National Center and State Collaborative

Appendix 3B – Study 4

NCSC GSEG Research Report

ELA and Mathematics Item Mapping Study: Performance Level Descriptions and Items

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National Center and State Collaborative

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ELA and Mathematics Item Mapping Study: Performance Level Descriptions and Items

September 2015

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National Center and State Collaborative.[1] (2015). *NCSC GSEG Research Report. ELA and Mathematics Item Mapping Study: Performance Level Descriptions and Items.* Minneapolis, MN: University of Minnesota, National Center and State Collaborative.

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National Center and State Collaborative

The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with the most significant cognitive disabilities.

NCSC is a collaborative of 24 states and five organizations. The NCSC states participating in the Spring 2015 NCSC operational assessment are: Arizona, Arkansas, Connecticut, District of Columbia, Idaho, Indiana, Pacific Assessment Consortium (PAC-6)[1], Maine, Montana, New Mexico, Rhode Island, South Carolina, South Dakota, and US Virgin Islands. As of Spring 2015, additional states are members of the NCSC Consortium, representing varying levels of participation. They are: California, Delaware, Florida, Louisiana, Maryland, New York, Oregon, Pennsylvania, Tennessee, and Wyoming.

The five NCSC partner organizations include: National Center on Educational Outcomes (NCEO) at the University of Minnesota, National Center for the Improvement of Educational Assessment (Center for Assessment), University of North Carolina at Charlotte, University of Kentucky, and edCount, LLC.

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This work was supported by a grant from the U.S. Department of Education, Office of Special Education Programs (H373X100002, Project Officer: Susan.Weigert@ed.gov). The contents do not necessarily represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

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[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).

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Executive Summary

Introduction

To serve students with the most significant cognitive disabilities, the National Center and State Collaborative (NCSC) is designing an alternate assessment as part of a system that includes curriculum, instruction, and professional development resources, all aligned with the college and career ready standards (CCRS).[2]

NCSC staff conducted the Item Mapping Study to examine the relationship between the items from the spring 2015 operational administration of the NCSC alternate assessment based on alternate achievement standards (AA-AAS) and the *performance level descriptions* (PLDs) for English language arts (ELA) and for mathematics. Panelists first determined the knowledge, skills, and abilities (KSAs) found in groups of items at each grade level within a content area. Panelists then determined the extent to which the KSAs in the items represented the KSAs in the PLDs, as well as the extent to which KSAs were present in the PLDs but missing from the group of items. Next, panelists analyzed which KSAs were present in the group of items but missing from the PLDs. Finally, panelists evaluated each item against the PLDs at each grade level and content area and determined the performance level, or PLD category, at which they would place the item. NCSC staff analyzed panelists' ratings of the relationship between the KSAs in item groups and the KSAs in the PLDs and used this information to inform the NCSC validity argument and to suggest changes to the PLDs for future iterations of the NCSC AA-AAS.

For purposes of this report, researchers addressed the following research questions about ELA and mathematics items in item groups:

1. What KSAs are present in a particular group of items?
2. How well do the KSAs in the item groups represent the KSAs in the PLDs? Do either the item groups or PLDs have gaps in the KSAs?
3. In which performance level or PLD category would panelists place each item? Does the panelists' placement of the items correspond to the placement of the items based on standard setting cut scores?

Methodology

Participants

Panelists who participated in the item mapping study were a subset of those who participated in the NCSC AA-AAS standard setting in the summer of 2015. A total of 29 ELA panelists and 33 mathematics panelists participated in the item mapping study,

[2] For a full copy of the report, please contact the Arizona Department of Education Director of Alternate Assessment, Audra Ahumada, at Audra.Ahumada@azed.gov.

with 3–9 panelists working in each of the grade-level and content area groups. Teachers and administrators from across the country with various backgrounds and experiences served as panelists. Approximately 82% of panelists (82.3%) indicated that they were special educators to students with significant cognitive disabilities at their grade level; the remaining 17.7% were general educators with content-specific expertise.

Establishing Item Groups

To evaluate the KSAs in the PLDs, researchers needed to create four groups of items that would correspond to four performance levels, or PLD categories. Specifically, researchers needed to create four groups of items that would match the abilities of the mid-range student in each of the four PLD categories. To do this, researchers needed the cut scores established during standard setting, the item difficulty levels, and the ordered item booklets.

Once standard setting concluded, the test development partner provided NCSC researchers with the cut scores by grade and content area. Each grade had three cut scores, and these scores were used to create four groups of items that corresponded to the PLD categories. Using the ordered item booklet and the item difficulty levels that the test development partner provided to NCSC researchers, researchers first identified the midpoint between each of the three cut scores. For example, if the first cut score fell on the eighth item in the ordered item booklet, researchers used the difficulty levels of the first item and the eighth item in the ordered item booklet to calculate the median difficulty level. Because the first cut score is bookended by the first item in the ordered item booklet, all items that fell below the midpoint between the first item and first cut score became part of item group 1.To create the next item group, researchers then calculated the median item difficulty between the first cut score (at the eighth item) and the second cut score (at the twentieth item). Researchers repeated this step to create the four item groups at each grade level for each content area (see Exhibit 4 for the number of items per group). Researchers created the item groups using the mid-point between each cut score to represent the mid-range student, and each of the four item groups corresponded to each of the four performance levels or PLD categories (e.g., item group 1 corresponded to performance level 1).

Data Collection Process

NCSC researchers provided panelists with ordered item booklets and PLDs on secure computers and in paper format. Because panelists had participated in the NCSC standard setting activities, they were familiar with these documents. NCSC researchers provided panelists with training to orient them to the tasks, and then panelists provided group-level consensus ratings as well as individual ratings to answer the study's three research questions concerning ELA and mathematics items and item groups.

Research Question 1: Group Ratings

Panelists worked with the members of their content area and grade-level group to list the KSAs present in each of the item groups and to reach consensus on those KSAs.

Researchers required panelists in each group to reach consensus on the KSAs found in an item group prior to moving on to individual ratings. Requiring this consensus on the KSAs in each item group ensured that each panelist used the same KSAs to answer the remaining questions.

Research Question 2: Individual Ratings

After reaching consensus on the KSAs in each item group, panelists worked independently to provide their overall ratings of the degree to which the KSAs in the item groups represented the KSAs found in the PLD categories. The panelists also noted any gaps between the KSAs represented in the items and those described in the PLDs. They used a rating scale to indicate the degree to which the KSAs in the group of items represented the KSAs in the PLDs (see Exhibit 1).

Exhibit 1. Rating the Relationship of KSAs in Items to KSAs in PLDs

Score	Description
0	This group of items barely represents or does not represent the knowledge, skills, and abilities found in the PLDs.
1	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, but there are notable gaps.
2	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, with small gaps.
3	This group of items fully represents the knowledge, skills, and abilities found in the PLDs.

After panelists provided their rating scores, they identified any gaps in KSAs between the item group and the corresponding PLDs. Specifically, panelists responded to the following questions:

- “What KSAs present in the PLDs are missing from this group of items?”
- “What KSAs present in this group of items are missing from the PLDs?”

Research Question 3: Individual Item PLD Ratings

After panelists compared KSAs in the item groups to KSAs in the corresponding PLDs and identified gaps, researchers asked panelists to place each item into the performance level or PLD category that they thought was the best fit. Researchers presented the items to panelists in the ordered item list. They acknowledged that panelists’ experience with the standard setting conducted prior to item mapping might introduce bias into the activity, but they asked panelists to focus on the KSA descriptions for an item and to compare those descriptions to the PLD categories, doing their best to set aside knowledge of the standard setting results.

Data Analysis

For the purpose of this report, researchers organized panelist-designated item group KSAs into tables by grade and content area.

To analyze how well the KSAs in the item groups represented the KSAs in the PLDs, researchers calculated the average rating score by content area, grade, and item group and provided the range of rating scores. In grade-specific tables, researchers presented the average rating scores, the range of rating scores, and the KSAs that panelists thought were present in the PLDs but missing from the group of items. Researchers expected that only a few of the KSAs that were present in the item groups would be missing from the PLDs, thus, researchers simply provided the list of missing KSAs in grade and content area tables.

To evaluate whether the panelists' PLD placement of the item corresponded to the PLD placement established during the standard setting process, researchers first assigned a panelist's rating to one of three groups:

(a) The placement coincides with that found through standard setting;

(b) The placement is at a higher performance level than that found through standard setting; or

(c) The placement is at a lower performance level than that found through standard setting.

Researchers then calculated the frequency and percent of panelists' PLD assignments falling into the above rating groups by content area and grade level.

Findings

Researchers described findings by research question.

Research Question 1: What KSAs are present in the group of items?

Panelists identified the KSAs that described each of the four item groups per content area. In general, panelists agreed on the KSAs for each item group and did not have any difficulty in understanding how the item groups related to the PLDs .

Research Question 2: How well do the KSAs in the item groups represent the KSAs in the PLDs? Do either the item groups or PLDs have gaps in the KSAs?

To address this question, panelists in each grade level used the lists of KSAs that they had identified as representative of the each of the four item groups and compared the KSAs in the item groups to the KSAs in the corresponding PLDs. Panelists rated the items using the 0–3 rating scale (see Exhibit 1) to indicate the extent to which the KSAs in the four item groups represented the KSAs in the PLDs.

ELA

ELA grade 3 panelists' average ratings ranged from 1.75 to 2.25 across item groups. Almost all panelists gave item groups a rating score of *2* or above, indicating that the KSAs in the item groups represented the KSAs in the PLDs, but with small gaps. However, one rater indicated that there were notable gaps between the KSAs in item groups 1 and 4 and the KSAs in the PLDs.

ELA grade 4 panelists' average ratings ranged from 1.60 to 2.30 across item groups. All grade 4 ELA panelists gave item groups 3 and 4 rating scores of *2* and *3*, indicating that the KSAs in the item groups represented the KSAs in the PLDs, with small gaps, or that the KSAs in the item groups fully represented the KSAs in the PLDs. However, two panelists indicated that there were notable gaps between the KSAs in item group 1 and the KSAs in the corresponding PLDs.

ELA grade 5 panelists' average ratings ranged from 1.30 to 2.00. They gave the KSAs in three of the four item groups a rating score of *2*, indicating that the KSAs in the items represented some of the KSAs found in the PLDs, with small gaps. However, two raters indicated that there were some notable gaps in the KSAs in item group 2.

