

PROMOTING DEEPER LEARNING THROUGH DOK

Deborah La Torre Matrondola, CRESST/UCLA

BACKGROUND

In partnership with organizations such as the Council of Chief State School Officers, the William and Flora Hewlett Foundation has been working towards the goal of promoting deeper learning and the development of 21st century skills. This is exemplified in one of the key goals of the foundation: "Increase economic opportunity and civic engagement by educating students to succeed in a changing world through deeper learning" (<http://www.hewlett.org/programs/education>).

At CRESST, we believe that one way to promote deeper learning is through the promotion of greater cognitive complexity in the assessments currently being developed to align with the Common Core State Standards (CCSS). As part of this effort, CRESST is conducting a multi-year evaluation, funded by the Hewlett Foundation (grant number 2012-8075), to monitor and support efforts being made by Smarter Balanced and PARCC.

COGNITIVE COMPLEXITY FRAMEWORKS

SMARTER BALANCED

Smarter Balanced is utilizing a cognitive rigor matrix developed by Hess and colleagues (2009), which integrates existing frameworks from Benjamin Bloom (1994) and Norman Webb, Alt, Ely, & Vesperman (2005).

Bloom's Taxonomy of Cognitive Process Dimensions:

- **Remember** is characterized by recognizing or recalling knowledge from long-term memory.
- **Understand** involves constructing meaning through interpreting, comparing, or explaining.
- **Apply** involves carrying out a familiar task or using procedural knowledge to carry out a non-routine task.
- **Analyze** involves breaking apart information or material into its constituent parts and determining how the parts relate to each other.
- **Evaluate** involves making judgments based on criteria.
- **Create** involves putting elements together to generate hypotheses, design procedures, or construct a product or model.

Webb's Depth-of-Knowledge (DOK) framework:

- **DOK1** is characterized as recall of a fact, term, concept, or procedure; basic comprehension.
- **DOK2** entails application of concepts and/or procedures involving some mental processing.
- **DOK3** requires abstract thinking, reasoning, and/or inferences that are more complex.
- **DOK4** involves extended analysis or investigation that requires synthesis and analysis across multiple contexts and non-routine applications.

Despite the inclusion of both frameworks in the matrix, it appears that Smarter Balanced is primarily focusing on the use of DOK during their item and task development process.

PARCC

PARCC developed separate cognitive complexity frameworks to classify the rigor of English language arts (ELA) and mathematics test items. These frameworks include four or five dimensions, with each measured on a three-level scale of low, medium, or high complexity.

ELA dimensions	Mathematics dimensions
<p>Text complexity: The qualitative and quantitative complexity of the reading passage(s).</p> <p>Command of textual evidence: refers to the amount and complexity of the text that must be processed.</p>	<p>Mathematical content: The complexity of the content standards to which the item is aligned.</p> <p>Mathematical practices: examines the complexity of the mathematical practices in which the student engages.</p> <p>Stimulus material: includes stimuli such as tables, graphs, and figures and/or online tools such as calculators.</p>
<p>Response mode: measures the item type or required method of response, such as selected response, short answer, or extended response.</p> <p>Processing demands: Linguistic demands of the item stems, instructions, and response options.</p>	

APPLICATION OF THE FRAMEWORKS

ENGLISH LANGUAGE ARTS

The following item from PARCC's Grade 8 Practice Test (2014) is used to illustrate the differences among the ELA dimensions. In this item, students are asked to read an 18-paragraph passage from a novel called *The Seven Keys of Balabad*, after which they are asked to write a short continuation of the story focusing on the obstacles they think the main character might confront and the actions they think he might take.

Text Complexity (Moderate)

The passage for this item fits the middle school band for both Lexile (1060L) and the Reading Maturity Metric (7.6). In addition, it includes some figurative language ("The sound of footsteps echoed back at him through the gloom..."), some less familiar vocabulary (e.g., voids, falcon, squabbles), and consists primarily of compound and complex sentences.

Command of Textual Evidence (Moderate)

Based on the prompt for this item, a student needs to write a continuation of the story that takes into account what obstacles the main character might confront and the actions this character would most likely take. In order to discern this, it would be necessary to read the entire passage closely.

Response Mode (Moderate)

This item uses a prose constructed response format. In this case, the student will need to write a narrative that takes into account the main ideas of the passage. While narrative prose would often be considered high in complexity, since the main ideas (i.e., obstacles and actions) are scaffolded, the synthesis of ideas is less challenging.

