Arizona

Arizona's Instrument to Measure Standards

Standard Setting Report: Mathematics
Grades 3-8 and High School

Submitted to the
Arizona Department of Education
November 2010

PEARSON

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EXECUTIVE SUMMARY

This document provides information about the procedures that were implemented for the standard setting that took place after the spring 2010 administration of Arizona's Instrument to Measure Standards (AIMS) for Mathematics. The AIMS mathematics assessment was administered to students in Grades 3-8 and high school in spring 2010. The AIMS assessments are designed to measure Arizona students' performance on the Arizona content standards. All AIMS Mathematics tests are written to Arizona content standards adopted in March 2008.

The AIMS high school Mathematics tests are criterion-referenced competency tests. Students' test scores on the AIMS high school tests are one component of the high school graduation requirements, and, beginning in spring 2006, passing scores have been required for students seeking to earn a diploma for graduation. Students in grade 10 have five opportunities to pass the test prior to graduation. The AIMS high school tests in Mathematics consist of multiple-choice items only.

The AIMS Mathematics tests for Grades 3-8 are dual purpose assessments —both criterion and norm-referenced scores are given based on performance on the tests. Criterion-referenced scores and norm-referenced scores are reported. Each Mathematics test consists of items written by Arizona teachers and items from Pearson's norm-referenced test, *Stanford Achievement Test Series, Tenth Edition* (Stanford 10). Some of the Stanford 10 items contribute to both criterion-referenced and norm-referenced scores. These items all match the Arizona content standards.

In the 2009-2010 school year, new mathematics content standards were implemented for grades 3-8 and high-school[1]. Due to the introduction of new standards there was a need to set new performance level cuts for the 2010 tests. A standard setting was conducted on May 13 and 14, 2010, for the AIMS high school test. A separate standard setting was conducted from June 1 through June 4, 2010, for grades 3 through 8. A vertical articulation process was conducted on June 3, 2010, for grades 3-8 and high school. All meetings were held at the Black Canyon Conference Center in Phoenix, Arizona.

There are four performance levels for the AIMS assessment:

1) Falls Far Below the Standard
2) Approaches the Standard
3) Meets the Standard
4) Exceeds the Standard

Pearson implemented an item mapping procedure (also known as Bookmark) at the standard setting. This approach has a number of advantages:

- The item mapping approach contains elements of both test-centered and examinee-centered approaches, focusing on the performance of borderline students at each proficiency level, but in the context of specific items from the assessment and grade level for which standards are being set.
- This approach provides a logical supporting framework within which panelists can make inferences about the knowledge and skills associated with students at different levels of performance.
- The item mapping procedure has been used for previous versions of the AIMS assessment, and thus is already relatively well known and accepted in the state. Aside from the technical reasons for using this approach, it also provided a degree of continuity between old and new AIMS tests.

The duration for the standard setting meeting for the high school meeting was two days and the duration for the standard setting meeting for the grades 3–5 and grades 6–8 groups was four days. The standard setting panelists engaged in the following activities:

[1] Please see Appendix Q for a copy of the Test Blueprints.

1. Opening session[2]
2. Review performance level descriptors[3]
3. Develop borderline student descriptors
4. Experience the test
5. Item mapping training[4]
6. Practice round of ratings
7. Round readiness check[5]
8. Round 1 ratings
9. Round 1 feedback and discussion
    a. Table page ratings
    b. Item p-values
10. Round 2 ratings
11. Round 2 feedback and discussion
    a. Table page ratings
    b. Total group page ratings
    c. Impact data
12. Round 3 ratings[6]
13. Vertical articulation
14. Performance level descriptor review and revision
15. Complete standard setting evaluation[7]

The final results after vertical articulation are presented below. Table 1 presents the final raw score cuts and percentage of points required for *Approaches the Standard*, *Meets the Standard*, and *Exceeds the Standard*. To achieve the *Approaches the Standard* cut, students had to have obtained 44% of the total test points for grade 3 to as much as 53% for high school. For this cut, the percent of points increases as grade increases. For grades 3-8 and high school, the raw score cut range for *Meets the Standard* was approximately 60%-65% of the points, and for *Exceeds the Standard*, it was between 81%-86% of the points.

Table 1: Final Raw Score Cuts after Vertical Articulation

Grade	Approaches		Meets		Exceeds		Items
	RS	% of Pts.	RS	% of Pts.	RS	% of Pts.	
Grade 3	29	44%	43	65%	57	86%	66
Grade 4	32	47%	44	65%	57	84%	68
Grade 5	32	48%	43	64%	57	85%	67
Grade 6	32	47%	43	63%	56	82%	68
Grade 7	34	50%	44	65%	57	84%	68
Grade 8	35	51%	41	60%	55	81%	68
High School	45	53%	52	61%	70	82%	85

Table 2 presents the final scaled score ranges for each performance level for each grade. The scale scores for grades 3 through 8 are on a vertical scale that ranges from 100 to 640 and has a mean of 400 and a standard deviation of 55. The scale scores for high school are distinct from the scale scores for grades 3 through 8. They range from 300 to 700 and have a mean of 500 and a standard deviation of 50.

[2] Please see Appendix F: Standard Setting Opening Comments.
[3] Please see Appendix A: Performance Level Descriptors.
[4] Please see Appendix G: Standard Setting Training.
[5] Please see Appendix K: Standard Setting Panelist Readiness Forms.
[6] The High-School Committee had four rounds of ratings.
[7] Please see Appendix S: Standard Setting Evaluation Forms.

Table 2: Final Scale Score Ranges by Grade

Grade	Falls Far Below	Approaches	Meets	Exceeds
Grade 3	100-302	303-346	347-405	406-540
Grade 4	120-330	331-365	366-415	416-560
Grade 5	140-347	348-380	381-435	436-580
Grade 6	160-365	366-397	398-445	446-600
Grade 7	180-381	382-410	411-459	460-620
Grade 8	200-408	409-425	426-474	475-640
High School	300-470	471-486	487-536	537-700

Figure 1 presents the plot of the mean scale scores on the tests in spring 2010 along with the scale score cut points for *Approaches the Standard*, *Meets the Standard*, and *Exceeds the Standard* for grades 3 through 8. As indicated in the figure, the scale score cut for Meets the Standard is slightly below the mean scale score across all grades. This indicates that the average performance of students in the state meets the required performance level. In addition, the growth curve across the grades for each proficiency level consistently increases.

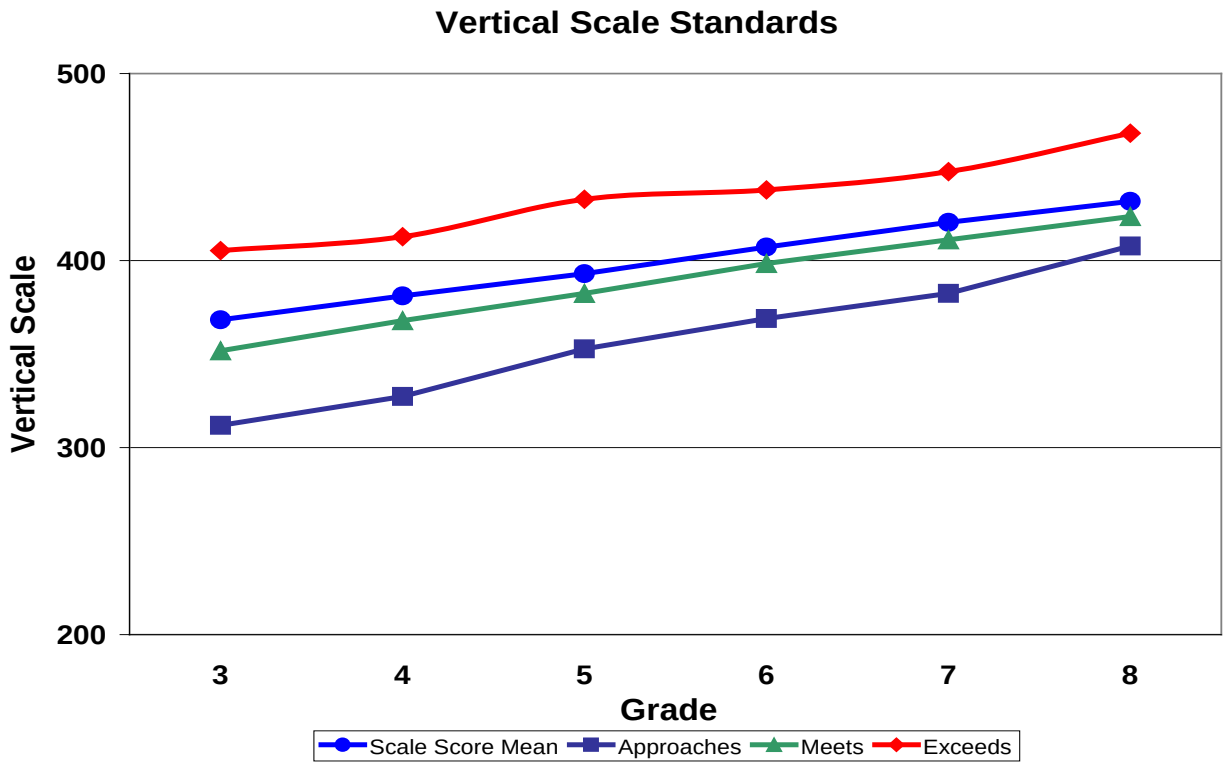

Figure 1: Final Scale Score Cut Points by Grade after Vertical **Articulation**

Figure 2 presents the impact data for grades 3-8 and high school after the vertical articulation process. The percentage of students in *Exceeds the Standard* is approximately 20-24% for all grades. The percentage of students in *Falls Far Below the Standard* monotonically increases between grades 3 through high school. Grade 3 has 11% of students in this category, whereas high school has 30% of students at *Falls Far Below the Standard*. The percentage of students in *Approaches the Standard* is approximately 20%-25% for grades 7 and below, but is smaller at 12%-14% for grade 8 and high school. However, this is consistent with the raw score cuts that are presented in Table 1. For grade 8 and high school, the panelists' cut scores for *Approaches the Standard* and *Meets the Standard* were fairly close. The discussions that took place during the performance level descriptor discussions also confirmed that the panelists in grade 8 and HS believed the *Approaches the Standard* category was narrower than the other performance levels. The percentage of students at *Meets the Standard* is approximately 38%-43% for students in elementary school. For middle and high school, the percentage of students at *Meets the Standard* is approximately 33%-37%.

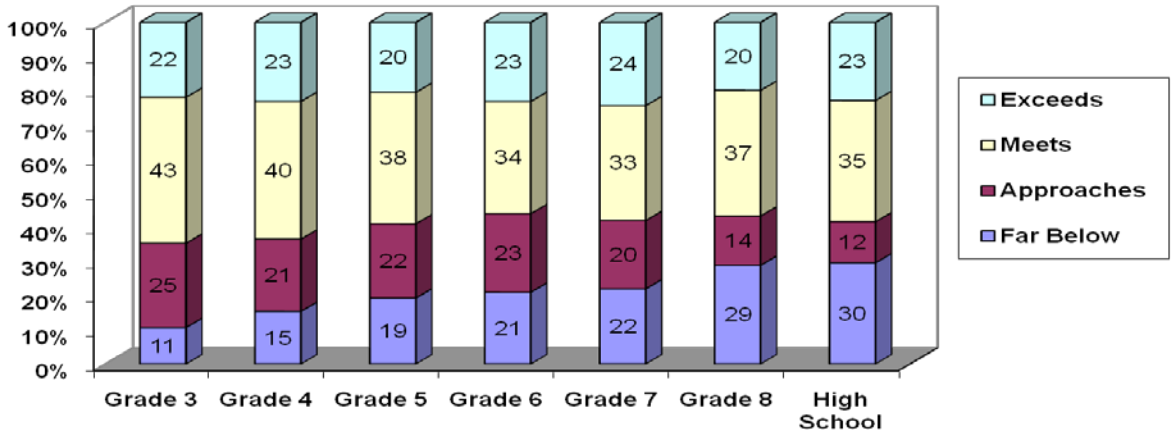

Figure 2: Final Percent of Students at Each Performance Level by Grade after Vertical Articulation

GENERAL STANDARD SETTING PROCEDURES

Panels

ADE invites Arizona educators to participate in the standard setting. Arizona educators have experience with the curriculum, content, and performance standards, as well as with the student groups and grade levels for which standards are being set. Participating educators represent the diverse demographics of students educated across the state. The input of these educators ensures standard setting reflects what students should know and be able to do.

ADE recruited panelists based on the following characteristics:

- Be subject matter experts
- Understand the examinee population
- Be able to estimate item difficulty
- Have knowledge of the instructional environment
- Appreciate the consequences of the standards
- Be representative of all the stakeholder groups

There were three panels and each panel consisted of approximately 18 panelists. Within each of the panels, there were three table groups. Each table group had a table leader. Prior to the standard setting meeting, table leaders were trained on their roles and responsibilities. Materials were emailed to the table leaders approximately one week prior to the standard setting meeting. In addition, table leaders met on the morning of the meeting to go over the table leader information sheet and table leader PowerPoint training that had been emailed to them. For more information about the table leader training, please review these documents in Appendices B and C. Appendix B contains the *Table Leader Information Sheet* and Appendix C contains the *Table Leader Training*.

One panel set standards for the high school test, one panel set standards for grades 3 and 5, and the third panel set standards for grades 6 and 8. The panels for the 3–5 and 6–8 grade bands set standards for the lower grade first and then for the upper grade. The initial standards for grades 4 and 7 were interpolated from the standards that had been set for grades 3, 5, 6, and 8 using a polynomial equation. The high school panel consisted of approximately equal numbers of high school mathematics teachers and curriculum specialists. The panels for the 3–5 and 6–8 grade bands consisted of approximately six panelists from each grade level. Panelists were divided into three tables of six panelists each. Please see Appendix R for information about the panelists. A chart is provided that provides information about the panelists' occupation, years of experience, highest level of education, certification, endorsements, gender, ethnicity, urbanicity, and district size, among other information.

Performance Level Descriptors

The Performance Level Descriptors (PLDs) were created in February 2009 by Arizona educators. Peer Review requires that PLDs be developed prior to the administration of the assessments and the subsequent Standard Setting. There are four performance levels[8] for the AIMS assessment:

1) *Falls Far Below the Standard*
2) *Approaches the Standard*
3) *Meets the Standard*
4) *Exceeds the Standard*

The PLD document found in Appendix A begins with a concise description of all four performance levels, each of which is further articulated in the bullets on the bottom of the document. This initial narrative piece is used for student reports.

[8] Please see Appendix A for a copy of the PLDs. Appendix A.1 provides the preliminary PLDs and Appendix A.3 provides the refined PLDs that came out of the standard setting.

The bullets at the bottom are designated as highlighted Performance Objectives (POs) from the Mathematics Standard, and several POs may have been combined into single bullets. Hence, the bullets were not necessarily verbatim transcriptions of the POs. In order to not replicate the entire academic standard, not all POs are represented in the PLDs, and the following statement is included below the bullets as a reminder of this fact: "These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard."

Methodology Overview

There are several well-established methods available for establishing performance standards. The item mapping procedure (Lewis, Green, Mitzel, Baum, & Patz, 1998)[9] was used in previous standard settings in Arizona. It has several favorable characteristics, namely: 1) it is a straightforward method based on the difficulty order of the test items; 2) it connects the judgment task of setting cut scores with the measurement model; and, 3) it connects test content with the performance level descriptors.

The item mapping procedure orders items for each test into a booklet according to the difficulty of the items, which is determined by item response theory (IRT) scaling techniques. Easy items are placed in the beginning of the booklet, and subsequent items become increasingly more difficult to the end of the booklet. Panelists examine each item and discuss: 1) the knowledge, skills, and abilities that must be applied to correctly respond to a given item; and, 2) the characteristics that make each item progressively more difficult than the previous item in the booklet.

The actual standard setting then proceeded in four rounds for high school and in three rounds for grades 3-8. Each round was designed to foster increased consensus among panelists, although reaching consensus was not necessary. The methodology is discussed in detail later in this report.

Data

Data from the spring 2010 administration of the AIMS mathematics tests were used for all computations and analyses. The Rasch model was used to scale and equate the tests. A vertical scaling study was conducted to create a new vertical scale across grades 3 through 8. Details of the vertical scaling process can be found in the 2010 AIMS Technical Report available from the ADE.

Response Probabilities

Once the tests were calibrated within each grade the Rasch item difficulty for each item was used to calculate the value of theta corresponding to a response probability of 0.67 using the following formula:

$$\theta_{RP} = \ln\left(\frac{k}{1-k}\right) + b$$

where *k* is the desired response probability and *b* is the Rasch item difficulty estimate.

The ordered item books were ordered by this value. The theta values at RP=0.67 were included in the item map as item locations. After performance level cut scores were determined on the theta scale for each grade level the new vertical scaling constants were applied to them to examine the relative positions of the performance cut points across the grade levels.

[9] Lewis, D.M., Green, D.R., Mitzel, H.C., Baum, K., & Patz, R.J. (1998). *The bookmark standard setting procedure: Methodology and recent implementations.* Paper presented at the Annual Meeting of the National Council on Measurement in Education.

Impact Data

Raw score to theta tables were created for each grade level as part of the calibration and scaling of the new tests. The raw score frequency distributions were used to identify the percent of students in each performance level during the standard setting. The theta values representing each of the performance cuts were compared to the thetas corresponding to raw scores in order to separate the distribution into performance levels.

Security

Maintaining the security and confidentiality of test items and student responses is of utmost importance. Pearson has experience providing for and working in secure environments and has established procedures for maintaining the confidentiality of student responses and the security of test forms and materials. These procedures were implemented at each standard setting meeting session.

As the panelists arrived, Pearson staff registered them and asked them to sign a statement of confidentiality. Upon registration, each panelist received a unique identification number. All materials received throughout the standard setting meeting possessed identification numbers, so strict inventory control could be implemented. Panelists were reminded of the confidential nature of the items, responses, and cut scores, and had to sign-in all material before leaving each day.

Staff

The following Pearson psychometric and content staff supported the AIMS mathematics standard settings:

Dr. Steven Fitzpatrick received his Ph.D. in Educational Psychology with a specialization in Quantitative Methods from the University of Texas at Austin and has been employed at Pearson since 2002. He is a Principal Research Scientist and serves as the lead Research Scientist on the AIMS program. He has nearly 30 years of experience in the psychometric field and is nationally renowned for his extensive experience and technical skill. Dr. Fitzpatrick oversaw the standard setting and data analysis in support of the standard setting activities during the standard setting meeting. He also presented the standard setting results to the Arizona State Board of Education.

Dr. Tracy Gardner received her Ph.D. in Research Methodology from the University of Pittsburgh and has been employed at Pearson since 2000. She is a manager in Psychometric and Research Services and serves as a Senior Research Scientist on the AIMS program. She has facilitated more than thirty standard setting meetings across fourteen states in her ten years at Pearson. Dr. Gardner served as the lead organizer of the AIMS standard setting meetings, and she facilitated the high school mathematics committee and the grades 6-8 mathematics committee.

Dr. Marc Johnson received his Ph.D. in Educational Psychology with a specialization in Quantitative Methods from the University of Texas at Austin and has been employed at Pearson as a Research Scientist since 2006. He has served as a facilitator for other standard setting meetings during his time at Pearson. Dr. Johnson served as the facilitator of the grades 3-5 mathematics committee.

Mr. Albert Hernandez received his B.S. in Mathematics and an M.S. in Curriculum and Instruction in Mathematics from Texas A&M University and has been employed at Pearson since 2002. Mr. Hernandez is a Senior Content Specialist in Mathematics and manages the content development activities and processes on AIMS. He provided mathematics content support for all three mathematics committees.

Additional psychometric and content staff were provided by the ADE.

DETAILED STANDARD SETTING PROCEDURES

Opening Session

The standard setting meeting opened with a general session[10] that welcomed the panelists, introduced members of the ADE and Pearson, explained roles of ADE, Pearson, and participants, and provided a general overview of the standard setting purpose and procedures. The ADE also provided a general overview of AIMS mathematics tests. Logistics, security, and reimbursement forms were discussed as well.

Introductions

After a break, panelists convened in their break-out room to begin the standard setting process. The participants were asked to introduce themselves and provide some information about their professional experience. Participants responded with the following information:

- Name
- Where are you from?
- How long have you been in your current position/field?
- What educational roles have you fulfilled?
- Have you participated in a standard setting before?
- Tell us something interesting about yourself.

Next the facilitator provided a review of the agenda in order for participants to develop a perspective of what was to be accomplished and the pace at which the meetings should proceed. It was noted that the facilitator might deviate from the time allotments on the agenda if ADE or Pearson felt that a topic required additional discussion.

Performance Level Descriptors

Next, panelists were familiarized with the performance levels. To familiarize panelists with the performance level descriptors (PLDs) and to help foster a shared understanding of them, Pearson facilitators distributed the preliminary PLDs that were developed by an Arizona educator committee in 2009. Discussion took place within the table group first and then continued as a full committee discussion. The goal of the table discussion was to help all panelists develop and share a strong, common understanding of the proficiency levels, with specific emphasis on the way those proficiency level descriptions relate to the relevant content and grade level of the appropriate AIMS test.

Panelists were asked to identify the main topics and skill sets assessed and then to identify the three to four key characteristics that distinguished performance at a given level from that of adjacent performance levels for each topic or skill set. Panelists conducted these tasks first in small group discussions at their table and then in a single large group for each committee.

After panelists had a good understanding of the distinguishing characteristics between the levels of performance level descriptors, they worked on identifying three characteristics that most distinguished students that were at the borderline of each performance level. They started with the borderline between *Meets the Standard* vs. *Approaches the Standard*. Within each table group, panelists were asked to identify three characteristics that most distinguished students that are at the borderline of *Meets the Standard* from the top of *Approaches the Standard*. Each table group recorded their responses on a flip chart. They repeated the same activity to distinguish three characteristics that differentiated between *Meets the Standard* vs. *Exceeds the Standard* and for *Falls Far Below the Standard* vs. *Approaches the Standard*. Once the table groups completed this task, they reconvened as a committee. Each table presented their distinguishing characteristics and the facilitator led a discussion of the commonalities and differences across the table groups. The facilitator captured the discussion on the group flip chart and then typed it up over the

[10] Please see Appendix F for a copy of the opening session training.

lunch break so that panelists could refer to the list throughout the standard setting meeting. Upon completing this task, the panelists were excused for lunch.

Experiencing the Test

After returning from lunch, the panelists took the test. An efficient way to help panelists become familiar with test content is to have them actually take the test under simulated testing conditions. Panelists were administered the test in a simulated testing environment and asked to consider carefully the skills and knowledge needed to successfully answer each item. In addition, they were asked to simultaneously put themselves in the position of a typical student in the course the test was developed to assess, and to try to "get inside the student's head" as they worked to solve each test item. Panelists had approximately one hour to take the test. After everyone completed the tests, the panelists self scored their responses using official keys and then had a group discussion. The facilitator asked the following questions during the group discussion:

1. What are your general impressions about the test?
2. Did the test generally cover the depth and breadth of the content standards?
3. Does the test generally have a range of item difficulties (e.g., easier items, moderate items, difficult items)?

Although some discussion about individual test items took place, the facilitator focused participants away from prolonged discussion on individual questions and brought the discussion back to the test in general. The facilitator encouraged participants to record any comments about test items on the index cards provided and advised the panelists that the comments would be passed along to ADE.

After the general group discussion about the test, the facilitator revisited the borderline student descriptors since some participants made reference to the descriptors during the general discussion of the test. The facilitator displayed the borderline student descriptors up on the screen with a projector, and the participants reviewed and discussed the descriptors that they constructed prior to lunch. In some cases, they added a few additional knowledge, skills, or abilities to the list.

Standard Setting Methodology Training

In the next activity, the lead Pearson facilitator led a training session on the item mapping procedure[11]. Under the item mapping procedure, panelists are presented with test items in actual order of empirical item difficulty. These items were presented in an ordered item booklet (OIB). The facilitator showed an actual OIB and explained that items appear as one item per page and that items are placed in order of difficulty in the OIB. The easiest item is first and the most difficult item is last. Therefore, the likelihood of getting an item correct decreases as one moves through the OIB.

Figure 3 was presented for illustrative purposes and the facilitator explained that this example assumed a 15-item mathematics practice test was used and one cut score was being selected. The facilitator emphasized that page numbers does not correspond to raw scores.

[11] Please see Appendix G for a copy of the training handouts.

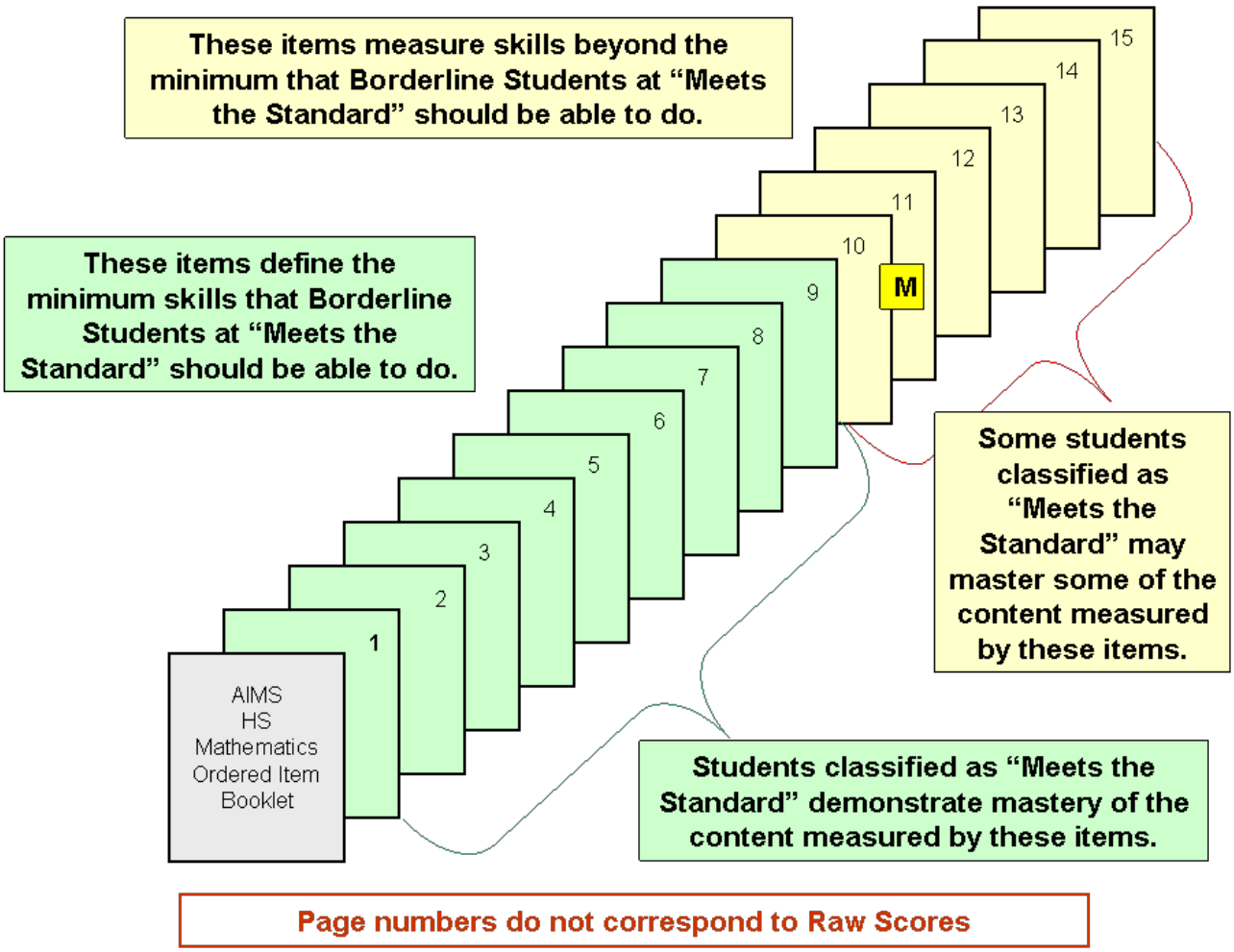

Figure 3: Locating Borderline Performance in the Ordered Item Booklet

Next, the facilitator provided a definition of mastery as defined by a standard dictionary and as defined for the AIMS standard setting. For AIMS standard setting, a group of students demonstrate mastery of the skills represented by an item if at least 2/3 of the borderline students answer the item correctly. An illustrative example was discussed next as shown in Figure 4 below. In this example, the low performing group mastered items 1-7; the middle performing group mastered items 1-11; the high performing group mastered items 1-14.

- Group A (Low Performing)
  - Mastered items 1-7
- Group B (Middle Performing)
  - Mastered Items 1-11
- Group C (High Performing)
  - Mastered Items 1-14

Percentage of Students Obtaining the Correct Answer

Page	Group A	Group B	Group C
1	94	96	99
2	92	94	99
3	90	92	96
4	86	90	94
5	81	89	92
6	75	85	90
7	70	82	88
8	66	76	85
9	61	75	84
10	58	72	83
11	53	69	83
12	45	63	81
13	30	56	76
14	26	50	70
15	14	47	65

Figure 4: **Sample Performance Characteristics of Various Groups**

The facilitator then provided information on how to move through the OIB. Panelists were asked to consider the following questions:

1. What does this item measure?
2. What makes this item more difficult than the items that precede it?

They were asked to read each page and consider the knowledge, skills, and abilities required to successfully answer the item. The page cut for *Meets the Standard* is placed to distinguish the content that borderline students at *Meets the Standard* should answer correctly from the content that they may not answer correctly. Panelists were asked to consider the following question, "Should most (67%) borderline students at *Meets the Standard* be able to answer this item correctly?" If the answer is yes, then they should read on because they have likely not yet hit the beginning of *Meets the Standard*. If the answer is no, then they may have entered into the content that borderline students at *Meets the Standard* may not answer correctly. Panelists were instructed to place their bookmark on the page after the last item that they expected the borderline students should be able to master.

In order to illustrate this process more concretely, the facilitator used a visual aid. See Figure 5 and Figure 6**.** Figure 5 shows how one would move through the OIB in theory. This figure attempted to illustrate that there is an absolute stopping point that separates the content that students at the borderline of *Meets the Standard* should master from the content that they will not likely master. The second figure (Figure 6) shows how one would move through the OIB in practice. In this more real world example, the figure illustrates that there are some items that students at the borderline of *Meets the Standard* should not need to master earlier in the OIB than where the cut page is. In addition, it shows that there are some items after the cut page that students who are at the borderline of *Meets the Standard* should be able to master. Panelists were instructed that this is a likely pattern and that they should not stop to place the bookmark because of one item. Please note that these figures used animation in the training and that not all information was on the slide at once.

Establishing the Page Cut for "Meets the Standard" (Theoretically)

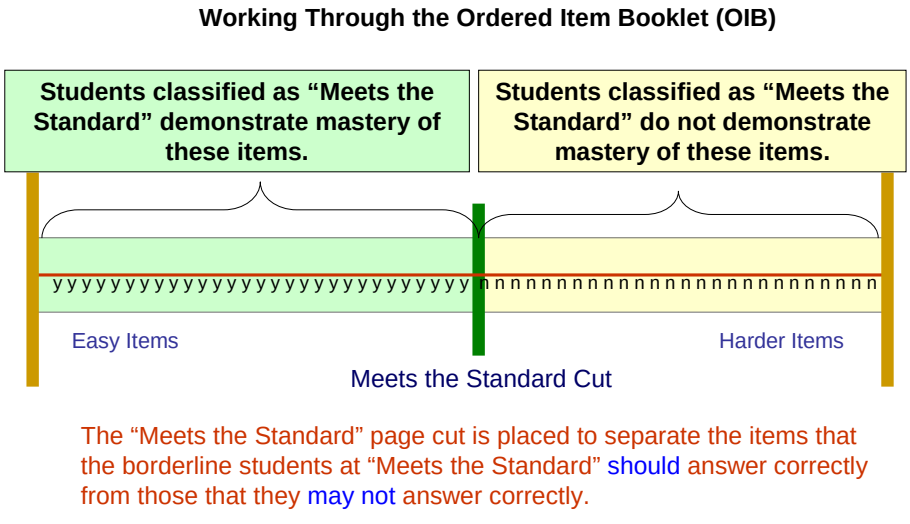

Figure 5: Establishing **the Page Cut for *Meets the Standard* (Theoretically)**

Establishing the Page Cut for "Meets the Standard" (In-Practice)

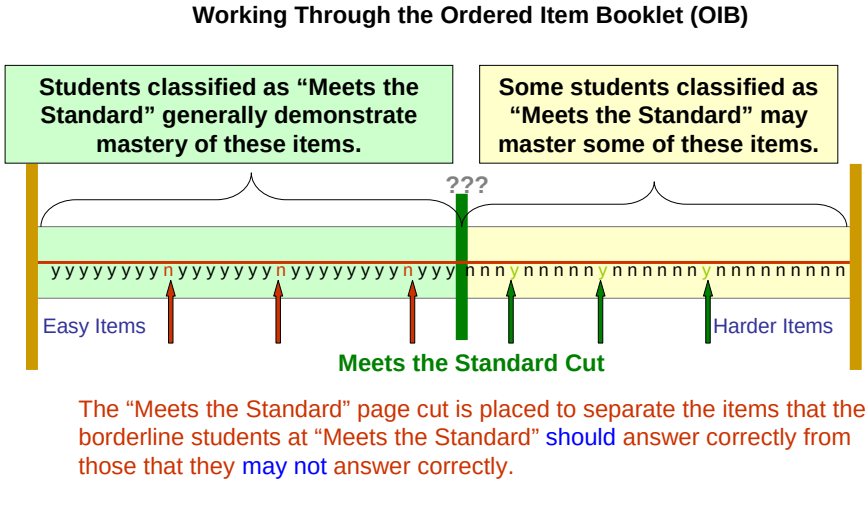

Figure 6: Establishing the **Page Cut for *Meets the Standard* (In-Practice)**

After going through the animated slides, the facilitator summarized the page cuts for the *Meets the Standard*, *Exceeds the Standard*, and *Approaches the Standard*:

- The page cut for *Meets the Standard* is placed to distinguish the content that borderline students at *Meets the Standard* should answer correctly from the content that they may not answer correctly.
- The page cut for *Exceeds the Standard* is placed to distinguish the content that borderline students at *Exceeds the Standard* should answer correctly from the content that they may not answer correctly.
- The page cut for *Approaches the Standard* is placed to distinguish the content that borderline students at *Approaches the Standard* should answer correctly from the content that they may not answer correctly.

To further explain the page cuts, animated graphics were presented next to show the cut for *Exceeds the Standard* and *Approaches the Standard*. The facilitator provided some advice in placing page selections. First, she informed the panelists that items do not differ a great deal in difficulty from one item to the next in the ordered item booklet. But because this empirical ordering may not exactly match the conceptual difficulty perceived by committee members as they proceed through the OIB, items may seem misplaced sometimes. However, in general, as the item difficulty increases, the likelihood of answering the item correctly decreases. She suggested finding the "ballpark" first, and then considering each item in that range to determine where to place the bookmark to indicate the selected page cut. She reminded the panelists to place their bookmark on the page after the last item that they expected the borderline student for that proficiency level should be able to master. She indicated to find the cut for *Meets the Standard* first, followed by the cut for *Exceeds the Standard* followed by the cut for *Approaches the Standard*. The facilitator informed the panelists that there is no "right" answer, but reminded them to keep the following information in mind. First, keep in mind what students "should" do, rather than what students "would" do. Second, she reminded them to keep in mind the 67% of the borderline students when deciding on a cut page. Third, panelists should keep in mind all students taking the AIMS mathematics assessment and not just students in their classroom or school.