ELA grade 6 panelists' average rating ranged from 1.33 to 1.67. They gave all four item groups a rating score of *1* or *2*, indicating that either notable or small gaps were present in the KSAs in each item group.

ELA grade 7 panelists' average ratings ranged from 1.00 to 3.00, and panelists consistently agreed on their ratings. All four panelists gave item group 1 a rating score of *1*, indicating that the KSAs in that group contained notable gaps. All four panelists also gave item groups 2 and 3 a rating score of *2*, indicating that the KSAs in those groups had small gaps. All four panelists gave a rating score of *3* to item group 4, indicating that the KSAs in the group fully represented the KSAs found in the PLDs.

ELA grade 8 panelists' average ratings ranged from 2.00 to 3.00, and panelists consistently agreed on their ratings. All panelists gave item groups 1 and 3 a rating score of *2,* indicating that the KSAs in the item groups represented some of the KSAs found in the PLDs, with small gaps. Some panelists gave item groups 2 and 4 a rating score of *3*, indicating that the item groups fully represented the KSAs in the PLDs.

ELA grade 11 panelists' average ratings ranged from 1.00 to 3.00. Panelists consistently gave item groups 2, 3, and 4 rating scores of *2* and *3*. However, all panelists gave item group 1 a rating score of *1*, indicating that the item group was missing several KSAs found in the corresponding PLDs.

Mathematics

Mathematics grade 3 panelists' average rating was 2.00 across all item groups. This rating indicated that the items represented some of the KSAs in the PLDs but had some small gaps.

Mathematics grade 4 panelists' average ratings ranged from 1.00 to 1.30. For each item group, panelists agreed that the KSAs in a particular item group represented some of

the KSAs found in the PLDs, but that there were either notable gaps or small gaps. All three panelists gave item groups 1 and 2 a rating score of *1*, indicating that there were notable gaps in the KSAs for each item group. One panelist indicated there were small gaps in the KSAs in item groups 3 and 4, but two panelists indicated that there were notable gaps in these item groups.

Mathematics grade 5 panelists' average ratings ranged from 0.00 to 2.25; they were the only group across content areas and grade levels to unanimously assign a rating score of *0* to an item group. They agreed that the KSAs in item group 1 barely represented or did not represent the KSAs in the PLDs. However, they found that the KSAs in item groups 2, 3, and 4 either fully represented or represented with small gaps the KSAs in the PLDs.

Mathematics grade 6 panelists' average ratings ranged from 1.25 to 2.25, and researchers found notable variability in their ratings across the item groups. Panelists noted that the KSAs in item group 1 did not represent the KSAs in the PLDs, barely represented the KSAs in the PLDs, or represented some of the KSAs in the PLDs, but with notable gaps. Three of the four panelists indicated that the KSAs in item group 2 barely represented or did not represent the KSAs in the PLDs. Panelists agreed that the KSAs in item group 3 contained small gaps or no gaps. Most panelists indicated that the KSAs in item group 4 did not represent the KSAs in the PLDs (they gave that item group a rating score of *0*), and another panelist indicated that there were notable gaps.

Mathematics grade 7 panelists' average ratings ranged from 1.00 to 2.00. They agreed that the KSAs in item groups 2, 3, and 4 represented the KSAs in the PLDs, with small gaps. All four panelists gave item group 1 a rating score of *1*, indicating that there were notable gaps in the KSAs in that item group.

Mathematics grade 8 panelists' average ratings ranged from 1.00 to 2.00. All panelists indicated that there were notable gaps in the KSAs in item group 1. Three panelists reported that the KSAs in item group 2 represented the KSAs in the PLDs with small gaps; however, one panelist indicated that there were notable gaps. Three panelists indicated that the KSAs in item group 3 represented the KSAs in the PLDs with small gaps; but again, one panelist indicated that there were notable gaps. All grade 8 mathematics panelists agreed that the KSAs in item group 4 represented the KSAs in the PLDs, with small gaps.

Mathematics grade 11 panelists' average ratings ranged from 1.60 to 2.40, and researchers found notable variability in their ratings across the item groups. Three of the nine panelists indicated that the KSAs in item group 1 contained notable gaps. Two panelists indicated that there were notable gaps in KSAs in item group 2. Six of the nine panelists indicated that there were notable gaps in the KSAs in item group 3. Finally, two panelists indicated that there were notable gaps in KSAs in item group 4.

Gaps in the PLDs

Panelists also identified the KSAs they found in the items but not in the PLDs (see Appendix F. ELA: KSAs Present in the Group of Items but Missing From the PLDs and

Appendix G. Mathematics: KSAs Present in the Group of Items but Missing From the PLDs). In general, ELA and mathematics panelists indicated that more KSAs were missing from item groups than were missing from PLDs; however, mathematics panelists identified more PLDs missing KSAs than did ELA panelists.

ELA panelists at grades 3, 4, and 6 noted that the PLDs were missing more KSAs than the item groups. However, in this same type of reverse comparison, ELA panelists at grades 5, 7, 8, and 11 noted that few KSAs were missing from the PLDs.

Mathematics panelists at grades 6 and 11 reported that more PLDs than item groups were missing KSAs. However, in this same type of reverse comparison, panelists at grades 3–5 and 7–8 reported that fewer KSAs were missing from the PLDs.

Research Question 3: In which performance level or PLD category would panelists place each item? Does the panelists' placement of the items correspond to the placement of the items based on standard setting cut scores?

As their final task, panelists assigned each individual item to the performance level that they thought best fit the item. Researchers reiterated that panelists should attempt to disregard item placement based on the cut scores determined through standard setting, and instead make decisions about assigning an appropriate performance level based on the panelist's assessment of what the item required rather than on the descriptors at each performance level.

In all ELA grades, 71.9% of panelists' placements of items corresponded to the same performance level as had been established through the application of cut scores from standard setting (see Exhibit 2). Grade 4 ELA panelists placed the fewest number of items in the same PLD level: only 57% placed items at the performance level corresponding to the PLD category established for the item by the application of the cut scores. Of item placements at a different performance level, 16.4% corresponded to a placement that was higher than the placement established through application of the cut scores, and 11.7% corresponded to a placement that was lower than the level established during standard setting.

Across all grades, 72.8% of mathematics panelists' placements of the items corresponded to the performance level established through the application of cut scores from standard setting. Mathematics panelists at grades 4 and 8 placed the fewest number of items in the same performance level or PLD category (65.8% and 67.5%, respectively). Of item placements at a performance level that differed from an item's performance level established through standard setting, 17.9% corresponded to a higher level and another 9.3% corresponded to a lower level.

Exhibit 2. Panelists' Performance Level Placements of Items, by Content Area and Grade

		Percent		
Content area	**Grade**	**Same**	**Higher**	**Lower**
ELA	3	75.8	6.8	17.4
	4	57.0	28.5	14.5
	5	75.0	10.7	14.3
	6	71.3	18.4	10.3
	7	73.6	20.0	6.4
	8	73.5	19.1	7.4
	11	77.6	11.0	11.4
	Total	71.9	16.4	11.7
Mathematics	3	74.8	24.5	0.6
	4	65.8	27.5	6.7
	5	78.8	16.3	5.0
	6	75.0	11.3	13.8
	7	70.6	17.5	11.9
	8	67.5	11.9	20.6
	11	77.2	16.1	6.7
	Total	72.8	17.9	9.3

Conclusions

NCSC examined the degree to which the NCSC AA-AAS operation items mapped to the ELA and mathematics PLDs to ascertain whether the KSAs captured by the items corresponded to and represented what NCSC intended to measure.

In general, ELA panelists indicated that the KSAs in the item groups represented the KSAs in the corresponding PLDs. Though many grades had panelists who assigned a rating score of *1* to some of the item groups, these ratings were typically made by one participant in a particular group. Across grades, the average alignment rating met or exceeded 2.00 in 18 of the 28 item groups (64.3%), indicating that the KSAs in the item groups represented the KSAs in the associated PLDs, with only small gaps. Of the item groups with an average rating of less than 2.00, six had an average rating of 1.60 or higher (21.4%). All grade 6 item group average ratings fell below 2.00, exhibiting the lowest averages of any grade.

Mathematics panelists provided notably more rating scores of *1* or *0* than did ELA panelists (34.3% and 19.6%, respectively); mathematics panelists were also the only panelists to assign a rating score of *0* to any item group. In comparison to the average ELA rating, the average mathematics rating met or exceeded 2.00 for only 12 of the 28 mathematics item groups (42.9%). Of the item groups with an average rating of less than 2.00, five had an average rating of 1.60 or higher (17.9%). However, no item group

in grade 4 had an average rating that reached 1.50, indicating that the KSAs in all grade 4 item groups represented some of the KSAs in the PLDs but with notable gaps.

Panelists indicated that some KSAs were missing when they used either the item group or the PLD as their frame of reference. They found fewer gaps when they used the item group as a frame of reference and evaluated whether a PLD was missing KSAs that were in the item group than when they used the PLD as a frame of reference and evaluated whether items were missing KSAs that were in the PLD.

Some 71.9% of ELA panelists' placement of items at a performance level corresponded to the performance level established through application of the cut scores. If panelists did not think that an item belonged to the same performance level, they most often placed the item at a higher level. Nearly 73% (72.8%) of mathematics panelists' placement of the items corresponded to the placement established through standard setting. But if panelists did not think an item belonged to the same performance level, they most often placed the item at a higher level.

Limitations and Recommendations

Familiarity with the PLDs and the items was integral to the success of the study. As such, researchers capitalized on the knowledge that panelists had gained during the standard setting process and scheduled the Item Mapping Study to occur directly after the standard setting process. However, panelists' familiarity with the cut scores, with the order of items in terms of difficulty, and with the application of the PLDs might have introduced bias into their descriptions of KSAs within an item group and their placement of items at a performance level. Researchers frequently reminded panelists to disregard the information they had learned during standard setting and found that some panelists recommended placing items at higher or lower performance levels than had been established with the cut scores from standard setting.

Many panelists indicated that the item groups were missing many of the KSAs found in the corresponding PLDs. This could be attributed to the placement of the cut scores. In addition, state partners may want to revisit the PLDs to ensure ample coverage of the KSAs.

