PARCC Mathematics
State Educator Item Review

March 4 – 8, 2013

Presenter:
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Partnership for Assessment of Readiness for College and Careers (PARCC)
Assessment Design
Mathematics, Grades 3-8 and High School End-of-Course

2 Optional Assessments/Flexible Administration

Diagnostic Assessment
• Early indicator of student knowledge and skills to inform instruction, supports, and PD
• Non-summative

Mid-Year Assessment
• Performance-based
• Emphasis on hard-to-measure standards
• Potentially summative

Performance-Based Assessment (PBA)
• Extended tasks
• Applications of concepts and skills
• Required

End-of-Year Assessment
• Innovative, computer-based items
• Required
PARCC states developed Claims for Mathematics based on the CCSSM.
PARCC states developed the Model Content Frameworks to provide guidance to key elements of excellent instruction aligned with the Standards.
The blueprints for the PARCC Mathematics Assessments have been developed using the CCSS, Claims and Model Content Frameworks.
Cognitive Complexity Framework development in partnership with item development contractors.
Performance Level Descriptors are in the process of being drafted.
Phase 1 of item development is well on its way.
Sub-claim A: Students solve problems involving the major content for their grade level with connections to practices

Sub-Claim B: Students solve problems involving the additional and supporting content for their grade level with connections to practices

Sub-claim C: Students express mathematical reasoning by constructing mathematical arguments and critiques

Sub-Claim D: Students solve real world problems engaging particularly in the modeling practice

Sub-Claim E: Students demonstrate fluency in areas set forth in the Standards for Content in grades 3-6
PARCC Model Content Frameworks

Approach of the Model Content Frameworks for Mathematics

• PARCC Model Content Frameworks provide a deep analysis of the CCSS, leading to more guidance on how focus, coherence, content and practices all work together.

• They **focus on framing the critical advances in the standards:**
  - Focus and coherence
  - Content knowledge, conceptual understanding, and expertise
  - Content and mathematical practices

• Model Content Frameworks for grades 3-8, Algebra I, Geometry, Algebra II, Mathematics I, Mathematics II, Mathematics III
Model Content Frameworks
Grade 3 Example

Key: ■ Major Clusters; □ Supporting Clusters; ○ Additional Clusters

Operations and Algebraic Thinking
■ Represent and solve problems involving multiplication and division.
■ Understand properties of multiplication and the relationship between multiplication and division.
■ Multiply and divide within 100.
■ Solve problems involving the four operations, and identify and explain patterns in arithmetic.

Number and Operations in Base Ten
○ Use place value understanding and properties of operations to perform multi-digit arithmetic.

Number and Operations — Fractions
■ Develop understanding of fractions as numbers.

Measurement and Data
■ Solve problems involving measurement and estimation of intervals of time, liquid volumes and masses of objects.
□ Represent and interpret data.
□ Geometric measurement: understand concepts of area and relate area to multiplication and addition.
○ Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

Geometry
□ Reason with shapes and their attributes.
ECD is a deliberate and systematic approach to assessment development that will help to establish the validity of the assessments, increase the comparability of year-to-year results, and increase efficiencies/reduce costs.

How we have been presenting Evidence-Centered Design (ECD)

**Claims**
Design begins with the inferences (claims) we want to make about students

**Evidence**
In order to support claims, we must gather evidence

**Task Models**
Tasks are designed to elicit specific evidence from students in support of claims
Claims Structure: Mathematics

Master Claim: On-Track for college and career readiness. The degree to which a student is college and career ready (or “on-track” to being ready) in mathematics. The student solves grade-level/course-level problems in mathematics as set forth in the Standards for Mathematical Content with connections to the Standards for Mathematical Practice.

Sub-Claim A: Major Content\(^1\) with Connections to Practices
The student solves problems involving the Major Content\(^1\) for her grade/course with connections to the Standards for Mathematical Practice.

Sub-Claim B: Additional & Supporting Content\(^2\) with Connections to Practices
The student solves problems involving the Additional and Supporting Content\(^2\) for her grade/course with connections to the Standards for Mathematical Practice.

Sub-Claim C: Highlighted Practices MP.3,6 with Connections to Content\(^3\) (expressing mathematical reasoning)
The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)
The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP. 1), reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

Sub-Claim E: Fluency in applicable grades (3-6)
The student demonstrates fluency as set forth in the Standards for Mathematical Content in her grade.

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\(^1\) For the purposes of the PARCC Mathematics assessments, the Major Content in a grade/course is determined by that grade level’s Major Clusters as identified in the PARCC Model Content Frameworks v.3.0 for Mathematics. Note that tasks on PARCC assessments providing evidence for this claim will sometimes require the student to apply the knowledge, skills, and understandings from across several Major Clusters.

\(^2\) The Additional and Supporting Content in a grade/course is determined by that grade level’s Additional and Supporting Clusters as identified in the PARCC Model Content Frameworks v.3.0 for Mathematics.

\(^3\) For 3 – 8, Sub-Claim C includes only Major Content. For High School, Sub-Claim C includes Major, Additional and Supporting Content.
• The PARCC assessments for mathematics will involve three primary types of tasks: Type I, II, and III.

• Each task type is described on the basis of several factors, principally the purpose of the task in generating evidence for certain sub-claims.