The facilitator informed the panelists that they would have three rounds of ratings and, that rounds 2 and 3 would come after feedback is provided to help inform judgments. The facilitator showed the panelists how to use the item map and page number recording sheet to capture their page cuts.

Practice Round

After the facilitator gave an explanation of the methodology, the panelists worked through a practice example with ten released items that allowed them to become familiar with the general process and materials to be employed. Each panelist provided a recommended page cut for the *Meets the Standard* cut and then had a discussion within their table group.

Round 1 Ratings

The table leader at each table asked for confirmation that panelists understood the task and asked if anyone had any questions. The panelists also filled out a readiness form, which indicated their willingness to proceed with the next task. Once a panelist completed Round 1, the facilitator or tabled leader collected the *Page Number Recording Sheet*, spot checked the *Page Number Recording Sheet* against the ordered item booklet, signed in the *Page Number Recording Sheet,* and placed in a designated folder for data entry. The facilitator or table leader also collected and signed in the remaining secure materials including the Ordered Item Booklets, Item Map, Test Booklet, Directions for Administration (DFA), Answer Key, and any notes. After all panelists were dismissed, the table leaders met with Pearson and ADE staff to discuss the activities of the day.

Round 2 Ratings

On the morning of the second day, the facilitator provided a process overview of the day and answered any questions of the panelists. Next, the facilitator discussed the types of feedback that would be provided. First, she explained that

panelists would receive the panelist agreement data, which indicate how panelists page cuts compare, one to another. These data showed the median, low, and high pages for entire standard setting panel and for the individual table groups as well as a graph indicating page numbers for each panelist at each performance level. Second, she noted that the panelists would receive student performance data, which provide the percentage of students that obtained the correct answer for each question. Third, the facilitator assured the panelists that *after* the completion of round 2 they would be receiving impact data, which indicate the percentage of students that would be classified in each performance level if the page cuts were implemented.

Each table received a document listing the OIB page number cuts for that table. This document included the OIB page number cuts for each participant based on the Round 1 ratings in addition to the median OIB page number cut at each level for that table. Panelists were told the following: "The feedback we just handed out provides the OIB page number cuts for each level by each participant in your table. The maximum, minimum, and standard deviations of the OIB page number cuts are also provided. The median is the middle value of the OIB page number cuts from all participants at your table. The maximum is the highest value of the OIB page number cuts from all participants at your table. The minimum is the lowest value of the OIB page number cuts from all participants at your table."

The panelists were informed that they were not expected to come to consensus on their OIB page number cut judgments, but that they were expected to discuss differences to get a feel for the reasons these differences in page cut locations exist. For example, are there underlying differences in what the participants believe these borderline students can/cannot do? Is there any evidence that participants implemented different procedures to assign ratings?

The facilitator instructed the participants to discuss their "Meets" ratings first, then move to "Exceeds," and then finally discuss the "Approaches" ratings. The table leader generally facilitated discussion within the table, but the facilitator floated among the tables to observe discussion and answer questions.

After approximately 45 minutes of discussion with the table group, the table leader handed out the *p*-values that corresponded to the items in the OIB. The facilitator explained that the *p*-values represented the percentage of students that answered the item correctly. The *p*-values are based on all the students[12], not just the borderline students at "Approaches," "Meets," and "Exceeds." The facilitator explained that the participants should use the *p*-values to check their estimates of how difficult an item is.

Following Round 1, panelists received feedback on their bookmark placement relative to the bookmark placement of other panelists within their small group. After Round 1, still in small table groups, panelists compared bookmarks and discussed the differences between them. Panelists were encouraged to describe the reasons they set bookmarks where they did. The discussion addressed all items in the range between the highest and lowest bookmark for a given achievement level. Discussion took place within the table only for this round. Following the discussion, panelists made their Round 2 ratings.

Round 3 Ratings

After Round 2, panelists engaged in similar discussion that that took place after Round 1. Feedback similar to the report provided after Round 1 was handed out to the table leaders. An OIB page number cut summary document was provided to each table. This document provided the median, minimum, and maximum OIB page number cut at each level for that table. In addition, participants were provided the median, maximum, and minimum OIB page number cuts for the committee. Discussion took place within the table group first, followed by discussion within the entire committee.

Following that discussion, panelists from the entire committee were presented with student impact data illustrating the percent of examinees that would be classified into each achievement category based on operational test results. The facilitator led a discussion about the impact data results and tried to ascertain if the results seemed reasonable and/or consistent with their expectations based on what students should know and be able to do as defined by the

[12] For the HS group only, the *p*-values were based on students in Cohort 12.

performance level descriptors. The impact data graphic representation provided panelists with information on what percentages of students were at each performance level for the populations of interest (all students, female/male, and ethnic groups: white, African-American, Hispanic, Native American, Asian). Panelists were given time to discuss the appropriateness of the group level OIB page number cuts given the proportion of students that would fall in each level. Panelists were instructed that they should make these decisions based on what they know about students in the state, the requirements of the test, and the standards.

After panelists completed their discussions and indicated that they understood the impact data and the other data associated with Round 2, they responded to the readiness survey. When participants answered "yes" to all of these questions, they made their Round 3 ratings.

Repeat Process for Second Test

The high school panel only had one set of tests for which to recommend cut scores. However, the grades 3-8 committees recommended cut scores on two tests. Therefore, the committees that worked on standard setting panels for grades 3-8 repeated the entire process for their second test once they completed Round 3 of their first test. This included the PLD process and the standard setting process. The grades 3-5 committee recommended cut scores first for grade 3 and then for grade 5, and the grades 6-8 committee recommended cut scores first for grade 6 and then for grade 8.

Panelist Evaluation Survey

The panelists responded to an evaluation survey upon completion of the standard setting activities. The high school group completed the survey after they completed their final round of ratings and the grades 3-5 and 6-8 groups completed the survey after Round 3 of the second grade level. Their responses are summarized in Appendix S.

Review PLDs for Grades 4 and 7

After completing their Round 3 ratings for the second test, the panelists reviewed the PLDs for grade 4 or 7 for the elementary and middle school committees, respectively, in order to get prepared for the vertical articulation committee that would take place after lunch. Panelists were asked to identify the main topics and skill sets assessed and then to identify the three to four key characteristics that distinguished performance at a given level from that of adjacent performance levels for each topic or skill set. Panelists conducted these tasks first in small group discussions at their table and then in a single large group for each committee.

After panelists had a good understanding of the distinguishing characteristics between the levels of performance level descriptors, they worked on identifying three characteristics that most distinguish students that are at the borderline of each performance level. They started with the borderline between *Meets the Standard* vs. *Approaches the Standard*. Within each table group, panelists were asked to identify three characteristics that most distinguished students that are at the borderline of *Meets the Standard* from the top of *Approaches the Standard*. Each table group recorded their responses on a flip chart. They repeated the same activity to distinguish three characteristics that differentiated between *Meets the Standard* vs. *Exceeds the Standard* and for *Falls Far Below the Standard* vs. *Approaches the Standard*. Once the table groups completed this task, they reconvened as a committee. Each table presented their distinguishing characteristics and the facilitator led a discussion of the commonalities and differences across the table groups. The facilitator captured the discussion on the group flip chart and then typed it up over the lunch break. Upon completing this task, the panelists were excused for lunch.

Vertical Articulation Process

On June 3, 2010, all of the panelists from both grade-level committees and the three table leaders from the HS committee met as a large group as a vertical articulation committee in order to provide recommendations on the final cuts for grades 3-8 and HS. The cut scores for grades 4 and 7 were interpolated using the vertical scale and a polynomial regression equation to establish the initial set of cut scores to present to the panelists. Pearson facilitators guided the

panelists in discussing and comparing final recommended cut scores resulting from the panel meetings and in evaluating the extent to which the recommended cut scores demonstrate a smooth, consistent articulation across the grade levels.

The vertical articulation started with a brief introduction by the Pearson lead facilitator who presented the committee a series of data. First, the committee received a chart that contained the final page numbers cut scores for grades 3, 5, 6, and 8, as well as the interpolated page number cuts for grades 4 and 7. Then a table was distributed that translated the page number cuts into raw scores for grades 3-8 and HS. Because the maximum raw score differed by test, the percent correct that corresponded to the raw score cuts was also presented. This information was presented in both a table and graph. Next, the lead facilitator presented a graph that showed a plot of the cuts across the vertical scale. The final set of data was a graphic that showed the impact data across all data for grades 3-8 and HS. The lead facilitator led the committee in a discussion about the initial results and then provided the committee members time to discuss the results with their original standard setting committee members (i.e., grade 3-5 and 6-8). Panelists made minor modifications to some page cut recommendations to bring outliers more into congruence with the recommendations of other grade panels.

PLD Refinement Process

On June 4, the committees met to refine the PLDs. The lead facilitator provided instruction for refining PLDs and provided a handout. (See Appendix A.2.) The panelists were told that the PLDs were created in February 2009 by Arizona educators, some of whom were serving on the standard setting committee. ADE staff explained that the PLD document begins with a concise description of all four performance levels, each of which is further articulated in the bullets on the bottom of the document. The committee members learned that the PLDs were designed as concise statements so that they could fit on student reports, viz., that there was a maximum character limit that could not be exceeded. The bullets at the bottom of the document are designated as highlighted Performance Objectives (POs) from the Mathematics Standard, and several POs may have been combined into single bullets. Hence, the bullets were not necessarily verbatim transcriptions of the POs. In summary, the committee members came to understand that the entire academic standard that was eligible for assessing had not been replicated in the PLDs. The PLDs actually provided a representative sample of the content standards by reflecting a portion of the POs.

Nevertheless, the PLDs had to be refined for all grades. The middle school group started with grade 8 and moved down to grades 7 and 6, respectively. The elementary group started with grade 5 and moved down to grades 4 and 3, respectively. The high school group only worked with the high school PLDs.

Within each table group, the panelists began by discussing the bullets at the bottom of the PLDs for their first grade. They were asked to determine if any bullets should move from one performance level to another. ADE staff explained that if a bullet (PO) is moved and the objective is noted in the narrative at the top of the PLD document, the objective must also be moved to the new performance level in the narrative. Because some bullets are a combination of POs, it may be necessary to break apart the bullet to associate the separate parts with different performance levels.

With respect to procedure, the panelists were told that, if needed, they should make the appropriate adjustments to the narrative. ADE staff advised the panelists that bullets should begin with an action verb if the panelists determine that new bullets are needed; however, removal of bullets was not recommended.

With respect to substance, the panelists were told that all assessments must conform to the test blueprint. With respect to the standards, even though not every bullet or PO has been covered in the current assessment, the cumulative coverage of current and future assessments will include all the performance objectives.

Once the discussions began in earnest, the table leaders captured the key points discussed at their table for each grade. Upon completion of the PLD bullet discussion, all panelists with the exception of the table leaders were dismissed. Prior to dismissal, the table leaders and facilitators collected and signed in all materials, and the facilitator and ADE staff thanked participants for their participation.

After dismissal of the participants, the table leaders for grades 3-8 met all together to share their tables' recommendations on the changes to the bullet statements. The lead facilitator conducted the discussion of the recommended changes and used track changes on an overhead projector to capture the changes in the existing PLD documents. Discussion started with grade 8 and moved backwards down to grade 3. Particular attention was paid to the grades 5 versus 6 distinction since different committees served on those two adjacent grades. It should be noted that the HS descriptors were reviewed as well during this meeting, but HS table leaders were not present since the HS mathematics committee took place three weeks prior. Care was taken to ensure consistency between grade 8 versus the HS PLDs. Once the adjustments were made to the bullets, the table leaders were instructed to adjust the narrative accordingly, but they were reminded that they could not exceed the maximum amount of characters assigned to the space. Once table leaders concluded this activity by coming to consensus, Pearson and ADE updated the PLDs as needed and provided final copies of all PLDs to the ADE for presentation to the State Board of Education (SBE).

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STANDARD SETTING RESULTS

Table 3 shows a summary of the median page number cuts by round for each grade. Each cut recommended by the standard setting panels is shown. The interpolated cuts for grades 4 and 7 are based on the round three results for grades 3, 5, 6, and 8. In some instances the cuts by round are similar (i.e., the range of recommended cuts is small from Round 1 to Round 3). However, there are a few cases where the range of cuts from Round 1 to Round 3 is not small. For example, the final recommended page cut (Round 4) for high school Approaches the Standard is at 21 whereas the initial cut (Round 1) was at 34. Similarly, the Meets the Standard cut for high school was initially at page 48, but the final recommended cut was at 36. The page cuts for Exceeds the Standard were generally consistent within grade-level, with the exception of Grade 5.

Table 3**: Page Number Summary by Round**

Grade	Round	Approaches	Meets	Exceeds	Total Items
Grade 3	Round 1	10	37	57	66
	Round 2	10	31	53	66
	Round 3	10	32	59	66
Grade 4	Interpolated	6	36	63	68
Grade 5	Round 1	13	39	57	67
	Round 2	11	34	54	67
	Round 3	8	31	63	67
Grade 6	Round 1	17	39	57	68
	Round 2	16	37	57	68
	Round 3	14	33	59	68
Grade 7	Interpolated	22	35	63	68
Grade 8	Round 1	14	31	56	68
	Round 2	13	31	57	68
	Round 3	10	29	57	68
High School	Round 1	34	48	77	85
	Round 2	36	44	78	85
	Round 3	34	41	78	85
	Round 4	21	36	78	85

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Table 4 shows the raw score cuts by round for each grade as determined with the use of the page cuts shown in Table 3**.** As expected this table shows similar patterns of round-by-round differences that were seen in Table 3**.**

Table 4: Raw Score Summary by Round

Grade	Round	Approaches	Meets	Exceeds	Total Items
Grade 3	Round 1	29	45	55	
	Round 2	29	42	52	
	Round 3	29	43	57	66
Grade 4	Interpolated	31	44	58	68
Grade 5	Round 1	35	45	53	
	Round 2	34	44	52	
	Round 3	30	43	58	67
Grade 6	Round 1	39	47	56	
	Round 2	39	47	56	
	Round 3	37	44	56	68
Grade 7	Interpolated	38	44	57	68
Grade 8	Round 1	36	42	55	
	Round 2	35	42	55	
	Round 3	35	41	55	68
High School	Round 1	51	58	70	
	Round 2	52	57	70	
	Round 3	51	56	70	
	Round 4	45	52	70	85

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Table 5: Final Raw Score Cuts after Vertical Articulation

	Approaches		Meets		Exceeds		Total Items
Grade	RS	% of Pts.	RS	% of Pts.	RS	% of Pts.	
Grade 3	29	44%	43	65%	57	86%	66
Grade 4	32	47%	44	65%	57	84%	68
Grade 5	32	48%	43	64%	57	85%	67
Grade 6	32	47%	43	63%	56	82%	68
Grade 7	34	50%	44	65%	57	84%	68
Grade 8	35	51%	41	60%	55	81%	68
High School	45	53%	52	61%	70	82%	85

Table 6: Final Scale Score Ranges by Grade

Grade	Falls Far Below	Approaches	Meets	Exceeds
Grade 3	100-302	303-346	347-405	406-540
Grade 4	120-330	331-365	366-415	416-560
Grade 5	140-347	348-380	381-435	436-580
Grade 6	160-365	366-397	398-445	446-600
Grade 7	180-381	382-410	411-459	460-620
Grade 8	200-408	409-425	426-474	475-640
High School	300-470	471-486	487-536	537-700

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Figure 7 presents the plot of the average scale score on the tests in spring 2010 along with the scale score cut points for *Approaches the Standard*, *Meets the Standard*, and *Exceeds the Standard* for grades 3 through 8. As indicated in the figure, the scale score cut for Meets the Standard is slightly below the average scale score across all grades. In addition, the growth curve across the grades for each proficiency level consistently increases.

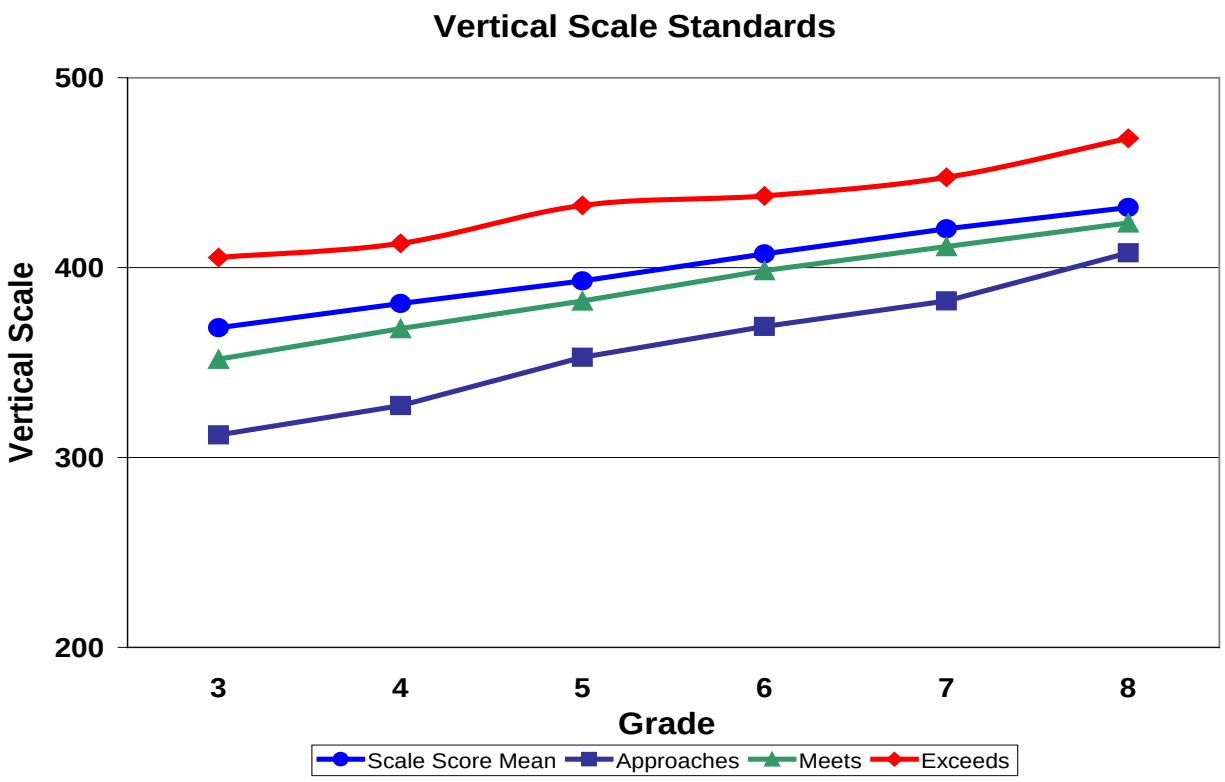

Figure 7: Final Scale Score Cut Points by Grade after Vertical Articulation

Figure 8 presents the impact data for grades 3-8 and high school after the vertical articulation process. The percentage of students in *Exceeds the Standard* is approximately 20-24% for all grades. The percentage of students in *Falls Far Below the Standard* monotonically increases between grades 3 through high school. Grade 3 has 11% of students in this category, whereas high school has 30% of students at *Falls Far Below the Standard*. The percentage of students in *Approaches the Standard* is approximately 20%-25% for grades 7 and below, but is smaller at 12%-14% for grade 8 and high school. However, this is consistent with the raw score cuts that are presented in Table 1. For grade 8 and high school, the panelists' cut scores for *Approaches the Standard* and *Meets the Standard* were fairly close. The discussions that took place during the performance level descriptor discussions also confirmed that the panelists in grade 8 and HS believed the *Approaches the Standard* category was narrower than the other performance levels. The percentage of students at *Meets the Standard* is approximately 38%-43% for students in elementary school. For middle and high school, the percentage of students at *Meets the Standard* is approximately 33%-37%.

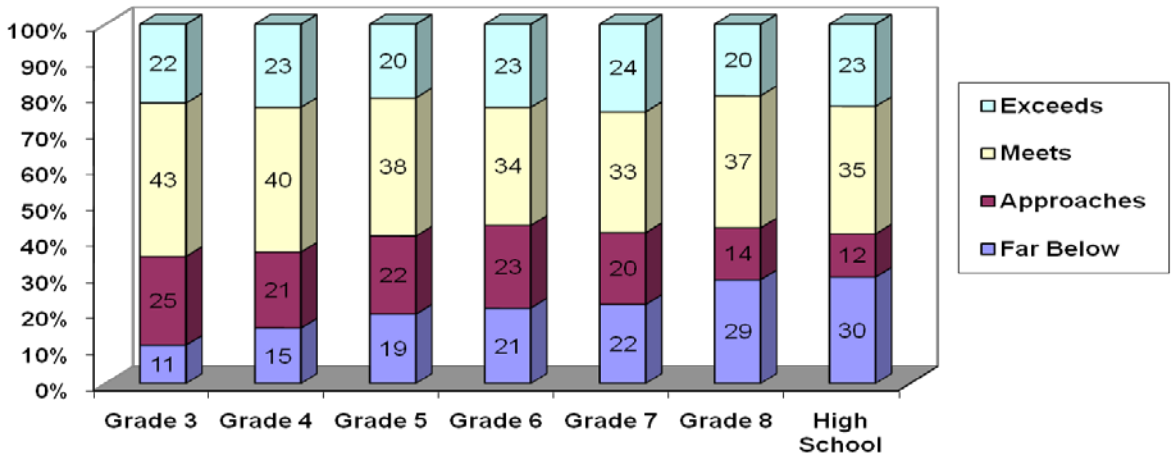

Figure 8: Final Percent of Students at Each Performance Level by Grade

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Appendix A: Performance Level Descriptors

Appendix A.1: Preliminary Performance Level Descriptors

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Arizona Mathematics Standard Performance Level Descriptors
High School

Exceeds the Standard – Students who score in this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level demonstrate a wealth of knowledge, skills, and abilities in fulfillment of the Mathematics Standard. They can create and analyze inductive and deductive arguments and solve problems that contain trigonometric ratios or advanced algebraic concepts.

Meets the Standard – Students who score in this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level are able to justify the relationships among subsets of the real numbers, solve problems using a system of linear equations and write the equation of a line given different pieces of information. They can calculate surface area and volume of 3-dimensional objects and determine probability in contextual situations.

Approaches the Standard – Students who score in this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and procedures by solving problems involving similar and congruent figures, organizing and displaying data, and solving and graphing linear equations or inequalities. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score in this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will typically require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Design simple experiments and recognize misrepresentations and distortions in sets of data. • Apply permutations and combinations to solve problems. • Factor higher order polynomials. • Solve formulas for specified variables. • Solve problems that can be modeled using quadratic equations or a system of linear equations. • Simplify and evaluate polynomials, rational expressions, radical expressions, and absolute value expressions. • Solve contextual problems using the sine, cosine, and tangent ratios in a right triangle • Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps using inductive or deductive reasoning.	• Differentiate and apply properties of real number operations. • Make inferences by comparing data sets. • Justify which measure of center is appropriate. • Determine whether the solution to a problem is reasonable. • Use probability to solve contextual situations. • Compare experimental and theoretical probability. • Solve network problems using graphs and matrices. • Solve a system of linear equations and describe the relationship of their graphs. • Factor quadratic polynomials. • Solve problems involving matrices, equations involving absolute value or radicals, and interest problems. • Write the equation of a line given different information. • Determine the domain and range of a function. • Sketch and interpret a graph that models a given context. • Create sequences using explicit and recursive formulas. • Verify characteristics of a plane figure using formulas for distance, midpoint, and slope. • Use the properties of circles and polygons to prove basic theorems and solve problems. • Describe the properties of a 2-dimensional figure that is the result of two or more transformations.	• Use estimation skills to determine the reasonableness of a solution. • Demonstrate computational fluency with expressions. • Solve word problems. • Organize and display data in a variety of representations. • Determine possible outcomes of an event. • Recognize, describe, and analyze sequences. • Add, subtract, and multiply polynomial and rational expressions. • Determine if a relation is a function. • Evaluate a function for a specified value. • Solve and graph linear equations or inequalities. • Solve problems using rate of change. • Analyze the properties of a figure after two or more transformations are performed. • Solve problems involving similar figures. • Prove similarity and congruence of triangles. • Use the triangle inequality property to solve problems. • Apply the basic rules of logic to arguments.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Graph a quadratic function. • Use dimensional analysis to convert units of measure. • Solve surface area and volume problems. • Select, or determine the purpose of, an algorithm. • State the inverse, converse, and contrapositive of a given statement and determine their truth value.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 3

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level use estimation strategies reasonably and fluently while integrating content from each of the other strands; convert customary units of measurement; apply problem solving strategies that test conjectures; use logical reasoning to draw conclusions; and relate vertex-edge graphs and systematic listing and counting to real-world situations.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can compose and decompose whole numbers and understand how they relate to each other; demonstrate the concept of multiplication and division; apply properties; use algebraic representations; solve problems involving basic facts; use efficient procedures to solve a variety of problems in context; interpret data; recognize numerical relationships; compare and order benchmark fractions; identify geometric transformations; and apply measurement skills.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to add and subtract whole numbers; count and represent money; organize and display data; describe, extend, find missing terms, and explain the rule in a numerical sequence; describe geometric figures based upon their attributes; recognize similarity and lines of symmetry; and determine area. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Make estimates appropriate to a given situation and determine reasonableness. • Solve problems using vertex-edge graphs. • Translate between the different representations of whole number relationships. • Convert units of length, weight, and capacity. • Make and test conjectures based on data. • Use logical reasoning to draw conclusions when solving problems. • Solve problems based on the multiplication principle of counting. • Describe changes in sequences of 2-dimensional figures.	• Express, sort, compare, and order whole numbers and record their equivalent forms. • Demonstrate fluency of multiplication and division facts. • Demonstrate the concepts of multiplication and division and apply them as inverse operations to solve problems. • Apply commutative, identity, and zero properties to multiplication and apply the identity property to division. • Express, compare, and order benchmark fractions. • Interpret and analyze displays of data. • Use symbols to represent unknown quantities. • Justify the use of colors in complex maps. • Recognize and describe a relationship between two quantities. • Create and solve simple one-step equations. • Identify and model a translation, reflection, or rotation. • Determine elapsed time.	• Add and subtract whole numbers. • Count and represent money. • Describe the effect of operations (multiplication and division) on the size of whole numbers. • Record, organize, and display data. • Recognize, describe, extend, create, and find missing terms in a numerical sequence. • Explain the rule for a given numerical sequence and verify that the rule works. • Recognize similar figures. • Identify and describe 3-dimensional figures. • Describe and compare attributes of two- and three-dimensional figures. • Identify all lines of symmetry. • Determine the area of a rectangular figure.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Apply measurement skills. • Measure and calculate perimeter. • Evaluate situations and select strategies to analyze and solve word problems. • Identify relevant, missing, and extraneous information related to solving a problem. • Represent possibilities for counting problems using arrays, charts, and systematic lists. • Investigate properties of vertex-edge graphs.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 4

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level solve problems that involve ratios, order of operations, measurement conversions, and conflict problems; make and test conjectures based on data and identify changes in a quantity over time.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level generalize and use efficient and accurate methods to multiply and divide multi-digit whole numbers; compose and decompose whole numbers using factors and multiples; make estimates; using benchmarks, compare and order whole numbers, fractions, decimals, and percents; interpret, analyze and compare displays of data using median, mode and range; analyze the attributes and properties of two- and three-dimensional figures, angles and lines; construct vertex-edge graphs and identify paths and circuits applicable to real-world situations.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to apply basic multiplication and division facts; add and subtract decimals and fractions with like denominators; solve one-step equations; apply measurement skills; plot coordinates; extend and find missing terms in a numerical sequence; and identify relevant, missing, extraneous information related to solving a problem. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use simple ratios to describe problems in context. • Apply order of operations with whole numbers. • Solve conflict problems by constructing and coloring vertex-edge graphs. • Identify the change in a quantity over time and make simple predictions. • Recognize changes in attributes of 2-dimensional figures. • Solve problems involving conversions. • Use logical reasoning to draw conclusions when solving problems. • Make and test conjectures based on data. • Justify that all possibilities have been enumerated without duplication.	• Express whole numbers, fractions, decimals, and percents using and connecting multiple representations. • Compose and decompose whole numbers using factors and multiples. • Compare and order decimals to hundredths. • Multiply and divide whole numbers. • Make estimates and use benchmarks to compare and perform computations with whole numbers, decimals, and fractions. • Use symbols to represent unknown quantities. • Interpret, analyze, and compare displays of data. • Apply median, mode, and range. • Describe and predict the probability and all possible outcomes of a given event. • Construct vertex-edge graphs to represent concrete situations and identify paths and circuits. • Recognize, describe, draw, and classify lines, angles, and 2-dimensional figures.	• Add and subtract decimals and fractions with like denominators. • Express fractions as fair sharing, parts of a whole, parts of a set, and locations on a real number line. • Demonstrate fluency of multiplication and division facts through 12. • Record, organize, and display data. • Create and solve one-step equations. • Recognize congruent figures. • Solve problems involving perimeter of 2-dimensional figures and area of rectangles. • Apply measurement skills to measure length, mass, and capacity using metric units. • Demonstrate the connection between map coloring and vertex coloring. • Recognize, describe, create, extend, and find missing terms and explain the rule in a numerical sequence.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Analyze common algorithms for computing with properties of operations. • Evaluate situations and select strategies to analyze and solve word problems. • Compute elapsed time to the minute. • Recognize the relationship between a 3-dimensional figure and its corresponding net(s). • Apply associative and distributive properties to solve multiplication and division problems. • Describe the change in perimeter or area when one attribute (length or width) of a rectangle changes.	• Identify relevant, missing, and/or extraneous information related to solving a problem. • Use coordinates to describe positions, plot line segments, and construct geometric figures in the first quadrant on a grid.

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 5

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level can use ratios and unit rates, express and interpret positive and negative numbers in context, solve two-step equations, determine theoretical probability of events, use Euler paths and circuits, apply geometric properties to solve area and perimeter problems, and draw logical conclusions.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can add and subtract fractions; compare, order, and determine equivalency among fractions, decimals, and percents; divide multi-digit whole numbers; apply mathematical properties to solve problems; interpret, describe, and analyze displays of data; analyze numerical patterns; solve problems using the multiplication principle of counting; classify quadrilaterals; identify simple valid arguments; and evaluate situations and select strategies to find and apply solutions to problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to locate integers on a number line, multiply multi-digit whole numbers, add and subtract decimals, solve problems involving properties of triangles, compare attributes of 2- and 3-dimensional figures, identify appropriate units of measure, and solve problems using elapsed time. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use ratios and unit rates to model, describe, and extend problems in context. • Express or interpret positive and negative numbers in context. • Simplify numerical expressions (including fractions and decimals) using the order of operations with or without grouping symbols. • Describe the theoretical probability of events. • Investigate and solve problems using Euler paths and circuits. • Create and solve two-step equations. • Measure angles between 0 and 360 degrees. • Solve problems involving perimeter and area of polygons using properties of parallelograms and triangles. • Make and test conjectures and draw logical conclusions.	• Determine equivalency among benchmark fractions, decimals, and percents. • Classify numbers as prime or composite. • Differentiate between factors and multiples. • Compare and order positive fractions, decimals, and percents. • Add and subtract fractions expressing solutions in simplest form. • Divide using multi-digit whole numbers. • Apply properties to solve numerical problems. • Make estimates appropriate to a given situation or computation. • Interpret, describe, and analyze displays of data. • Solve problems using the multiplication principle of counting. • Analyze numerical patterns. • Classify quadrilaterals by their properties.	• Locate integers on a number line. • Multiply multi-digit whole numbers. • Add and subtract decimals through thousandths. • Solve problems involving properties of triangles. • Compare attributes of 2- and 3-dimensional figures. • Solve problems using elapsed time. • Identify appropriate units of measure.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Analyze algorithms for adding and subtracting fractions and decimals and calculating area and perimeter of simple polygons.	• Evaluate situations and select strategies to find and apply solutions to problems. • Identify simple valid arguments using *if... then* statements based on graphic organizers. • Use mean, median, mode and range to describe the distribution of a data set. • Perform probability experiments including making predications, recording data and comparing results.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 6

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level can use prime factorization, express relationships between exponents and roots, add and subtract integers, and make mathematical arguments. They can also solve problems involving Hamilton paths and circuits, two-step equations with fractions and decimals, geometric problems involving angles, area, perimeter, and volume, and use logical reasoning.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can work fluently with fractions, decimals, and percents; compare and order integers; simplify and evaluate expressions; interpret, analyze, and describe displays of data; apply theoretical probability; solve problems involving circumference; identify a missing coordinate on the coordinate plane; convert within measurement systems; and evaluate situations and select strategies to find and apply solutions to problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to express the absolute value of a number, solve problems by applying properties, use transformational geometry, select appropriate units of measure, and graph points on a coordinate plane. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use prime factorization to determine greatest common factor and least common multiple. • Express the inverse relationships between exponents and roots for perfect squares and cubes. • Apply and interpret the concepts of addition and subtraction with integers using models. • Provide a mathematical argument to explain operations with two or more fractions or decimals. • Build and explore tree diagrams where items repeat. • Investigate and solve problems using Hamilton paths and circuits. • Create and solve two-step equations with fractions and decimals. • Solve problems involving supplementary, complementary, and vertical angles. • Solve problems involving area and perimeter of regular and irregular polygons.	• Convert between fractions, decimals, percents, and ratios. • Express a whole number as the product of its prime factors. • Demonstrate an understanding of fractions as rates or as division of whole numbers. • Compare and order integers, positive fractions, positive decimals, and positive percents. • Multiply and divide decimals or fractions. • Simplify numerical expressions using the order of operations. • Use benchmarks as meaningful points of comparison for rational numbers. • Interpret, describe, and analyze displays of data. • Determine theoretical probability and apply it to predicting experimental outcomes. • Analyze numerical patterns using all four operations. • Describe the relationship between two quantities in a function.	• Express that a number's distance from zero on the number line is its absolute value. • Apply properties to solve numerical problems. • Make estimates appropriate to a given situation and verify the reasonableness of the results. • Identify a simple translation or reflection of a 2-dimensional figure on a coordinate plane. • Graph ordered pairs in any quadrant of the coordinate plane. • Determine the appropriate unit of measure for a given context. • Estimate the measure of objects using a scale drawing or map.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Describe the relationship between the volume of a figure and the area of its base. • Create, analyze, and justify algorithms for multiplication and division of fractions and decimals and area of compound figures. • Make and test conjectures based on information collected from explorations and experiments. • Solve simple logic problems and justify solution methods and reasoning.	• Use an algebraic expression to represent a quantity. • Evaluate an expression by substituting given fractions and decimals for the variable. • Solve problems involving the relationship among the circumference, diameter, and radius of a circle. • Identify the missing coordinate of a polygon on the coordinate plane. • Solve problems involving conversion within the U.S. Customary and within the metric system. • Solve problems involving the area of simple polygons using formulas for rectangles and triangles. • Evaluate situations and select strategies to find and apply solutions to problems. • Compare sets of data by analyzing trends. • Explore counting problems using Venn diagrams with three attributes.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 7

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level can solve problems using proportional reasoning; determine the effect outliers have on summary statistics; experiment with probability events to determine whether they are dependent or independent; solve multi-step equations; and find measures of composite figures.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can problem solve with rational numbers using number sense, operations, and properties; use discrete mathematics to solve problems; create and solve two-step equations and translate between linear graphs and tables; solve circumference, area, and volume problems; and justify conjectures and solve logic problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to compute and estimate rational and common irrational numbers; solve problems by selecting and interpreting multi-line graphs and scatterplots; create, solve, and evaluate single variable expressions and one-step equations and inequalities; use graphs and tables to model and analyze change; analyze the attributes and properties of 2- and 3- dimensional figures; and analyze, communicate, and solve a problem situation using multiple representations. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Solve problems using ratio and proportion, percentages, tax, discount, tips, measurement, and scale drawings. • Identify outliers and determine their effect on mean, median, mode, and range. • Experiment with two different events to determine whether the two events are dependent or independent of each other. • Solve multi-step equations using inverse properties with rational numbers. • Create an algorithm and calculate the area and perimeter of composite 2-dimensional figures. • Create a net to calculate the surface area of a given solid. • Estimate the measure of an object in one system of units given the measure of that object in another system and the approximate conversion factor.	• Use factors, multiples, or prime factorization to solve contextual problems. • Simplify expressions using the order of operations and mathematical properties. • Determine and compare theoretical and experimental probabilities; including compound probabilities. • Analyze relationships and solve counting problems using tree and Venn diagrams. • Solve problems using Euler/Hamilton paths and circuit. • Create and solve two-step equations using inverse properties with rational numbers; justify the process using mathematical properties. • Translate between graphs and tables that represent a linear equation; describe the graph's characteristics. • Solve problems involving the circumference and area of a circle by calculating and estimating. • Justify the appropriate unit of measure and compute the volume of a solid.	• Convert between, compare, and order rational numbers. • Make estimates for a situation, and apply benchmarks for rational and common irrational numbers. • Estimate square roots of numbers less than 1000. • Add, subtract, multiply, and divide integers. • Solve problems by selecting and interpreting displays of data, including multi-line graphs and scatterplots. • Recognize, describe, create, and analyze numerical and geometric sequences using tables or graphs. • Create, evaluate, and solve single variable expressions and one-step equations and inequalities. • Use graphs and tables to model and analyze change. • Recognize the relationship between central angles and intercepted arcs; identify arcs and chords of a circle. • Use geometric properties to draw and classify solids. • Analyze relationships between angles created by parallel lines cut by a transversal. • Identify polygons having the same perimeter or area.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Make and test conjectures based on information collected from explorations and experiments. • Solve logic problems.	• Analyze, communicate, and solve a problem situation using multiple representations.