Processing Demands (Moderate)

In the example shown, the reading task, which students initially complete earlier in the practice test, includes a four sentence prompt and the writing task includes a three sentence prompt. These prompts include some less common words, some pronouns, and some prepositional phrases.

DOK (Level 3)

DOK3 items require students to think abstractly as they write short essays about or in response to an entire passage. With this ELA item, students must synthesize details from across an 18-paragraph passage and then infer what obstacles the main character might encounter next.

MATHEMATICS

The following item from Smarter Balanced's Grade 8 Practice Test (2014) is used to illustrate the differences among the mathematics dimensions. In this item, students are asked to write an explanation describing the three transformations they would have to perform to prove that the two figures shown on the coordinate grid are congruent.

Mathematical Content (Low)

This item requires students to have an understanding of coordinate grids, congruent figures, and transformations. In states such as California, this content was traditionally introduced in Grade 7 or in pre-algebra. Because of this, the item content does not currently reflect a major shift.

Mathematical Practices (Moderate)

The item shown asks students to describe the transformations necessary to prove that two figures are congruent. In order to do this, students would need to reason abstractly and construct a viable argument, both of which are hallmarks of a moderately complex mathematical practice.

Stimulus Material (Low)

This dimension takes into account the number of stimuli and tools. In the practice item shown, only one incremental stimuli, a coordinate graph, is provided.

Response Demands (Moderate)

While this practice item does require students to construct a written response a few sentences in length, it only requires students to examine but not manipulate a figure on a coordinate graph. In addition, this item is low in complexity for mathematical content.

Processing Demands (Moderate)

The item shown is a few sentences in length, includes some academic words (e.g., coordinate grid, congruent, and transformations), and some prepositional phrases (e.g., on the coordinate grid, sequence of basic transformations).

DOK (Level 3)

Items and tasks at DOK3 are more complex, require reasoning, the following of a sequence of steps, and often have more than one possible answer. Items requiring an explanation, such as shown, are often at this level as well.

REPRESENTATION OF DOK (SMARTER BALANCED)

The following tables show the distribution of DOK in ELA and mathematics for the most recent content specifications (2014; 2013) and practice tests (2014) from Smarter Balanced.

	ELA	n	% DOK1	% DOK2	% DOK3	% DOK4
Elementary school (Grade 4)						
Content specs (targets)		35	17.5	38.6	31.6	12.3
Practice test (items)		34	8.8	50.0	32.4	8.8
Practice test (points)		48	6.3	35.4	31.3	27.1
Middle school (Grade 8)						
Content specs (targets)		38	18.3	36.7	28.3	16.7
Practice test (items)		34	5.9	52.9	32.4	8.8
Practice test (points)		48	4.2	37.5	29.2	29.2
High school (Grade 11)						
Content specs (targets)		38	18.3	33.3	28.3	20.0
Practice test (items)		34	8.8	47.1	35.3	8.8
Practice test (points)		47	6.4	34.0	29.8	29.8

	Mathematics	n	% DOK1	% DOK2	% DOK3	% DOK4
Elementary school (Grade 4)						
Content specifications		30	24.6	41.0	24.6	9.8
Practice test (items)		32	21.9	56.3	21.9	0.0
Practice test (points)		37	21.6	54.1	24.3	0.0
Middle school (Grade 8)						
Content specifications		28	21.8	41.8	25.5	10.9
Practice test (items)		35	28.6	54.3	14.3	2.9
Practice test (points)		43	23.3	53.5	18.6	4.7
High school (Grade 11)						
Content specifications		34	28.4	40.3	22.4	9.0
Practice test (items)		36	11.1	61.1	25.0	2.8
Practice test (points)		42	9.5	61.9	23.8	4.8

SUMMARY

Potential gaps in the frameworks:

- **ELA and mathematics processing demands:** The descriptors do not take into account instances where the amount and complexity of the text in a prompt do not match.
- **ELA response mode:** Would a short constructed response item where a student writes a synonym be considered low or moderate?
- **Mathematics stimulus material:** Would the use of a single transformative tool, such as a technology-enhanced graph, without any other stimuli be considered low or moderate?
- **Mathematics DOK:** Descriptors for DOK1 and DOK2 tend to emphasize keywords and/or verbs, which may over simplify the process of learning to apply the framework.

Representation of DOK for Smarter Balanced:

- **ELA:** For ELA as many as 48% of the assessment targets and 44% of the practice items represented DOK3/4. Interestingly, 60% of practice item points were also at DOK3/4.
- **Math:** For Math as many as 36% of the assessment targets represented DOK3/4. In contrast, less than 28% of practice items and less than 29% of practice item points were at DOK3/4.