thead>
<tr>
<th>Street Name</th>
<th>Road Length (in miles)</th>
<th>Cost of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.75</td>
<td>$0</td>
</tr>
<tr>
<td>G</td>
<td>1</td>
<td>$0</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>$0</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>$2,000</td>
</tr>
<tr>
<td>AGFE</td>
<td>6.75 miles</td>
<td>$2,000</td>
</tr>
</tbody>
</table>

Total Cost: $2,000
Total Length: 6.75 miles

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
Student Performance: Design and Systems

Successfully carried out a design using trade-offs to choose between alternative solutions.

Reported taking something apart in order to fix it or see how it works, outside of school.

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
Opportunities: Bike Lanes Example

Differentiate student performance by strategy used

- Number and sequence of actions taken or actions not taken

Connection to providing design rationale

- Correct explanation related to number/sequence of actions

Differentiation of student strategies

- Insights into approaches used during route design process

Berger, M. (2017, April). NAEP TEL, NAEP Digitally Based Assessment Symposium, AERA.
New Items and Tools: Math Example

2015 PP
Multiple Choice
Short CR
Extended CR

2015 DBA
Multiple Choice
Short CR
Extended CR
Equation Editor
Multiple Select
Matching
Zones
Grids

2017 DBA
Multiple Choice
Short CR
Extended CR
Equation Editor
Multiple Select
Matching
Zones
Grids
Inline Choice
Bar Graph
Box Plots
Ruler

New Items and Tools: Math Example

Process Data, Reading: Eight Students’ DBA Performance

- Process data will give us a deeper understanding of how students spend their time during the assessment.

Greer, E. A. (2017, April). NAEP Reading, *NAEP Digitally Based Assessment Symposium, AERA.*
Process Data, Reading: Students Sorted by Reading Time

Greer, E. A. (2017, April). NAEP Reading, NAEP Digitally Based Assessment Symposium, AERA.
Process Data, Writing: Good Writers Write Differently

Persky, H. (2017, April). NAEP Writing, NAEP Digitally Based Assessment Symposium, AERA.
Reporting NAEP Science Results

• Main reporting goal of Integrated Science Assessment in 2019, to include all three formats in the Main Science scales (overall and three content areas)
  – Requires adding Hybrid Hands-On Tasks and Interactive Computer Tasks
• Scaling to Learn Study from 2015 supported efficacy and feasibility of integration for the DBA discretes, DBA tasks, and hybridized hands-on tasks
• Extended Reporting will reflect on strategies/process
Potential Uses of Process Data

- NAEP Observables include in Extended Reporting for:
  
  - Process data such as in use of simulators
  - Information foraging, & use of data & resources
  - Problem-solving for strategic solutions
Questions? Discussion?

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