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 8

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by achievement that is substantially beyond the goal for all students. Students who perform at this level can solve problems involving percent increase/decrease and simple rates; use summary statistics to analyze the distribution of data; represent counting problems algebraically; compute slope and intercepts from a graph or an equation; predict changes when composing and decomposing plane and solid figures; find the midpoint on a coordinate grid and model rotation about the origin.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can use number sense to solve contextual problems and simplify expressions; solve problems involving probability, directed graphs, and systematic counting; recognize rate of change as slope; solve problems using the Pythagorean Theorem and proportional reasoning; calculate surface area; and solve logic problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to compare and classify real numbers and order on a number line; solve, select, and interpret data problems and compound probability experiments; solve linear equations and inequalities and represent them in multiple ways; explore the Pythagorean Theorem and calculate volume problems; and use problem solving strategies to solve problems. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Solve problems involving percent increase, percent decrease, and simple rates. • Make inferences by comparing the same summary statistic for two or more data sets. • Describe how summary statistics relate to the shape of the distribution. • Determine whether information is represented effectively and appropriately given a graph or a set of data by identifying sources of bias; compare and contrast the effectiveness of different representations of data. • Solve counting problems and represent counting principles algebraically including factorial notation. • Compute slope and intercepts • Predict results of combining, subdividing, and changing shapes of plane figures and solids. • Make and test a conjecture about how to find the midpoint between any two points in the coordinate plane.	• Solve contextual problems with factors, multiples, divisibility or remainders, prime numbers, and composite numbers. • Simplify numerical expressions using the order of operations that include grouping symbols, square roots, cube roots, absolute values, and positive exponents. • Use all possible outcomes (sample space) to determine the probability of dependent and independent events. • Determine theoretical and experimental conditional probabilities in compound probability experiments. • Represent, analyze, and solve counting problems with or without ordering and repetitions. • Use directed graphs to solve problems. • Recognize rate of change as slope • Use proportional reasoning to determine congruence and similarity of triangles. • Use the Pythagorean Theorem to solve problems.	• Compare and order real numbers. • Classify the relationship between the subsets of the real number system. • Estimate the location of rational and common irrational numbers on a number line. • Solve, select, and interpret displays of data, including box-whisker plots and scatterplots. • Create and make conjectures about numerical and geometric sequences. • Use multiple representations to describe and model functions; translate among representations. • Demonstrate that proportional relationships are linear using equations, graphs, or tables. • Write or identify algebraic expressions, equations, or inequalities that represent a situation. • Use rational number substitution to evaluate expressions. • Solve linear equations and inequalities. • Graph an inequality on a number line. • Identify all of the attributes of circles.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Model the result of rotations in multiples of 45 degrees of a 2-dimensional figure about the origin.	• Solve geometry and measurement problems using ratios and proportions. • Calculate the surface area of rectangular prisms, right triangular prisms, and cylinders. • Solve logic problems.	• Use the Pythagorean Theorem to find the distance between two points in the coordinate plane. • Calculate the volume of rectangular prisms, right triangular prisms, and cylinders. • Use problem solving strategies to solve problems.

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Refinement of Mathematics PLDs

Instructions to tables for refinement of the Mathematics PLDs:

Background

- The PLDs were created in February 2009 by Arizona educators. Peer Review requires that PLDs are developed prior to the administration of the assessments and the subsequent Standard Setting. The "tweaking" of the PLDs will be performed at the Standard Setting.
- The top part of the PLDs presents all four performance levels and is a generalized reflection of the bullets on the bottom. This narrative piece is used for student reports. There is a maximum character count for the narrative/student reports which must not be exceeded.
- The bullets at the bottom are designated as highlighted POs from the Mathematics Standard, and several POs may have been combined into single bullets. The bullet text and PO verbiage are usually not verbatim. In order to not replicate the entire academic standard, not all POs are represented in the PLDs, and the statement "**These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.**" is included below the bullets as a reminder of this fact.

Procedures

1. The Mathematics Standard must be available as a reference for this activity.
2. Begin with the bullets at the bottom. Determine if any bullets should move from one performance level to another. If a bullet (PO) is moved and the objective is noted in the narrative at the top of the PLD, the objective must also be moved to the new performance level in the narrative.
3. Since some bullets are a combination of POs, it may be necessary to break apart the bullet to place the separate parts in different performance levels. If needed, make the appropriate adjustments to the narrative.
4. Note the bullet's beginning action verb. The verb may be changed and along with the rest of the text, a new bullet may be added to a different performance level.
5. New bullets may be added if appropriate and necessary; however, removal of bullets is not recommended. All assessments must conform to the test blueprint, and although not all the bullets will be covered in the current assessment, over time, the future assessments will include all the performance objectives identified in the bullets.
6. Adjust the narrative accordingly, but do not exceed the maximum amount of characters assigned to the space.
7. Table Leaders will share their tables' recommendations, and Track Changes will be made to the existing document.

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Appendix A.3: Final Performance Level Descriptors after Refinement Process

Arizona Mathematics Standard Performance Level Descriptors
High School

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level demonstrate knowledge, skills, and abilities in fulfillment of the Mathematics Standard. They can create and analyze inductive and deductive arguments and solve problems that contain trigonometric ratios or algebraic concepts.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level are able to justify the relationships among subsets of the real numbers, solve problems using a system of linear equations and write the equation of a line.. They can calculate surface area and volume of 3-dimensional objects and determine probability in contextual situations. They can solve and factor quadratic equations.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and procedures by being able to solve problems involving similar and congruent figures, organize and display data, and solve and graph linear equations or inequalities. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will typically require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Design simple experiments and recognize misrepresentations and distortions in sets of data. • Apply permutations and combinations to solve problems. • Solve problems that can be modeled using quadratic equations or a system of linear equations. • Simplify and evaluate polynomials, rational expressions, radical expressions, and absolute value expressions. • Solve contextual problems using the sine, cosine, and tangent ratios in a right triangle • Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps using inductive or deductive reasoning. • Solve contextual problems using scientific notation • Solve formulas for specified variables when the solution involves more than one operation.	• Differentiate and apply properties of real number operations. • Justify which measure of center is appropriate. • Determine whether the solution to a problem is reasonable. • Use probability to solve contextual situations. • Compare experimental and theoretical probability. • Solve network problems using graphs and matrices. • Solve a system of linear equations and describe the relationship of their graphs. • Factor quadratic polynomials. • Solve problems involving matrices, equations involving absolute value or radicals, and interest problems. • Write the equation of a line given different information. • Determine the domain and range of a function. • Sketch and interpret a graph that models a given context. • Create sequences using explicit and recursive formulas. • Verify characteristics of a plane figure using formulas for distance, midpoint, and slope. • Use the properties of circles and polygons to prove basic theorems and solve problems. • Describe the effects of a 2-dimensional figure that is the result of two or more transformations. • Graph a quadratic function. • Use dimensional analysis to convert units of measure.	• Use estimation skills to determine the reasonableness of a solution. • Demonstrate computational fluency with expressions and equations. • Organize and display data in a variety of representations. • Recognize, describe, and analyze sequences. • Add, subtract, and multiply polynomial and rational expressions. • Determine if a relation is a function. • Evaluate an expression for a specified value. • Solve and graph linear equations or inequalities. • Solve problems using rate of change. • Describe the properties of a figure after two or more transformations are performed. • Solve problems involving similar figures. • Apply the basic rules of logic to arguments. • Make inferences by comparing data sets. • Perform operations with matrices • Determine the specific term of a sequence • Find simple flaws in reasoning • Verify characteristics of a plane figure using the formula for midpoint.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Solve surface area and volume problems. • Select, or determine the purpose of, an algorithm. • State the inverse, converse, and contrapositive of a given statement and determine their truth value. • Factor higher order polynomials. • Solve formulas for specified variables. • Distinguish between permutations and combinations to solve problems. • Solve problems using the sine, cosine, and tangent ratios in a right triangle • Prove similarity and congruence of triangles. • Use the triangle inequality property to solve problems. • Determine possible outcomes of an event. • Solve word problems.	• Use the properties of circles to solve problems. • Solve volume problems. • Solve simple probability and counting problems. • Write simple inequalities.

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 3

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level use estimation strategies reasonably and fluently while integrating content from each of the other strands, convert customary units of measurement, apply problem solving strategies that test conjectures, use logical reasoning to draw conclusions, and relate vertex-edge graphs and systematic listing and counting to real-world situations.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can compose and decompose whole numbers and understand how they relate to each other, demonstrate the concept of multiplication and division, apply properties, use algebraic representations, solve problems involving basic facts, use efficient procedures to solve a variety of problems in context, interpret data, recognize numerical relationships, compare and order benchmark fractions, identify geometric transformations, and apply measurement skills.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to add and subtract whole numbers; count and represent money; organize and display data; describe, extend, find missing terms, and explain the rule in a numerical sequence; describe geometric figures based upon their attributes; recognize similarity and lines of symmetry; and determine area. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Make estimates appropriate to a given situation and determine reasonableness. • Solve problems using vertex-edge graphs. • Translate between the different representations of whole number relationships. • Convert units of length, weight, and capacity. • Make and test conjectures based on data. • Use logical reasoning to draw conclusions when solving problems. • Solve problems based on the multiplication principle of counting. • Describe changes in sequences of 2-dimensional figures.	• Express, sort, compare, and order whole numbers and record their equivalent forms. • Solve multiplication and division facts through 10. • Demonstrate the concepts of multiplication and division and apply them as inverse operations to solve problems. • Apply commutative, identity, and zero properties to multiplication and apply the identity property to division. • Express, compare, and order benchmark fractions. • Interpret and analyze displays of data. • Use symbols to represent unknown quantities. • Justify the use of colors in complex maps. • Recognize and describe a relationship between two quantities. • Create and solve simple one-step equations. • Identify and model a translation, reflection, or rotation. • Determine elapsed time to the hour and half-hour.	• Add and subtract whole numbers. • Count and represent money. • Describe the effect of operations (multiplication and division) on the size of whole numbers. • Record, organize, and display data. • Recognize, describe, extend, create, and find missing terms in a numerical sequence. • Explain the rule for a given numerical sequence and verify that the rule works. • Recognize similar figures. • Identify and describe 3-dimensional figures. • Describe and compare attributes of 2- and 3-dimensional figures. • Identify all lines of symmetry. • Determine the area of a rectangular array.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Apply measurement skills. • Measure and calculate perimeter. • Evaluate situations and select strategies to analyze and solve word problems. • Identify relevant, missing, and extraneous information related to solving a problem. • Represent possibilities for counting problems using arrays, charts, and systematic lists. • Investigate properties of vertex-edge graphs.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 4

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level solve problems that involve ratios, order of operations, measurement conversions, and conflict problems; make and test conjectures based on data; and identify changes in a quantity over time.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level generalize and use efficient and accurate methods to multiply and divide multi-digit whole numbers; compose and decompose whole numbers using factors and multiples; make estimates; use benchmarks to compare and order whole numbers, fractions, decimals, and percents; interpret, analyze and compare displays of data using median, mode, and range; analyze the attributes and properties of 2- and 3-dimensional figures, angles, and lines; and compute elapsed time to the minute.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to apply basic multiplication and division facts; add and subtract decimals and fractions with like denominators; solve one-step equations; apply measurement skills; plot coordinates; extend and find missing terms in a numerical sequence; and identify relevant, missing, or extraneous information related to solving a problem. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use simple ratios to describe problems in context. • Apply order of operations with whole numbers. • Solve conflict problems by constructing and coloring vertex-edge graphs. • Identify the change in a quantity over time and make simple predictions. • Recognize which attributes change when 2-dimensional figures are cut up or rearranged.. • Solve problems involving conversions. • Use logical reasoning to draw conclusions when solving problems. • Make and test conjectures based on data. • Justify that all possibilities have been enumerated without duplication. • Analyze common algorithms for computing with properties of operations.	• Express whole numbers, fractions, decimals, and percents using and connecting multiple representations. • Compose and decompose whole numbers using factors and multiples. • Compare and order decimals to hundredths. • Multiply and divide whole numbers. • Make estimates and use benchmarks to compare and perform computations with whole numbers, decimals, and fractions. • Use symbols to represent unknown quantities. • Interpret, analyze, and compare displays of data. • Apply median, mode, and range. • Describe and predict the probability and all possible outcomes of a given event. • Construct vertex-edge graphs to represent concrete situations and identify paths and circuits. • Recognize, describe, draw, and classify lines, angles, and 2-dimensional figures.	• Add and subtract decimals and fractions with like denominators. • Express fractions as fair sharing, parts of a whole, parts of a set, and locations on a real number line. • Solve multiplication and division facts through 12. • Record, organize, and display data. • Create and solve one-step equations. • Recognize congruent figures. • Solve problems involving perimeter of 2-dimensional figures and area of rectangles. • Apply measurement skills to measure length, mass, and capacity using metric units. • Demonstrate the connection between map coloring and vertex coloring. • Recognize, describe, create, and extend a numerical sequence.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Evaluate situations and select strategies to analyze and solve word problems. • Compute elapsed time to the minute. • Recognize the relationship between a 3-dimensional figure and its corresponding net(s). • Apply associative and distributive properties to solve multiplication and division problems. • Describe the change in perimeter or area when one attribute (length or width) of a rectangle changes.	• Find missing terms and explain the rule in a numerical sequence. • Identify relevant, missing, and/or extraneous information related to solving a problem. • Use coordinates to describe positions, plot line segments, and construct geometric figures in the first quadrant on a grid.

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 5

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level can use ratios and unit rates, solve two-step equations, use Euler paths and circuits, apply geometric properties to solve area and perimeter problems, and draw logical conclusions.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can add and subtract fractions; compare, order, and determine equivalency among fractions, decimals, and percents; express and interpret positive and negative numbers in context; divide multi-digit whole numbers; apply mathematical properties to solve problems; interpret, describe, and analyze displays of data; analyze numerical patterns; solve problems using the multiplication principle of counting; classify quadrilaterals; identify simple valid arguments; and evaluate situations and select strategies to find and apply solutions to problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to locate integers on a number line, multiply multi-digit whole numbers, add and subtract decimals, solve problems involving properties of triangles, compare attributes of 2- and 3-dimensional figures, identify appropriate units of measure, and solve problems using elapsed time. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use ratios and unit rates to model, describe, and extend problems in context. • Simplify numerical expressions (including fractions and decimals) using the order of operations with or without grouping symbols. • Investigate and solve problems using Euler paths and circuits. • Create and solve two-step equations. • Measure angles between 0 and 360 degrees. • Solve problems involving perimeter and area of polygons using properties of parallelograms and triangles. • Make and test conjectures and draw logical conclusions.	• Determine equivalency among benchmark fractions, decimals, and percents. • Classify numbers as prime or composite. • Compare and order positive fractions, decimals, and percents. • Add and subtract fractions expressing solutions in simplest form. • Divide using multi-digit whole numbers. • Apply properties to solve numerical problems. • Make estimates appropriate to a given situation or computation. • Interpret, describe, and analyze displays of data. • Solve problems using the multiplication principle of counting. • Analyze numerical patterns. • Classify quadrilaterals by their properties.	• Locate integers on a number line. • Multiply multi-digit whole numbers. • Add and subtract decimals through thousandths. • Solve problems involving properties of triangles. • Compare attributes of 2- and 3-dimensional figures. • Solve problems using elapsed time. • Identify appropriate units of measure. • Differentiate between factors and multiples.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Analyze algorithms for adding and subtracting fractions and decimals and calculating area and perimeter of simple polygons.	• Evaluate situations and select strategies to find and apply solutions to problems. • Identify simple valid arguments using *if... then* statements based on graphic organizers. • Use mean, median, mode and range to describe the distribution of a data set. • Perform probability experiments including making predications, recording data, and comparing results. • Express or interpret positive and negative numbers in context. • Describe the theoretical probability of events.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 6

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level can use prime factorization, express relationships between exponents and roots, and make mathematical arguments. They use logical reasoning and can solve problems involving Hamilton paths and circuits, two-step equations with fractions and decimals, and geometric problems involving volume.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can work fluently with fractions, decimals, and percents; compare and order integers; use models to represent integer operations; simplify and evaluate expressions; interpret, analyze, and describe displays of data; apply theoretical probability; solve problems involving perimeter and area; identify a missing coordinate on the coordinate plane; convert within measurement systems; and evaluate situations and select strategies to find and apply solutions to problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to express the absolute value of a number, solve problems by applying properties, use transformational geometry, select appropriate units of measure, and graph points on a coordinate plane. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Use prime factorization to determine greatest common factor and least common multiple. • Express the inverse relationships between exponents and roots for perfect squares and cubes. • Provide a mathematical argument to explain operations with two or more fractions or decimals. • Build and explore tree diagrams where items repeat. • Investigate and solve problems using Hamilton paths and circuits. • Create and solve two-step equations with fractions and decimals. • Solve problems involving supplementary, complementary, and vertical angles. • Describe the relationship between the volume of a figure and the area of its base. • Create, analyze, and justify algorithms for multiplication and division of fractions and decimals and area of compound figures.	• Convert between fractions, decimals, percents, and ratios. • Express a whole number as the product of its prime factors. • Apply and interpret the concepts of addition and subtraction with integers using models. • Demonstrate an understanding of fractions as rates or as division of whole numbers. • Compare and order integers, positive fractions, positive decimals, and positive percents. • Multiply and divide decimals or fractions. • Simplify numerical expressions using the order of operations. • Interpret, describe, and analyze displays of data. • Determine theoretical probability and apply it to predicting experimental outcomes. • Analyze numerical patterns using all four operations. • Describe the relationship between two quantities given by a chart, table or graph	• Express that a number's distance from zero on the number line is its absolute value. • Apply properties to solve numerical problems. • Make estimates appropriate to a given situation and verify the reasonableness of the results. • Identify a simple translation or reflection of a 2-dimensional figure on a coordinate plane. • Graph ordered pairs in any quadrant of the coordinate plane. • Determine the appropriate unit of measure for a given context. • Estimate the measure of objects using a scale drawing or map. • Solve problems involving the area of simple polygons using formulas for rectangles and triangles. • Use benchmarks as meaningful points of comparison for rational numbers.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Make and test conjectures based on information collected from explorations and experiments. • Solve simple logic problems and justify solution methods and reasoning.	• Use an algebraic expression to represent a quantity. • Evaluate an expression by substituting given fractions and decimals for the variable. • Solve problems involving the relationship among the circumference, diameter, and radius of a circle. • Identify the missing coordinate of a polygon on the coordinate plane. • Solve problems involving conversion within the U.S. Customary and within the metric system. • Evaluate situations and select strategies to find and apply solutions to problems. • Compare sets of data by analyzing trends. • Explore counting problems using Venn diagrams with three attributes. • Solve problems involving area and perimeter of regular and irregular polygons.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 7

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level can solve problems using proportional reasoning, determine the effect outliers have on summary statistics, experiment with probability events to determine whether they are dependent or independent, solve multi-step equations, and find measures of composite figures.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can problem solve with rational numbers using number sense, operations, and properties; use discrete mathematics to solve problems; create and solve two-step equations and translate between linear graphs and tables; solve circumference, area, and volume problems; and justify conjectures and solve logic problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to compute and estimate rational and common irrational numbers; solve problems by selecting and interpreting multi-line graphs and scatterplots; create, solve, and evaluate single variable expressions and one-step equations and inequalities; use graphs and tables to model and analyze change; analyze the attributes and properties of 2- and 3- dimensional figures; and communicate the solution to a problem situation using multiple representations. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Solve problems using ratio and proportion, percentages, tax, discount, tips, measurement, and scale drawings. • Determine the effect of outliers on mean, median, mode, and range. • Experiment with two different events to determine whether the two events are dependent or independent of each other. • Solve multi-step equations using inverse properties with rational numbers. • Create an algorithm and calculate the area and perimeter of composite 2-dimensional figures. • Create a net to calculate the surface area of a given solid. • Estimate the measure of an object in one system of units, given the measure of that object in another system of units and the approximate conversion factor.	• Use factors, multiples, or prime factorization to solve contextual problems. • Simplify expressions using the order of operations and mathematical properties. • Determine and compare theoretical and experimental probabilities, including compound probabilities. • Analyze relationships and solve counting problems using tree and Venn diagrams. • Solve problems using Euler/Hamilton paths and circuit. • Create and solve two-step equations using inverse properties with rational numbers and justify the process using mathematical properties. • Translate between graphs and tables that represent a linear equation and describe the graph's characteristics. • Solve problems involving the circumference and area of a circle by calculating and estimating. • Justify the appropriate unit of measure and compute the volume of a solid.	• Convert between, compare, and order rational numbers. • Make estimates for a situation and apply benchmarks for rational and common irrational numbers. • Add, subtract, multiply, and divide integers. • Solve problems by selecting and interpreting displays of data, including multi-line graphs and scatterplots. • Recognize, describe, create, and analyze numerical and geometric sequences using tables or graphs. • Create, evaluate, and solve single variable expressions and one-step equations and inequalities. • Use graphs and tables to model and analyze change. • Identify arcs and chords of a circle. • Use geometric properties to draw and classify solids. • Identify polygons having the same perimeter or area. • Communicate the solution to a problem situation using multiple representations.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
	• Make and test conjectures based on information collected from explorations and experiments. • Solve logic problems. • Estimate square roots of numbers less than 1000. • Analyze relationships between angles created by parallel lines cut by a transversal. • Recognize the relationship between central angles and intercepted arcs.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Arizona Mathematics Standard Performance Level Descriptors
Grade 8

Exceeds the Standard – Students who score at this level illustrate a superior academic performance as evidenced by performing substantially beyond the achievement goal for all students. Students who perform at this level can solve problems involving percent increase/decrease and simple rates, use summary statistics to analyze the distribution of data, represent counting problems algebraically, compute slope and intercepts from a graph or an equation, predict changes when composing and decomposing plane and solid figures, find the midpoint on a coordinate grid and model rotation about the origin.

Meets the Standard – Students who score at this level demonstrate a solid academic performance on subject matter as reflected by the Mathematics Standard. Students who perform at this level can use number sense to solve contextual problems and simplify expressions; solve and graph inequalities; solve problems involving probability, directed graphs, and systematic counting; recognize rate of change as slope; solve problems using the Pythagorean Theorem and proportional reasoning; calculate surface area; and solve logic problems.

Approaches the Standard – Students who score at this level show partial understanding of the knowledge and application of the skills that are fundamental for proficient work. Students who perform at this level show some understanding of the Mathematics Standard's concepts and are able to compare and classify real numbers and order on a number line; solve, select, and interpret data problems and compound probability experiments; solve linear equations and represent them in multiple ways; calculate volume problems; and use problem solving strategies to solve problems. Some gaps in knowledge and skills are evident and may require additional instruction and remediation in order to achieve a satisfactory level of understanding.

Falls Far Below the Standard – Students who score at this level may have significant gaps in the knowledge and skills that are necessary to satisfactorily meet the Mathematics Standard. Students will usually require a considerable amount of additional instruction and remediation in order to achieve a satisfactory level of understanding.

Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Solve problems involving percent increase, percent decrease, and simple rates. • Make inferences by comparing the same summary statistic for two or more data sets. • Describe how summary statistics relate to the shape of the distribution. • Determine whether information is represented effectively and appropriately given a graph or a set of data by identifying sources of bias; analyze the effectiveness of different representations of data. • Solve counting problems and represent counting principles algebraically including factorial notation. • Compute slope and intercepts • Predict results of combining, subdividing, and changing shapes of plane figures and solids. • Make and test a conjecture about how to find the midpoint between any two points in the coordinate plane.	• Solve contextual problems with factors, multiples, divisibility or remainders, prime numbers, and composite numbers. • Simplify numerical expressions using the order of operations that include grouping symbols, square roots, cube roots, absolute values, and positive exponents. • Use all possible outcomes (sample space) to determine the probability of dependent and independent events. • Determine theoretical and experimental conditional probabilities in compound probability experiments. • Represent, analyze, and solve counting problems with or without ordering and repetitions. • Use directed graphs to solve problems. • Recognize rate of change as slope • Use proportional reasoning to determine unknown measurements in similar triangles. • Use the Pythagorean Theorem to solve problems and find the distance between two points in the coordinate plane.	• Compare and order real numbers. • Classify the relationship between the subsets of the real number system. • Estimate the location of rational and common irrational numbers on a number line. • Solve, select, and interpret displays of data, including box and whisker plots and scatterplots. • Make conjectures about numerical and geometric sequences. • Demonstrate that proportional relationships are linear using equations, graphs, or tables. • Write or identify algebraic expressions, equations, or inequalities that represent a situation. • Use rational number substitution to evaluate expressions. • Solve linear equations. • Graph an inequality on a number line. • Identify all of the attributes of circles. • Calculate the volume of rectangular prisms, right triangular prisms, and cylinders. • Use problem solving strategies to solve problems.

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Students at the "Exceeds the Standard" level generally know the skills required at the "Meets" and "Approaches" levels and are able to:	Students at the "Meets the Standard" level generally know the skills required at the "Approaches" level and are able to:	Students at the "Approaches the Standard" level generally know and are able to:
• Model the result of rotations in multiples of 45 degrees of a 2-dimensional figure about the origin.	• Solve geometry and measurement problems using ratios and proportions. • Calculate the surface area of rectangular prisms, right triangular prisms, and cylinders. • Solve logic problems. • Describe and model functions and their relationships. • Solve inequalities. • Identify slope and y-intercept from a graph or equation in slope-intercept form.	

These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.

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Appendix B: Table Leader Information Sheet

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
MATHEMATICS STANDARD SETTING:
TABLE LEADER INFORMATION SHEET

BLACK CANYON CONFERENCE CENTER
PHOENIX, ARIZONA

Role Description

- Facilitate discussion
- Keep process on track
- Vote as one of the table members
- Monitor group discussion
- Watch the clock and monitor time
- Might need to cut off discussion or diplomatically resolve differences between members

Specific Tasks:

1. Before all rounds
    a. Make sure participants put ID numbers on forms
    b. Check that participants complete readiness forms
    c. If someone puts a NO on readiness form, see if you can help explain. If participant is still unsure, inform Pearson facilitator
    d. Ensure that table members understand activity
    e. Notify group leaders of any problems
2. After Round 1
    a. Check that participants recorded page number correctly on Item Position Recording Sheets by comparing recorded page numbers to pages marked in booklets
    b. Collect all table members' recording sheets and give to facilitator
3. After Round 1 agreement data are shared
    a. Ensure that all members participate in discussion and encourage all points of view
    b. Check that participants understand agreement data
    c. Check that participants mark highest and lowest item positions after table data are shared
    d. Lead discussion on what those items are measuring and whether a student who meets the minimum requirements should be able to answer them
4. After Rounds 2 and 3
    a. Ensure that all members participate in discussion and encourage all points of view.
    b. Check that participants understand agreement data AND impact data
    c. Check that participants mark highest and lowest item positions after table data and group data are shared
    d. Lead a discussion on what those items are measuring and whether a target student who meets the minimum requirements should be able to answer them
5. Before breaks and at end of day
    a. Remind participants to leave all secure materials on the table
    b. Remind participants to initial checkout materials sheet
    c. Collect all materials and verify that all have been received
6. After collection at the end of the day
    a. Turn in all materials to Pearson
    b. Participate in debriefing session with ADE (except last day)

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Appendix C: Table Leader Training

The training was the same for the HS committee and the grades 3-8 committees.

Standard Setting on Arizona's Instrument to Measure Standards (AIMS) for Grades 3 through 8 Mathematics: Table Leader Training

Tracy Gardner, Ph.D.
Manager, Psychometric and Research Services
PEARSON

1

PEARSON

Purpose of Standard Setting

- The purpose of this standard setting is to establish recommended cut scores on the AIMS Grades 3 through 8 Mathematics assessment.
- You were selected to serve on the committee for a variety of reasons:
  - Familiarity with the knowledge and skills required to "master" the content standards at various performance levels
  - Represent various jurisdictions and demographic variables
- You were selected to be a table leader because of your experience, ability to lead, and strong communication skills.

2

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Standard Setting Roles

- Lead Research Scientist
- Lead Standard Setting Facilitator
- Statistical Analyst
- Program Management
- ADE Staff
- Table Leader
- Participants

3

PEARSON

Table Leader Roles

- Facilitate discussion
- Keep process on track
- Vote as one of the table members
- Monitor group discussion
- Watch the clock and monitor time
- Might need to cut off discussion or diplomatically resolve differences between members

4

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PEARSON

Table Leader Tasks

- Provide instructions
  - ID numbers
  - How to fill out rating form
  - How to hand in materials
- Lead discussion at table and across tables
  - Ensure that all participants engage in discussion
- Verify understanding
  - Process
  - Feedback
- Verify completeness
  - Readiness forms
  - Rating forms
- Materials collection and audit
- Notify facilitator of problems

Click here for: Table Leader Handout

5

PEARSON

Standard Setting Overview

- Develop a shared understanding of each Performance Level Descriptor (PLD)
- Develop "Borderline Student" Descriptors
- Take and discuss the test
- Standard setting training and practice
- Participate in three rounds of ratings
  - Round 1: Independent
  - Round 2: Independent, but with table discussion
  - Round 3: Independent, but with table & full group discussion
- Repeat process for the second test
- Participate in vertical articulation process
- Finalize Performance Level Descriptors

6

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Table Leader Role in PLD Review

- Within each table group, ask, "What should students know and be able to do at each level?"
  - "Approaches", "Meets", "Exceeds"
- Appoint a recorder to write on the flip chart.
- Suggestions should be:
  - Concrete
  - Clearly related to the PLD definitions
  - Summarize the current descriptions
- Note: This concept will be presented by the facilitator and the slide will be on the screen, but the table leader will facilitate the conversation at his/her table.

7

PEARSON

Table Leader Role in PLD Review (2)

- Ask Table Members to describe concretely students who are at "Meets the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?
- Repeat for Exceeds and Approaches

8

PEARSON

Table Leader Role in Borderline Student Descriptors

- Ask table members to think about the borderline students at "Meets the Standard".
  - Identify three knowledge, skills, or abilities that MOST distinguish a student who just barely "Meets the Standard."
  - Record the three responses on your flipchart.
- Repeat for "Exceeds" and "Approaches".

9

PEARSON

Three Rounds of Ratings

- Round 1 Ratings
  - Independently
- Round 2 Ratings
  - Independently, but after discussion with your table group
- Round 3 Ratings
  - Independently, but after discussion with your table group and entire committee

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Standard Setting Item Map and Rating Sheet

- Each panelist will be provided with an item map that provides information about each item.
- Each panelist will record his/her recommended page number on a page number recording sheet.
- The table leader will help panelists with questions about how to use these documents.

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Table Leader Role Before All Rounds

- Make sure participants put ID numbers on forms.
- Check that participants complete readiness forms.
- If someone puts a NO on readiness form, see if you can help explain. If participant is still unsure, inform Pearson facilitator.
- Ensure that table members understand activity.
- Notify group leaders of any problems.

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Table Leader Roles After Rounds 2 and 3

- Ensure that all members participate in discussion and encourage all points of view.
- Check that participants understand agreement data AND impact data.
- Check that participants mark highest and lowest item positions after table data and group data are shared.
- Lead a discussion on what those items are measuring and whether a target student who meets the minimum requirements should be able to answer them.

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Table Leader Roles During PLD Refinement

- Refinement Procedure
  - Begin with the bullets, and determine if any bullets should move from one performance level to another.
    - It may be necessary to break apart the bullet.
    - New bullets may be added if necessary.
  - Adjust the narratives at the top as necessary.
  - Discussion will be at the table group.
  - Table leaders will share tables' recommendations with a combined grade level panel.

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Table Leader Roles Before Breaks and at End of Day

- Remind participants to leave all secure materials on the table.
- Remind participants to initial checkout materials sheet.
- Collect all materials and verify that all have been received.