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NCSC ELA and Mathematics Item Mapping Study: Performance Level Descriptions and Items

Introduction

To serve students with the most significant cognitive disabilities, the National Center and State Collaborative (NCSC) is designing an alternate assessment based on alternate achievement standards (AA-AAS) as part of a system that includes curriculum, instruction, and professional development resources, all aligned with the college and career ready standards (CCRS). NCSC is committed to developing an assessment system that connects instruction and assessment. As part of this commitment, NCSC conducted the Item Mapping Study in the summer of 2015 to investigate the relationship between the items from the spring 2015 operational assessment administration and the English Language Arts (ELA) and the mathematics *performance level descriptions* (PLDs). This report details the findings from the Item Mapping study.

The purpose of the Item Mapping Study was to examine the alignment of the knowledge, skills, and abilities (KSAs) in the PLDs with the KSAs in item groups that researchers created using the standard setting cut scores and item difficulty levels. Researchers sought to ascertain whether the original PLDs captured the KSAs as NCSC intended. NCSC researchers conducted the study immediately following the test development partner's standard setting meeting for the spring 2015 administration. Conducting the study immediately following standard setting allowed researchers to capitalize on the panelists' familiarity with and knowledge of the operational items as presented in the ordered item booklets.

Researchers asked panelists representing each grade level and content area to describe the KSAs in the groups of items that researchers had created using the standard setting cut scores and item difficulty levels. Panelists used these KSAs (a) to identify how well item groups mapped onto the corresponding PLD categories, (b) to describe any missing KSAs in either the item groups or the PLDs, and (c) to assign each individual item to a particular performance level, or PLD category. Ultimately, researchers will use the results to improve the PLDs where needed and to strengthen the validity argument.

Research Questions

NCSC staff developed the research questions with the goal of collecting evidence to determine how well the item groups mapped onto the PLDs. Researchers addressed the following research questions about the ELA and mathematics items and item groups:

1. What KSAs are present in this group of items?
2. How well do the KSAs in the item groups represent the KSAs in the PLDs? Do either the item groups or PLDs have gaps in the KSAs?
3. In which performance level or PLD category would panelists place each item? Does the panelists' placement of the items correspond to the placement of the items based on standard setting cut scores?

Standard Setting

During standard setting, panelists used a modified bookmark method to set cut scores for each performance level. The bookmark method involved providing panelists with an ordered item booklet, which orders the items on the operational assessment from least to most difficult. In describing the task of setting cut scores, test development partners asked panelists to think about the characteristics of a student who would barely make it past a particular item, and to set the cut score at that item. Thus, the focus of standard setting was the student on the cusp of the cut score. Researchers used these cut scores to create the item groups for the Item Mapping Study.

Methodology

Panelists

Three to nine panelists worked in each of the grade-level and content-area groups (see Exhibit 1 and Exhibit 2). Teachers and administrators from across the country with various backgrounds and experiences served as panelists during item mapping. They reported their experience through a brief questionnaire (see Appendix A. Panelist Questionnaire). Approximately 82% of panelists (82.3%) indicated that they were special educators to students with significant cognitive disabilities at their panel grade level, though some general educators also participated in the study (see Exhibit 3).

Panelists represented the following NCSC partner states who participated in the spring 2015 operational assessment administration: Arizona, Arkansas, Connecticut, Idaho, Indiana, Maine, Montana, New Mexico, Rhode Island, South Carolina, and South Dakota, as well as the District of Columbia and the U.S. Virgin Islands.

Exhibit 1. Total Number of Panelists: ELA

Grade	Number of panelists
3	4
4	5
5	3
6	3
7	4
8	4
11	6
Total	29

Exhibit 2. Total Number of Panelists: Math

Grade	Number of panelists
3	4
4	3
5	4
6	4
7	4
8	5
11	9
Total	33

Exhibit 3. Panelist Background and Experience

Experience	Number of panelists*	Percentage of panelists
Special educator of students with significant cognitive disabilities at panel grade levels	51	82.3
General educator/content specialist with mathematics/ELA expertise at panel grade levels	8	12.9
Administrator with expertise with students with significant cognitive disabilities	11	17.7
Experience teaching students who are blind, deaf, or deaf-blind	20	32.3
Experience teaching students who are English learners and have significant cognitive disabilities	21	33.9

Note. Panelists could respond to multiple options.

Performance Level Descriptions

Performance level descriptions (PLDs) describe the KSAs that students performing at a given level should possess. In creating the PLDs, NCSC went through an iterative process that involved obtaining feedback from organizational partners and content experts. The in-depth examination of the grade-level PLD categories within and across grade levels and content areas ensured that the PLDs provided progressive descriptions of what students are expected to know and be able to do as an outcome of progress across grades, with the end goal being college, career, and community readiness. The NCSC PLDs describe the KSAs that are expected of the mid-range student, or the student whose skills and abilities would match the middle of a particular PLD level.

Establishing Item Groups

To evaluate the KSAs in the PLDs, researchers needed to create a group of items that would correspond to each of the four PLD categories, or performance levels. Specifically, researchers needed to create four groups of items that corresponded to the mid-range student in each of the four performance levels. To do this, researchers needed the cut scores established during standard setting, the item difficulty levels, and the ordered item booklets.

Once standard setting concluded, the test development partner provided NCSC researchers with the cut scores by grade and content area. Each grade had three cut scores, and these scores were used to create four groups of items that corresponded to the four performance levels. Using the item difficulty levels that the test development partner provided to NCSC researchers, and the ordered item booklet, researchers first identified the midpoint between each of the three cut scores. For example, if the first cut score fell on the eighth item in the ordered item booklet, researchers used the difficulty levels of the first item and the eighth item in the ordered item booklet to calculate the median difficulty level. Because the first cut score is bookended by the first item in the ordered item booklet, all items that fell below the midpoint between the first item and first cut score became part of item group 1.To create the next item group, researchers then calculated the median item difficulty between the first cut score (at the eighth item) and the second cut score (at the twentieth item). Researchers repeated this step to create the four item groups at each grade level for each content area (see Exhibit 4 for the number of items per group). Researchers created the item groups using the mid-point between each cut score to represent the mid-range student, and each of the four item groups corresponded to each of the four performance levels or PLD categories (e.g., item group 1 corresponded to performance level 1).

Exhibit 4. Number of Items per Item Group

	Grade	**Item group**			
		1	**2**	**3**	**4**
ELA	3	4	6	13	7
	4	4	8	12	8
	5	5	5	10	5
	6	5	5	12	7
	7	4	7	8	12
	8	4	9	8	11
	11	4	6	14	8
Mathematics	3	4	10	15	10
	4	6	7	13	9
	5	5	7	16	11
	6	7	10	13	7
	7	5	9	10	14
	8	4	10	14	10
	11	4	7	12	15

Data Collection Process

NCSC researchers provided panelists with ordered item booklets and PLDs on secure computers and in paper format. NCSC researchers first provided training to the groups to orient them to the tasks (see Appendix B. Item Mapping Training). After NCSC researchers provided the training sessions, panelists provided group-level and individual ratings. On the first day of the study, ELA and mathematics panelists at grade 11 completed the rating process. On the second day of the study, ELA and mathematics panelists at grades 3–8 completed the rating process.

Research Question 1: Group Level Ratings

Panelists worked with their content-area and grade-level groups to list the KSAs in each of the four groups of items, each of which had anywhere from 4 to 16 items. Panelists collaborated within their content-area and grade-level groups to describe the KSAs in each item group. Specifically, panelists in each group responded to the question, "What knowledge, skills, and abilities are found in this group of items?" Researchers required panelists in each group to reach consensus on the KSAs found in item groups prior to moving on to individual ratings. Requiring consensus on the KSAs for each item group ensured that each panelist used the same KSAs to answer the remaining questions.

Research Question 2: Individual Ratings

After reaching consensus in describing the KSAs in each item group, panelists worked independently to provide their overall ratings of the item groups and to note any gaps between the KSAs in the items and the KSAs in the PLDs.

Panelists first rated the degree to which the KSAs in the item groups represented the KSAs in the PLDs. During the training session and throughout the rating process, NCSC researchers reminded panelists that the PLDs describe the mid-range student, or the student whose skills and abilities would match the middle of a particular PLD level, and they explained that they created the four item groups in each grade level and content area using the item difficulty midpoint between the cut scores. Panelists used a rating scale to indicate the degree to which the KSAs in the group of items represent the KSAs in the PLDs (see Exhibit 5).

Exhibit 5. Rating the Relationship of KSAs in Items to KSAs in PLDs

Score	Description
0	This group of items barely represents or does not represent the knowledge, skills, and abilities found in the PLDs.
1	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, but there are notable gaps.
2	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, with small gaps.
3	This group of items fully represents the knowledge, skills, and abilities found in the PLDs.

After panelists provided their rating scores, they identified any gaps between KSAs in the item group and KSAs in the corresponding PLDs. Specifically, panelists responded to the following questions:

- "What KSAs present in the PLDs are missing from this group of items?"
- "What KSAs present in this group of items are missing from the PLDs?"

Research Question 3: Individual Item PLD Ratings

Upon completing the description of any gaps between the KSAs in the item group and the KSAs in the corresponding PLDs, researchers asked panelists to place each item into the performance level they thought was the best fit. Researchers presented panelists with the items in the ordered item list they had seen during the standard setting meeting. Researchers acknowledged that panelists' familiarity with the ordered item booklets and the cut scores may have biased their item assignments.

Participant Evaluation

At the conclusion of the study, panelists completed an evaluation of the study's process (see Appendix C. Evaluation Form). Researchers asked panelists to rate their agreement—*strongly agree* (4), *agree* (3), *disagree* (2), or *strongly disagree* (1)—with a series of statements about the study. Panelists' evaluations reflect high levels of satisfaction with the process and the outcomes of the study (see Exhibit 6).

Exhibit 6. Participant Evaluation Results

Statement	Average rating
1. Facilities were appropriate to the work.	3.5
2. Introductory presentation and training sessions were clear.	3.2
3. The process used was appropriate to the work.	3.4
4. The process used resulted in good information about the items and the PLDs.	3.4
5. I was able to make a contribution to the study.	3.6
6. I am satisfied with the rating scale used.	3.4
7. I am confident that my holistic ratings are reasonable.	3.5
8. I am confident that my item level ratings are reasonable.	3.5

Data Analysis

Researchers did not analyze the KSAs that participants used to describe each item group. Researchers simply tabled the list of KSAs by content area and grade.