10 Source: Appendix D of the PARCC Task Development ITN on page 17
## Overview of PARCC Mathematics Task Types

<table>
<thead>
<tr>
<th>Task Type</th>
<th>Description of Task Type</th>
</tr>
</thead>
</table>
| **I. Tasks assessing concepts, skills and procedures** | • Balance of conceptual understanding, fluency, and application  
• Can involve any or all mathematical practice standards  
• Machine scorable including innovative, computer-based formats  
• Will appear on the End of Year and Performance Based Assessment components  
• Sub-claims A, B and E |
| **II. Tasks assessing expressing mathematical reasoning** | • Each task calls for written arguments / justifications, critique of reasoning, or precision in mathematical statements (MP.3, 6).  
• Can involve other mathematical practice standards  
• May include a mix of machine scored and hand scored responses  
• Included on the Performance Based Assessment component  
• Sub-claim C |
| **III. Tasks assessing modeling / applications** | • Each task calls for modeling/application in a real-world context or scenario (MP.4)  
• Can involve other mathematical practice standards  
• May include a mix of machine scored and hand scored responses  
• Included on the Performance Based Assessment component  
• Sub-claim D |

For more information see PARCC Task Development ITN Appendix D.
Design of PARCC Math Summative Assessment

• Performance Based Assessment (PBA)
  – Type I items (Machine-scorable)
  – Type II items (Mathematical Reasoning/Hand-Scored – scoring rubrics are drafted but PLD development will inform final rubrics)
  – Type III items (Mathematical Modeling/Hand-Scored and/or Machine-scored - scoring rubrics are drafted but PLD development will inform final rubrics)

• End-of-Year Assessment (EOY)
  – Type I items only (All Machine-scorable)
Several types of evidence statements are being used to describe what a task should be assessing, including:

- Those using **exact standards language**
- Those transparently **derived from exact standards** language, e.g., by splitting a content standard
- **Integrative evidence statements** that express plausible direct implications of the standards without going beyond the standards to create new requirements
- **Sub-claim C & D evidence statements**, which put MP.3, 4, 6 as primary with connections to content
Several types of evidence statements are being used to describe what a task should be assessing, including:

1. Those using **exact standards language**

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<tr>
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<th>Clarifications, limits, emphases, and other information intended to ensure appropriate variety in tasks</th>
<th>Relationship to Mathematical Practices</th>
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| 8.EE.1| Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 1/3^3 = 1/27$.* | i) Tasks do not have a context.  
ii) Tasks center on the properties and equivalence, not on simplification. For example, a task might ask a student to classify expressions according to whether or not they are equivalent to a given expression. | MP.7                                   |
Several types of evidence statements are being used to describe what a task should be assessing, including:

2. Those transparently derived from exact standards language, e.g., by splitting a content standard

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<tr>
<td>8.F.5-1</td>
<td>Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear).</td>
<td>i) Pool should contain tasks with and without contexts.</td>
<td>MP.2, MP.5</td>
</tr>
<tr>
<td>8.F.5-2</td>
<td>Sketch a graph that exhibits the qualitative features of a function that has been described verbally.</td>
<td>i) Pool should contain tasks with and without contexts.</td>
<td>MP.2, MP.5, MP.7</td>
</tr>
</tbody>
</table>
Several types of evidence statements are being used to describe what a task should be assessing, including:

3. **Integrative evidence statements** that express plausible direct implications of the standards without going beyond the standards to create new requirements

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| 4.Int.1| Solve one-step word problems involving adding or subtracting two four-digit numbers.   | The given numbers are such as to require an efficient/standard algorithm (e.g., 7263 + 4875, 7263 – 4875, 7406 – 4637). The given numbers do not suggest any obvious *ad hoc* or mental strategy (as would be present for example in a case such as 16,999 + 3,501 or 7300 – 6301, for example).  

i) Grade 4 expectations in CCSSM are limited to whole numbers less than or equal to 1,000,000; for purposes of assessment, both of the given numbers should be limited to 4 digits.                                                                 | MP.1 |
Several types of evidence statements are being used to describe what a task should be assessing, including:

4. **Sub-claim C & Sub-claim D Evidence Statements**, which put MP.3, 4, 6 as primary with connections to content

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<tr>
<td>HS.C.5.11</td>
<td>Given an equation or system of equations, reason about the number or nature of the solutions. Content scope: A-REI.11, involving any of the function types measured in the standards.</td>
<td>i) For example, students might be asked how many positive solutions there are to the equation $e^x = x+2$ or the equation $e^x = x+1$, explaining how they know. The student might use technology strategically to plot both sides of the equation without prompting.</td>
<td>MP.3</td>
</tr>
</tbody>
</table>
What’s Next for PARCC Mathematics?

• Continue with Phase 1 of item development (50% of item bank)
• Conduct Research Studies on functionality and student interaction with items in Spring 2013
• Begin Phase 2 of item development
• Conduct Field Testing in Spring 2014
• Items are developed and internally reviewed by ETS, Pearson, and associated sub-contractors

• Items are brought to the Core Leader Group for an initial review with the PARCC states.

• Items are revised by the contractors.

• Some items are brought to a reconciliation review if more work on the item is necessary.

• Items are brought to Bias and Sensitivity Review and State Educator Review.
State Educator Reviewer Role

- Know and understand that the items have gone through extensive reviews
- Follow the steps of review outlined by the contractors during training to maintain focus
- Do not spend too much time on any one item
- Know and respect test security
- Review items quickly and consistently
State Educator Group Norms

- Begin on time
- End on time
- Respect questions
- Monitor your own airtime
- Stay on agenda
- Hold yourself personally accountable
- Do not use hostile language
- Respect the group
- Listen attentively
- Listen respectfully
- Discuss issues, not people
- Probe ideas; do not criticize people
- Show respect for views of others
- Avoid side conversations
- Assume positive intentions
- Observe basic conversational courtesies
- Avoid use of cell phone, personal/work laptops, and checking personal emails
• Math OWG
  o Acts as the PARCC lead in review group
  o Full participant in review group
  o Helps to keep group moving at a nice pace
  o Makes sure every committee member is heard
  o Will reconcile any items or issues with contractors at the end of each review day
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