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Recap of Table Leader Tasks

- Provide instructions
- Lead discussion at table and across tables
- Verify understanding
- Verify completeness of forms
- Materials collection and audit
- Notify facilitator of problems

Click here for: Table Leader Handout

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Appendix D: Standard Setting Agendas

Appendix D.1: High School Agenda

DAY 1	
TIME	**ACTIVITY**
7:30-8:30	Breakfast & Registration
8:30-9:00	Opening Remarks ▪ Welcome & Why you are here ▪ Review Agenda ▪ Security Forms ▪ Reimbursement
9:00-9:45	Overview of the Tests (ADE) ▪ History ▪ Purposes ▪ Test Specifications Overview of Standard Setting (Pearson) ▪ Purpose ▪ Item Mapping Methodology
9:45-10:00	BREAK
10:00-12:00	Committee Introductions Performance Level Descriptors ▪ Discuss knowledge, skills, and abilities (KSAs) for each performance level ▪ Define the distinguishing characteristics of borderline student performance
12:00-12:45	Lunch
12:45-2:00	Take the Test ▪ Take test ▪ Score test ▪ Discuss test
2:00-2:15	BREAK
2:15-3:00	Process of Standard Setting ▪ Item Mapping ▪ Ordered Item Booklet ▪ Practice Booklet and Quiz ▪ Item Map ▪ Ratings Forms ▪ Practice Round ▪ Process Check
3:00-4:15	Round 1 Standard Setting ▪ Readiness Check ▪ Round 1 Ratings ▪ Materials Collection
4:15-4:30	Table leaders debrief
4:30-5:00	ADE-Pearson debrief

Appendix D.1: High School Agenda (Continued)

DAY 2	
TIME	**ACTIVITY**
7:30-8:30	Breakfast
8:30-9:30	Round 1 feedback and discussion ▪ Table Discussion of table agreement data ▪ Handouts 1. Table Agreement Data 2. P-values (Item Performance Data)
9:30-10:00	Round 2 Standard Setting ▪ Readiness Check ▪ Round 2 Ratings
10:00-10:30	BREAK (and check out of hotel)
10:30-11:30	Round 2 feedback and discussion ▪ Table discussion of table agreement data ▪ Group discussion of group agreement data ▪ Group discussion of impact data ▪ Handouts 1. Table Agreement Data 2. Group Agreement Data 3. Impact Data
11:30-12:00	Round 3 Standard Setting ▪ Readiness Check ▪ Round 3 Ratings
12:00-12:45	LUNCH
12:45-1:15	Present final results ▪ Group discussion of agreement data ▪ Group discussion of impact data
1:15-2:45	PLD Revisions by Large Group
2:45-3:00	Break
3:00-3:30	Debrief with ADE
3:30-3:45	Standard Setting Closure ▪ Complete Survey on the Standard Setting Process ▪ Materials Collection
3:45-4:00	Table leaders debrief
4:00-4:30	ADE-Pearson debrief

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Appendix D.2: Grades 3-8 Agenda

DAY 1	
TIME	**ACTIVITY**
7:30-8:30	Breakfast & Registration
8:30-9:00	Opening Remarks ▪ Welcome & Why you are here ▪ Review Agenda ▪ Security Forms ▪ Reimbursement
9:00-9:30	Overview of the Tests (ADE) ▪ History ▪ Purposes Overview of Standard Setting (Pearson) ▪ Purpose ▪ Item Mapping Methodology
9:30-9:45	BREAK (Move to Breakout Room)
9:45-12:00	Committee Introductions Performance Level Descriptors ▪ Discuss knowledge, skills, and abilities (KSAs) for each performance level ▪ Define the distinguishing KSAs of borderline student performance
12:00-12:45	Lunch
12:45-1:45	Take Test 1 ▪ Take test ▪ Score test
1:45-2:00	Discuss Test 1
2:00-2:15	Further define distinguishing KSAs of borderline student performance
2:15-2:30	BREAK (Move to General Session Room)
2:30-3:00	Standard Setting Training ▪ Item Mapping Procedure ▪ Ordered Item Booklet ▪ Item Map ▪ Ratings Forms
3:00-3:15	BREAK (Move to Breakout Room)
3:15-3:30	Practice Round
3:30-4:30	Round 1 Standard Setting (Test 1) ▪ Readiness Check ▪ Round 1 Ratings ▪ Materials Collection
4:30-4:45	Table leaders debrief
4:45-5:15	ADE-Pearson debrief

Appendix D.2: Grades 3-8 Agenda (Continued)

DAY 2	
TIME	**ACTIVITY**
7:30-8:00	Breakfast
8:00-9:00	Round 1 feedback and discussion (Test 1) ▪ Table Discussion of table agreement data ▪ Handouts 1. Table Agreement Data 2. P-values (Item Performance Data)
9:00-9:30	Round 2 Standard Setting (Test 1) ▪ Readiness Check ▪ Round 2 Ratings
9:30-10:00	BREAK
10:00-11:00	Round 2 feedback and discussion (Test 1) ▪ Table discussion of table agreement data ▪ Group discussion of group agreement data ▪ Group discussion of impact data ▪ Handouts 1. Table Agreement Data 2. Group Agreement Data 3. Impact Data
11:00-12:00	Round 3 Standard Setting (Test 1) ▪ Readiness Check ▪ Round 3 Ratings
12:00-12:45	LUNCH
12:45-2:15	Performance Level Descriptors (Test 2) ▪ Discuss knowledge, skills, and abilities (KSAs) for each performance level ▪ Define the distinguishing KSAs of borderline student performance
2:15-2:30	BREAK
2:30-3:45	Take Test 2 ▪ Take test ▪ Score test ▪ Discuss test
3:45-4:30	Round 1 Standard Setting (Test 2) ▪ Readiness Check ▪ Round 1 Ratings ▪ Materials Collection
4:30-4:45	Table leaders debrief
4:45-5:00	ADE-Pearson debrief

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Appendix D.2: Grades 3-8 Agenda (Continued)

DAY 3	
TIME	**ACTIVITY**
7:30-8:00	Breakfast
8:00-9:00	Round 1 feedback and discussion (Test 2) ▪ Table Discussion of table agreement data ▪ Handouts o Table Agreement Data o P-values (Item Performance Data)
9:00-9:30	Round 2 Standard Setting (Test 2) ▪ Readiness Check ▪ Round 2 Ratings
9:30-9:45	BREAK
9:45-10:30	Round 2 feedback and discussion (Test 2) ▪ Table discussion of table agreement data ▪ Group discussion of group agreement data ▪ Group discussion of impact data ▪ Handouts o Table Agreement Data o Group Agreement Data o Impact Data
10:30-11:00	Round 3 Standard Setting (Test 2) ▪ Readiness Check ▪ Round 3 Ratings
11:00-11:15	BREAK
11:15-11:45	Present final results ▪ Group discussion of agreement data ▪ Group discussion of impact data
11:45-12:00	Complete Survey (Standard Setting Process)
12:00-12:45	LUNCH
12:45-2:45	Vertical Articulation ▪ Present the results of each panel ▪ Group discussion of results for grades 3, 5, 6, and 8 ▪ Review performance level descriptors and tests for grades 4 and 7 ▪ Panelists make suggestions for revisions of cuts for grades 3, 5, 6, and 8 and make recommended cuts for grades 4 and 7
2:45-3:00	BREAK
3:00-3:45	Present impact data and discuss revisions made to cuts (all grades)

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Appendix D.2: Grades 3-8 Agenda (Continued)

DAY 3 (Continued)	
TIME	**ACTIVITY**
3:45-4:00	Make final revision to cuts (all grades)
4:00-4:15	Vertical Articulation Closure ▪ Materials Collection
4:15-4:30	Present final results
4:30-4:45	Table leaders debrief
4:45-5:15	ADE-Pearson debrief

DAY 4	
7:30-8:00	Breakfast
8:00-8:45	PLD Refinement Discussion (within Table Groups) ▪ First Test (Grade 3 or Grade 6)
8:45-9:30	PLD Refinement Discussion (within Table Groups) ▪ Second Test (Grade 4 or Grade 7)
9:30-9:45	Break
9:45-10:30	PLD Refinement Discussion (within Table Groups) ▪ Third Test (Grade 5 or Grade 8)
10:30-10:40	Dismissal of participants
10:45-12:00	PLD Modification Across Grade All Levels (Table Leaders Only)

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Appendix E: Standard Setting Scripts

Appendix E.1: High School Mathematics

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING SCRIPT FOR FACILITATORS
HIGH SCHOOL MATHEMATICS

MAY 13-14, 2010
BLACK CANYON CONFERENCE CENTER
PHOENIX, ARIZONA

OVERVIEW OF STANDARD SETTING TASKS

The standard setting for High School Mathematics will take place on May 13-14 at the Black Canyon Conference Center[1]. Prior to the standard setting, table leaders will be trained via a Web-based Power Point presentation. The Standard Setting will consist of the following activities. Each of these will be described in detail in this standard setting script that is intended for the standard setting facilitators.

A. Table Leader Training
B. Opening Session
C. Performance Level Descriptors Review
D. Borderline Student Descriptors Development
E. Take and discuss the test
F. Item Mapping Training
G. Practice Round of Ratings
H. Round Readiness Check
I. Round 1 Ratings
J. Round 1 Feedback and Discussion (Table level)
    1. Table page ratings for each cut
    2. Item p-values
K. Round 2 Ratings
L. Round 2 Feedback and Discussion
    1. Table page ratings
    2. Total Group page ratings
    3. Impact data
M. Round 3 Ratings
N. Performance Level Descriptor Review
O. Standard Setting Evaluation

TABLE LEADER TRAINING

Date: TBD
Materials:

- **Agenda**
- **Table Leader PowerPoint Presentation**
- **Table Leader Handout**

Three table leaders will be assigned by ADE. Table leaders are experienced educators and may have had a previous role with the assessment. The primary role of the table leader is to monitor the group interaction, keep the group focused on the task at hand and keep time for the group. Prior to the actual standard setting meeting, the table leaders will be given an overview of the standard setting meeting via a web-based application called Web Ex. They will receive training on how the Item Mapping Standard

[1] A separate script exists for the standard setting for grades 3-8 Mathematics, which takes place on June 1-4.

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Setting procedure works. We will discuss their role and responsibilities during the standard setting meeting.

Pearson will explain to table leaders what their role will be in general and relative to each standard setting task. We will make sure they understand that they will be leading the discussions within their group. Therefore, they need to have a clear understanding of the process. Below is a bulleted list of information that we plan to share during the table leader training.

Role Description

- Facilitate discussion.
- Keep process on track.
- Vote as one of the table members.
- Monitor group discussion.
- Watch the clock and monitor time.
- Cut off discussion or diplomatically resolve differences between members when necessary.

Specific Tasks:

1. Before all rounds
    a. Make sure participants put ID numbers on forms.
    b. Check that participants complete readiness forms.
    c. If someone puts a NO on readiness form, see if you can help explain. If participant is still unsure, inform Pearson facilitator.
    d. Ensure that table members understand activity.
    e. Notify group leaders of any problems.
2. After Round 1
    a. Check that participants recorded page number correctly on Item Position Recording Sheets by comparing recorded page numbers to pages marked in booklets.
    b. Collect all table members' recording sheets and give to facilitator.
3. After Round 1 agreement data are shared
    a. Ensure that all members participate in discussion and encourage all points of view.
    b. Check that participants understand agreement data.
    c. Check that participants mark highest and lowest item positions after table data are shared.
    d. Lead discussion on what those items are measuring and whether a student who meets the minimum requirements should be able to answer them.
4. After Rounds 2 and 3
    a. Ensure that all members participate in discussion and encourage all points of view.
    b. Check that participants understand agreement data AND impact data.
    c. Check that participants mark highest and lowest item positions after table data and group data are shared.
    d. Lead a discussion on what those items are measuring and whether a borderline student who meets the minimum requirements should be able to answer them.
5. Before breaks and at end of day
    a. Remind participants to leave all secure materials on the table.
    b. Remind participants to initial checkout materials sheet.
    c. Collect all materials and verify that all have been received.
6. After collection at the end of the day
    a. Turn in all materials to Pearson.
    b. Participate in debriefing session with ADE (except last day).

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MAY 12, 2010

5:00pm – 7:00pm Room Set-Up

- Verify Set-Up of Room against room diagram in Facilitator Binder.
- Take Inventory of Supply Box (See Table 1).
- Take inventory of Facilitator Binder (See Table 2).
- Take inventory of other materials (See Table 3).
- Take inventory of participants folders (See Table 4).

MAY 13, 2010

OPENING SESSION

6:30am – 7:30am Room Set-Up

- Set up laptop (with plug and mouse)
- Set up projector
- Set out Pencils at every place
- Set out post-its and highlighters in the middle of tables
- Remove all pads of paper
- Have room locked
- Go to breakfast area

Table 1: Supply Inventory

Number	Item
2	Stapler
1	Box of Staples
2	Box of Paper Clips
2	Scotch Tape
1	Color Printer: purchase on-site
26	Stacks of colored post-it notes
30	Folders for Participants
30	Pencils (Papermate Sharp Writer)
30	Pens
3	Table number cards (table 1,2,3)
30	Name badges
30	Name tents
26	Highlighters
5	Large colored markers
5	Sharpie Markers
1	Index card Packages
2	Reams of paper: White
1	Reams of paper: Light Blue
1	Reams of paper: Light Green
1	Reams of paper: Yellow
4	Easels
4	Pads of Easel Paper

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Table 2: Materials Included in Facilitator Binder

Number	Item	Notes	S/D sided	Paper/Ink Color
8	Agenda: General		D	White-BW
8	Agenda: Annotated (Pearson) - Script		D	White-BW
2	Room sign-in sheets - per committee		S	White-Color
2	Secure material sign-in sheets - per committee		S	White-Color
10	Curriculum Frameworks (content standards)	2 per table	D	White-BW
26	Answer sheet		D	Light blue-BW
26	Answer keys in test order		D	Light blue-BW
26	P-values in OIB order		D	Light blue-BW
~~26~~	~~Process Check Quiz~~[2]		~~S~~	~~Light green-BW~~
26	Round Readiness Forms: Rounds 1-3		S	Light green-BW
26	Page Number Recording Sheet		D	Light-Yellow-BW
26	Item Position Recording Sheet		S	Light-Yellow-BW
26	Final Evaluation form: SS		S	White-BW

Table 3: Other Materials that are Not Included in Facilitator Binder

Number	Item	Notes	S/D sided	Paper/Ink Color
26[3]	Test Booklet		booklet	actual from test
5	Directions for Administration	1 copy per table	booklet	actual from test
26	Ordered Item Booklet: Practice Round		S	White-BW
26	Ordered Item Booklet		S	White-BW (black bind)

7:30-8:00 Breakfast

8:00-8:30 Registration

Set up – Participants should check in with Pearson staff. Upon arrival, each participant will be given a folder. Participants should write down their names on the cover of the folder. See Table 4 for items included in Participant Folder.

Table 4: Materials Included in Participant Folder

Item	Location
Agenda	Left pocket
~~Demographic Information Survey~~[4]	~~Left pocket~~
Non-disclosure form	Left pocket
Reimbursement form	Left pocket
PowerPoint Training Presentation: General SS Session	Right pocket
Item Mapping Handouts	Right pocket
Test Blueprint	Right pocket
Performance level descriptors - per committee	Right pocket

[2] Per ADE, the "Process Check Quiz" will not be needed.
[3] There are 26 copies of each secure material to accommodate 18 panelists plus 8 additional copies for Pearson facilitators and ADE staff.
[4] Per ADE, this information is in the ADE database. This handout will no longer be needed.

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As indicated on the sign-in sheets that are included in the facilitator binder, the master copies for ADE and Pearson staff are labeled as A-H as defined below in Table 5. The panelists receive numerical copies of materials from 1-18. Table 1 will receive materials 1-6; Table 2 receives materials 2-12; Table 3 receives materials 13-18.

Table 5: Master Copies of Secure Materials

A	Facilitator: Tracy
B	Content Floater: Albert
C	Lead RS: Steve
D	Dept of Education
E	Dept of Education
F	Dept of Education
G	Dept of Education
H	Pearson

8:00-8:30 Opening Remarks – ADE and Pearson RS (Steve or Tracy)

- **Welcome and Why You Are Here**
- **Review of Agenda**
- **Security Forms/Non-disclosure forms**
- **Reimbursement forms**

ADE formally welcomes participants and explains the purpose of the standard setting meeting[5].

Pearson RS (Steven or Tracy) introduces the Pearson staff involved and their role in the standard setting meeting. Go over the agenda and the security forms and administrative tasks. Emphasize that the secure materials are based on operational items and security is of paramount importance throughout the standard setting process.

9:00-9:15 Overview of the Tests (ADE)

- **History**
- **Purposes**
- **Blueprint**

ADE staff gives a brief overview of the Mathematics test; provide historical background of the test, purposes of the test, and implementation of the HS Mathematics test. Introduce key concepts of the test, the test blueprint etc.

9:15-9:45 Overview of Standard Setting (Pearson)

- **Purpose**
- **Item Mapping Methodology**

[5] Per ADE, please note the conversation about "expectations" on April 19 by Steve, Cheryl, and Irene.

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Pearson RS (Tracy) introduces participants to the Item Mapping Procedure via a PowerPoint presentation.

Pearson staff should collect the signed confidentiality agreement form before participants break.

9:45-10:00 BREAK

10:00-10:15 Introductions

- Introduce yourself and give some background.
- Make sure everyone is in the correct room.

Once everyone is settled in the room, the participants are asked to introduce themselves and provide some information about their professional experience. Participants may share the following:

- Name.
- Where are your from?
- How long you have been in your current position/field?
- What educational roles you have fulfilled?
- Have you participated in a standard setting before?
- Tell us something interesting about yourself.

Remind the participants to write their names on their folders if they have not done so already. A review of the agenda for the rest of the day is provided in order for participants to develop a perspective of what is to be accomplished and the pace at which the meetings should proceed. Note that we might deviate from the time allotments on the agenda if we feel a topic requires additional discussion.

10:15-12:00 Performance Level Descriptors

- **Discuss knowledge, skills, and abilities (KSAs) for each performance level**
- **Define the distinguishing characteristics of borderline student performance**

Careful notes need to taken during performance level descriptors discussions. The participants will be split into three groups/tables, with six people per table. One member per table should be appointed as note taker.

Next, panelists will be familiarized with the performance level descriptors To familiarize panelists with the performance level descriptors and to help foster a shared understanding of them, Pearson facilitators will distribute a document listing the four performance level descriptors and then use this document to work with panelists to help summarize these descriptors. The goal will be to help all panelists develop and share a strong, common understanding of each proficiency level with specific emphasis on the way those proficiency level descriptions relate to the relevant content and grade level of the appropriate AIMS test. Panelists will be asked to identify the main topics and skill sets assessed and then to identify the three to four key characteristics that distinguish performance at a given level from that of adjacent performance levels for each topic or skill set. Panelists will conduct these tasks first in small group discussions at their table and then in a single large group.

After panelists have a good understanding of the distinguishing characteristics between the levels of performance level descriptors, they will work on identifying three characteristics that most distinguish students that are at the borderline of each performance level. They will start with the borderline between "Meets the Standard" vs. "Approaches the Standard." Within each table group, panelists will be asked to identify three characteristics or behaviors that most distinguish students that are at the borderline of "Meets the Standard" from the top of "Approaches the Standard." Each table group will

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record their responses on a flip chart. They will repeat the same activity to distinguish three characteristics that differentiate between "Meets the Standard" vs. "Exceeds the Standard" and for "Falls Far Below the Standard" vs. "Approaches the Standard." Once the table groups have completed this task, they will reconvene as a single large group. Each table will present their distinguishing characteristics and the facilitator will lead a discussion of the commonalities and differences across the table groups. The facilitator will capture the discussion on the group flip chart. Upon completing this task, the panelists will be excused for lunch.

12:00-12:45 LUNCH

- Inform location of lunch.
- Remind them when to return.
- Have them place all material in a pile at their seating location.
- Do not leave your room until it is locked.
- Get door unlocked at 12:40 and then remain in room.

12:45-2:00 Take the Test

- **Take test**
- **Score test**
- **Discuss test**

Important Notes

- Hand out Test Booklets and Answer Sheets to each teacher
- Verify that each teacher gets the correct security number (sign-out materials)
- This is an individual, independent activity (no discussion)
- When each teacher completes the test give them the scoring key (sign-out materials)
- Placing all secure materials inside, the teachers will close the Test Booklets.

In order for participants to gain an appreciation of the assessment experience and the instrument's degree of difficulty, participants are asked to take the operational test. Participants will spend approximately one hour taking the test. Participants should work independently so that the testing experience is as similar to a live administration as possible.

After participants complete the test, ask them to score their own responses using the scoring key provided. The scoring key will be provided after the participants finish the assessment. If participants finish earlier than the group, they may take a break, but remind them to stay close to the room because as soon as all participants have completed the test, a group discussion will take place. The group discussion should start no later than 1:45. If it looks like participants need more time, then the group discussion of the test may need to take place at 2:15 (after the break). If this occurs, the facilitator will need to make up time during the standard setting methodology training and practice session to get the participants back on schedule.

Spend some time to discuss the overall test experience. Ask questions such as:

1. What are your general impressions about the test?
2. Did the test generally cover the depth and breadth of the content standards?
3. Does the test generally have a range of item difficulties (e.g., easier items, moderate items, difficult items)?

Although some discussion about individual test items is normal, focus participants away from prolonged debate. Ask participants to record any comments about test items on the index cards provided for discussion at a later time.

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2:00-2:15 BREAK

2:15-3:00 Process of Standard Setting

- **Item Mapping**
- **Ordered Item Booklet**
- **Practice Booklet and Quiz**
- **Item Map**
- **Ratings Forms**
- **Practice Round**
- **Process Check**

Pearson RS (Tracy) introduces the Item Mapping process. Give participants a review of the Item Mapping procedure. Instruct participants to use four tools when placing their bookmarks; the Arizona Math content standards, the borderline student descriptors, the PLDs, and the KSAs represented by the items. A formal PowerPoint presentation will be provided.

A practice ordered-item book will be developed by Pearson. This allows participants to practice the procedure without feeling the pressure of reviewing real items. Using these items, the group as a whole will practice setting the "Meets the Standard" page cut.

3:00-4:15 Round 1 Standard Setting

- **Readiness Check**
- **Round 1 Ratings**
- **Materials Collection**

Important Notes

- Hand out Item Map
- Hand out Page Number Recording Sheet
- Hand out Ordered Item Booklet
- Verify security numbers match (sign-out)

The facilitator will provide a short summary of the procedure just discussed. When no more questions are asked, and after all participants complete the two readiness questions, Round 1 will begin. Once participants demonstrate that they understand how to place their bookmarks through the check set, ask participants to make their Round 1 cuts. Remind participants that this is an individual activity. Check with the table leaders that everyone is ready for Round 1. Each participant should place the "Meets the Standard" bookmark first followed by "Approaches" and "Exceeds." When finished, the table leader will collect and verify that all materials are received. Participants will be reminded that the meeting will resume the next morning at 8:30 (with breakfast starting at 7:30).

Important Notes

When a panelist completes Round 1

- Collect Page Number Recording Sheets (group them by table).
- Spot check Page Number Recording Sheet.
- Sign in Page Number Recording Sheet.
- Place sheet in designated folder and give to Greg or Steve once all sheets are collected.

Collect (and Sign-In) All Other Secure Materials

- Ordered Item Booklets
- Item Map
- Test Booklet

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- DFA
- Answer Key
- Answer Sheet
- Any notes

Closing the room

- Box all material and supplies.
- Pack up projector and laptop.
- Take everything to Secure Room.
- Get security to lock the room.

4:15-4:30 Table Leaders Debrief

The table leaders will meet with Pearson and/or ADE staff to discuss the activities of the day.

END OF DAY 1

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DAY 2 – May 14, 2010

6:45 – 7:15 Room Set-UP

- Place **all** materials and supplies on the table where the panelists were sitting from the day before.
- Set up projector and computer.
- Load the excel workbooks onto your computer.

7:30-8:30 Breakfast

8:30-9:30 Round 1 feedback and discussion

- **Table Discussion of table agreement data**
- **Handouts**
  1. **Table Agreement Data**
  2. **P-values (Item Performance Data)**

Important Notes

- Go over agenda for the day.
- Hand out Page Number Recording Sheets (sign-out).
- Hand out Item Maps.
- Hand out table stats and graphs to corresponding tables.
- Hand out p-values (sign-out).
- Have panelists sign-in and initial-out all of the materials.
- Round 1 results
  - Review OIB page number cut graphs and tables.
  - Have the committee members find themselves on the graph.
- Discussions will occur within each table (the entire committee will have the opportunity to discuss Round 2 results before Round 3 ratings).
  - Discuss obvious distributions, grouping and/or overlapping.

Start on Round 1 feedback discussion. For each table, an OIB page number cut feedback document will be provided. This document will provide the OIB page number cuts for each participant based on the Round 1 ratings in addition to the median OIB page number cut at each level for that table. In reviewing the OIB page number cut report participants will be asked to think about the following:

- How similar are their OIB page number cuts to that of the group (i.e., is a given participant more lenient or stringent than the other participants)?
- If so, why is this the case?
- Do participants have different conceptualization of these borderline students?

Participants will be told the following: "The feedback we just handed out provides the OIB page number cuts for each level by each participant in your table. The maximum, minimum, and standard deviations of the OIB page number cuts are also provided."

- Median is the middle value of the OIB page number cuts from all participants at your table;
- Maximum is the highest value of the OIB page number cuts from all participants at your table;
- Minimum is the lowest value of the OIB page number cuts from all participants at your table;

Inform participants that we do not intend them to come to consensus on their OIB page number cut judgments, but we do want them to discuss differences to get a feel for why differences exist. Let them know that we want them to try to better understand the reasons for the differences. Are there

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underlying differences in what the participants believe these borderline students can /can not do? Do they implement different procedures to assign ratings?

Ask the participants to discuss their "Meets" ratings first, then move to "Exceeds," and finally the "Approaches" ratings. The table leader generally facilitates discussion within the table, but the facilitator will float among the tables to observe discussion and answer questions.

After discussion of table agreement data, present the table with **p-values**. Explain the p-values are percent of the students that answered the item correctly. The p-values are based on all the students in Cohort 12, not just the borderline students at "Approaches," "Meets," and "Exceeds." Explain that the participants should use the p-values to check their estimates of how difficult an item is. Participants are allowed a bit time to discuss this, and then round 2 will follow.

9:30-10:00 Round 2 Standard Setting

- **Readiness Check**
- **Round 2 Ratings**

Participants will be reminded that data are intended to inform, but not dictate their item ratings. When participants indicate that they understand the data they have been provided, have them fill out the readiness survey. When everyone answers "yes" to the Round 2 questions on the readiness survey, participants can start working on their round 2 ratings.

Important Notes

When a panelist completes Round 2

- Collect Page Number Recording Sheets (group them by table).
- Spot check Page Number Recording Sheet.

When all have completed Round 2 ratings

- Place in designated folder and give to Steve or Greg.

10:00-10:30 BREAK

Over break, Pearson staff members enter data for Round 2 and generate feedback reports.

10:30-11:30 Round 2 Feedback and Discussion

- **Table discussion of table agreement data**
- **Group discussion of group agreement data**
- **Group discussion of impact data**
- **Handouts**
    1. **Table Agreement Data**
    2. **Group Agreement Data**
    3. **Impact Data**

Feedback similar to the report provided after Round 1is handed out first. For each table, an OIB page number cut summary document will be provided. This document will provides the median, minimum, and maximum OIB page number cut at each level for that table.

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In addition, participants will be provided the median[6], maximum, and minimum OIB page number cuts for the committee (across tables). The facilitator leads the discussion with all tables combined. Point out the differences and similarities across tables. Remind the participants that consensus is not required.

Finally, participants will be provided a graphical display of the impact of using the median OIB page number cut for all students.

The impact data graphic representation provides participants with information on what percentages of students are at each performance level for the populations of interest (all students, female/male, and ethnic groups: White, Hispanic, Native American, Asian).

Participants will be given time to discuss, within the Group, the appropriateness of the group level OIB page number cuts given the proportion of students that would fall in each level. Let participants know that they should make these decisions based on what they know about students in the state, the requirements of the test, and the standards. Recommendations:

- Do not change OIB page number cuts based solely on how you believe the impact data will be perceived. Think about whether the percentages represented by the impact data are an accurate reflection of how students currently should be distributed given the proficiency level descriptions and the content/skills measured by the test. Try to balance your concerns on what you believe to be appropriate given the content of the test and what others (in the state) will regard as acceptable.
- If you do not believe the proportion of students falling in each level is appropriate do not arbitrarily modify OIB page number cuts (e.g, add 5% to each proportion in a given level). You have already given the items and OIB page number cuts, as well as conceptualization of the borderline students, a lot of thought, so don't throw that all away.
- How does a participant modify OIB page number cuts to influence proportion of students in a given level?

After participants have completed their discussions and indicate that they understand the impact data and the other data associated with Round 2, they will respond to the readiness survey. When participants answer "yes" to all of these questions, they will make their Round 3 Ratings.

11:30-12:00 Round 3 Standard Setting

- **Readiness Check**
- **Round 3 Ratings**

Important Notes

When a panelist completes Round 3

- Collect Page Number Recording Sheets (group them by table)
- Spot check Page Number Recording Sheet

When all have completed Round 3 ratings

- Place in designated folder and give to Steve or Greg

Check with the table leaders that everyone is ready for Round 3. Each participant should place the "Meets the Standard" bookmark first followed by "Approaches" and "Exceeds". Remind participants that bookmark placement is always an independent activity. Collect the Page Number Recording Sheets as participants complete them.

[6] ADE indicated that the mean OIB page cut for the entire group may be handed out here.

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12:00-12:45 LUNCH

12:45-1:15 Present final results

- **Group discussion of agreement data**
- **Group discussion of impact data**

Present a summary of Round 3 final recommended OIB page number cuts across tables. Facilitator leads the discussion with all tables combined. Participants will be provided a graphical display of the impact of using the median OIB page number cut for all participants. The impact data graphic representation provides participants with information on what percentages of students are at each performance level for all the students included in Cohort 12. Participants will discuss their final results. The participants will be reminded that these results are derived from the OIB page number cut recommendations.

1:15-2:45 PLD Discussion and Borderline Descriptor Revisions by Large Group

The Facilitator presents instruction for refining PLDs. Panelists will be asked to discuss the definitions within each performance level, particularly with respect to the items immediately on either side of each bookmark and propose any final edits to the Borderline Student Descriptors that might be made to more clearly reflect the primary skill and knowledge attributes of students classified in each performance level. Specifically they will perform the following steps:

1. Start with the page number between "Approaches the Standard" and "Meets the Standard."
2. Read items around that page (3 above and 3 below).
3. Identify skills needed for correct response.
4. Evaluate why each item is more difficult than the preceding one.
5. Review performance level labels, descriptors, and borderline student descriptors.
6. List skills that differentiate the two levels.
7. Suggest revisions to descriptors (if necessary).
8. Move to the page between "Meets the Standard" and "Exceeds the Standard" and repeat steps 2-7.
9. Move back to the page between "Falls Far Below the Standard" and "Approaches the Standard" and repeat steps 2-7.

2:45-3:00 BREAK

3:00-3:30 Debrief with ADE

ADE will debrief with full committee and providing closing remarks.

3:30-3:45 Standard Setting Closure

- **Complete Survey on the Standard Setting Process**
- **Materials Collection**

Participants will be given evaluation forms to complete and return. The participants' ratings of the standard setting process and their comments will be solicited. Remind the participants that after they complete the forms, they need to leave all secured materials that have not already been collected (e.g., scratch paper etc.).

Important Notes

Collect Secure Materials (to be picked up)-

- Item Map

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- Page Number Recording Sheet
- Ordered Item Booklet
- Test Booklet
- DFA
- Answer Key
- Answer Sheet
- P-Values
- Borderline Student Descriptors
- Any feedback data (charts and graphs provided after Rounds 1-3)

3:45-4:00 Table Leaders Debrief
4:00-4:30 ADE-Pearson Debrief

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Appendix E.2: Grades 3-8 Mathematics

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING SCRIPT FOR FACILITATORS
GRADES 3-8 MATHEMATICS

JUNE 1-4, 2010
BLACK CANYON CONFERENCE CENTER
PHOENIX, ARIZONA

OVERVIEW OF STANDARD SETTING TASKS

The standard setting for Grades 3-8 Mathematics will take place from June 1-4 at the Black Canyon Conference Center[1]. The Standard Setting will consist of the following activities. Each of these will be described in detail in this standard setting script that is intended for the standard setting facilitators.

A. Table Leader Training
B. Opening Session
C. Performance Level Descriptors Review
D. Borderline Student Descriptors Development
E. Take and discuss the test
F. Item Mapping Training
G. Practice Round of Ratings
H. Round Readiness Check
I. Round 1 Ratings
J. Round 1 Feedback and Discussion (Table level)
    1. Table page ratings for each cut
    2. Item p-values
K. Round 2 Ratings
L. Round 2 Feedback and Discussion
    1. Table page ratings
    2. Total Group page ratings
    3. Impact data
M. Round 3 Ratings
N. Vertical Articulation
O. Performance Level Descriptor Review
P. Standard Setting Evaluation

[1] A separate script exists for the standard setting for HS Mathematics, which took place on May 13-14, 2010.

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MAY 31, 2010

5:00pm – 7:00pm Ensure arrival of materials/supplies (Hotel)

- Take Inventory of Supply Box
- Take inventory of Facilitator Binder
- Take inventory of other materials
- Take inventory of participants folders (See Table 1).

JUNE 1, 2010

6:30am – 7:30am Room Set-Up (Tracy, Marc, Norma)

- Verify Set-Up of Room against room diagram in Facilitator Binder.
- Place seating cards at chair locations (Table leaders are in positions 1, 7, and 13)
  - Table 1: Participants 1-6
  - Table 2: Participants 7-12
  - Table 3: Participants 13-18
- Set up laptop (with plug and mouse)
- Set up projector
- Set out Pencils at every place
- Set out post-its and highlighters in the middle of tables
- Remove all pads of paper
- Have room locked
- Go to breakfast area

7:30am – 8:00am Table Leader Training (Tracy)

Materials:

- **Participant Folder**
- **Table Leader PowerPoint Presentation**
- **Table Leader Handout**

Six table leaders (three per committee) will be assigned by ADE. Table leaders are experienced educators and may have had a previous role with the assessment. The primary role of the table leader is to monitor the group interaction, keep the group focused on the task at hand and keep time for the group. Prior to the actual standard setting meeting, Pearson will email three documents to the table leaders: 1) agenda, 2) Table Leader PowerPoint Presentation, and 3) Table Leader Handout. We will discuss their role and responsibilities during the standard setting meeting.

Pearson will explain to table leaders what their role will be in general and relative to each standard setting task. We will make sure they understand that they will be leading the discussions within their group. Therefore, they need to have a clear understanding of the process. Below is a bulleted list of information that we plan to share during the table leader training.

Role Description

- Facilitate discussion.
- Keep process on track.
- Vote as one of the table members.
- Monitor group discussion.
- Watch the clock and monitor time.
- Cut off discussion or diplomatically resolve differences between members when necessary.

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Specific Tasks:

1. Before all rounds
    a. Make sure participants put ID numbers on forms.
    b. Check that participants complete readiness forms.
    c. If someone puts a NO on readiness form, see if you can help explain. If participant is still unsure, inform Pearson facilitator.
    d. Ensure that table members understand activity.
    e. Notify group leaders of any problems.
2. After Round 1
    a. Check that participants recorded page number correctly on Item Position Recording Sheets by comparing recorded page numbers to pages marked in booklets.
    b. Collect all table members' recording sheets and give to facilitator.
3. After Round 1 agreement data are shared
    a. Ensure that all members participate in discussion and encourage all points of view.
    b. Check that participants understand agreement data.
    c. Check that participants mark highest and lowest item positions after table data are shared.
    d. Lead discussion on what those items are measuring and whether a student who meets the minimum requirements should be able to answer them.
4. After Rounds 2 and 3
    a. Ensure that all members participate in discussion and encourage all points of view.
    b. Check that participants understand agreement data AND impact data.
    c. Check that participants mark highest and lowest item positions after table data and group data are shared.
    d. Lead a discussion on what those items are measuring and whether a borderline student who meets the minimum requirements should be able to answer them.
5. Before breaks and at end of day
    a. Remind participants to leave all secure materials on the table.
    b. Remind participants to initial checkout materials sheet.
    c. Collect all materials and verify that all have been received.
6. After collection at the end of the day
    a. Turn in all materials to Pearson.
    b. Participate in debriefing session with ADE (except last day).