To analyze how well the KSAs in the item groups represented the KSAs in the PLDs, researchers calculated the average rating by content area, grade, and item group. Researchers presented the average ratings by item group in a table, along with the KSAs that panelists reported as missing in that item group. Researchers expected that only a few of the KSAs that were present in the items would be missing from the PLDs, they created tables for the list of missing KSAs in the PLDs.

To evaluate whether the panelists' PLD placement of the item corresponded to the placement established during standard setting, researchers calculated the frequency of panelists' PLD assignment by content area and grade. Specifically, researchers calculated the frequency with which panelists' PLD assignment matched the PLD assignment that had been established during standard setting, and the frequency with which placements were higher or lower than that placement.

Results

Researchers described results by research question.

Research Question 1: What KSAs are present in the group of items?

Panelists identified the KSAs that described each of the four item groups (see Appendix D. ELA Items: Knowledge, Skills, and Abilities Identified by Panelists and Appendix E. Mathematics Items: Knowledge, Skills, and Abilities Identified by Panelists). In general, panelists easily reached consensus in identifying the KSAs for each item group and did not have any difficulty in understanding how the item groups related to the PLDs.

Research Question 2: How well do the KSAs in the item groups represent the KSAs in the PLDs? Do either the item groups or PLDs have gaps in the KSAs?

To address this question, panelists used the lists of KSAs that they identified as representative of the item group and compared these to the KSAs in the corresponding PLDs. Panelists gave the items a score of 0–3 to indicate the extent to which the KSAs in the four item groups represented the KSAs in the PLDs (see Exhibit 4). Panelists also indicated which KSAs were present in the PLDs but missing from the item groups. Exhibits 5–18 represent the panelists' average ratings and the range of individual ratings.

ELA: Gaps in the Item Groups

ELA grade 3 panelists' average ratings ranged from 1.75 to 2.25 (see Exhibit 7). Panelists' gave item groups rating scores of *2* and above, with the exception of one rater who gave item group level 2 a rating score of *1* and one rater who gave item group level 4 a rating score of *1*. The panelist who provided a *1* rating score to item group 2 indicated that using information from charts, graphs, and diagrams to answer questions, identifying the purpose of text features, describing the relationships between characters, identifying simple words, and identifying categories related to the set of facts were missing from the items. The panelist who gave item group 4 a rating score of *1*

indicated that finding the main idea and supplementary ideas in informational text, finding the main idea of something visually presented, and using information from charts, graphs, and diagrams to answer questions were missing.

Exhibit 7. ELA: Grade 3 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	2.00	2	Identify characters/setting in literary text; identify title, caption or heading in info text; identify word meaning; detail from text; identify topic in a literary text.
2	1.75	1–2	Use info from charts, graphs, diagrams to answer questions; identify the purpose of text features; describe relationship between characters; identify simple words; identify category related to set of facts; details from text.
3	2.25	2–3	Identify the purpose of text features; identify grade level words; identify a text feature to present information.
4	2.25	1–3	Main idea and supplementary ideas in informational text; main idea of visually presentation; use information from charts, graphs, or diagrams to answer questions; identify purpose of text features in info text.

Note. Missing KSAs were provided by panelists.

Grade 4 ELA panelists consistently rated the KSAs in item groups 3 and 4 as representing the KSAs in the PLDs with only small gaps or no gaps (see Exhibit 8). Two panelists rated the KSAs in item group 1 as having notable gaps, and one of those two panelists rated the KSAs in item group 2 as containing notable gaps. In item group 1, the two panelists noted that the following KSAs were missing: identifying charts, graphs, diagrams, or timelines in an informational text, using context to identify the meaning of multiple meaning words, and identifying the concluding sentence. However, item group 1 contained only four items, so several KSAs present in the PLDs were likely absent from the small item group. The panelist who provided a rating score of *1* to item group 2 indicated that the following KSAs were missing: using context to identify the meaning of multiple meaning words; identifying simple words; locating information in charts, graphs, and diagrams; and identifying the concluding sentence related to information in an explanatory text.

Exhibit 8. ELA: Grade 4 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.60	1–2	Identify charts, graphs, diagrams, or timelines in an info text; use context to identify the meaning of multiple meaning words; identify concluding sentence.
2	1.80	1–2	Use context to identify the meaning of multiple meaning words; identify simple words; locate information in charts, graphs, diagram; identify concluding sentenced related to information in explanatory text; determine theme.
3	2.40	2–3	Describe character traits using text based details in literacy text; determine the main idea of informational text; identify supportive details; explain how the info provided in charts, graphs, diagrams contributes to understanding; identify a text feature.
4	2.80	2–3	Determine the theme of literary text and identifying supportive details; explain how information from charts, graphs, diagrams, or timelines contributes to an understanding.

Note. Missing KSAs were provided by panelists.

ELA grade 5 panelists gave the KSAs in three of the four item groups a rating score of 2, indicating that the KSAs in the items represented some of the KSAs found in the PLDs, with only small gaps (see Exhibit 9). However, two raters indicated that there were some notable gaps in the KSAs in item group 2. These two raters noted that the following KSAs in the PLDs were missing from the items: determining the main idea with supporting details; using details from the text to support the author's point of view; comparing and contrasting how information and events are presented in two texts; using context to identify the meaning of multiple meaning words; and comparing characters, settings, and events.

Exhibit 9. ELA: Grade 5 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	2.00	2	Identify character setting and event in a literary event; identify main idea of informational text; anything having to do with informational text including topic, main idea.
2	1.30	1-2	Determine main idea with supporting details; use details from text to support author's point of view; compare and contrast how information and events are presented in two texts; use context to identify the meaning of multiple meaning words; compare characters, settings and events.
3	2.00	2	Use details from text to support an author in informational text; include a variety of sentence types including phrases and transition words; support an explanatory text topic with relevant information; compare characters, setting, events; determine main idea and supporting details.
4	2.00	2	Compare characters, setting, and events in literary text; use details from text to support an author’s point in informational text; compare and contrast how info and events are presented in two informational texts.

Note. Missing KSAs were provided by panelists.

Panelists gave the ELA grade 6 KSAs in the item groups an average rating between 1.33 and 1.67 (see Exhibit 10). Panelists gave all four item groups rating scores of *1* or *2*, indicating that compared to the KSAs in the PLDs, there were either notable or small gaps in the KSAs in each item group. Two panelists noted that in item group 1, identifying an event from beginning to end; identifying a character; and identifying a description were missing. In item group 2, a panelist reported that comparing alike and different; making inferences about characters; and identifying the introduction, body, and conclusion were missing. In item group 3, a panelist noted that using evidence from the text to support the author’s claim; and supporting inferences about characters using literacy text were missing. In item group 4, panelists noted that summarizing text from beginning to end; asking what is next (in the beginning, middle, and the end); making inferences about characters; and using details in literary text were missing. Researchers noted that item groups 1 and 2 each possessed only five items; thus it is likely that some of the KSAs present in the PLDs were missing from the small item groups.

Exhibit 10. ELA: Grade 6 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.33	1-2	Identify event beginning to end; make inferences; address writing; identify a character; identify a description; variety of text - only literary; multi- meaning word in informational text; identifying an event.
2	1.67	1-2	Summarize literary text beginning to end; variety of text; compare alike and different; make inferences about characters; identify introduction, body and conclusion.
3	1.67	1-2	Few items addressing writing; evidence from text to support author's claim; support inferences about characters using literary text; variety of text- needs both, not two informational texts being compared; transition words, phrases.
4	1.67	1-2	Summarize text beginning to end, keyword is summarize; ask what is next, beginning, middle, end; inferences about characters using details in literary text; variety of text- only informational; detail from literary text.

Note. Missing KSAs were provided by panelists.

Grade 7 ELA panelists consistently agreed on their ratings (see Exhibit 11). All four panelists gave item group 1 a rating score of *1*, indicating that its KSAs contained notable gaps; this item group also possessed only four items. All four panelists also gave item groups 2 and 3 a rating score of *2*, indicating that the KSAs in the item groups contained only small gaps. All four panelists gave item group 3 a rating score of *3*, indicating that the KSAs in the item group fully represented the KSAs found in the PLDs. Panelists noted that in item group 1, the following KSAs were missing: identify the theme and conclusion, compare and contrast, and identify a supporting claim.

Exhibit 11. ELA: Grade 7 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.00	1	Theme; conclusion; compare and contrast; identify a supporting claim.
2	2.00	2	[The items are] not missing anything referenced in the PLD, however, [skills are] touched on lightly; Nothing missing but not as developed as could be.
3	2.00	2	Compare and contrast how two authors write about the same topic in informational texts.
4	3.00	3	None.

Note. Missing KSAs were provided by panelists.

Grade 8 ELA panelists consistently agreed on their ratings (see Exhibit 12). All panelists gave item groups 1 and 3 a rating score of 2, indicating that the KSAs in the items represented the KSAs in the PLDs, but contained small gaps. Panelists gave item groups 2 and 4 a rating score of *3*, indicating that the KSAs in the items fully represented the KSAs in the PLDs. Panelists provided examples of some missing KSAs even if they provided a *2* or *3* rating score.

Exhibit 12. ELA: Grade 8 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	2.00	2	Identify a fact related to a presented argument in informational text; identify a similar topic in two informational texts; use context to identify the meaning of multiple meaning words.
2	3.00	3	Use details to support a conclusion (in writing not reading).
3	2.00	2	Use details to support a conclusion from a literary text.
4	3.00	3	Used two texts but not looking for disagreement on facts or interpretation.

Note. Missing KSAs were provided by panelists.

Grade 11 ELA panelists consistently gave the item groups 2, 3, and 4 ratings of *2* and *3* (see Exhibit 13). However, all grade 11 ELA panelists gave item group 1 a rating score of *1* and indicated that the item group was missing the following KSAs: literature; writing; identifying a summary of a literary text; using context to identify the meaning of

multiple meaning words; identifying information unrelated to a given topic; describing words; identifying an event from a literary text; identifying what an author tells as the main idea; all literary text components; and identifying a word. Because item group 1 contained only four items, it is possible that KSAs present in the corresponding PLD category were missing from the small group of items.

Exhibit 13. ELA: Grade 11 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.00	1	No literature, no writing; identify summary of a literacy text; use context to id meaning of multi-meaning words; identify info unrelated to a given topic; describe words; identify an event from literary text; identify what an author tells; all literary text components; identify a word.
2	2.20	2-3	Support summary; use context to id the meaning of grade level phrases; two info texts; develop central idea; authors word choice; explain why an author's use of specific word choices within text; author's point of view; context to identify meaning; identify how to group information by text structure.
3	2.70	2-3	Identify relevant information; authors use of specific words; use details to support a summary; grade level phrases; evaluate how author's use of specific details in literary text contribute to text (embedded but not fully represented).
4	3.00	3	None.

Note. Missing KSAs were provided by panelists.

Mathematics: Gaps in the Item Groups

Mathematics grade 3 panelists provided a *2* rating score across the four item groups, indicating that the KSAs in the items represented some of the KSAs in the PLDs, but had some small gaps (see Exhibit 14).

Exhibit 14. Mathematics: Grade 3 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	2.00	2	[Identify] growing number patterns; identify an object showing a specified number of parts shaded; identify an object equally divided into two parts.
2	2.00	2	Identify a set of objects as nearer to 1 or 10; identify a representation of the area of a rectangle (found in level 1).
3	2.00	2	Solve addition and subtraction word problems (level 2 and 4); check the correctness of an answer in the context.
4	2.00	2	Identify multiplication patterns; transfer data from an organized list to a bar graph (level 3).

Note. Missing KSAs were provided by panelists.

Mathematics panelists in grade 4 agreed that the KSAs in the item groups represented some of the KSAs in the PLDs, but that there were either notable gaps or small gaps in the KSAs (see Exhibit 15). All three panelists agreed that there were notable gaps in the KSAs in item groups 1 and 2. Panelists noted that in item group 1, identifying values rounded to the nearest tens place, comparing representations of a fraction, and identifying a rectangle with smaller or larger perimeters were missing. Panelists noted that in item group 2, identifying a model of a multiplication comparison, differentiating parts and wholes, computing the perimeter of a rectangle, and identifying equivalent fractions were missing. One panelist noted that in item groups 3 and 4, there were only small gaps in item KSAs, but two panelists indicated that there were notable gaps. The panelists who indicated that there were notable gaps in the KSAs in item group 3 indicated that transferring data from a graph, checking the correctness of an answer in the context of a scenario, and identifying equivalent fractions were missing. Panelists noted that in item group 4, rounding numbers to the nearest 10, 100, and 1000; sorting a set of two-dimensional shapes; and computing the perimeter of a rectangle were missing.

Exhibit 15. Mathematics: Grade 4 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.00	1	Identify values rounded to the nearest tens place; compare representations of a fraction (e.g., shaded diagram); identify a rectangle with smaller or larger perimeter.
2	1.00	1	Identify a model of a multiplication comparison; differentiate parts and wholes; compute the perimeter of a rectangle; identify equivalent fractions.
3	1.33	1-2	Transfer data graph; check the correctness of an answer in the context of a scenario; identify equivalent fractions.
4	1.33	1-2	Round number to nearest 10, 100, 1000; sort a set of two-dimensional shapes; compute the perimeter of a rectangle.

Note. Missing KSAs were provided by panelists.

Grade 5 mathematics panelists agreed that the KSAs in group 1 items barely represented the KSAs in the PLDs, or did not represent the KSAs in the PLDs (see Exhibit 16). Item group 1 also had only five items, which means that KSAs present in the corresponding PLD category could have been missing from the small item group. Panelists found that in item groups 2, 3, and 4, the KSAs either fully represented the KSAs in the PLDs or represented the KSAs in the PLDs with only small gaps.

Exhibit 16. Mathematics: Grade 5 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing in groups of items?
1	0.00	0	Solve one-step subtraction word problems; divide sets (no greater than 6) into two equal parts; identify values in the tenths place; identify a number in the ones, tens or hundreds place; identify a given axis of a coordinate plan; match the conversion of 3 feet to 1 yard to a model; calculate elapsed time (i.e., hours) - not elapsed time.
2	2.00	2	Identify place values to the hundredths place; compare the values of two products based upon multipliers; round decimals to nearest whole number.
3	2.25	2-3	Solve multiplication and division word problems; perform operations with decimals; convert between minutes and hours.
4	2.25	2-3	Solve word problems involving fractions; identify place values to the hundredths place.

Note. Missing KSAs were provided by panelists.

Grade 6 mathematics panelists provided several ratings of *1* to various item groups (see Exhibit 17). Specifically, panelists noted that the KSAs in item group 1 did not represent the KSAs in the PLDs, barely represented the KSAs in the PLDs, or represented some of the KSAs in the PLDs, but with notable gaps. Two panelists indicated that the KSAs in group 1 items did not represent or barely represented the KSAs in the PLDs. They noted that the items were missing the following KSAs: addition, identifying a representation of a set of data arranged into even groups, identifying a number less than zero on a number line, and identifying the meaning of an unknown in a modeled equation. Three of the four panelists indicated that the KSAs in item group 2 barely represented or did not represent the KSAs in the PLDs. They noted that recognizing a representation of the sum of two halves, identifying the median of the equation needed to determine the mean of a set of data, and performing one-step operations with two decimals were missing. Panelists agreed that the KSAs in item group 3 contained only small gaps or no gaps. Concerning item group 4, a panelist indicated that the KSAs in the items did not represent the KSAs in the PLDs, and another panelist indicated that there were notable gaps in the item KSAs. Both panelists noted that identifying the median of the equation needed to determine the mean set of data, solving real world measurement problems involving unit rates, and identifying positive and negative numbers on a number line were missing.

Exhibit 17. Mathematics: Grade 6 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.50	1-2	Addition; identify a representation of a set of data arranged into even groups (mean); identify a number less than 0 on a number line; identify meaning of an unknown in a modeled equation.
2	1.25	1-2	Distinguish answer from more distractors; recognize a representation of the sum of two halves; identify median of the equation needed to determine the mean of a set of data; perform one-step operations with two decimals.
3	2.25	2-3	Determine the meaning of a valve from a set of data; perform operations using up to three digit numbers; solve real world measurement problems using unit rate; compute area of parallelogram.
4	1.50	0-3	Parts can equal more than a whole; identify the median or the equation needed to determine the mean set of data; solve real world measurement problems involving unit rates; identify positive and negative numbers on a number line.

Note. Missing KSAs were provided by panelists.

Grade 7 mathematics panelists agreed that the KSAs in item groups 2, 3, and 4 represented the KSAs found in the PLDs, with only small gaps (Exhibit 18). For item group 1, which possessed five items, all four panelists provided a *1* rating, indicating that there were notable gaps in the item KSAs. The KSAs that were in the PLDs but that were not in the items included representing negative numbers, multiplication or division by a positive number, and representing the area and circumference of a circle.

Exhibit 18. Mathematics: Grade 7 KSA Ratings

Item Group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.00	1	Representation of negative numbers/multiplication or division by a positive number; representations of area and circumference of a circle.
2	2.00	2	Solve multiplication problems with positive/negative whole numbers; interpret graphs to qualitatively contrast data sets.
3	2.00	2	Solve division problems with positive and negative whole numbers; use a proportional relationship to solve a percent problem; solve multiplication problems with positive and negative whole numbers.
4	2.00	2	Compute area of a circle; ability to find the surface area of a three-dimensional right prism.

Note. Missing KSAs were provided by panelists.

Grade 8 mathematics panelists reported that the KSAs in item group 4 represented the KSAs found in the PLDs, with only small gaps (see Exhibit 19). Three panelists found that the KSAs in item group 3 represented the KSAs in the PLDs with only small gaps; but one panelist indicated that there were notable gaps in the item KSAs. This panelist indicated that the KSAs of identifying congruent figures, calculating the slope of a positive linear graph, and solving for the volume of a cylinder were present in the PLDs but missing from the group of items. Three panelists reported that the KSAs in item group 2 represented the KSAs in the PLDs with only small gaps; but one panelist indicated that there were notable gaps in the item KSAs. This panelist indicated that the KSAs of identifying the solution to an equation containing a variable and matching a given relationship between two variables to a model were present in the PLDs but missing from the item group. All panelists indicated that the KSAs in item group 1 had notable gaps. Specifically, panelists reported that identifying the relatively larger data set presented in a graph, identifying congruent rectangles, identifying similar rectangles, and identifying an ordered pair and its point on a graph—all in the PLDs—were missing from the items.

Exhibit 19. Mathematics: Grade 8 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.00	1	Identify the relatively larger data set presented in a graph; identify congruent rectangles; identify similar rectangles; identify an ordered pair and its point on a graph.
2	1.75	1-2	Identify the solution to an equation which contains a variable; match a given relationship between two variables to a model.
3	1.75	1-2	High task complexity: identify congruent figures; calculate slope of a positive linear graph; solve for the volume of a cylinder.
4	2.00	2	Plot provided data on a graph.

Note. Missing KSAs were provided by panelists.

Researchers found that the nine mathematics grade 11 panelists varied in their ratings (see Exhibit 20). Three of the nine panelists indicated that, as compared to the KSAs in the PLDs, the KSAs in item group 1 contained notable gaps. These gaps included extending a linear graph, completing the formula for area of a figure, and using a table to match a unit conversion. Two panelists indicated that there were notable gaps in the KSAs in item group 2, including identifying the model that represents a square number and calculating the mean and median of a set of data. Six of the nine panelists indicated that there were notable gaps in the KSAs in item group 3, including finding the mean and median of a set of data, plotting data on a histogram, identifying a histogram which represents a provided data set, and determining two similar triangles when a scale factor is given. Finally, two panelists indicated that there were notable gaps in the KSAs in item group 4, and they explained that there was no item asking students to find the median.

Exhibit 20. Mathematics: Grade 11 KSA Ratings

Item group	Average	Range	What KSAs are present in PLDs but missing from item groups?
1	1.90	1-3	Extension of a linear graph; no unit conversions; no area questions; match equation w/ a variable to a real world situation; complete the formula for area of a figure; use table to match a unit conversion.
2	1.90	1-3	Identify the model that represents a square number; calculate the mean and median of a set of data.
3	1.60	1-3	Mean and median of a set of data; plot data on a histogram; identify a histogram [that] represents a provided data set; determine two similar with triangles when scale factor given.
4	2.40	1-3	No median.

Note. Missing KSAs were provided by panelists.

Gaps in the PLDs

Panelists also identified the KSAs that they found in the items but not in the PLDs (see Appendix F. ELA: KSAs Present in the Group of Items but Missing From the PLDs and Appendix G. Mathematics: KSAs Present in the Group of Items but Missing From the PLDs). In general, panelists indicated that more KSAs were missing from item groups than from PLDs. Mathematics panelists identified more PLDs missing KSAs than did ELA panelists.