7:30-8:00 Breakfast

8:00-8:30 Registration (Norma)

Participants should check in with Pearson staff. Upon arrival, each participant will be given a folder. Participants should write down their names on the cover of the folder. See Table 1 for items included in Participant Folder.

Table 1: Materials Included in Participant Folder

Item	Location
Agenda	Left pocket
Non-disclosure form	Left pocket
Reimbursement form	Left pocket
PowerPoint Training Presentation: General SS Session	Right pocket
PowerPoint: Breakout Session	Right pocket
PowerPoint: Methodology Training	Right Pocket
Item Mapping Handouts	Right pocket
Test Blueprint	Right pocket
Performance level descriptors - per committee	Right pocket

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As indicated on the sign-in sheets that are included in the facilitator binder, the master copies for ADE and Pearson staff are labeled as A-H as defined below in Table 2. The panelists receive numerical copies of materials from 1-18. Table 1 will receive materials 1-6; Table 2 receives materials 2-12; Table 3 receives materials 13-18.

Table 2: Master Copies of Secure Materials

A	Pearson: Tracy Gardner (Grades 6-8) or Marc Johnson (Grades 3-5)
B	Pearson: Albert Hernandez
C	Pearson: Steve Fitzpatrick
D	ADE: Roberta Alley
E	ADE: Charlie Bruen
F	ADE: Frank Brashear
G	ADE: Lee Scott
H	ADE

8:30-9:00 Opening Remarks – ADE and Pearson RS (Roberta and Tracy)

- **Welcome and Why You Are Here**
- **Review of Agenda**
- **Security Forms/Non-disclosure forms (Norma)**
- **Reimbursement forms (Norma)**

ADE formally welcomes participants and explains the purpose of the standard setting meeting.

Pearson RS (Tracy) introduces the Pearson staff involved and their role in the standard setting meeting. Go over the agenda and the security forms and administrative tasks. Emphasize that the secure materials are based on operational items and security is of paramount importance throughout the standard setting process.

9:00-9:15 Overview of the Tests (ADE: Roberta)

- **History**
- **Purposes**

ADE staff gives a brief overview of the Mathematics test; provide historical background of the test, purposes of the test, and implementation of the HS Mathematics test. Introduce key concepts of the test, the test blueprint etc.

9:15-9:30 Overview of Standard Setting (Tracy)

- **Purpose**
- **Item Mapping Methodology**

Pearson RS (Tracy) introduces participants to the Item Mapping Procedure via a PowerPoint presentation.

Pearson staff should collect the signed confidentiality agreement form before participants break.

9:30-9:45 BREAK to move to break-out rooms

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9:45-10:10 Committee Introductions

- Introduce yourself and give some background.
- Make sure everyone is in the correct room.

Once everyone is settled in the room, the participants are asked to introduce themselves and provide some information about their professional experience. Participants may share the following:

- Name.
- Where are your from?
- How long you have been in your current position/field?
- What educational roles you have fulfilled?
- Have you participated in a standard setting before?
- Tell us something interesting about yourself.

Remind the participants to write their names on their folders if they have not done so already. A review of the agenda for the rest of the day is provided in order for participants to develop a perspective of what is to be accomplished and the pace at which the meetings should proceed. Note that we might deviate from the time allotments on the agenda if we feel a topic requires additional discussion.

10:00-12:00 Performance Level Descriptors

- **Discuss knowledge, skills, and abilities (KSAs) for each performance level**
- **Define the distinguishing characteristics of borderline student performance**

Careful notes need to taken during performance level descriptors discussions. The participants will be split into three groups/tables, with six people per table. One member per table should be appointed as note taker.

Next, panelists will be familiarized with the performance level descriptors To familiarize panelists with the performance level descriptors and to help foster a shared understanding of them, Pearson facilitators will distribute a document listing the four performance level descriptors and then use this document to work with panelists to help summarize these descriptors. The goal will be to help all panelists develop and share a strong, common understanding of each proficiency level with specific emphasis on the way those proficiency level descriptions relate to the relevant content and grade level of the appropriate AIMS test. Panelists will be asked to identify the main topics and skill sets assessed and then to identify the three to four key characteristics that distinguish performance at a given level from that of adjacent performance levels for each topic or skill set. Panelists will conduct these tasks first in small group discussions at their table and then in a single large group.

After panelists have a good understanding of the distinguishing characteristics between the levels of performance level descriptors, they will work on identifying three characteristics that most distinguish students that are at the borderline of each performance level. They will start with the borderline between "Meets the Standard" vs. "Approaches the Standard." Within each table group, panelists will be asked to identify three characteristics or behaviors that most distinguish students that are at the borderline of "Meets the Standard" from the top of "Approaches the Standard." Each table group will record their responses on a flip chart. They will repeat the same activity to distinguish three characteristics that differentiate between "Meets the Standard" vs. "Exceeds the Standard" and for "Falls Far Below the Standard" vs. "Approaches the Standard." Once the table groups have completed this task, they will reconvene as a single large group. Each table will present their distinguishing characteristics and the facilitator will lead a discussion of the commonalities and differences across the table groups. The facilitator will capture the discussion on the group flip chart. Upon completing this task, the panelists will be excused for lunch.

12:00-12:45 LUNCH

- Inform location of lunch.
- Remind them when to return.

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- Have them place all material in a pile at their seating location.
- Type up borderline student descriptors and request for Michelle to print them
- Do not leave your room until it is locked.
- Get door unlocked at 12:40 and then remain in room.

12:45-1:45 Take the Test

- **Take test**
- **Score test**
- **Discuss test**

Important Notes

- Hand out Test Booklets
- Verify that each panelist gets the correct security number
- This is an individual, independent activity (no discussion)
- When each panelist completes the test give them the scoring key
- Placing all secure materials inside, the panelists will close the Test Booklets.

In order for participants to gain an appreciation of the assessment experience and the instrument's degree of difficulty, participants are asked to take the operational test. Participants will spend approximately one hour taking the test. Participants should work independently so that the testing experience is as similar to a live administration as possible.

After participants complete the test, ask them to score their own responses using the scoring key provided. The scoring key will be provided after the participants finish the assessment. If participants finish earlier than the group, they may take a break, but remind them to stay close to the room because as soon as all participants have completed the test, a group discussion will take place. The group discussion should start no later than 1:45.

Spend some time to discuss the overall test experience. Ask questions such as:

1. What are your general impressions about the test?
2. Did the test generally cover the depth and breadth of the content standards?
3. Does the test generally have a range of item difficulties (e.g., easier items, moderate items, difficult items)?

Although some discussion about individual test items is normal, focus participants away from prolonged debate. Ask participants to record any comments about test items on the index cards provided for discussion at a later time.

1:45-2:00 Discuss the test

2:00-2:15 Further define distinguishing KSA's of borderline student performance

Now that the panelists have taken the test, they may have more bullets to add to their borderline student descriptors. Show them up on the screen (via projector) and ask if panelists have any additional KSA's to add to their list.

2:15-2:30 BREAK to move to General Session Room

2:30-3:00 Process of Standard Setting (Tracy)

- **Item Mapping**
- **Ordered Item Booklet**

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- **Practice Booklet and Quiz**
- **Item Map**
- **Ratings Forms**

Pearson RS (Tracy) introduces the Item Mapping process. Give participants a review of the Item Mapping procedure. Instruct participants to use four tools when placing their bookmarks; the Arizona Math content standards, the borderline student descriptors, the PLDs, and the KSAs represented by the items. A formal PowerPoint presentation will be provided.

3:00-3:15 BREAK to move to Breakout Room

3:15-3:30 Reiterate Key Slides and Practice Round

A practice ordered-item book will be developed by Pearson. (Grade 3 or Grade 8). This allows participants to practice the procedure without feeling the pressure of reviewing real items. Using these items, the group as a whole will practice setting the "Meets the Standard" page cut. Participants may discuss with their table group.

Important Notes

- Hand out Practice Item Map
- Hand out Practice OIB

3:30-4:30 Round 1 Standard Setting (for Lower Grade)

- **Readiness Check**
- **Round 1 Ratings**
- **Materials Collection**

Important Notes

- Hand out Readiness Form
- Hand out Item Map
- Hand out Page Number Recording Sheet
- Hand out Ordered Item Booklet
- Verify security numbers match (sign-out)

The facilitator will provide a short summary of the procedure just discussed. When no more questions are asked, and after all participants complete the two readiness questions, Round 1 will begin. Once participants demonstrate that they understand how to place their bookmarks through the check set, ask participants to make their Round 1 cuts. Remind participants that this is an individual activity. Check with the table leaders that everyone is ready for Round 1. Each participant should place the "Meets the Standard" bookmark first followed by "Approaches" and "Exceeds." When finished, the table leader will collect and verify that all materials are received. Participants will be reminded that the meeting will resume the next morning at 8:00 (with breakfast starting at 7:30).

Important Notes

When a panelist completes Round 1

- Collect Page Number Recording Sheets (group them by table).
- Spot check Page Number Recording Sheet.
- Sign in Page Number Recording Sheet.
- Place recording sheet in designated folder and give to Michelle once all sheets are collected.

Collect (and Sign-In) All Other Secure Materials (Use Secure Material Sign-In Sheet)

- Ordered Item Booklets
- Item Map
- Test Booklet
- DFA

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- Answer Key
- Answer Sheet
- Any notes

Closing the room

- Prepare room for the next day
- Get security to lock the room.

4:30-4:45 Table Leaders Debrief

The table leaders will meet with Pearson and/or ADE staff to discuss the activities of the day.

END OF DAY 1

DAY 2 – JUNE 2, 2010

6:45 – 7:15 Room Set-Up

- Place **all** materials and supplies on the table where the panelists were sitting from the day before.
- Set up projector and computer.
- Load the excel workbooks onto your computer.

7:30-8:00 Breakfast

8:00-9:00 Round 1 feedback and discussion

- **Table Discussion of table agreement data**
- **Handouts**
  1. **Table Agreement Data**
  2. **P-values (Item Performance Data)**

Important Notes

- Go over agenda for the day.
- Hand out Page Number Recording Sheets.
- Hand out Item Maps.
- Hand out table stats and graphs to corresponding tables.
- Hand out p-values.
- Round 1 results
  - Review OIB page number cut graphs and tables.
  - Have the committee members find themselves on the graph.
- Discussions will occur within each table (the entire committee will have the opportunity to discuss Round 2 results before Round 3 ratings).
  - Discuss obvious distributions, grouping and/or overlapping.

Start on Round 1 feedback discussion. For each table, an OIB page number cut feedback document will be provided. This document will provide the OIB page number cuts for each participant based on the Round 1 ratings in addition to the median OIB page number cut at each level for that table. In reviewing the OIB page number cut report participants will be asked to think about the following:

- How similar are their OIB page number cuts to that of the group (i.e., is a given participant more lenient or stringent than the other participants)?
- If so, why is this the case?
- Do participants have different conceptualization of these borderline students?

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Participants will be told the following: "The feedback we just handed out provides the OIB page number cuts for each level by each participant in your table. The maximum, minimum, and standard deviations of the OIB page number cuts are also provided."

- Median is the middle value of the OIB page number cuts from all participants at your table;
- Maximum is the highest value of the OIB page number cuts from all participants at your table;
- Minimum is the lowest value of the OIB page number cuts from all participants at your table;

Inform participants that we do not intend them to come to consensus on their OIB page number cut judgments, but we do want them to discuss differences to get a feel for why differences exist. Let them know that we want them to try to better understand the reasons for the differences. Are there underlying differences in what the participants believe these borderline students can /can not do? Do they implement different procedures to assign ratings?

Ask the participants to discuss their "Meets" ratings first, then move to "Exceeds," and finally the "Approaches" ratings. The table leader generally facilitates discussion within the table, but the facilitator will float among the tables to observe discussion and answer questions.

After discussion of table agreement data, present the table with **p-values**. Explain the p-values are percent of the students that answered the item correctly. The p-values are based on all the students in Cohort 12, not just the borderline students at "Approaches," "Meets," and "Exceeds." Explain that the participants should use the p-values to check their estimates of how difficult an item is. Participants are allowed a bit time to discuss this, and then round 2 will follow.

9:00-9:30 Round 2 Standard Setting

- **Readiness Check**
- **Round 2 Ratings**

Participants will be reminded that data are intended to inform, but not dictate their item ratings. When participants indicate that they understand the data they have been provided, have them fill out the readiness survey. When everyone answers "yes" to the Round 2 questions on the readiness survey, participants can start working on their round 2 ratings.

Important Notes

When a panelist completes Round 2

- Collect Page Number Recording Sheets (group them by table).
- Spot check Page Number Recording Sheet.

When all have completed Round 2 ratings

- Place in designated folder and give to Steve or Greg.

9:30-10:00 BREAK

Over break, Pearson staff members enter data for Round 2 and generate feedback reports.

10:00-11:00 Round 2 Feedback and Discussion

- **Table discussion of table agreement data**
- **Group discussion of group agreement data**
- **Group discussion of impact data**
- **Handouts**
    1. **Table Agreement Data**
    2. **Group Agreement Data**
    3. **Impact Data**

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Feedback similar to the report provided after Round 1 is handed out first. For each table, an OIB page number cut summary document will be provided. This document will provides the median, minimum, and maximum OIB page number cut at each level for that table.

In addition, participants will be provided the median[2], maximum, and minimum OIB page number cuts for the committee (across tables). The facilitator leads the discussion with all tables combined. Point out the differences and similarities across tables. Remind the participants that consensus is not required.

Finally, participants will be provided a graphical display of the impact of using the median OIB page number cut for all students.

The impact data graphic representation provides participants with information on what percentages of students are at each performance level for the populations of interest (all students, female/male, and ethnic groups: White, Hispanic, Native American, Asian).

Participants will be given time to discuss, within the Group, the appropriateness of the group level OIB page number cuts given the proportion of students that would fall in each level. Let participants know that they should make these decisions based on what they know about students in the state, the requirements of the test, and the standards. Recommendations:

- Do not change OIB page number cuts based solely on how you believe the impact data will be perceived. Think about whether the percentages represented by the impact data are an accurate reflection of how students currently should be distributed given the proficiency level descriptions and the content/skills measured by the test. Try to balance your concerns on what you believe to be appropriate given the content of the test and what others (in the state) will regard as acceptable.
- If you do not believe the proportion of students falling in each level is appropriate do not arbitrarily modify OIB page number cuts (e.g, add 5% to each proportion in a given level). You have already given the items and OIB page number cuts, as well as conceptualization of the borderline students, a lot of thought, so don't throw that all away.
- How does a participant modify OIB page number cuts to influence proportion of students in a given level?

After participants have completed their discussions and indicate that they understand the impact data and the other data associated with Round 2, they will respond to the readiness survey. When participants answer "yes" to all of these questions, they will make their Round 3 Ratings.

11:00-12:00 Round 3 Standard Setting

- **Readiness Check**
- **Round 3 Ratings**

Important Notes

When a panelist completes Round 3

- Collect Page Number Recording Sheets (group them by table)
- Spot check Page Number Recording Sheet

When all have completed Round 3 ratings

- Place in designated folder and give to Michelle

Check with the table leaders that everyone is ready for Round 3. Each participant should place the "Meets the Standard" bookmark first followed by "Approaches" and "Exceeds". Remind participants that bookmark

[2] ADE indicated that the mean OIB page cut for the entire group may be handed out here.

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placement is always an independent activity. Collect the Page Number Recording Sheets as participants complete them.

12:00-12:45 LUNCH

The tasks in this section repeat for Test 2 (Grade 5 or Grade 8). Please refer back to that section of this script for the summary details.

12:45-2:15 Performance Level Descriptors (Test 2)

- **Discuss knowledge, skills, and abilities (KSAs) for each performance level**
- **Define the distinguishing KSA's of borderline student performance**

2:15-2:30 BREAK

2:30-3:45 Take Test 2

- **Take test**
- **Score test**
- **Discuss test**

3:45-4:30 Round 1 Standard Setting (Test 2)

- **Readiness Check**
- **Round 1 Ratings**
- **Materials Collection**

4:30-4:45 Table leaders debrief

4:45-5:00 ADE-Pearson debrief

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DAY 3 – JUNE 2, 2010

DAY 3	
TIME	**ACTIVITY**
7:30-8:00	Breakfast
8:00-9:00	Round 1 feedback and discussion (Test 2) ▪ Table Discussion of table agreement data ▪ Handouts ▪ Table Agreement Data ▪ P-values (Item Performance Data)
9:00-9:30	Round 2 Standard Setting (Test 2) ▪ Readiness Check ▪ Round 2 Ratings
9:30-9:45	BREAK
9:45-10:30	Round 2 feedback and discussion (Test 2) ▪ Table discussion of table agreement data ▪ Group discussion of group agreement data ▪ Group discussion of impact data ▪ Handouts o Table Agreement Data o Group Agreement Data o Impact Data
10:30-11:00	Round 3 Standard Setting (Test 2) ▪ Readiness Check ▪ Round 3 Ratings
11:00-11:15	BREAK
11:15-11:45	Present final results ▪ Group discussion of agreement data ▪ Group discussion of impact data
11:45-12:00	Complete Survey (Standard Setting Process)
12:00-12:45	LUNCH
12:45-2:45	Vertical Articulation ▪ Present the results of each panel ▪ Group discussion of results for grades 3, 5, 6, and 8 ▪ Review performance level descriptors and tests for grades 4 and 7 ▪ Panelists make suggestions for revisions of cuts for grades 3, 5, 6, and 8 and make recommended cuts for grades 4 and 7
2:45-3:00	BREAK
3:00-3:45	Present impact data and discuss revisions made to cuts (all grades)
3:45-4:00	Make final revision to cuts (all grades)
4:00-4:15	Vertical Articulation Closure ▪ Materials Collection (See below)
4:15-4:30	Present final results
4:30-4:45	Table leaders debrief
4:45-5:15	ADE-Pearson debrief

PEARSON

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Standard Setting Closure

- **Complete Survey on the Standard Setting Process**
- **Materials Collection**

Participants will be given evaluation forms to complete and return. The participants' ratings of the standard setting process and their comments will be solicited. Remind the participants that after they complete the forms, they need to leave all secured materials that have not already been collected (e.g., scratch paper etc.).

Important Notes

Collect Secure Materials (to be picked up)-

- Item Map
- Page Number Recording Sheet
- Ordered Item Booklet
- Test Booklet
- DFA
- Answer Key
- Answer Sheet
- P-Values
- Borderline Student Descriptors
- Any feedback data (charts and graphs provided after Rounds 1-3)

4:30-4:45 Table Leaders Debrief **4:00-4:30**
ADE-Pearson Debrief

DAY 4 – JUNE 2, 2010

DAY 4	
7:30-8:00	Breakfast
8:00-8:45	PLD Refinement Discussion (within Table Groups) ▪ First Test (Grade 3 or Grade 6)
8:45-9:30	PLD Refinement Discussion (within Table Groups) ▪ Second Test (Grade 4 or Grade 7)
9:30-9:45	Break
9:45-10:30	PLD Refinement Discussion (within Table Groups) ▪ Third Test (Grade 5 or Grade 8)
10:30-10:40	Dismissal of participants
10:45-12:00	PLD Modification Across Grade All Levels (Table Leaders Only)

The Facilitator presents instruction for refining PLDs. Panelists will be asked to discuss the definitions within each performance level, particularly with respect to the items immediately on either side of each bookmark and propose any final edits to the Borderline Student Descriptors that might be made to more clearly reflect the primary skill and knowledge attributes of students classified in each performance level. Discussion will take place within table groups and the table leader will take notes on the recommended changes. Once the table groups have completed their task, the table leaders will meet all together with ADE (Frank) and Pearson (Tracy) to finalize the descriptors. Tracy will show the descriptors up on the screen and make the recommended changes as they are reported by the table leaders.

Background

- The PLDs were created in February 2009 by Arizona educators. Peer Review requires that PLDs are developed prior to the administration of the assessments and the subsequent Standard Setting. The "tweaking" of the PLDs will be performed at the Standard Setting.

- The top part of the PLDs presents all four performance levels and is a generalized reflection of the bullets on the bottom. This narrative piece is used for student reports. There is a maximum character count for the narrative/student reports which must not be exceeded.

- The bullets at the bottom are designated as highlighted POs from the Mathematics Standard, and several POs may have been combined into single bullets. The bullet text and PO verbiage are usually not verbatim. In order to not replicate the entire academic standard, not all POs are represented in the PLDs, and the statement "**These descriptors do not include all the skills and knowledge as contained in the Mathematics Standard.**" is included below the bullets as a reminder of this fact.

Procedures

1. The Mathematics Standard must be available as a reference for this activity.
2. Begin with the bullets at the bottom. Determine if any bullets should move from one performance level to another. If a bullet (PO) is moved and the objective is noted in the narrative at the top of the PLD, the objective must also be moved to the new performance level in the narrative.
3. Since some bullets are a combination of POs, it may be necessary to break apart the bullet to place the separate parts in different performance levels. If needed, make the appropriate adjustments to the narrative.
4. Note the bullet's beginning action verb. The verb may be changed and along with the rest of the text, a new bullet may be added to a different performance level.
5. New bullets may be added if appropriate and necessary; however, removal of bullets is not recommended. All assessments must conform to the test blueprint, and although not all the bullets will be covered in the current assessment, over time, the future assessments will include all the performance objectives identified in the bullets.
6. Adjust the narrative accordingly, but do not exceed the maximum amount of characters assigned to the space.
7. Table Leaders will share their tables' recommendations, and Track Changes will be made to the existing document.

12:00-12:30 Debrief with ADE over Lunch

ADE will debrief with full committee and providing closing remarks.

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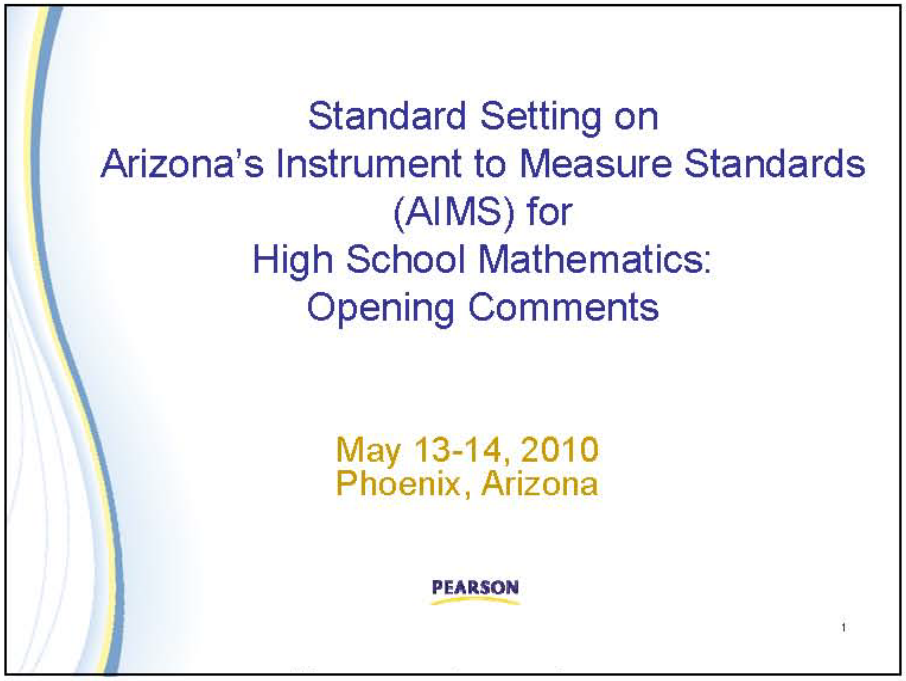
Appendix F: Standard Setting Opening Comments

Appendix F.1: Standard Setting Opening Comments (High School)



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PEARSON

Roles

- Lead Research Scientist
- Lead Standard Setting Facilitator
- Statistical Analyst
- Program Management
- ADE Staff
- Table Leader
- Participants

3

PEARSON

Why You Are Here

- The purpose of this standard setting is to establish recommended cut scores on the AIMS High School Mathematics assessment.
- You were selected to serve on this committee for a variety of reasons:
  - Familiarity with the knowledge and skills required to "master" the content standards at various performance levels
  - Represent various jurisdictions and demographic variables

4

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PEARSON

Standard Setting Overview

- Develop a shared understanding of each Performance Level Descriptor (PLD)
- Develop "Borderline Student" Descriptors
- Take and discuss the test
- Standard Setting Training and Practice
- Participate in three rounds of ratings
  - Round 1: Independent
  - Round 2: Independent, but with table discussion
  - Round 3: Independent, but with table & full group discussion
- Finalize Performance Level Descriptors

5

PEARSON

Logistics

- Location of Meals and Breaks
- Security Forms
- Reimbursement Forms

6

PEARSON

Security

- DO NOT:
  - Remove any secure materials from the room on breaks or at end of day.
  - Discuss cut scores (yours or others) with anyone outside of the meeting.
  - Discuss secure materials with non-participants.
- Notes should be taken in our materials only.
- Panelist ID number

7

PEARSON

Overview of Arizona's Instrument to Measure Standards (AIMS)

- History
- Purposes

8

PEARSON

What is Standard Setting?

- Process used to determine recommended cut scores on an assessment that will classify student performance into different categories
  - Provides a frame of reference for the interpretation of test scores
  - A semi-quantitative, semi-standardized judgment process
  - A routine, daily activity for teachers

9

PEARSON

What are Standards?

- Content Standards
  - Define desired student knowledge, skills, and competencies
- Performance Standards
  - Clear descriptions "performance indicators"
  - Commentaries on how well a student must know the content to be placed in a performance level

10

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PEARSON

Performance Level Descriptors (PLD)

- Falls Far Below the Standard
- Approaches the Standard
- Meets the Standard
- Exceeds the Standard

11

PEARSON

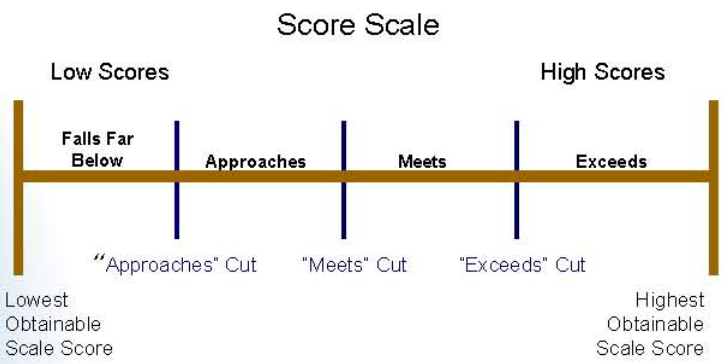
Borderline Student Descriptions

- The cut score is set at the beginning of the performance level.
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- Define Borderline Student Descriptions for each of those levels

12

PEARSON

Four Performance Levels: Three Cuts



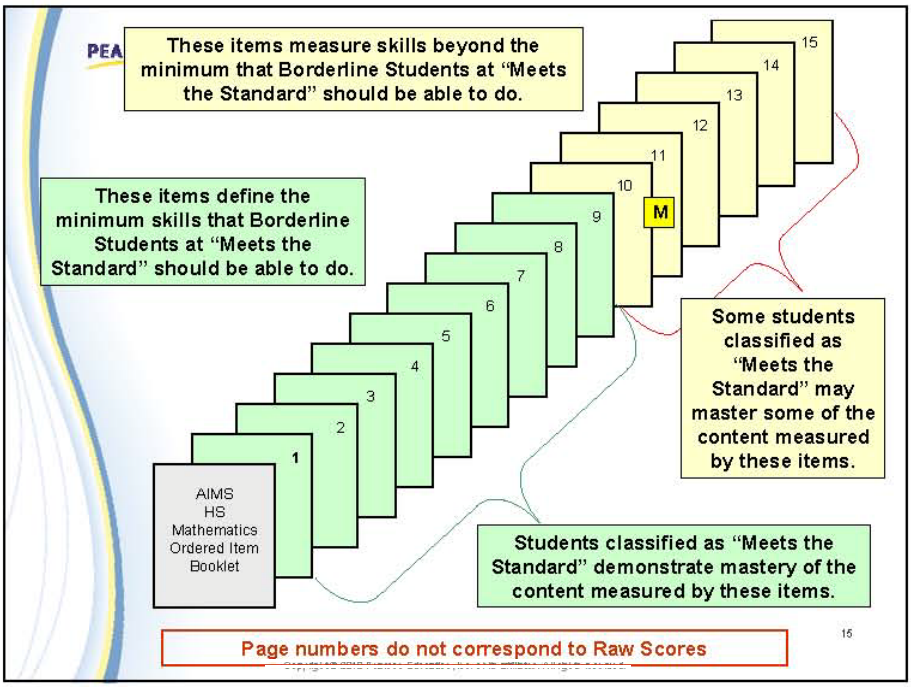
13

PEARSON

Standard Setting: Item Mapping Procedure

- Items appear as one item per page.
- Items are placed in order of difficulty in the ordered item booklet (OIB).
  - Easiest item is first.
  - Most difficult item is last.
  - Therefore, the likelihood of getting an item correct decreases as you move through the OIB.
- Example on next slide (illustrative purposes):
  - Assume 15-item mathematics practice test
  - Assume one cut score with two categories

14



PEARSON

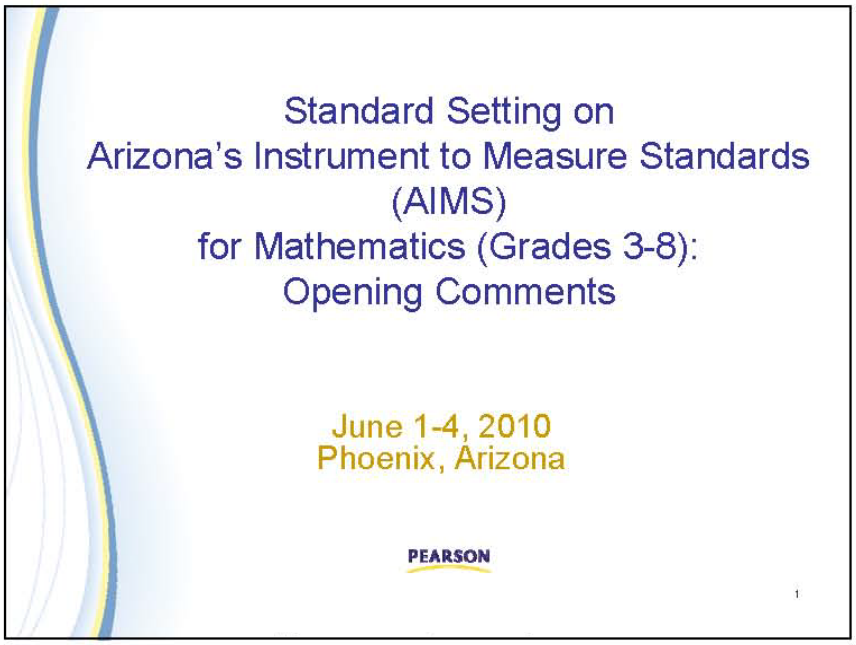
Recap of Activities

- Develop a shared understanding of each Performance Level Descriptor (PLD)
- Develop "Borderline Student" Descriptors
- Take and discuss the test
- Standard Setting Training and Practice
- Participate in three rounds of ratings
  - Round 1: Independent
  - Round 2: Independent, but with table discussion
  - Round 3: Independent, but with table & full group discussion
- Finalize Performance Level Descriptors
- Evaluation of Process

16

PEARSON
Break
• Fill out non-disclosure agreements.
• Hand non-disclosure agreements to facilitator.
• Please take a 15-minute break.
• We will review Performance Level Descriptors after we come back.
17

Appendix F.2: Standard Setting Opening Comments (Grades 3-8)



PEARSON

Roles

- Lead Research Scientist
- Standard Setting Facilitator
- Statistical Analyst
- Program Management
- ADE Staff
- Table Leader
- Participants

3

PEARSON

Why You Are Here

- The purpose of this standard setting is to establish recommended cut scores on the AIMS mathematics assessment for grades 3-8.
- You were selected to serve on this committee for a variety of reasons:
  - Familiarity with the knowledge and skills required to "master" the content standards at various performance levels
  - Represent various jurisdictions and demographic variables

4

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PEARSON

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  - Round 3: Independent, but with table & full group discussion
- Participate in a vertical articulation process across grades
- Finalize Performance Level Descriptors

5

PEARSON

Logistics

- Location of Meals and Breaks
- Security Forms
- Reimbursement Forms

6

PEARSON

Security

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7

PEARSON

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- Purposes

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PEARSON

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PEARSON

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PEARSON

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PEARSON

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12

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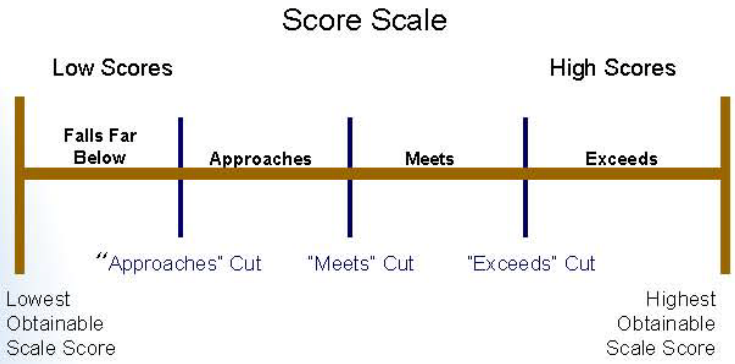
PEARSON

Four Performance Levels: Three Cuts



13

PEARSON

Standard Setting: Item Mapping Procedure

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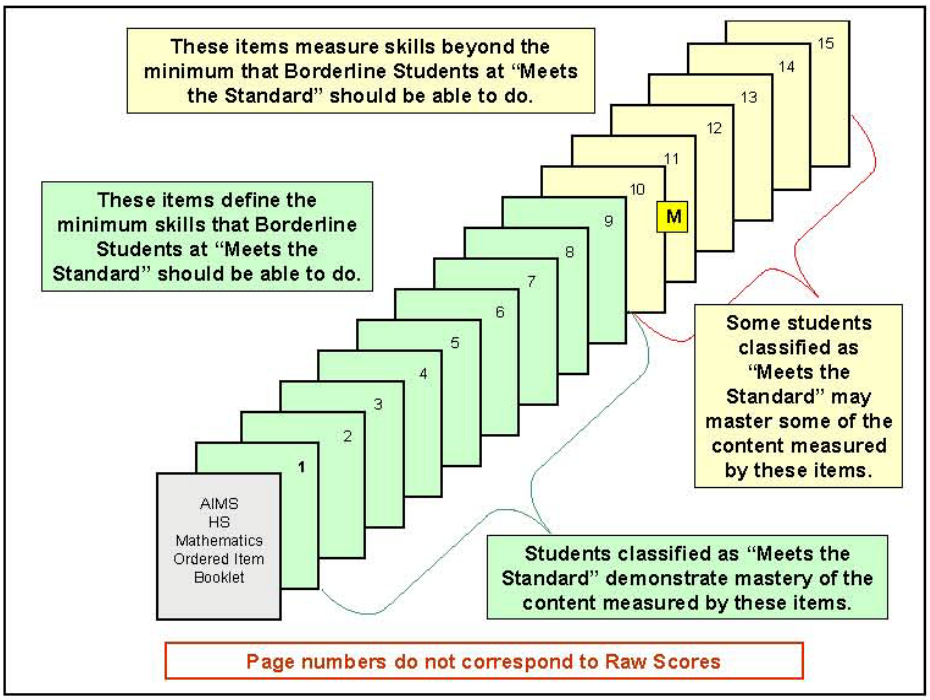
  - Therefore, the likelihood of getting an item correct decreases as you move through the OIB.
- Example on next slide (illustrative purposes):
  - Assume 15-item mathematics practice test
  - Assume one cut score with two categories

14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These items define the minimum skills that Borderline Students at "Meets the Standard" should be able to do.
Some students classified as "Meets the Standard" may master some of the content measured by these items.
Students classified as "Meets the Standard" demonstrate mastery of the content measured by these items.
AIMS HS Mathematics Ordered Item Booklet
1
2
3
4
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14
15
Page numbers do not correspond to Raw Scores

PEARSON
Recap of Activities
Develop a shared understanding of each Performance Level Descriptor (PLD)
Develop "Borderline Student" Descriptors
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Standard setting training and practice
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Round 1: Independent
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Round 3: Independent, but with table & full group discussion
Participate in the vertical articulation process
Finalize Performance Level Descriptors
Evaluation of process
16

PEARSON
Break
• Fill out non-disclosure agreements.
• Hand non-disclosure agreements to facilitator.
• Please take a 15-minute break and move to your break-out room.
17

Appendix G: Standard Setting Training

Appendix G.1: Standard Setting Training (High School)

PEARSON

Performance Level Descriptors (PLD)

- Performance Levels
  - Falls Far Below the Standard
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- Read the descriptors on the handout that is included in the right pocket of your folder.
- What distinguishes each level?
  - Compare "Meets" to "Exceeds".
  - Compare "Approaches" to "Meets".
  - Think about what might distinguish "Falls Far Below" from "Approaches".

3

PEARSON

Performance Level Descriptors

- Within each table group, ask, "What should students know and be able to do at each level?"
  - "Approaches," "Meets," and "Exceeds"
- Appoint a recorder to write on the flip chart.
- Suggestions should be:
  - Concrete.
  - Clearly related to the PLD definitions provided earlier.
  - Summarize the current descriptions.

4

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PEARSON

Performance Level Descriptors: "Meets the Standard"

- Describe concretely the students who are at "Meets the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?
  - What *academic behaviors* demonstrate that they are at the "Meets the Standard"?

5

PEARSON

Performance Level Descriptors: "Exceeds the Standard"

- Describe concretely the students who are at "Exceeds the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?
  - What *academic behaviors* demonstrate that they are at "Exceeds the Standard"?

6

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PEARSON

Performance Level Descriptors: "Approaches the Standard"

- Describe concretely the students who are at "Approaches the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?
  - What *academic behaviors* demonstrate that they "Approaches the Standard"?

7

PEARSON

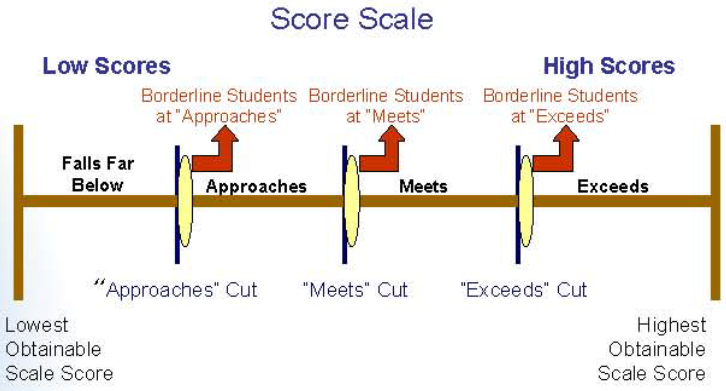
Establishing Recommended Cut Scores

- The cut score is set at the beginning of the performance level:
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- When determining cut scores we need to think about the "Borderline Student's" performance for that performance level:
  - The "borderline student" just barely makes it into the performance level.

8

PEARSON

Establishing Recommended Cut Scores: Finding the Cut



9

PEARSON

Examples of "Real World" Performance Levels

- Total Blood Cholesterol Level
  - Less than 200 mg/dL: Desirable
  - 200–239 mg/dL: Borderline-High Risk
  - 240 mg/dL and over: High Risk
- Blood Sugar Level
  - Normal Levels: 70 - 150 mg
  - High: above 150 mg

10

PEARSON

Distinguishing "Meets the Standard" from "Approaches the Standard"

- Think about the borderline students at "Meets the Standard".
  - Identify three characteristics or behaviors that MOST distinguish a student who just barely "Meets the Standard."
  - Record the three responses on your flipchart.

11

PEARSON

Distinguishing "Exceeds the Standard" from "Meets the Standard"

- Think about the borderline students at "Exceeds the Standard".
  - Identify three characteristics or behaviors that MOST distinguish a student who just barely "Exceeds the Standard."
  - Record the three responses on your flipchart.

12

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PEARSON

Distinguishing "Falls Far Below the Standard" from "Approaches the Standard"

- Think about the borderline students at "Approaches the Standard".
  - Identify three characteristics or behaviors that MOST distinguish a student who just barely "Approaches the Standard."
  - Record the three responses on your flipchart.

13

PEARSON

Borderline Student Descriptors

- Reconvene as whole committee.
- Each table presents their examples of, "What should students know and be able to do at each level?"
- Each table describes the three distinguishing characteristics.
- Look for differences and commonalities across tables.
- The facilitator will capture the discussion on the group flip chart.

14

PEARSON

Lunch

- Please take 45-minute break for lunch.
- Reconvene in this room at 12:45.

15

PEARSON

Recap of Completed Activities

- Reviewed Performance Level Descriptors (PLD)
  - Falls Far Below the Standard
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- Developed the Borderline Student Descriptors
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard

16

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PEARSON

Take the Test

- Gain an appreciation of the assessment
- Work independently
- Group discussion after everyone has completed and scored their test

17

PEARSON

Score the Test

- When you are done taking the test, please let the facilitator know.
- Use the scoring key to score your test.
- You may take a break if you finish before the rest of the group.
  - If you take a break, please stay close by.
  - As soon as all participants have scored their test, we will have a group discussion.

18

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PEARSON

Group Discussion About the Test

- What are your general impressions about the test?
- Did the test generally cover the depth and breadth of the content standards?
- Does the test generally have a range of item difficulties (e.g., easier items, moderate items, difficult items)?

19

PEARSON

Break

- Please take a 15-minute break.
- Reconvene in this room at 2:15.

20

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PEARSON

Purpose of Presentation

- The purpose of this part of the presentation is to introduce you to the process that we will use to establish recommended cut-scores on Arizona's Instrument to Measure Standards (AIMS) for High-School Mathematics.

21

PEARSON

Standard Setting: Item Mapping Procedure

- Items appear as one item per page.
- Items are placed in order of difficulty in the ordered item booklet (OIB).
  - Easiest item is first.
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  - Therefore, the likelihood of getting an item correct decreases as you move through the OIB.
- Example on next slide (illustrative purposes):
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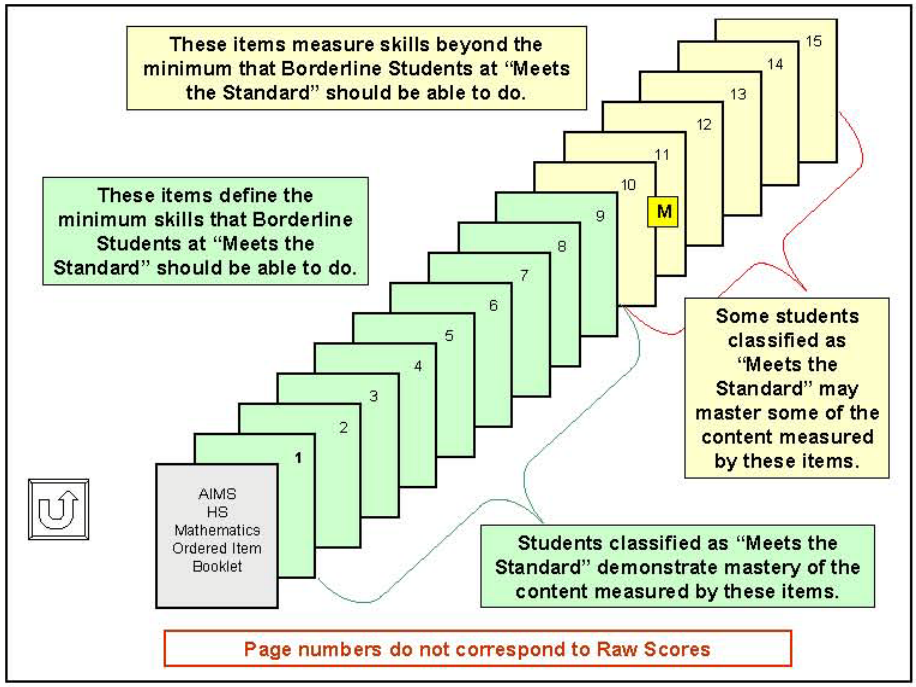
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AIMS HS Mathematics Ordered Item Booklet
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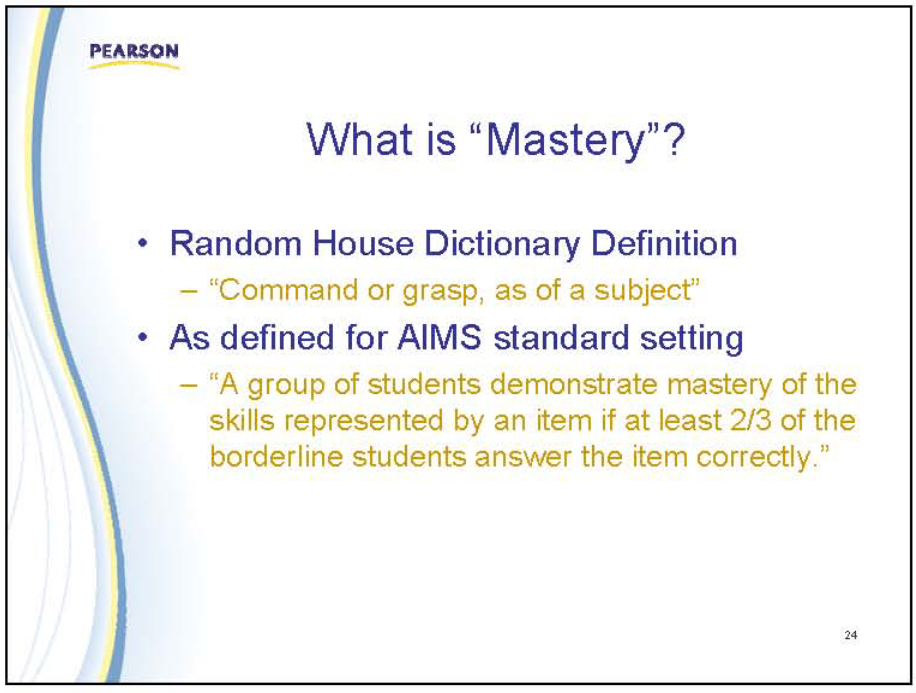
Page numbers do not correspond to Raw Scores


PEARSON
What is "Mastery"?
• Random House Dictionary Definition
– "Command or grasp, as of a subject"
• As defined for AIMS standard setting
– "A group of students demonstrate mastery of the skills represented by an item if at least 2/3 of the borderline students answer the item correctly."
24

Mastery Illustrative Example

- Group A (Low Performing)
  - Mastered items 1-7
- Group B (Middle Performing)
  - Mastered Items 1-11
- Group C (High Performing)
  - Mastered Items 1-14

Percentage of Students Obtaining the Correct Answer

Page	Group A	Group B	Group C
1	94	96	99
2	92	94	99
3	90	92	96
4	86	90	94
5	81	89	92
6	75	85	90
7	70	82	88
8	66	76	85
9	61	75	84
10	58	72	83
11	53	69	83
12	45	63	81
13	30	56	76
14	26	50	70
15	14	47	65

PEARSON

Moving Through the Ordered Item Booklet

- Questions to consider:
  - What does this item measure?
  - What makes this item more difficult than the items that precede it?
- Read each page and consider the knowledge, skills, and abilities required to successfully answer the item.

26

PEARSON

Page Cut: "Meets the Standard"

- The page cut for "Meets the Standard" is placed to distinguish the content that borderline students at "Meets the Standard" should answer correctly from the content that they may not answer correctly.
  - Should most (67%) borderline students at "Meets the Standard" be able to answer this item correctly?
    - If you answer "Yes", read on because you have likely not yet hit the beginning of "Meets the Standard".
    - If you answer "No", then you have likely entered into the content that borderline students at "Meets the Standard" may not answer correctly.

27

PEARSON

Page Cut: "Meets the Standard"

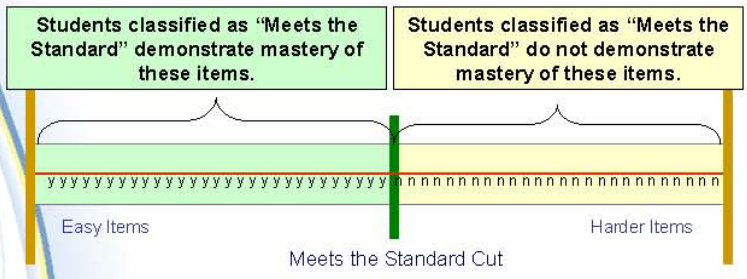
- Place your bookmark on the page AFTER the last item you expect the borderline students should be able to master.

28

PEARSON

Establishing the Page Cut for "Meets the Standard" (Theoretically)

Working Through the Ordered Item Booklet (OIB)



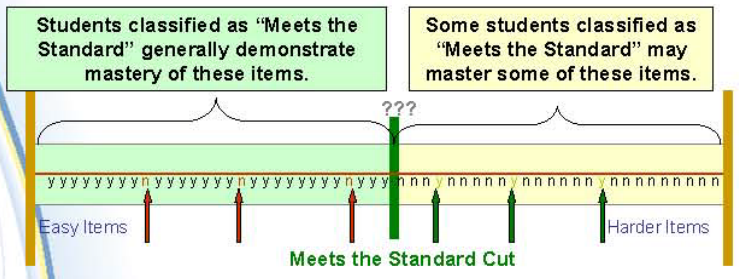
The "Meets the Standard" page cut is placed to separate the items that the borderline students at "Meets the Standard" should answer correctly from those that they may not answer correctly.

29

PEARSON

Establishing the Page Cut for "Meets the Standard" (In-Practice)

Working Through the Ordered Item Booklet (OIB)



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30

PEARSON

Page Cut Point Summary

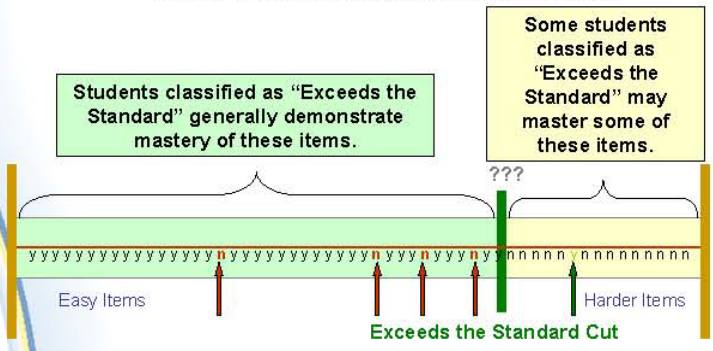
- The page cut for **"Meets the Standard"** is placed to distinguish the content that borderline students at "Meets the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Exceeds the Standard"** is placed to distinguish the content that borderline students at "Exceeds the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Approaches the Standard"** is placed to distinguish the content that borderline students at "Approaches the Standard" should answer correctly from the content that they may not answer correctly.

31

PEARSON

Establishing the Page Cut for "Exceeds the Standard"

Working Through the Ordered Item Booklet (OIB)

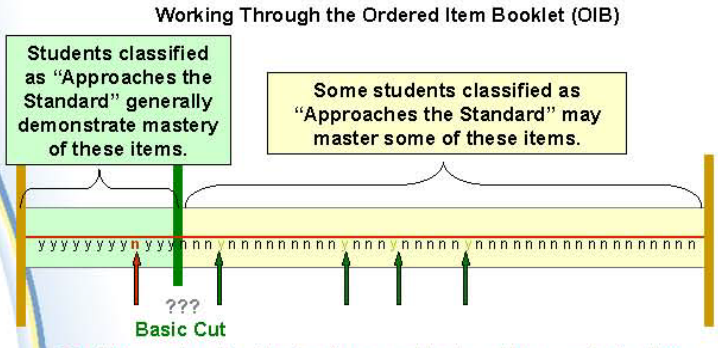


The "Exceeds the Standard" page cut is placed to separate the items that the borderline students at "Exceeds the Standard" should answer correctly from those that they may not answer correctly.

32

PEARSON

Establishing the Page Cut for "Approaches the Standard"



The "Approaches the Standard" page cut is placed to separate the items that the borderline students at "Approaches the Standard" should answer correctly from those that they may not to answer correctly.

33

PEARSON

Advice in Placing Your Page Selections

- Items do not differ a great deal in difficulty from one item to the next in the ordered item booklet.
  - Items may seem misplaced sometimes.
  - As the item difficulty increases, the likelihood of answering the item correctly decreases.
- Find the "ballpark" first, then consider each item in that range to determine where to place your bookmark to indicate your selected page.

34

PEARSON

Advice in Placing Your Page Selections

- Place your bookmark on the page AFTER the last item you expect the borderline student for that proficiency level should be able to master.
  - First cut: "Meets the Standard"
  - Second cut: "Exceeds the Standard"
  - Third cut: "Approaches the Standard"

35

PEARSON

"How do I know if I'm right?"

- There is no "*right.*"
- Did you keep in mind:
  - "*Should*"?
  - The *borderline students*?
    - Specifically, 67% of borderline students
  - *All* Arizona students taking the AIMS Mathematics Assessment?
  - Our discussions?

36

PEARSON

Three Rounds of Ratings

- Round 1 Ratings
  - Independently
- Round 2 Ratings
  - Independently, but after discussion with your table group
- Round 3 Ratings
  - Independently, but after discussion with your table group and entire committee

37

PEARSON

Standard Setting Item Map and Rating Sheet

- You will be provided with an item map that provides information about each item.
- You will record your recommended page number on a page number recording sheet.

38

PEARSON

Practice Exercise

- Review the practice item booklet.
- Questions to consider:
  - What does this item measure?
  - What makes this item more difficult than the items that precede it?
- Read each page and consider the knowledge, skills, and abilities required to successfully answer the item.
- Ask yourself the following question:
  - Should most (67%) borderline students at "Meets the Standard" be able to answer this item correctly?
- Place your bookmark on the page AFTER the last item you expect the borderline students should be able to master.

39

PEARSON

Readiness Survey

- Consider the task we ask of you.
- Answer the questions on the Readiness Survey for Round 1.
- Table leaders give the thumbs up when everyone at table is ready to go.

40

PEARSON

Round 1-What to Do?

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark "zones" first; then "revisit the neighborhoods" to set the cuts.

41

PEARSON

Complete Round 1 Ratings

- Complete independently.
- Once completed, your table leader and/or facilitator will collect and check in all of your materials.
- See you back tomorrow morning at 7:30 for breakfast.
- Meeting starts at 8:30.

42

PEARSON

Day 2 Overview

- Round 1 Feedback
- Round 2 Standard Setting
- Round 2 Feedback
- Round 3 Standard Setting
- Round 3 Results
- Revisit Performance Level Descriptors.
- Complete Survey.

43

PEARSON

Feedback Data Provided

- Panelist Agreement Data (After Rounds 1-3)
  - How do your cut-points compare to those of other panelists?
    - Median, low, and high pages for entire standard setting panel and for your individual table group
    - Graph indicating page numbers for each panelist at each performance level
- Student Performance Data (After Rounds 1-3)
  - Provides the percentage of students that obtained the correct answer
- Impact Data (After Rounds 2-3)
  - If the cut points represented by the page numbers were implemented, what is the percentage of students who would be classified in each performance level?

44

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PEARSON

Round 1 Panelist Agreement Data

- At your table:
  - Examine data showing min, max, and median for your table.
  - Mark min and max of the table in the book. Keep your neighborhood stickies in place.
  - Table Leader leads discussion of why placements were made.
  - Discuss in order lowest to highest.

45

PEARSON

Student Data

- These were data collected in the Spring 2010 operational test.
- All students from Cohort 2012 are included (who received a valid score).
- Students that did not attempt the test are not included in the data.

46

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Student Achievement Data

- Item difficulty="*p*-values" (% correct)
- Data tells how students *DID* perform.
- Data CANNOT tell how students SHOULD perform *nor* how students at the borderline of "Approaches", "Meets", or "Exceeds the Standard" perform.

47

PEARSON

Why Round 2?

- You are now an improved advisor.
- Consider judgments & views of your peers.
- Consider student achievement data.
- Goal: NOT consensus, but *reflection*

YOU ARE NOW A *BETTER* ADVISOR,
because you are a better-informed advisor.

48

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PEARSON

Round 2 - What to Do?

1. Reflect on earlier ratings – yours & peers.
2. Reflect on the table discussion.
3. Think about the panelist agreement and student achievement data.
4. Consider changing the zones around your earlier cuts.
5. Reconsider each page in the zone.
6. Decide if you want to move your page numbers.
7. Choose the point that best defines the *borderline* of each category.

49

PEARSON

Reminder

- Remember to mark the pages that separate the items that borderline students should answer correctly from those items they may not answer correctly.

50

PEARSON

Round 2-What to Do?

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark off "zones" first; then "revisit the neighborhoods" to set the cuts.

51

PEARSON

Readiness Survey

- Consider the task we ask of you.
- Answer the questions on the Readiness Survey for Round 2.
- Table leaders give the thumbs up when everyone at table is ready to go.

52

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PEARSON

Round 2 Ratings

Please complete your Round 2 ratings now.

53

PEARSON

Break!

- Please take a 30-minute break.
- Reconvene in your committee room.

54

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PEARSON

Round 2
Panelist Agreement Data

Results will be posted here.

55

PEARSON

Round 2 Panelist Agreement Data

- At your table:
  - Examine data showing min, max, and median for your table
  - Mark min and max of the table in the book. Keep your neighborhood stickies in place.
  - Table Leader leads discussion of why placements were made.
  - Discuss in order from lowest to highest

56

PEARSON

Student Achievement Data

- Impact data:
  - The impact data show the percentage of students in each of the performance levels based on the current cut score recommendations.
  - The impact data are based on the Spring 2010 test administration - Same sample as the p-values.

57

PEARSON

Impact Data

Impact data will be presented now.

58

PEARSON

Group Discussion of Round 2 Ratings

- WHY????
- Hearing from your peers helps you to:
  - Become more **comfortable** with your judgments and recommendations.
  - **Reconsider** your earlier judgments and recommendations.

59

PEARSON

"How do I know if I'm right?"

- There is no "*right.*"
- Did you keep in mind:
  - "*Should*"?
  - The *borderline students*?
    - Specifically, 67% of borderline students
  - *All* Arizona students taking the AIMS Mathematics Assessment?
  - Our discussions?

60

PEARSON

Round 3 - What to Do ?

1. Reflect on earlier ratings – yours & peers.
2. Reflect on the table discussion.
3. Think about the panelist agreement and student achievement data.
4. Consider changing the zones around your earlier page placements.
5. Decide if you want to move your page number selections.
6. Choose the point that best defines the *borderline* of each category.

61

PEARSON

Round 3 Steps

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark off "zones" first; then "revisit the neighborhoods" to set the cuts.

62

PEARSON

Readiness Survey

- Consider the task we ask of you.
- Answer the readiness questions for Round 3.
- Table leaders give thumbs up.

63

PEARSON

Participant Item Ratings

- What percent of borderline students in each performance level should get this item correct?
  - Borderline Approaches
  - Borderline Meets
  - Borderline Exceeds
- Mark your answers on your rating sheet
  - You will rate each item three times
  - Ratings must be in 5% increments from 5 to 95

64

PEARSON

Lunch

- Please return in 45 minutes.
- Reconvene in your committee room.

65

PEARSON

Final Recommended Cut Points and Results

Results will be presented here.

66

PEARSON

Steps in PLD Review and Revision

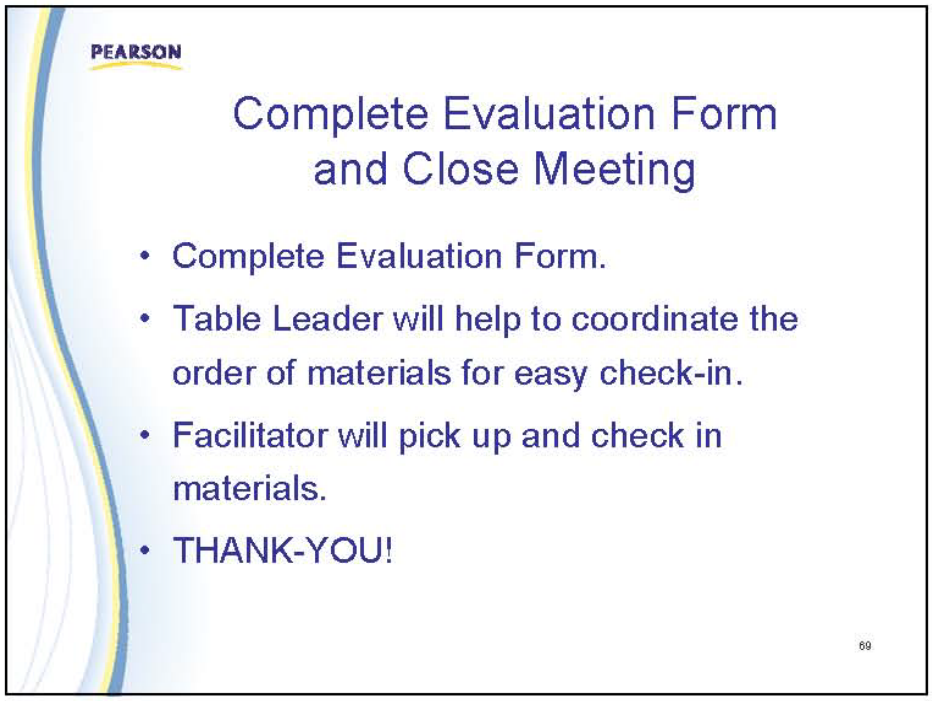
1. Start with the page number between "Approaches the Standard" and "Meets the Standard."
2. Read items around that page (3 above and 3 below).
3. Identify skills needed for correct response.
4. Evaluate why each item is more difficult than preceding one.
5. Review performance level labels, descriptors, and borderline student descriptors.
6. List skills that differentiate the two levels.
7. Suggest revisions to descriptors (if necessary).
8. Move to the page between "Meets the Standard" and "Exceeds the Standard" and repeat steps 2-7.
9. Move back to the page between "Falls Far Below the Standard" and "Approaches the Standard" and repeat steps 2-7.

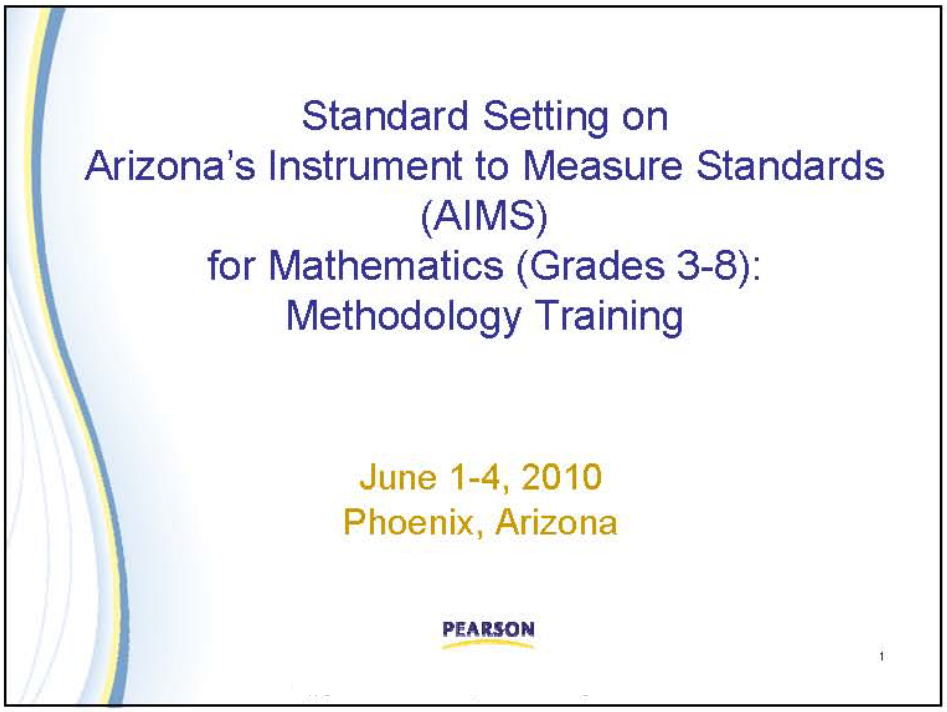
67

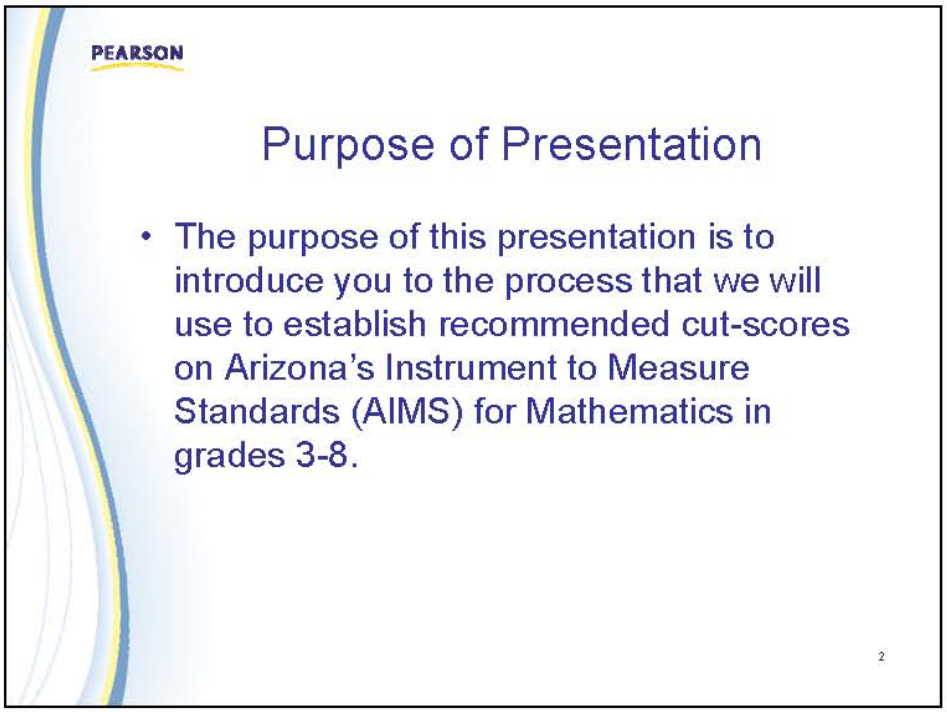
PEARSON

Closing Remarks from ADE

68


PEARSON
Complete Evaluation Form and Close Meeting
• Complete Evaluation Form.
• Table Leader will help to coordinate the order of materials for easy check-in.
• Facilitator will pick up and check in materials.
• THANK-YOU!
69


Standard Setting on
Arizona's Instrument to Measure Standards
(AIMS)
for Mathematics (Grades 3-8):
Methodology Training
June 1-4, 2010
Phoenix, Arizona
PEARSON
1

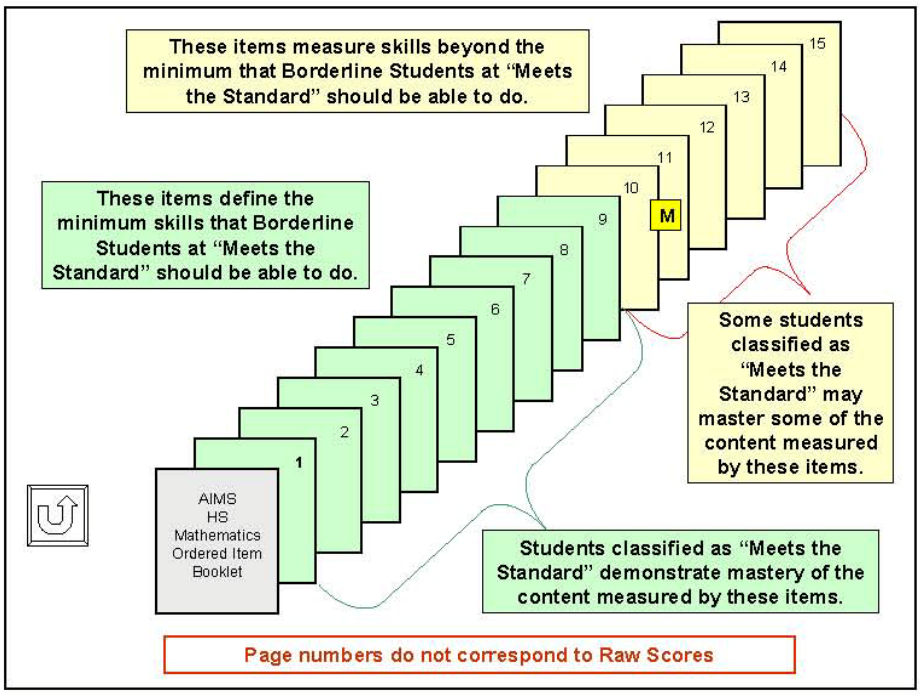

PEARSON
Purpose of Presentation
• The purpose of this presentation is to introduce you to the process that we will use to establish recommended cut-scores on Arizona's Instrument to Measure Standards (AIMS) for Mathematics in grades 3-8.
2

PEARSON

Standard Setting: Item Mapping Procedure

- Items appear as one item per page.
- Items are placed in order of difficulty in the ordered item booklet (OIB).
  - Easiest item is first.
  - Most difficult item is last.
  - Therefore, the likelihood of getting an item correct decreases as you move through the OIB.
- Example on next slide (illustrative purposes):
  - Assume 15-item mathematics practice test
  - Assume one cut score with two categories

3



PEARSON

What is "Mastery"?

- Random House Dictionary Definition
  - "Command or grasp, as of a subject"
- As defined for AIMS standard setting
  - "A group of students demonstrate mastery of the skills represented by an item if at least 2/3 of the borderline students answer the item correctly."

5

Mastery Illustrative Example

- Group A (Low Performing)
  - Mastered items 1-7
- Group B (Middle Performing)
  - Mastered Items 1-11
- Group C (High Performing)
  - Mastered Items 1-14

Percentage of Students Obtaining the Correct Answer

Page	Group A	Group B	Group C
1	94	96	99
2	92	94	99
3	90	92	96
4	86	90	94
5	81	89	92
6	75	85	90
7	70	82	88
8	66	76	85
9	61	75	84
10	58	72	83
11	53	69	83
12	45	63	81
13	30	56	76
14	26	50	70
15	14	47	65

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PEARSON

Moving Through the Ordered Item Booklet

- Questions to consider:
  - What does this item measure?
  - What makes this item more difficult than the items that precede it?
- Read each page and consider the knowledge, skills, and abilities required to successfully answer the item.

7

PEARSON

Page Cut: "Meets the Standard"

- The page cut for "Meets the Standard" is placed to distinguish the content that borderline students at "Meets the Standard" should answer correctly from the content that they may not answer correctly.
  - Should most (67%) borderline students at "Meets the Standard" be able to answer this item correctly?
    - If you answer "Yes", read on because you have likely not yet hit the beginning of "Meets the Standard".
    - If you answer "No", then you have likely entered into the content that borderline students at "Meets the Standard" may not answer correctly.