In ELA, at grades 3, 4, and 6, panelists indicated that PLDs were missing the most KSAs; however, they found that the PLDs at all other grades were missing few KSAs. In mathematics, at grades 6 and 11, panelists also reported the most KSAs missing from the PLDs. Panelists at grades 3–5 and 7–8 reported the fewest number of KSAs missing from the PLDs.

Research Question 3: In which performance level or PLD category would panelists place each item? Does the panelists' placement of the items correspond to the placement of the items based on standard setting cut scores?

As their final task, panelists assigned each individual item in the ordered item booklet to the performance level to which they thought it belonged. Researchers reiterated that panelists should disregard the cut scores determined during standard setting, and that panelists should place the items in a performance level based on their own assessment of the items.

In all ELA grades, 71.9% of panelists' PLD placement of the operational items corresponded to the placement that had been established by the standard setting cut scores (see Exhibit 21). Grade 4 ELA panelists placed the fewest number of items in the same performance level; specifically, only 57% of panelists' PLD placement of the items corresponded to the same placement established by the standard setting cut scores. At all other ELA grades, 71% of panelists' placement of the items corresponded to the PLD placement of the item established during standard setting. Of panelists' placement of items in a different performance level, 16.4% corresponded to a performance level that was higher than the level established by the standard setting cut scores, and 11% corresponded to a performance level that was lower than the level established by the standard setting cut scores.

Across all grades, 72.8% of mathematics panelists' placement of the items corresponded to the same PLD placement that had been established by the standard setting cut score. Mathematics panelists at grades 4 and 8 placed the fewest number of items in the same performance level (65.8% and 67.5%, respectively). Of panelists' placement of items in a performance level different from the level established by the standard setting cut score, 17.9% corresponded to a higher performance level; another 9.3% corresponded to a lower level.

Exhibit 21. Panelists' Performance Level Placements of Items, by Content Area and Grade

		Percent		
Content area	**Grade**	**Same PLD level**	**Higher PLD level**	**Lower PLD level**
ELA	3	75.8	6.8	17.4
	4	57.0	28.5	14.5
	5	75.0	10.7	14.3
	6	71.3	18.4	10.3
	7	73.6	20.0	6.4
	8	73.5	19.1	7.4
	11	77.6	11.0	11.4
	Total	71.9	16.4	11.7
Mathematics	3	74.8	24.5	0.6
	4	65.8	27.5	6.7
	5	78.8	16.3	5.0
	6	75.0	11.3	13.8
	7	70.6	17.5	11.9
	8	67.5	11.9	20.6
	11	77.2	16.1	6.7
	Total	72.8	17.9	9.3

Conclusions

NCSC mapped the alignment of the ELA and mathematics PLDs and the operational items (a) to ascertain whether the original PLDs captured the KSAs as NCSC intended and (b) to identify any gaps in the PLDs.

In general, ELA panelists indicated that the KSAs in the item groups reflected the KSAs in the corresponding PLDs. In many grades, a rating score of *1* was assigned to the item groups, but these ratings were usually made by only one panelist. Across grades, the average rating met or exceeded 2.00 in 18 of the 28 item groups (64.3%), meaning that the KSAs found in the item groups represented the KSAs found in the PLDs with only small gaps. Of the item groups with an average rating of less than 2.00, six item groups had an average rating of 1.6 or higher (21.4%), indicating that more individual panelists provided a rating of 2.0 or higher. However, all grade 6 average group ratings fell below 2.00, exhibiting the lowest averages of any grade.

Mathematics panelists provided notably more rating scores of *1* or *0* than did ELA panelists (34.3% and 19.6%, respectively); mathematics panelists were also the only panelists to assign a rating score of *0* to any item group. In comparison to the average ELA rating, the average mathematics rating met or exceeded 2.00 in only 12 of the 28 mathematics item groups (42.9%). Of the item groups with an average rating of less than 2.00, five had an average rating of 1.60 or higher (17.9%). No item group in mathematics grade 4 had an average rating that reached 1.50. This finding indicates that the KSAs in the mathematics grade 4 item groups represented some of the KSAs in the PLDs, but with notable gaps.

Panelists indicated that the item groups contained some KSAs not present in the corresponding PLDs; but overall, panelists listed far fewer missing KSAs in the PLDs than they listed in the item groups.

In rating the performance level of the individual items, 71.9% of ELA panelists' placement of the items corresponded to the performance level that had been established by the standard setting cut score. If panelists did not think an item belonged to the same performance level, panelists most often placed the item in a higher level. Nearly 73% (72.8%) of mathematics panelists' placement of the items corresponded to the same level established by the standard setting cut score. If panelists did not think an item belonged to the same performance level, panelists most often placed the item in a higher level.

Limitations and Recommendations

Familiarity with the PLDs and the items was integral to the success of the study. As such, researchers capitalized on the knowledge that panelists had gained during the standard setting process and scheduled the Item Mapping Study to occur directly after the standard setting meeting. However, because panelists were familiar with the cut scores and with the order of items in regards to difficulty, panelists had knowledge of the performance level in which each item would be placed. Researchers frequently reminded panelists to disregard the information that they had learned during standard

setting, but researchers recognized that prior knowledge may have influenced panelists' assignment of items to performance levels or PLD categories. However, researchers found that some panelists recommended placing some items in higher or lower performance levels.

Researchers used the cut scores established during standard setting to create the item groups. These groups are therefore dependent on those cut scores. If the cut scores change, the item groups will change as well. Some item groups were relatively small, and their small size meant that a large number of KSAs were missing from those groups. If the standard setting process had resulted in cut scores placed further apart, these item groups would have been larger and would likely have captured additional KSAs.

Many panelists indicated that the item groups were missing some of the KSAs found in the corresponding PLDs, and this gap could be attributed to the small size of some item groups, which was based on the cut points created during standard setting. In addition, state partners may want to revisit the PLDs to ensure ample coverage of the KSAs.

Appendix A. Panelist Questionnaire

In reporting the results of this item mapping study to those who must interpret and use them, it will be important to describe the background of the panelists who conducted the ratings; the report describing this study will include summary information about the panelists who participated in this process. Researchers will use your responses to generate this summary information, but will not be used to identify you or be connected to your ratings. Please do not indicate your name on this form. You may use the back of this form to provide additional information, as needed.

1. Please indicate your current position. Include content area(s) and grade level(s).

_____

_____

2. Please indicate other teaching or administrative positions you have held.

_____

_____

3. For how many years have you been a professional educator?

_____

4. How many years of experience do you have in your area of expertise (ELA/mathematics, special education, etc.)?

_____

_____

5. Please indicate the teaching and/or administrative certificates you currently hold.

_____

_____

6. Please indicate your degree(s) and other qualifications.

_____

_____

7. Do you have specialized training or experience in working with students with disabilities and/or students with the most significant cognitive disabilities? If yes, please explain.

_____

_____

8. Please check all of the following statements that apply to you:

   - ❑ I conduct/have conducted professional development for teachers in my content area.

- ❑ I have/had a leadership role in curriculum planning in my school or district.
- ❑ I have taught future teachers in a higher education setting.

9. If there is other information that would help us understand your expertise in your content area, please describe it here (like experience as an assessment item writer or reviewer, range finder, etc.).

_____

_____

_____

10. What is your gender? ❑ Male ❑ Female
11. What is your ethnicity? _____

Appendix B. Item Mapping Training

Item Mapping

August 12-13, 2015
Indianapolis, IN

ncsc
National Center and State Collaborative

The contents of this product were developed under a grant from the Department of Education (PR/Award # H373X100002, Project Officer, Susan Weigert-Bell ges). However, the contents do not necessarily represent the policy of the Department of Education and no assumption of endorsement by the Federal government should be made.

Agenda

Time	Activity
8:00 – 8:30 am	Panelists arrive and sign in
8:30 – 9:30 am	Training; complete questionnaire
9:30 - 9:45 am	Break
9:45 am - 12:00 pm	Ratings
12:00 - 12:45 pm	Lunch
12:45 – 3:00 pm	Ratings; complete evaluation form

Purpose

- Examine alignment of performance level descriptors and the items in the ordered item booklets
- Materials
  - Ordered Item Booklets (OIBs)
  - Item maps
  - Performance level descriptors

Round 1 Activities

- Table Group
  - List knowledge, skills, and abilities in each item group
    - Definition of each item group will be provided at your table
  - Describe the KSA for the entire group of items
- Individually:
  - Provide overall rating
  - Provide 'gap information'

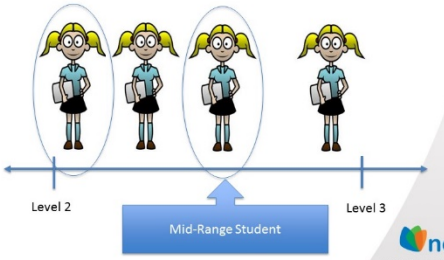
Representation of the PLDs

- Representation: the degree to which the group of items represents the knowledge, skills, and abilities found in the PLDs

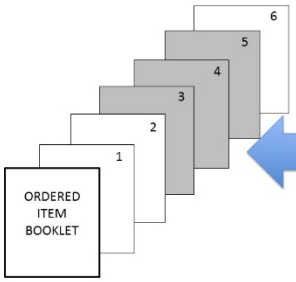
Code	Description
0	This group of items barely represents or does not represent the knowledge, skills, and abilities found in the PLDs
1	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, but there are notable gaps
2	This group of items represents some of the knowledge, skills, and abilities found in the PLDs, with small gaps
3	This group of items fully represents the knowledge, skills, and abilities found in the PLDs

Performance Level Descriptors

- PLDs describe the mid-range students



Round 1 Activities



Level 3 Item Group: Items 3 - 5

You will create a list of the knowledge, skill, and abilities in items 3, 4, and 5.

Round 1 Activities

Mathematics Example

*Solve multiplication problems (3,5)
*Collect and display data in a graph (6)
*Determine appropriate operation to solve a word problem (4)

ELA Example

*Reference text to support answer to literal questions (13)
*Determine the main idea from a text (11)
*Use context from a sentence to determine the meaning of a word (10)

Round 1 Activities

- How did we select the items?
  - Midway point on the scale
  - Items go from one midpoint to the next

Round 1 Rating

- Make rating individually

Item Group	Items	What knowledge, skills, and abilities are found in this group of items?	Does this group of items represent the knowledge, skills, and abilities in the PLDs? (0-3 scale)	What knowledge, skills, and abilities present in the PLDs are missing in this group of items?	What knowledge, skills, and abilities present in this group of items are missing in the PLDs?
Level 1					
Level 2					

Round 2 Activities: Individual

- For each item, select the PLD to which you think it best aligns.

Grade	Subject	RP50 Item List	OI_position	In reviewing the PLDs, at what level would you place this item?
3	MAT	110959A	1	
3	MAT	111434A	2	
3	MAT	111424A	3	
3	MAT	111389A	4	
3	MAT	112555A	5	
3	MAT	110964A	6	
3	MAT	112564A	7	
3	MAT	110923A	8	
3	MAT	111429A	9	
3	MAT	111425A	10	
3	MAT	111416A	11	
3	MAT	111382A	12	
3	MAT	110862A	13	
3	MAT	111377A	14	
3	MAT	110842A	15	
3	MAT	112552A	16	

Questions?

Item Groups for Grade 11

	MATH	ELA
Level 1	1-4	1-4
Level 2	5-11	5-10
Level 3	12-23	11-24
Level 4	24-38	25-32

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Appendix C. Evaluation Form

Item Mapping Study

With which panel did you work?
☐ Mathematics
☐ ELA

Grade Level: _____

Please check the box that that most closely reflects your opinion.

	Strongly agree	Agree somewhat	Disagree somewhat	Strongly disagree
1. The facilities were appropriate to the work.	☐	☐	☐	☐
2. The introductory presentation and training materials were clear.	☐	☐	☐	☐
3. The process used was appropriate to the work.	☐	☐	☐	☐
4. The process used resulted in good information about the items and PLDs.	☐	☐	☐	☐
5. I was able to make a contribution to the study.	☐	☐	☐	☐
6. I am satisfied with the rating scale used.	☐	☐	☐	☐
7. I am confident that my holistic ratings are reasonable.	☐	☐	☐	☐
8. I am confident that my item-level ratings are reasonable.	☐	☐	☐	☐

THANK YOU FOR YOUR TIME AND EFFORT!

If there are comments you would like to make about the study process or the ratings that resulted, or about what you learned from participating, or anything else, please make them here. Feel free to use the back of the paper if you need more space.

Appendix D. ELA Items: Knowledge, Skills, and Abilities Identified by Panelists

Grade level	Item group	Items	Knowledge, skills, and abilities
3	1	1-4	Picture matching; identify topic by picture; receptive identification; academic vocabulary
	2	5-10	Academic vocabulary; match picture to sentence; listener receptive; picture discrimination; context clues; vocabulary; character traits; identify supporting detail; sequencing; main idea
	3	11-23	Academic vocabulary; central idea; reading comprehension/listening; read/use chart; listener receptive; generalization; identify details; picture referencing; infer; multi meaning words; context clues; sequencing; identify text feature
	4	24-30	Academic vocabulary; match text feature to topic; receptive identification; context clues; multi meaning words; letter sounds; decoding; supporting details; main idea; categorizing; letter discrimination; expressive language
4	1	1-4	Answering a literal question about a detail from a narrative; character descriptions and relationship with setting; identify topic and main idea; vocabulary skills; making connections
	2	5-12	Academic vocabulary/main character; identify detail of support; problem/solution; identify conclusion; use detail to answer questions; cause and effect; identify character traits; use charts and diagrams
	3	13-24	Describe character traits; academic vocabulary; multi-meaning words; sequencing; identify conclusion; identify theme; using diagram to answer questions; using details to answer questions; making inferences; reading simple words
	4	25-32	Vocabulary and reading simple words; multi-meaning vocabulary; context clues; using supporting detail to draw inference; answer questions about a diagram; use diagram to answer questions
5	1	1-5	Understanding of sequencing; identifying beginning of literary text; identify a detail; understanding that beginning means at the start; identify vocabulary using context

Grade level	Item group	Items	Knowledge, skills, and abilities
			clues; categorizing/classifying objects; topic; how things are alike/different; prediction; drawing conclusion
	2	6-10	Identify a detail; distinguishing between relevant and non-relevant information; identify character versus non-character; understand of setting/identify setting; identify a detail about character; writing about topic; ability to choose from three options, two of which are plausible
	3	11-20	Sequencing, specifically ending; detail from text; choosing answer with only text, no pictures; dialogue; drawing conclusion/inferencing; understanding compound sentences; choosing from three options, two plausible; distinguishing between how text is presented diagram versus text; purpose of a diagram; authors point of view, using detail to support; multiple meaning; using context clues; compare/contrast
	4	21-25	Main idea; supporting details; choosing from three options, all plausible; understanding more complex ideas; using context clues; inference; complex sentences/high text complexity; using details in text to support author's point of view
6	1	1-5	Word meaning; facts; facts/details/inference; main idea; details
	2	6-10	Comparing inference; detail in text; word meaning/context; multi-meaning words; point of view/detail in text; compare and contrast; introduction
	3	11-22	Order of events; what happens next; compare/contrast – conclusion; compare/contrast two different things; mean of word within text; sequencing – middle; summarize – opinion; sequencing – ending supporting details; supporting evidence – details
	4	23-29	Transition words – sequencing; word meaning within text; facts; sequencing – ending, middle; transition words; supporting facts – authors point
7	1	1-4	Matching photo to text; listening to passage; vocabulary/key words; low-level inference
	2	5-11	Author's perspective; make inferences and refer to text; basic matching; moderate text complexity; field of choices increase; perspective taking/social emotional; if/then;

Grade level	Item group	Items	Knowledge, skills, and abilities
			cause/effect
	3	12-19	Prerequisite understanding of friendship or themes; evidence to support theme; grade-level phrases and vocab; understanding text features and elements; make inferences; increase skills in visualization
	4	20-31	Text features and ability to work within; high level of vocabulary and sentence structure; ability to breakdown complex texts; compare and contrast two authors; understand grade-level phrases; use text to support learning and understanding; understand how graphics support text; make high-level inferences and use to support conclusions and understanding
8	1	1-4	Listening; recall; evidence from text; social/emotional; vocabulary; infer vocabulary; identifying central idea; match the character feelings to feelings; matching
	2	5-12	Listening to longer text; identifying a solution; selecting response without graphics; elements of story; cause/effect; analyze text; compare texts; recall information/details; shades of meaning/vocabulary; context clues; transfer; writing intro; theme; increase vocabulary rigor (illustrate); infer theme
	3	13-20	Distinguish quotes, facts, maps; stamina when listening/reading; identify setting; identifying/applying facts; distinguish fact/opinion; simile/vocabulary; author's argument; text features; writing to solve problem; matching
	4	21-31	Vocabulary; extract further evidence from text; interpret text under graphics; identify/relate character actions to events; precise words or details; apply precise words; social/emotional – think like reader; shades of meaning; context clues; transfer/generalize knowledge; read questions carefully; critical listening skills; decreased graphic support; identify evidence; infer author's meaning; use details/evidence; conclusion; identify argument
11	1	1-4	Key details; fact recall
	2	5-10	Persuasive writing; key details; topic recall; draw conclusions/evidence to support claim; author's purpose

Grade level	Item group	Items	Knowledge, skills, and abilities
	3	11-24	Draw conclusions; context clues; key details; use details to support idea; relevant details; inference; recall; author's point of view
	4	25-32	Using transition words; key details to support ideas; supportive evidence/prior knowledge; supporting conclusions; author's word choice

Appendix E. Mathematics Items: Knowledge, Skills, and Abilities Identified by Panelists

Grade	Item group	Items	Knowledge, skills, and abilities
3	1	1-4	Identifying objects represented on a graph; identify which shaded part is greater; solve simple addition word problems; match/identify the area of a shape
	2	5-14	Dividing rectangles into equal parts; solve simple addition word problems; multiply single digit numbers using arrays; identify equal parts of a whole, with shading; solve simple subtraction word problems; solve increasing patterns
	3	15-29	Dividing a rectangle into equal parts; measure the area of a rectangle; solving single digit multiplication problems using an array; solve increasing number patterns; rounding numbers to the nearest 10; transfer data to a picture graph; identifying fractions with equal parts; comparing fractions with the same denominators; using symbols
	4	30-39	Finding an equation to solve a word problem; solving a subtraction word problem; identifying fractions with equal parts; rounding numbers to the nearest 10; comparing fractions with the same denominator; solving a word problem and checking for correctness; solving a multiplication problem
4	1	1-6	Interpreting data on a bar graph; attributes of shapes (sides, identification); multiplication use arrays and equations (identification); equivalent fraction using fraction bars (different denominators); create array dividing set into equal group
	2	7-13	Comparing fraction using fraction bars; sorting shapes by attributes (number of sides); rounding using base ten blocks (nearest 10); multiplication using arrays and equation (match expression with array); division of objects into equal groups; rounding open number line with point identified
	3	14-26	Division into equal groups; sorting shapes by number of angles; classify shapes by number of sides; find perimeter of a rectangle (add all sides); multiplicative comparison with model identify equation; comparing fractions with symbols and models (equal, less than, greater than); identify parts of a whole using geometric shapes (two trapezoids is a hexagon); rounding open number line no points to

Grade	Item group	Items	Knowledge, skills, and abilities
			nearest 1000, 100
	4	27-35	Comparing fractions with different denomination using fraction bars (>, <, =); comparing fractions with different denominators using area model; division of objects into equal groups; using data to compare a bar graph, line plot with fractions; multiplication using arrays repeated addition or multiplying; finding equivalent fractions using bar models; multiplicative comparisons with model (2 digit by 1 digit)
5	1	1-5	A clock measurement time; identifying a representation of addition with fractions; comparing information on a graph; decimals represent part of a whole
	2	6-12	Locate x and y axis; identify a number in place value; when numbers add to a set it increases; use operation to convert measurement; addition of two fractions; solve word problem using money notation
	3	13-28	Use xy to compare two sets of information on a graph; choose operation to convert measurements; choose operation to solve one-step word problem division; identify number in place value; rounding decimals to the nearest whole number using number line; solve a word problem one step using fraction; compare products of multiplications; find ordered pair in a coordinate grid
	4	29-39	Solve word problem for elapse time using hour and minutes; choose operations to convert measurement word problems; plot in coordinate grid a ordered pair; use key to compare and locate information to solve a word problem; use multiplication or division to solve word problems; solve word problem using multiplication with decimals and no visuals
6	1	1-7	Identify percent as part of 100; 1:1 correspondence to 100; addition; match identical items (same/different); comparisons of quantities; read bar graph
	2	8-17	Percent can be represented in a grid; simple problem solving; know a number can be less than 0; distinguish the answer amid more distractors; match a visual or a set of numbers to a given ratio; basic understanding of how to write a ratio