8

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PEARSON

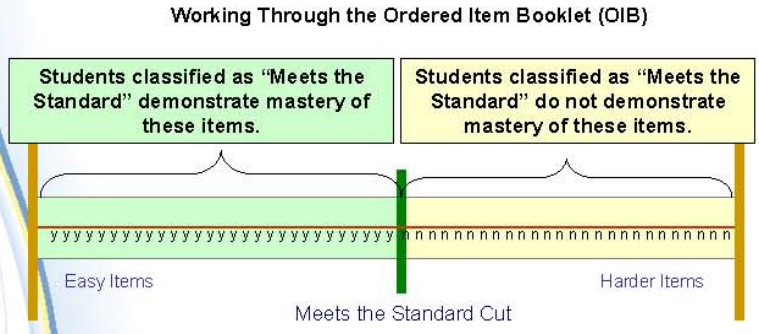
Page Cut: "Meets the Standard"

- Place your bookmark on the page AFTER the last item you expect the borderline students should be able to master.

9

PEARSON

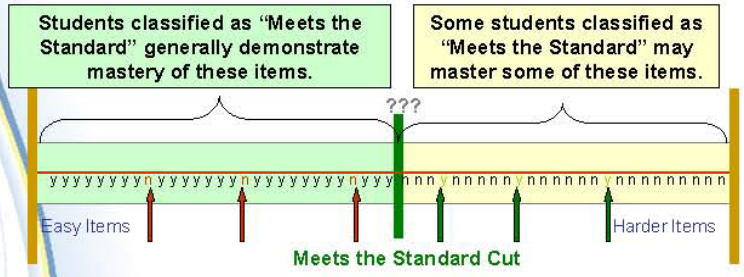
Establishing the Page Cut for "Meets the Standard" (Theoretically)


Working Through the Ordered Item Booklet (OIB)
Students classified as "Meets the Standard" demonstrate mastery of these items.
Students classified as "Meets the Standard" do not demonstrate mastery of these items.
y y y

PEARSON

Establishing the Page Cut for "Meets the Standard" (In-Practice)

Working Through the Ordered Item Booklet (OIB)



The "Meets the Standard" page cut is placed to separate the items that the borderline students at "Meets the Standard" should answer correctly from those that they may not answer correctly.

11

PEARSON

Page Cut Point Summary

- The page cut for **"Meets the Standard"** is placed to distinguish the content that borderline students at "Meets the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Exceeds the Standard"** is placed to distinguish the content that borderline students at "Exceeds the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Approaches the Standard"** is placed to distinguish the content that borderline students at "Approaches the Standard" should answer correctly from the content that they may not answer correctly.

12

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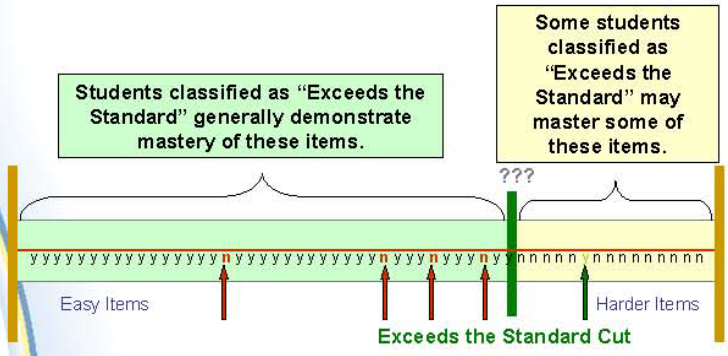
PEARSON

Establishing the Page Cut for "Exceeds the Standard"

Working Through the Ordered Item Booklet (OIB)



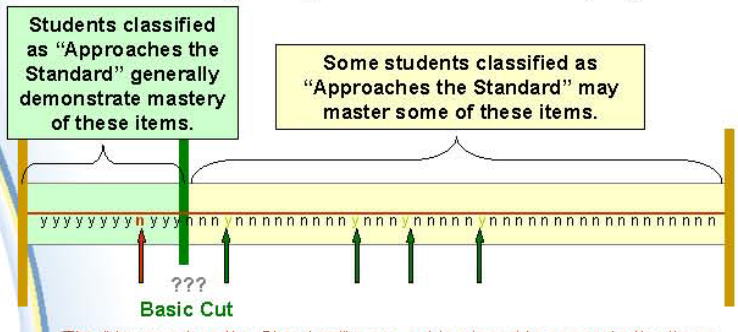
The "Exceeds the Standard" page cut is placed to separate the items that the borderline students at "Exceeds the Standard" should answer correctly from those that they may not answer correctly.

13

PEARSON

Establishing the Page Cut for "Approaches the Standard"

Working Through the Ordered Item Booklet (OIB)



The "Approaches the Standard" page cut is placed to separate the items that the borderline students at "Approaches the Standard" should answer correctly from those that they may not to answer correctly.

14

PEARSON

Advice in Placing Your Page Selections

- Items do not differ a great deal in difficulty from one item to the next in the ordered item booklet.
  - Items may seem misplaced sometimes.
  - As the item difficulty increases, the likelihood of answering the item correctly decreases.
- Find the "ballpark" first, then consider each item in that range to determine where to place your bookmark to indicate your selected page.

15

PEARSON

Advice in Placing Your Page Selections

- Place your bookmark on the page AFTER the last item you expect the borderline student for that proficiency level should be able to master.
  - First cut: "Meets the Standard"
  - Second cut: "Exceeds the Standard"
  - Third cut: "Approaches the Standard"

16

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PEARSON

"How do I know if I'm right?"

- There is no "*right*."
- Did you keep in mind:
  - "*Should*"?
  - The *borderline students*?
    - Specifically, 67% of borderline students
  - *All* Arizona students taking the AIMS Mathematics Assessment?
  - Our discussions?

17

PEARSON

Three Rounds of Ratings

- Round 1 Ratings
  - Independently
- Round 2 Ratings
  - Independently, but after discussion with your table group
- Round 3 Ratings
  - Independently, but after discussion with your table group and entire committee

18

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PEARSON

Standard Setting Item Map and Rating Sheet

- You will be provided with an item map that provides information about each item.
- You will record your recommended page number on a page number recording sheet.

19

PEARSON

Vertical Articulation Process

- We will work though the all rounds of one grade before moving onto the next grade.
  - Each committee will establish recommended page number cut scores on two grades.
    - Grades 3 and 5
    - Grades 6 and 8
  - Psychometric team will interpolate to find recommended cut scores for grades 4 and 7.
- All grade committees will convene on Thursday afternoon for vertical articulation.

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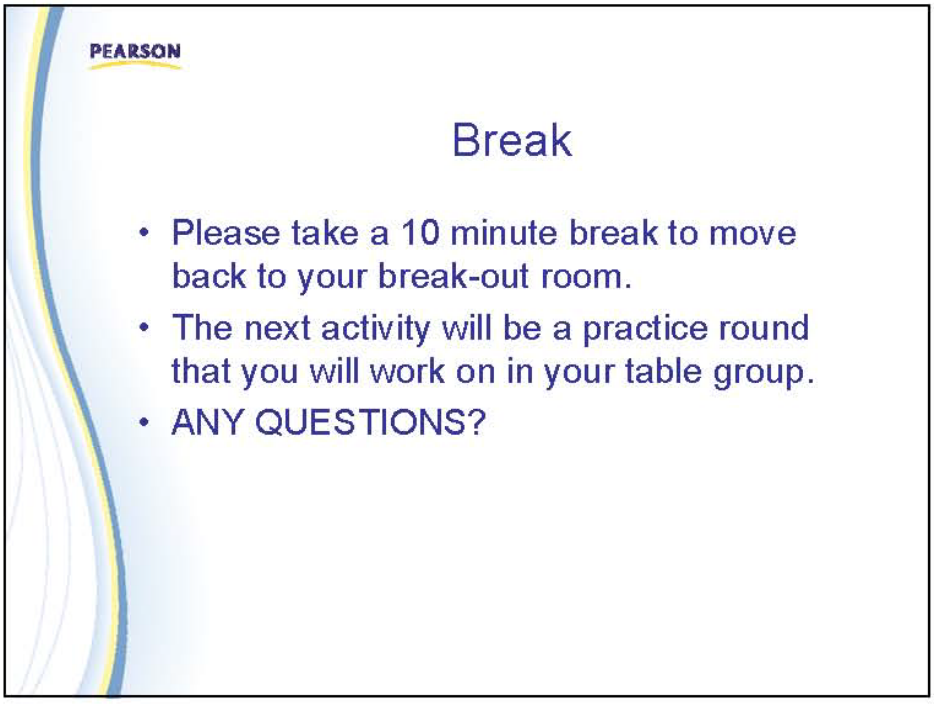
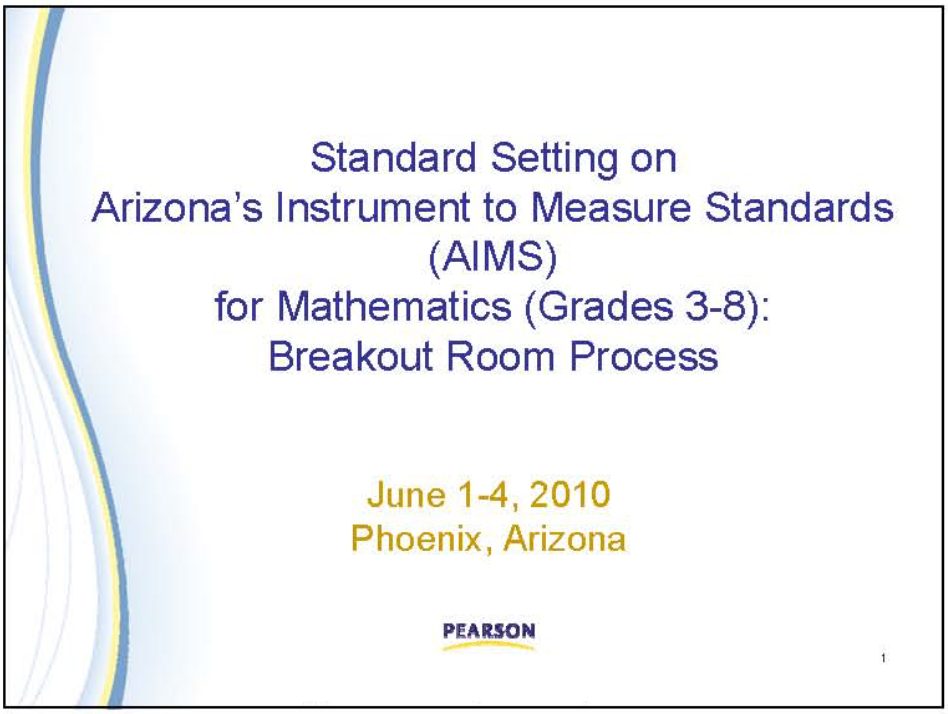

PEARSON
Break
• Please take a 10 minute break to move back to your break-out room.
• The next activity will be a practice round that you will work on in your table group.
• ANY QUESTIONS?

Appendix H: Slides for Break-Out Room (Grades 3-8)



PEARSON

Performance Level Descriptors (PLD)

- Performance Levels
  - Falls Far Below the Standard
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- Read the descriptors on the handout that is included in the right pocket of your folder.
- What distinguishes each level?
  - Compare "Meets" to "Exceeds".
  - Compare "Approaches" to "Meets".
  - Think about what might distinguish "Falls Far Below" from "Approaches".

3

PEARSON

Performance Level Descriptors

- Within each table group, ask, "What should students know and be able to do at each level?"
  - "Approaches," "Meets," and "Exceeds"
- Appoint a recorder to write on the flip chart.
- Suggestions should be:
  - Concrete.
  - Clearly related to the PLD definitions provided earlier.
  - Summarize the current descriptions.

4

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PEARSON

Performance Level Descriptors: "Meets the Standard"

- Describe concretely the students who are at "Meets the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?

5

PEARSON

Performance Level Descriptors: "Exceeds the Standard"

- Describe concretely the students who are at "Exceeds the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?

6

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Performance Level Descriptors: "Approaches the Standard"

- Describe concretely the students who are at "Approaches the Standard".
  - What should they be able to *do*?
  - What *skills* should they possess?
  - What should they *know*?

7

PEARSON

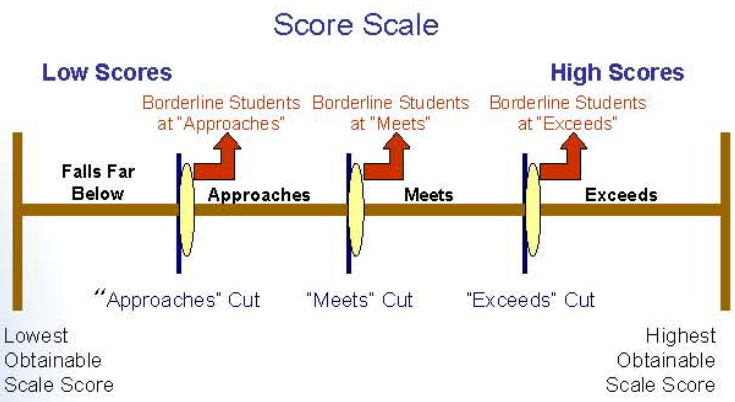
Establishing Recommended Cut Scores

- The cut score is set at the beginning of the performance level:
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- When determining cut scores we need to think about the "Borderline Student's" performance for that performance level:
  - The "borderline student" just barely makes it into the performance level.

8

PEARSON

Establishing Recommended Cut Scores: Finding the Cut



9

PEARSON

Examples of "Real World" Performance Levels

- Total Blood Cholesterol Level
  - Less than 200 mg/dL: Desirable
  - 200–239 mg/dL: Borderline-High Risk
  - 240 mg/dL and over: High Risk
- Blood Sugar Level
  - Normal Levels: 70 - 150 mg
  - High: above 150 mg

10

PEARSON

Distinguishing "Meets the Standard" from "Approaches the Standard"

- Think about the borderline students at "Meets the Standard".
  - Identify three knowledge, skills, or abilities that MOST distinguish a student who just barely "Meets the Standard."
  - Record the three responses on your flipchart.

11

PEARSON

Distinguishing "Exceeds the Standard" from "Meets the Standard"

- Think about the borderline students at "Exceeds the Standard".
  - Identify three knowledge, skills, or abilities that MOST distinguish a student who just barely "Exceeds the Standard."
  - Record the three responses on your flipchart.

12

PEARSON

Distinguishing "Falls Far Below the Standard" from "Approaches the Standard"

- Think about the borderline students at "Approaches the Standard".
  - Identify three knowledge, skills, or abilities that MOST distinguish a student who just barely "Approaches the Standard."
  - Record the three responses on your flipchart.

13

PEARSON

Borderline Student Descriptors

- Reconvene as whole committee.
- Each table presents examples of, "What should students know and be able to do at each level?"
- Each table describes the three distinguishing characteristics.
- Look for differences and commonalities across tables.

14

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PEARSON

Lunch

- Please take 45-minute break for lunch.
- Reconvene in this room at 12:45.

15

PEARSON

Recap of Completed Activities

- Reviewed Performance Level Descriptors (PLD)
  - Falls Far Below the Standard
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard
- Developed the Borderline Student Descriptors
  - Approaches the Standard
  - Meets the Standard
  - Exceeds the Standard

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Take the Test

- Gain an appreciation of the assessment
- Work independently
- Group discussion after everyone has completed and scored their test

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Score the Test

- When you are done taking the test, please let the facilitator know.
- Use the scoring key to score your test.
- You may take a break if you finish before the rest of the group.
  - If you take a break, please stay close by.
  - As soon as all participants have scored their test, we will have a group discussion.

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Group Discussion About the Test

- What are your general impressions about the test?
- Did the test generally cover the depth and breadth of the content standards?
- Does the test generally have a range of item difficulties (e.g., easier items, moderate items, difficult items)?

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Break

- Please take a 15-minute break.
- Reconvene in the general session room.

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Standard Setting: Item Mapping Procedure Recap

- Items appear as one item per page.
- Items are placed in order of difficulty in the ordered item booklet (OIB).
  - Easiest item is first.
  - Most difficult item is last.
  - Therefore, the likelihood of getting an item correct decreases as you move through the OIB.
- Example on next slide (illustrative purposes):
  - Assume 15-item mathematics practice test
  - Assume one cut score with two categories

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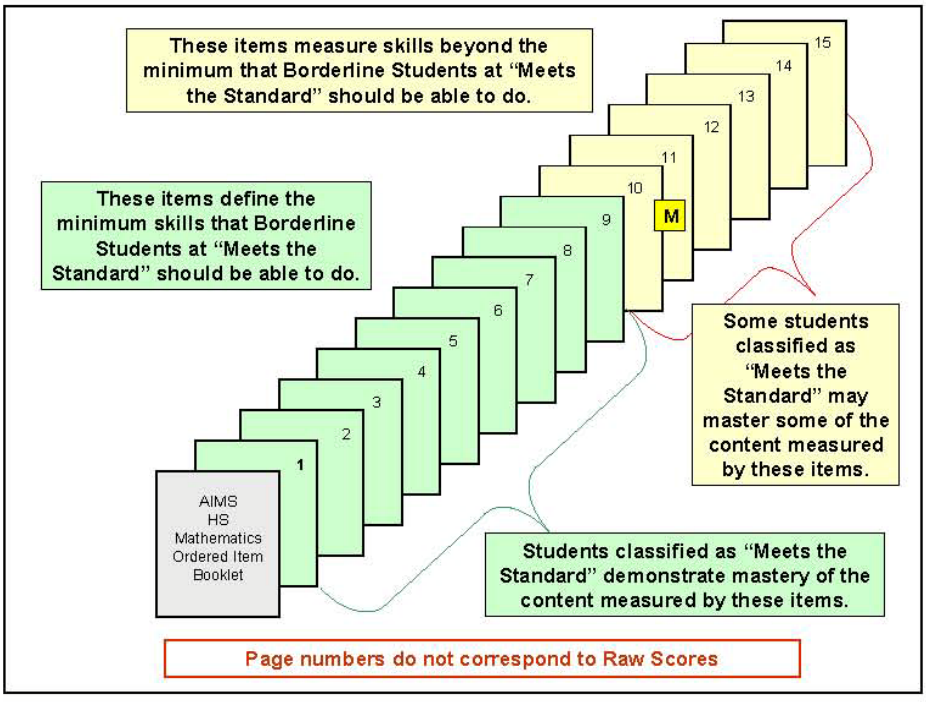

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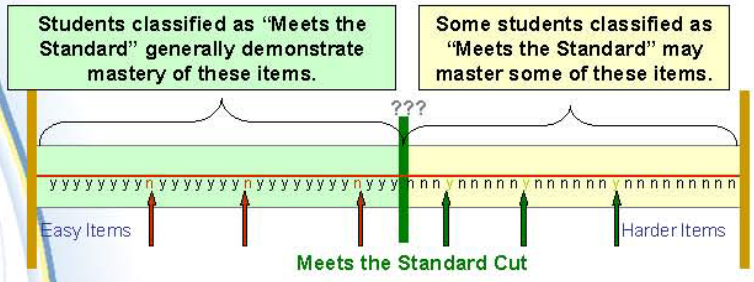
Establishing the Page Cut for "Meets the Standard" (In-Practice)

Working Through the Ordered Item Booklet (OIB)



The "Meets the Standard" page cut is placed to separate the items that the borderline students at "Meets the Standard" should answer correctly from those that they may not answer correctly.

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Page Cut Point Summary

- The page cut for **"Meets the Standard"** is placed to distinguish the content that borderline students at "Meets the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Exceeds the Standard"** is placed to distinguish the content that borderline students at "Exceeds the Standard" should answer correctly from the content that they may not answer correctly.
- The page cut for **"Approaches the Standard"** is placed to distinguish the content that borderline students at "Approaches the Standard" should answer correctly from the content that they may not answer correctly.

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Practice Exercise

- Review the practice item booklet.
- Questions to consider:
  - What does this item measure?
  - What makes this item more difficult than the items that precede it?
- Read each page and consider the knowledge, skills, and abilities required to successfully answer the item.
- Ask yourself the following question:
  - Should most (67%) borderline students at "Meets the Standard" be able to answer this item correctly?
- Place your bookmark on the page AFTER the last item you expect the borderline students should be able to master.

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Readiness Survey

- Consider the task we ask of you.
- Answer the questions on the Readiness Survey for Round 1.
- Table leaders give the thumbs up when everyone at table is ready to go.

26

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Round 1-What to Do?

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark "zones" first; then "revisit the neighborhoods" to set the cuts.

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Complete Round 1 Ratings

- Complete independently.
- Once completed, your table leader and/or facilitator will collect and check in all of your materials.
- See you back tomorrow morning at 7:30 for breakfast.
- Meeting starts at 8:00.

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Process Overview for Today

- Round 1 Feedback
- Round 2 Standard Setting
- Round 2 Feedback
- Round 3 Standard Setting
- PLD's for Test 2
- Take and discuss Test 2
- Round 1 Standard Setting for Test 2

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Feedback Data Provided

- Panelist Agreement Data (After Rounds 1-3)
  - How do your cut-points compare to those of other panelists?
    - Median, low, and high pages for entire standard setting panel and for your individual table group
    - Graph indicating page numbers for each panelist at each performance level
- Student Performance Data (After Rounds 1-3)
  - Provides the percentage of students that obtained the correct answer
- Impact Data (After Rounds 2-3)
  - If the cut points represented by the page numbers were implemented, what is the percentage of students who would be classified in each performance level?

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Round 1 Panelist Agreement Data

- At your table:
  - Examine data showing min, max, and median for your table.
  - Mark min and max of the table in the book. Keep your neighborhood stickies in place.
  - Table Leader leads discussion of why placements were made.
  - Discuss in order lowest to highest.

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Student Data

- These were data collected in the Spring 2010 operational test.
- All students are included (who received a valid score).
- Students that did not attempt the test are not included in the data.

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Student Achievement Data

- Item difficulty="*p*-values" (% correct)
- Data tells how students *DID* perform.
- Data CANNOT tell how students SHOULD perform *nor* how students at the borderline of "Approaches", "Meets", or "Exceeds the Standard" perform.

33

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Why Round 2?

- You are now an improved advisor.
- Consider judgments & views of your peers.
- Consider student achievement data.
- Goal: NOT consensus, but *reflection*

YOU ARE NOW A *BETTER* ADVISOR,
because you are a better-informed advisor.

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Round 2 - What to Do?

1. Reflect on earlier ratings – yours & peers.
2. Reflect on the table discussion.
3. Think about the panelist agreement and student achievement data.
4. Consider changing the zones around your earlier cuts.
5. Reconsider each page in the zone.
6. Decide if you want to move your page numbers.
7. Choose the point that best defines the *borderline* of each category.

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Reminder

- Remember to mark the pages that separate the items that borderline students should answer correctly from those items they may not answer correctly.

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Round 2-What to Do?

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark off "zones" first; then "revisit the neighborhoods" to set the cuts.

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Readiness Survey

- Consider the task we ask of you.
- Answer the questions on the Readiness Survey for Round 2.
- Table leaders give the thumbs up when everyone at table is ready to go.

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Round 2 Panelist Agreement Data

- At your table:
  - Examine data showing min, max, and median for your table
  - Mark min and max of the table in the book. Keep your neighborhood stickies in place.
  - Table Leader leads discussion of why placements were made.
  - Discuss in order from lowest to highest

39

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Student Achievement Data

- Impact data:
  - The impact data show the percentage of students in each of the performance levels based on the current cut score recommendations.
  - The impact data are based on the Spring 2010 test administration - Same sample as the p-values.

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Group Discussion of Round 2 Ratings

- WHY????
- Hearing from your peers helps you to:
  - Become more **comfortable** with your judgments and recommendations.
  - **Reconsider** your earlier judgments and recommendations.

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"How do I know if I'm right?"

- There is no "*right.*"
- Did you keep in mind:
  - "*Should*"?
  - The *borderline students*?
    - Specifically, 67% of borderline students
  - *All* Arizona students taking the AIMS Mathematics Assessment?
  - Our discussions?

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PEARSON

Round 3 - What to Do ?

1. Reflect on earlier ratings – yours & peers.
2. Reflect on the table discussion.
3. Think about the panelist agreement and student achievement data.
4. Consider changing the zones around your earlier page placements.
5. Decide if you want to move your page number selections.
6. Choose the point that best defines the *borderline* of each category.

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Round 3 Steps

- Start with "Meets the Standard."
- Read each page.
- Identify skills needed for a correct response.
- Review performance level labels and descriptors.
- Decide: Do borderline students who minimally are at "Meets the Standard" have ***a 67% chance or better*** of answering this question correctly?
- Mark the page number on your recording form.
- Move to the "Exceeds the Standard" borderline.
- Go back to the "Approaches the Standard" borderline.
- Mark off "zones" first; then "revisit the neighborhoods" to set the cuts.

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Readiness Survey

- Consider the task we ask of you.
- Answer the readiness questions for Round 3.
- Table leaders give thumbs up.

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Vertical Articulation

- Present the results of each panel
- Group discussion of Round 3 results for grades 3,5,6, and 8
- Review PLD's for all grades
- Make suggestions for revisions of cut scores: Round 4
- Present results based on Round 4 revisions
- Make suggestions for revisions of cut scores: Round 5
- Present final results
- Final debrief of process

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Refinement of Mathematics PLD's

- Background
  - Created in February, 2009 by Arizona educators
  - The narratives at the top are used on student score reports.
  - The bullets highlight certain Performance Objectives (POs) from the Mathematics Standards.
    - Not all POs are represented
    - Some POs are combined into single bullets

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Refinement of Mathematics PLD's

- Refinement Procedure
  - Begin with the bullets, and determine if any bullets should move from one performance level to another.
    - It may be necessary to break apart the bullet.
    - New bullets may be added if necessary.
  - Adjust the narratives at the top as necessary.
  - Discussion will be at the table group.
  - Table leaders will share tables' recommendations with a combined grade level panel.

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THANK-YOU!

- You are the ambassadors of AIMS!

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Complete Evaluation Form and Close Meeting

- Complete Evaluation Form.
- Table Leader will help to coordinate the order of materials for easy check-in.
- Facilitator will pick up and check in materials.
- THANK-YOU!

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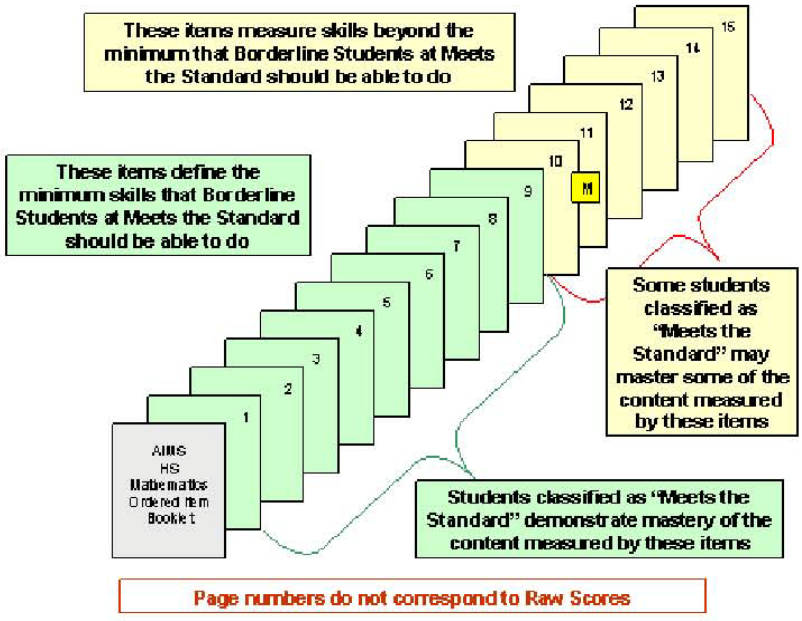
Appendix I: Standard Setting Steps

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
ITEM MAPPING STEPS
HIGH SCHOOL MATHEMATICS

Please follow the following steps when working through the ordered item booklet (OIB).

1. Read item.
2. Identify skills needed for correct response.
3. Evaluate why each item is more difficult than preceding one.
4. Review performance level definitions and borderline student descriptors.
5. Ask yourself: "Should most (67%) borderline students at Meets the Standard be able to answer this item correctly?"
6. Mark the "zone" or "neighborhood" – the first "no" followed by a "yes" and the first "no" followed by only "no's."
7. Identify the last page at which a student just at the performance level should have at least a 67% probability of answering last item correctly (the last "yes" item).
8. Place your bookmark on the page AFTER the last item you expect the borderline students should be able to master.
9. Record the page number with your bookmark on the Item Position Recording Sheet.
10. Repeat for the next performance level.



Appendix J: Standard Setting Item Maps

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
ITEM MAP
GRADE 3 MATHEMATICS

OIB Page Number	AZID Number	Test Item Number	Location	Key	Strand/ Concept/ PO	What does this item ask the student to know?	Why is this item more difficult that the last item(s)?
1	2109766	73	-1.3733		4.2.2		
2	2109734	15	-0.9064		1.1.5		
3	3015432	61	-0.8850		3.1.2		
4	2109763	67	-0.8650		4.1.4		
5	3148289	68	-0.6858		1.1.3		
6	3148311	59	-0.6422		1.1.1		
7	2109755	53	-0.4531		3.3.3		
8	41093031	81	-0.4119		1.2.3		
9	41093119	64	-0.3726		4.4.4		
10	3148338	35	-0.3343		1.1.5		
11	2109731	13	-0.3069		1.1.1		
12	41093157	44	-0.2079		2.1.1		
13	41093019	32	-0.1567		1.2.1		

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Appendix K: Standard Setting Panelist Readiness Forms

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
ROUND READINESS FORM
HIGH SCHOOL MATHEMATICS

Panelist ID: _____

Instructions: Please circle your response to the following questions.

Round 1		
I understand my task for Round 1.	**No**	**Yes**
I am ready to begin Round 1.	**No**	**Yes**

Round 2		
I understand my task for Round 2.	**No**	**Yes**
I understand the data that was presented from Round 1.	**No**	**Yes**
I am ready to begin Round 2.	**No**	**Yes**

Round 3		
I understand my task for Round 3.	**No**	**Yes**
I understand the data that was presented from Round 2.	**No**	**Yes**
I am ready to begin Round 3.	**No**	**Yes**

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Appendix L: Standard Setting Page Number Recording Sheet

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
ITEM POSITION RECORDING SHEET
HIGH SCHOOL MATHEMATICS

Table Number _____

Panelist ID _____

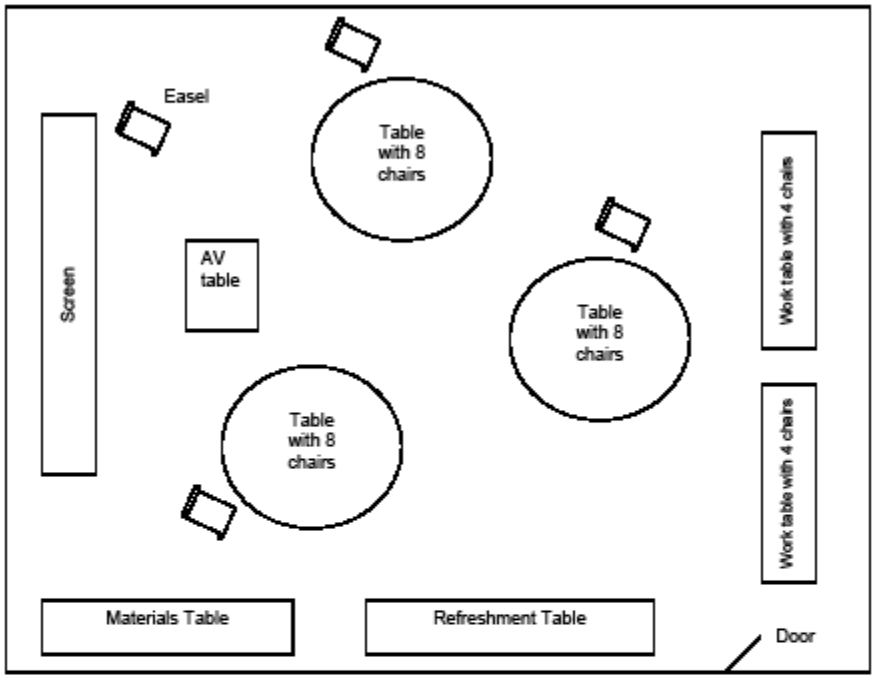
Please enter the page number that corresponds to cut score for Approaches the Standard, Meets the Standard, and Exceeds the Standard. Please make sure that you enter your cut scores in the appropriate column for each round.