Grade	Item group	Items	Knowledge, skills, and abilities
	3	18-30	A percent can represent a real world scenario; add two and three digit numbers without carry; knowledge of a thermometer; negative numbers can be represented in the real world; a variable can represent a number; correlation between addition and subtraction; identify ration from a story problem; understand decimal placement; single digit multiplication; solve for area; understand number line; understand formula for mean and median
	4	31-37	Complete math tasks independently; parts can be combined to be more than a whole; solve a simple algebraic equation
7	1	1-5	How to use a bar graph; what a three-dimensional figure is; know common math vocabulary; how to match a ratio; identify surface area; compare quantities; identify surface area
	2	6-14	Identify an unknown; match a ratio to a model; proportional relationships; find surface area (three-dimensional figure); negative numbers/division; unit rate
	3	15-24	Comparing data; find ratio; finding surface area; unit rate (identify); proportional relationship; solve for an unknown; area of a circle
	4	25-38	Find area of a circle; equation with a variable; solving division problems with positive and negative numbers; word problems with ratios; proportional relationships in a table/graph; solving multiplication of positive and negative numbers; word problems with percent
8	1	1-4	Plotting a decimal on a number line; compare the area of rectangles; identify the height of a cylinder; interpreting data on a line graph
	2	5-14	Recognize similar triangles; locating points on a graph; identify relationship in a table; recognize congruent rectangles; identify a line graph increasing over time; recognize y-intercept; identify the radius of a cylinder
	3	15-28	Read and interpret data on a line graph; finding the slope of a line; read and interpret data from a table; solve an equation that uses multiplication; classify a linear relationship; identify change of area; completing the formula to find volume of a

Grade	Item group	Items	Knowledge, skills, and abilities
			cylinder; recognize similar rectangles; plotting ordered pair on a graph; identify an approximation of an irrational number on a number line
	4	29-38	Describe the relationship of data in a table; describe the change in area; calculate the volume of a cylinder; identify an approximation of an irrational number on a number line; calculate the rate of decrease; solve an equation using division; describe an calculate the change in area; describe the relationship of data in a graph
11	1	1-4	Identify data points; identify parts of a line graph; know a point on a line; know a point falls on a line; variable can be used for unknown quantity; 1:1 correlation of number and quantity; addition of sets; order of numbers; right and left; least and greatest; grouping; conservation of number
	2	5-11	Straight line; understanding of graph; extension of line; 1:1 correspondence; addition of sets; understanding of sets; order of number, number line; right/left; least/greatest; abstract concepts; right angle; opposite; hypotenuse; origins; up/down; measurement terms; key concepts of word problems; parts of a histogram; understand of equations; addition of sets
	3	12-23	Multiplication, equation with two variables; three-dimensional figures; volume; metric units; terminology 'cubed'; area; division; understand definition of a formula; apply a formula; concept of money; order of operations; term 'base number'; time; x and y axis on a line graph; concepts of measurement; key concepts of word problems; exponents and vocabulary; multiplication; data table; understand equation; addition; variables; prediction; term estimation; measurement terms
	4	24-38	Division; prediction; conversion of measurement; multiple variables; data table; x and y axis/line graph; multiplication; concept of a word problem; use of a straight edge; extension of a line; concept of time; concept of money; weight (measurement); exponent; square number; square root; shape of a square; calculate mean; define mean; define average; addition; data set; subtraction; order of operations; conversion table; tablespoon, cup, ounces; match data to graph; right angle; similar triangles; scale factor; data ranges; grouping data; histogram

Appendix F. ELA: KSAs Present in the Group of Items but Missing From the PLDs

Grade	PLD level	KSAs present in this group of items, but missing from the PLDs
3	1	Academic vocabulary (diagram); picture matching; receptive language identification
	2	Sequencing; academic vocabulary/transition word; character traits; match picture to sentence through receptive language skills; picture discrimination; general vocabulary; picture discrimination
	3	Sequencing; inferencing; identify text features (heading); generalization; receptive language matching; reading and listening comprehension
	4	Identify text feature to present info in text; decoding/ letter sounds; receptive identification; categorization, expressive language, multi-meaning words; academic vocabulary; letter/sound discrimination
4	1	Making connections between character and environment/setting, emerging and making connections; answering literal questions about a detail from literary text; identifying main idea
	2	Simple cause and effect (narrative text); two-step sequencing of events (problem/solution); identifying details of supporting characters; problem/solution (two-step); identifying main character traits
	3	Making inferences; identifying conclusion sequencing (writing); inferences/simple words; sequencing
	4	Simple words; multi-meaning words; drawing inferences from supporting details; context clues
5	1	Identifying vocabulary using context clues; categorizing/classifying objects; predicting; drawing conclusions
	2	Identifying details; identifying character; identifying details about a character; writing about a topic – details

Grade	PLD level	KSAs present in this group of items, but missing from the PLDs
	3	Drawing conclusions; making inferences; understanding dialogue
	4	Making inferences
6	1	Variety of text- informational missing; making connection from photos to line drawings; understanding and using concepts of beginning to end; ability to understand without pictures; maintain focus on multi-age text; making inferences
	2	Variety of text- informational missing; narrator point of view; ability to compare and contrast; maintain focus on a multi-page text; summarize; context clues
	3	Variety of text- informational missing; compare and contrast
	4	Ability to understand high level reading material; ability to breakdown complex text; assimilate information from variety of sources; transitioning words and sequencing; focus on next, beginning, middle, end; compare and contrast in writing
7	1	Simple matching to support understanding to text; reader's ability to synthesize what was read and respond
	2	Emotional vocabulary; compare and contrast; low/ moderate text complexity; if/then; test taking skills; cause/effect; author's perspective/opinion
	3	None
	4	High level of inference to support conclusions and understanding; details to support inferences
8	1	None
	2	Hold in memory/working memory; language- if/then; specific language; translation
	3	Language; understanding similes; higher level thinking; using text features

Grade	PLD level	KSAs present in this group of items, but missing from the PLDs
	4	Linguistics; understanding negative modals (should); language structures, other vocabulary prevent ruined; expectation that students know to compare/contrast articles; theory of mim
11	1	No recall to infer; close sentences (fill in blanks- writing); no literary text components; identify summary of literary text; identify an event from literary text; identify central idea; no writing
	2	Context to identify meaning of level text; complex ideas and relationships; details presented; informational text
	3	Draw conclusions; words not used; infer to draw conclusions (need to draw inference to come up with conclusion); sequencing
	4	Cont. idea of an informational text; infer meaning from text

Appendix G. Mathematics: KSAs Present in the Group of Items but Missing From the PLDs

Grade	PLD level	KSAs present in the group of items, but missing from the PLDs
3	1	Present in different upper levels; area (match/identify area is in level 2 rather than level 1).
	2	5 is in upper level, 6 is in lower level.
	3	1 is in lower level, 2 is in upper level.
	4	4 is covered in question 40, 7 is in the third level; rounding to the nearest ten.
4	1	None.
	2	Comparing fractions using fraction bars
	3	Identifying parts of a whole using geometric shapes; comparing fractions using fraction bar model; checking correctness of an answer in the context of the scenario
	4	Finding equivalent fractions using bar models; multiplicative comparisons of models (2 digits x 1 digit)
5	1	Understand purpose of different measurement tools; identify a representation of addition of 2 fractions; understand that decimals and fractions represent part of a whole, clocks measure time; read and compare information in a graph; understand that decimals represent part of a whole
	2	Identifying and locating the X and Y axis; choosing the operation to convert measurement; identifying place value to hundreds, tens, ones; when numbers are added to a set, set value increases; solve one step word problem using money notation
	3	Perform operations with decimals; convert between minutes and hours

Grade	PLD level	KSAs present in the group of items, but missing from the PLDs
	4	Solve problems involving fractions; identify values in the hundreds place
6	1	identify the object that appears most frequently in a set of data (mode); reading a bar graph, one to one correspondence, addition, match same/similar/different, compare quantities; perform an operation up to 20
	2	Identify the median of the equation needed to determine the mean of a set of data; 2 halves equal a whole; simple problem solving; write a ratio; distinguish answer between more distractors; how to formulate/ write a ratio; percent can be represented on a grid;
	3	Perform operations using up to 3-digit numbers; correlation between addition and subtraction; negative numbers represented in the real world; measurement tools and comparative language; single digit multiplication; use formula; use mathematical symbols in an equation
	4	Identify (-)+ on a number line; tank independence/analysis; parts can be combined to be more than a whole; regrouping with decimals; use formula to solve
7	1	Ratios
	2	Solve division problems +/-; identify proportional relationships between quantities represented in a table
	3	Compute area of a circle
	4	Percentages (use proportional relationships to solve percentage problems); identify the meaning of unknown in a modeled equation; solve +/- whole numbers, identify the meaning of an unknown in a word problem.
8	1	Interpret data on a line graph
	2	Locating a point on a grid; identify the radius of a cylinder
	3	Finding the slope of a line; completing a formula to find volume of a cylinder

Grade	PLD level	KSAs present in the group of items, but missing from the PLDs
	4	Calculate rate of decrease; describe relationship of data in a table; calculate the volume of a cylinder
11	1	Greatest to least; complete the formula; area of a figure; one to one correspondence; measuring concepts; what a data point is; variable used for unknown quantity; one to one correspondence; order of numbers/ number lines; concepts of right/left/least/greatest; number concept; order of operations
	2	Abstract concepts; measurement concepts; calculate the median of a set of data; set grouping; basic number concepts; abstract concepts; using a formula; cubed numbers; straight line; one to one correspondence; right/left/up/down; concept of opposite; word problem; number concepts
	3	Calculate median; volume; estimations; order or operations; use of formula; concepts of a word problem; multiplication; data tables; equations with multiple variables; formula use; order of operations; concept of time; cubed
	4	Calculate median; compute variable expressions; volume measurement; data tables; exponents; order of operations; estimations of data tables; median; division; shapes; subtraction; grouping/range of data; average; multiple unknown variables