	Round 1	Round 2	Round 3
Approaches			
Meets			
Exceeds			

Appendix M: Standard Setting Room Layout

Room Layout for Standard Setting

If using side-by-side meeting rooms with a breakdown wall, the breakdown wall is here (and the other room would be next to here. (or in the case of this diagram above these words)



Check-In Table with 6 chairs (outside of meeting room)

Appendix N: Table of Contents for Facilitator Binder

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
MATHEMATICS STANDARD SETTING FOR GRADES 3-8

TABLE OF CONTENTS

1. Agenda
2. Standard Setting Script
3. Table Leader Training
4. Table Leading Information Sheet
5. Opening Comments (PowerPoint)
6. Standard Setting Methodology Training (PowerPoint)
7. Standard Setting Process (PowerPoint)
8. Item Mapping Steps Handout
9. Blueprint
10. Performance Level Descriptors
11. Answer Keys in Test Booklet Order
12. Round Readiness Form
13. Item Position Recording Sheet
14. Answer Keys in Ordered Item Booklet Order
15. Evaluation Form
16. Room Layout
17. Materials Sheet
18. Supply Sheet
19. Standard Setting Process Checklist
20. Sign-In Sheet
21. Secure Materials Sign-Out Sheets
22. PLD Refinement Procedure
23. Practice Item Maps
24. Item Maps
25. P-Values
26. Arizona Mathematics Standard Articulated by Grade Level
27. Practice Ordered Item Booklets
28. Ordered Item Booklets

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Appendix O: Standard Setting Results

Appendix O.1: Round by Round Standard Setting Results

Mathematics: Grade 3 Overall

	Approaches	Meets	Exceeds
Round 1 Median	10	37	57
Round 2 Median	10	31	53
Round 3 Median	10	32	59

	Approaches	Meets	Exceeds
Round 1 Theta	-0.29	0.90	1.87
Round 2 Theta	-0.29	0.67	1.54
Round 3 Theta	-0.29	0.74	2.13

	Far Below	Approaches	Meets	Exceeds
Round 1 Impact	11%	30%	31%	29%
Round 2 Impact	11%	22%	28%	39%
Round 3 Impact	11%	25%	43%	22%

Mathematics: Grade 5 Overall

	Approaches	Meets	Exceeds
Round 1 Median	13	39	57
Round 2 Median	11	34	54
Round 3 Median	8	31	63

	Approaches	Meets	Exceeds
Round 1 Theta	0.09	0.81	1.51
Round 2 Theta	0.03	0.73	1.41
Round 3 Theta	-0.25	0.66	2.10

	Far Below	Approaches	Meets	Exceeds
Round 1 Impact	24%	21%	22%	32%
Round 2 Impact	23%	21%	22%	35%
Round 3 Impact	16%	25%	41%	18%

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Mathematics: Grade 6 Overall

	Approaches	Meets	Exceeds
Round 1 Median	17	39	57
Round 2 Median	16	37	57
Round 3 Median	14	33	59

	Approaches	Meets	Exceeds
Round 1 Theta	0.28	0.86	1.65
Round 2 Theta	0.28	0.86	1.65
Round 3 Theta	0.14	0.63	1.65

	Far Below	Approaches	Meets	Exceeds
Round 1 Impact	32%	18%	24%	26%
Round 2 Impact	32%	18%	24%	26%
Round 3 Impact	28%	15%	31%	26%

Mathematics: Grade 8 Overall

	Approaches	Meets	Exceeds
Round 1 Median	14	31	56
Round 2 Median	13	31	57
Round 3 Median	10	29	57

	Approaches	Meets	Exceeds
Round 1 Theta	0.13	0.54	1.62
Round 2 Theta	0.06	0.54	1.62
Round 3 Theta	0.06	0.47	1.62

	Far Below	Approaches	Meets	Exceeds
Round 1 Impact	31%	15%	34%	20%
Round 2 Impact	29%	17%	34%	20%
Round 3 Impact	29%	14%	37%	20%

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Mathematics: High School Overall

	Approaches	Meets	Exceeds
Round 1 Median	34	48	77
Round 2 Median	36	44	78
Round 3 Median	34	41	78
Round 4 Median	21	36	78

	Approaches	Meets	Exceeds
Round 1 Theta	0.45	0.86	1.72
Round 2 Theta	0.51	0.80	1.72
Round 3 Theta	0.45	0.74	1.72
Round 4 Theta	0.13	0.51	1.72

	Far Below	Approaches	Meets	Exceeds
Round 1 Impact	40%	13%	24%	23%
Round 2 Impact	42%	9%	26%	23%
Round 3 Impact	40%	9%	28%	23%
Round 4 Impact	30%	12%	35%	23%

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Round by Round Page Number Summaries

Grade 3				
		Approaches	Meets	Exceeds
Round 1				
	Median	10	37	57
	Maximum	20	51	66
	Minimum	2	18	46
Round 2				
	Median	10	31	53
	Maximum	12	47	60
	Minimum	7	20	49
Round 3				
	Median	10	32	59
	Maximum	12	34	60
	Minimum	7	21	54

Grade 5				
		Approaches	Meets	Exceeds
Round 1				
	Median	13	39	57
	Maximum	21	54	63
	Minimum	7	18	51
Round 2				
	Median	11	34	54
	Maximum	14	37	56
	Minimum	7	24	51
Round 3				
	Median	8	31	63
	Maximum	8	31	63
	Minimum	7	23	54

Grade 6				
		Approaches	Meets	Exceeds
Round 1				
	Median	17	39	57
	Maximum	30	54	65
	Minimum	6	14	51
Round 2				
	Median	16	37	57
	Maximum	19	47	61
	Minimum	10	22	53
Round 3				
	Median	14	33	59
	Maximum	16	43	61
	Minimum	11	27	57

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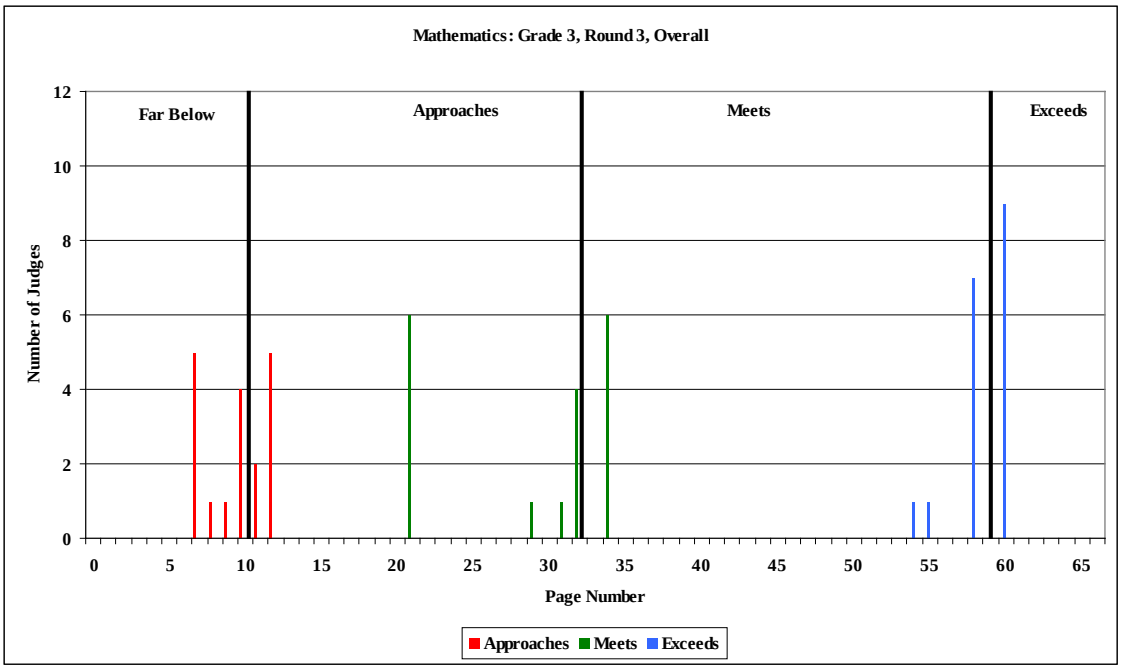
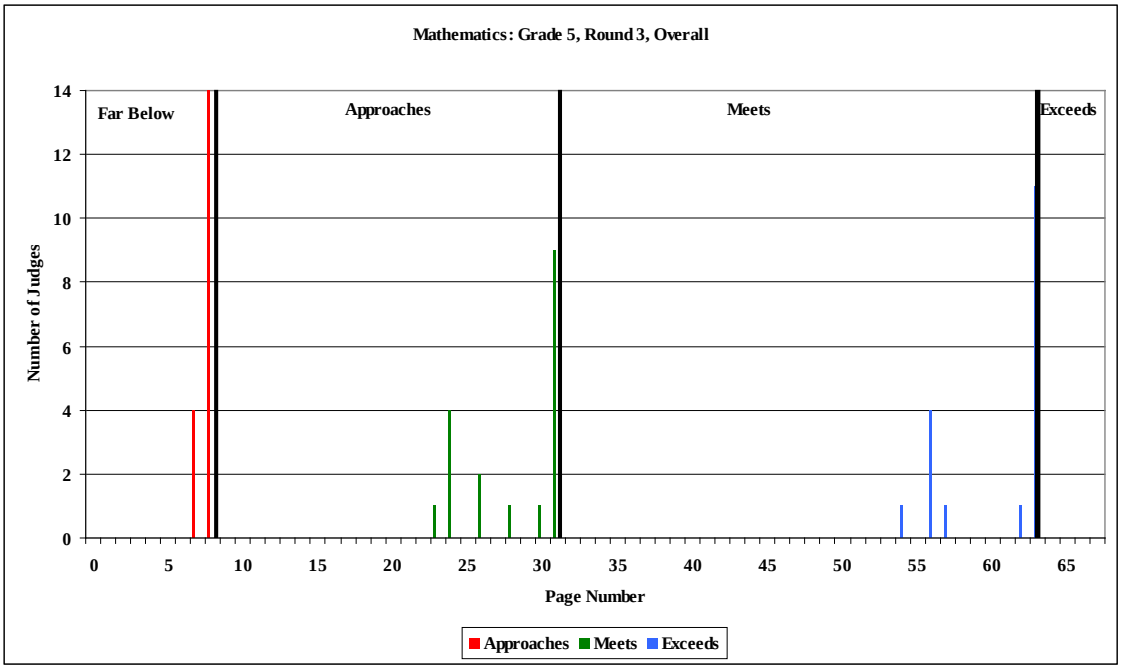
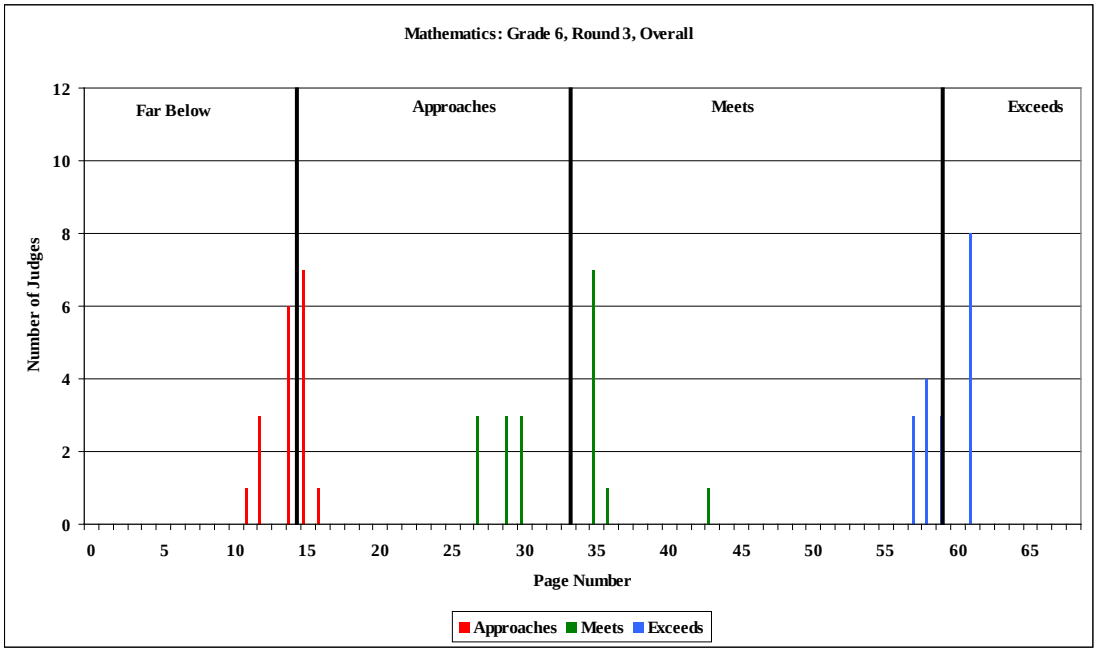
Grade 8				
		Approaches	Meets	Exceeds
Round 1				
	Median	14	31	56
	Maximum	21	52	61
	Minimum	5	22	52
Round 2				
	Median	13	31	57
	Maximum	20	37	58
	Minimum	10	24	54
Round 3				
	Median	10	29	57
	Maximum	15	35	58
	Minimum	10	25	54

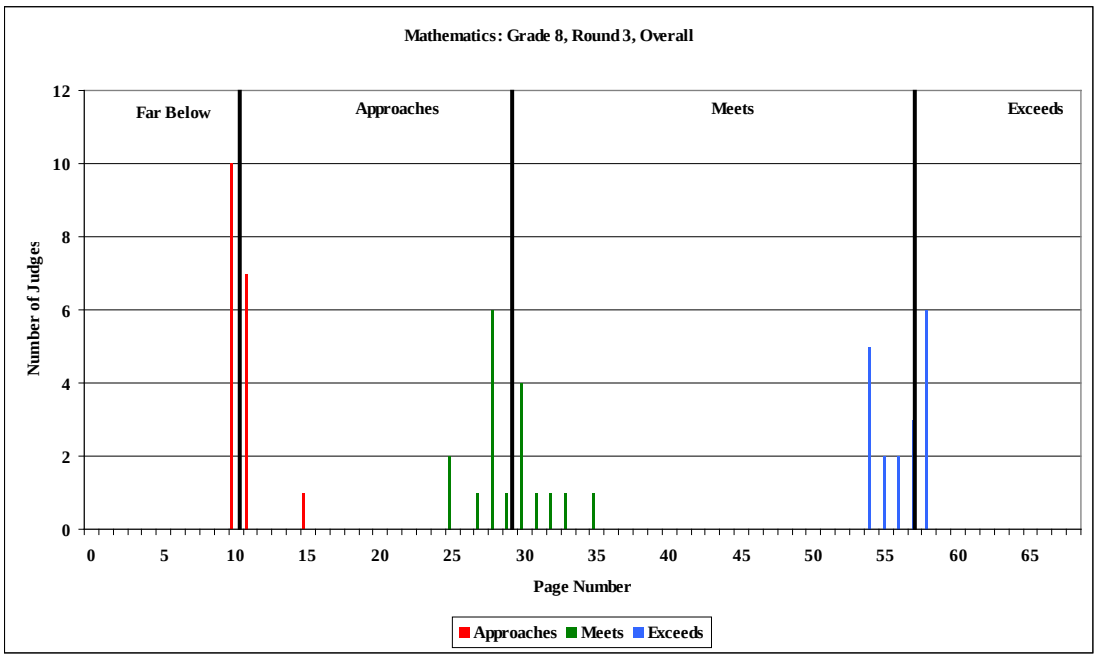
High School				
		Approaches	Meets	Exceeds
Round 1				
	Median	34	48	77
	Maximum	53	74	81
	Minimum	8	28	49
Round 2				
	Median	36	44	78
	Maximum	47	58	79
	Minimum	21	37	75
Round 3				
	Median	34	41	78
	Maximum	43	49	79
	Minimum	23	37	75
Round 4				
	Median	21	36	78
	Maximum	32	44	82
	Minimum	20	34	75

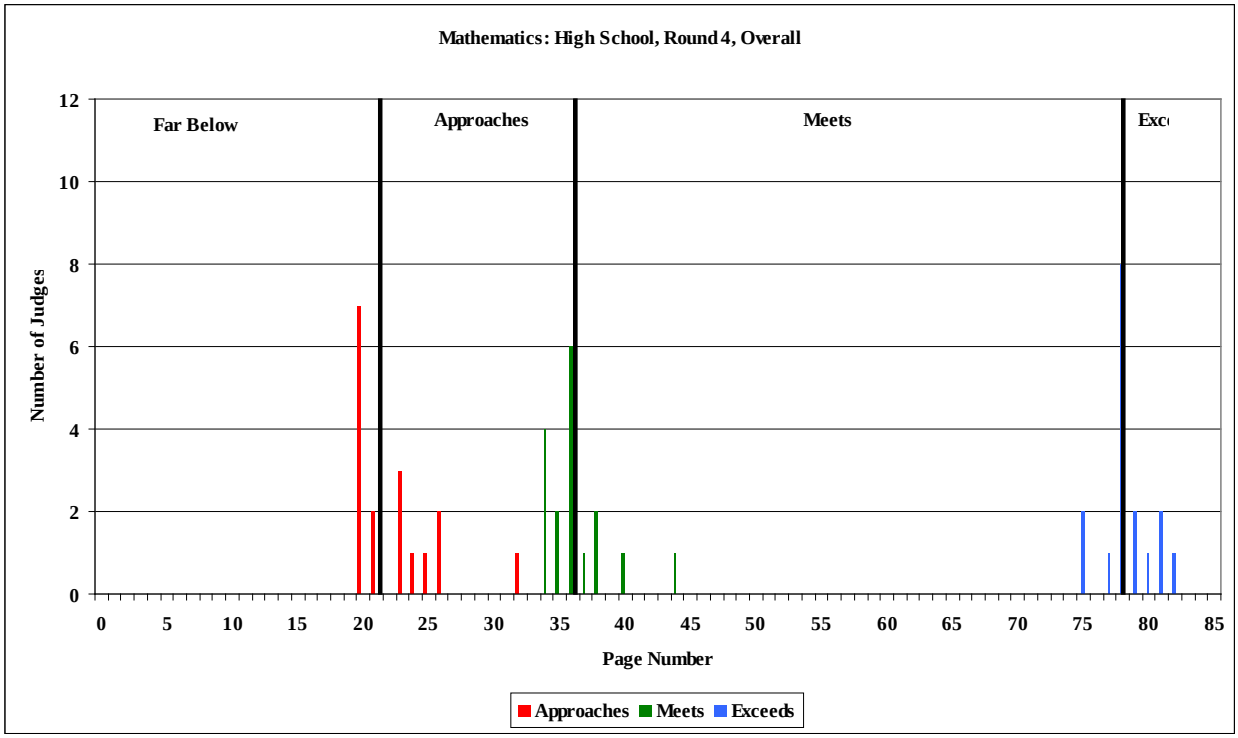
Appendix O.2: Final Round Page Number Summaries from Standard Setting





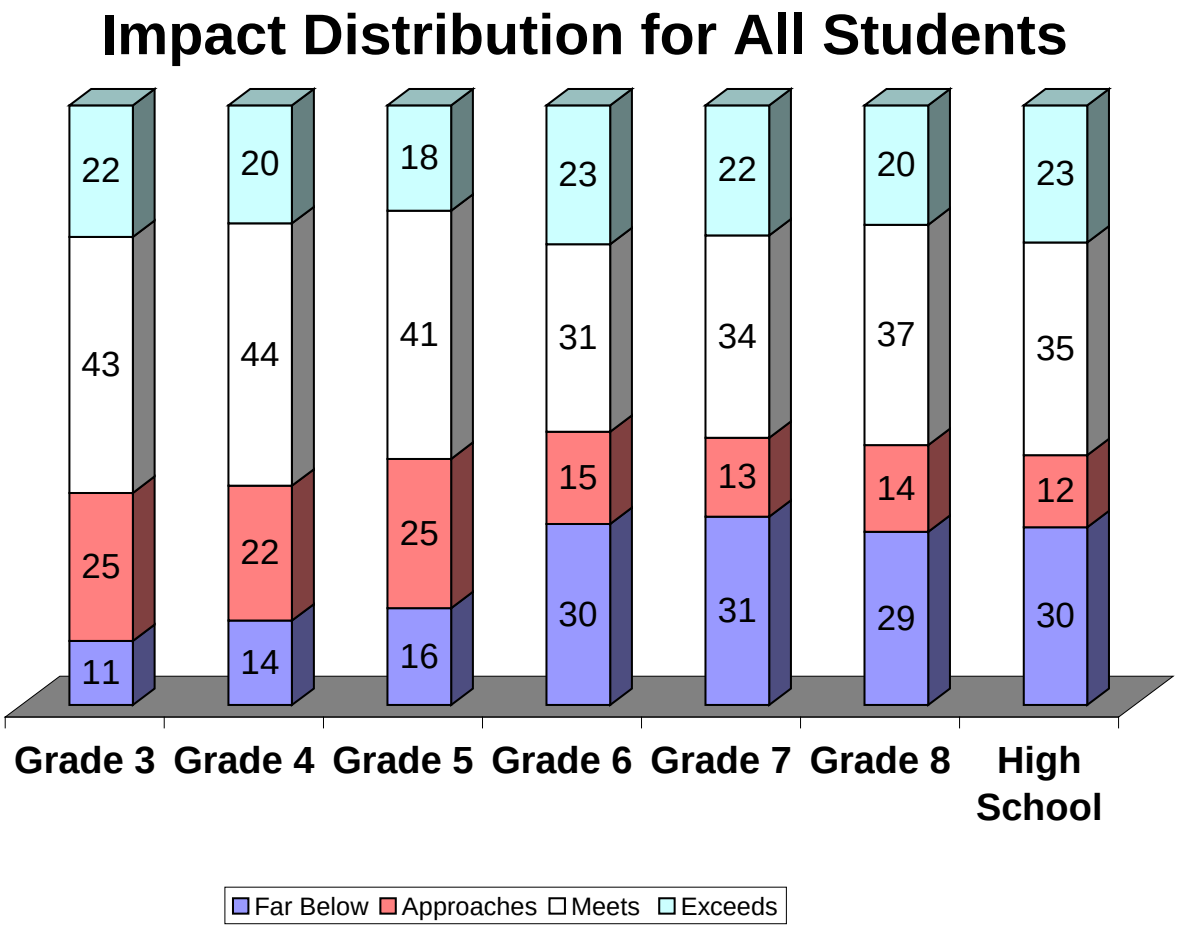

Mathematics: Grade 6, Round 3, Overall
Far Below
Approaches
Meets
Exceeds
Number of Judges
Page Number
Approaches
Meets
Exceeds


Mathematics: Grade 8, Round 3, Overall
Far Below
Approaches
Meets
Exceeds
Number of Judges
Page Number
Approaches
Meets
Exceeds

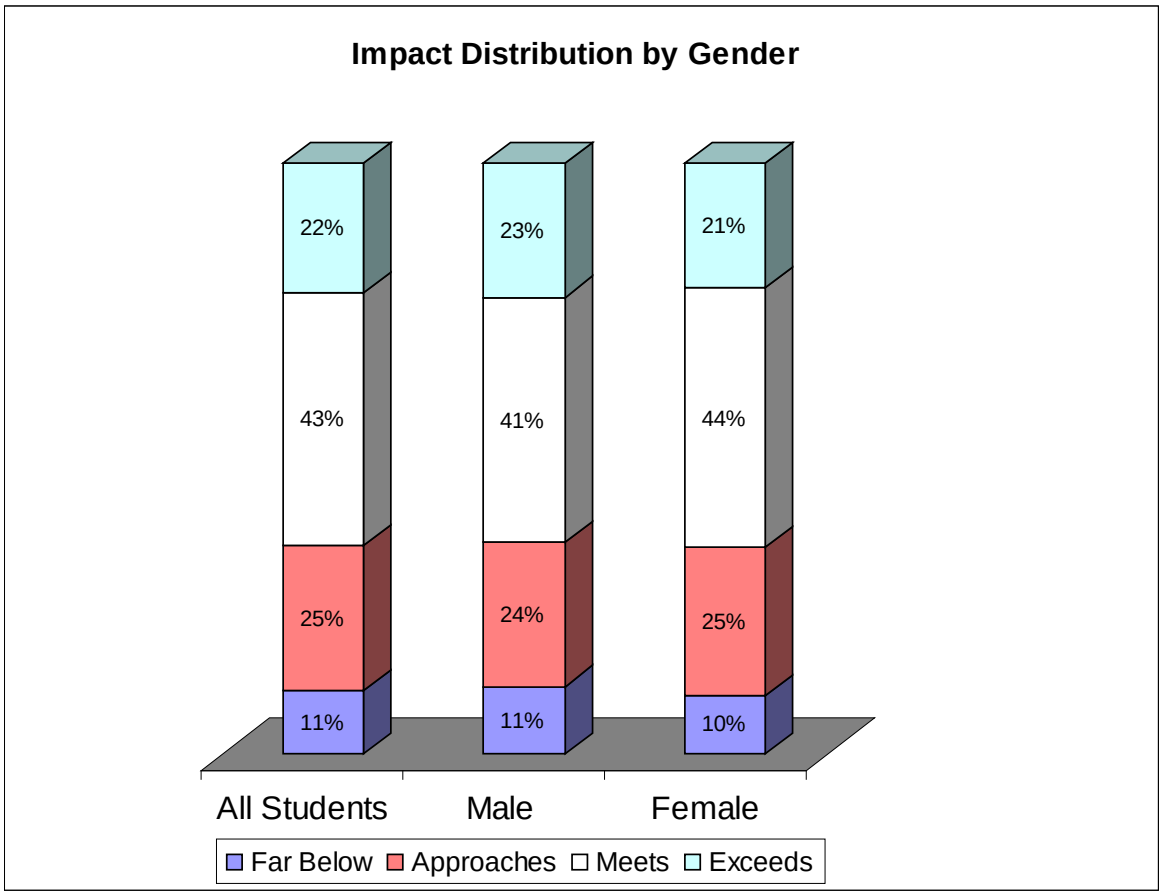

Mathematics: High School, Round 4, Overall
Far Below
Approaches
Meets
Exc
Number of Judges
0
2
4
6
8
10
12
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85
Page Number
Approaches
Meets
Exceeds

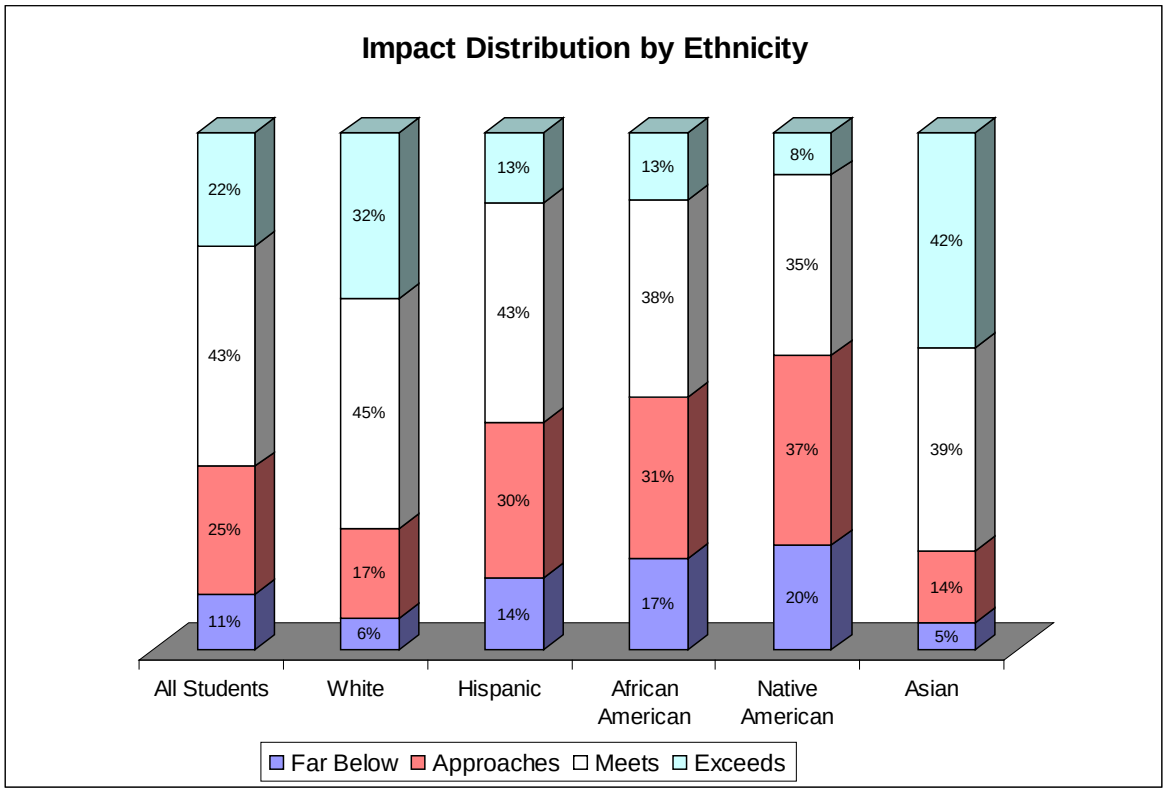
Appendix P: Proficiency Level Results after Final Round[13] of Standard Setting

Appendix P.1: Overall for All Grades

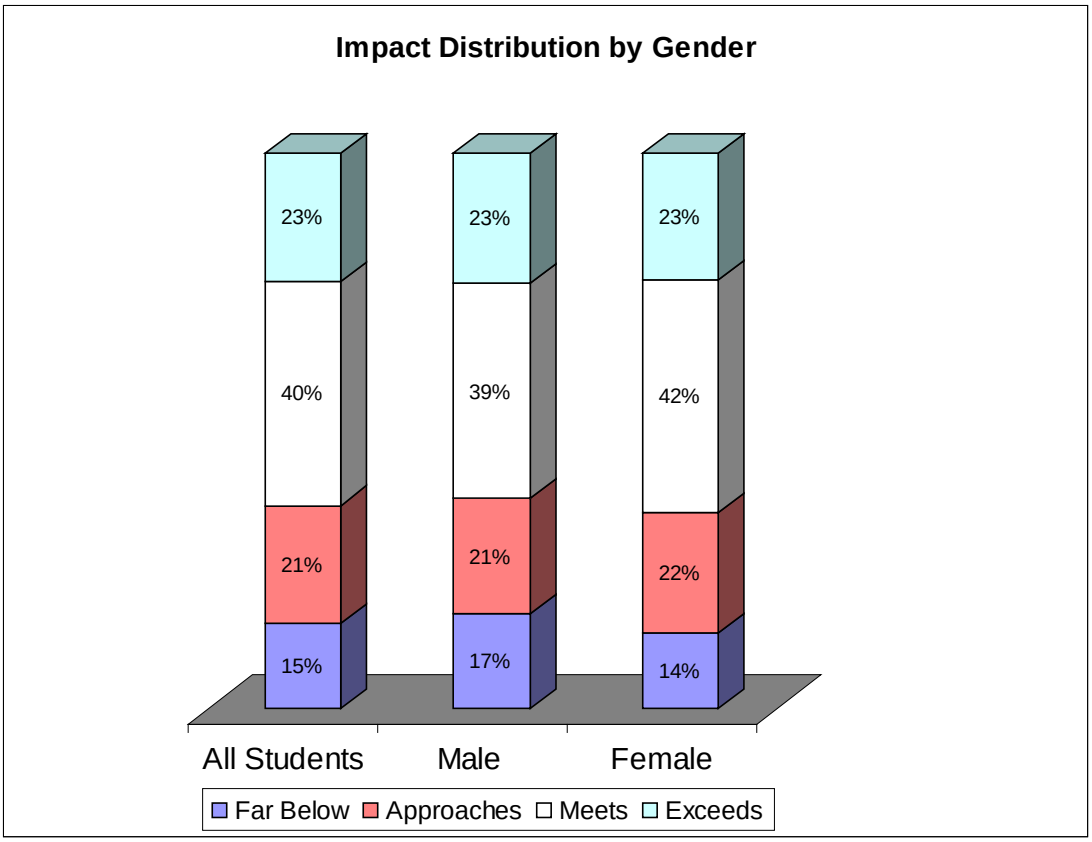


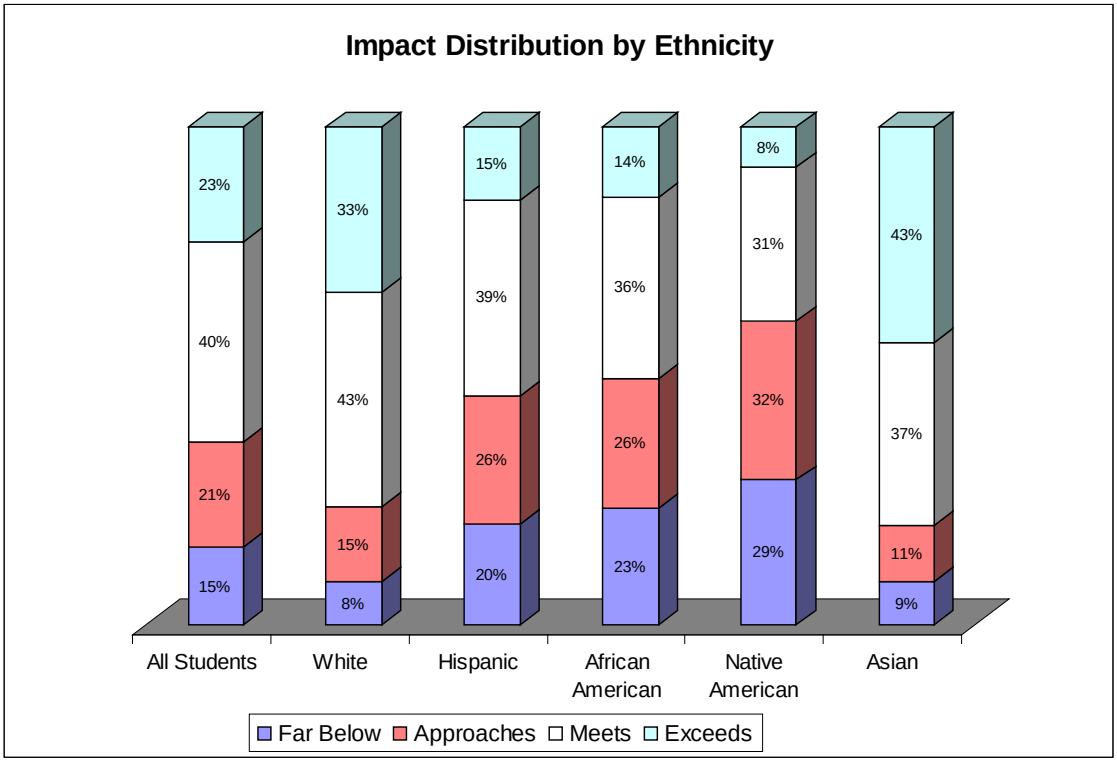
Appendix P.2: Grade 3 Impact Data after Round 3 of Standard Setting



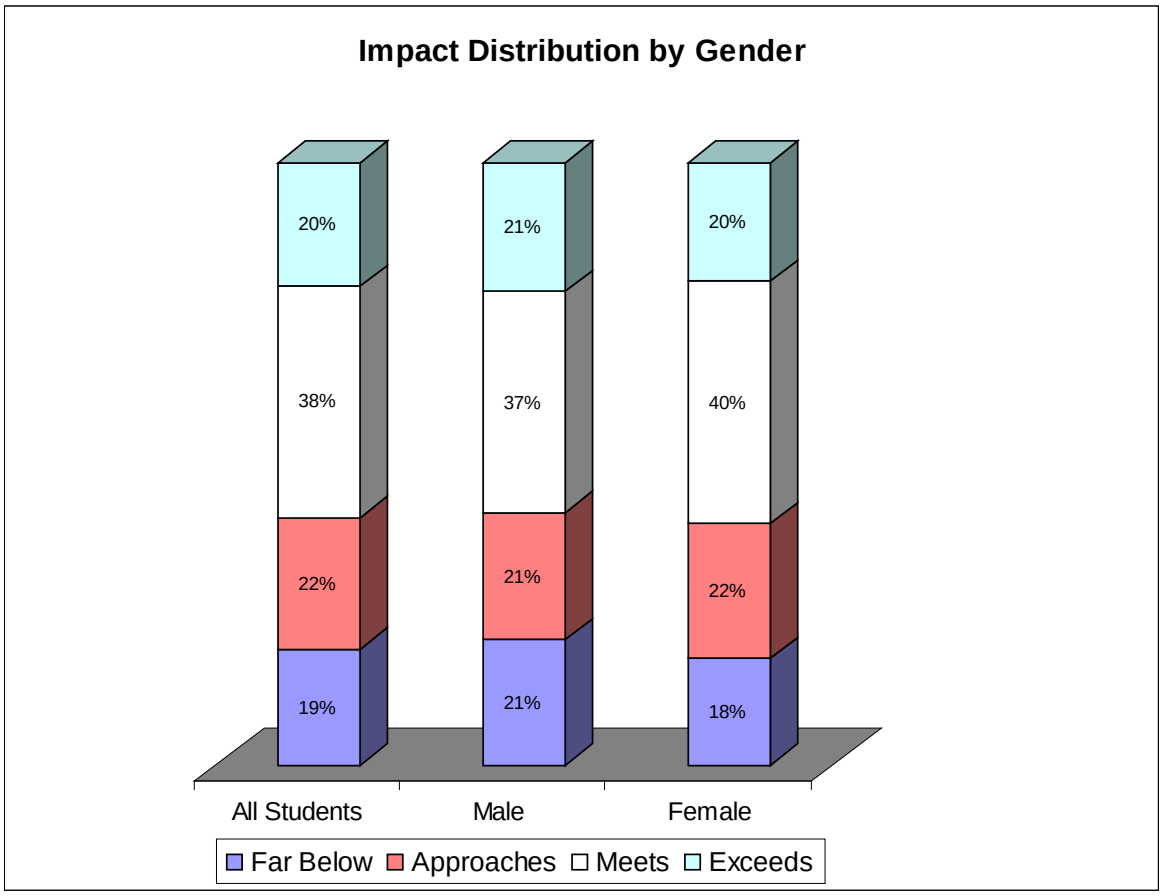


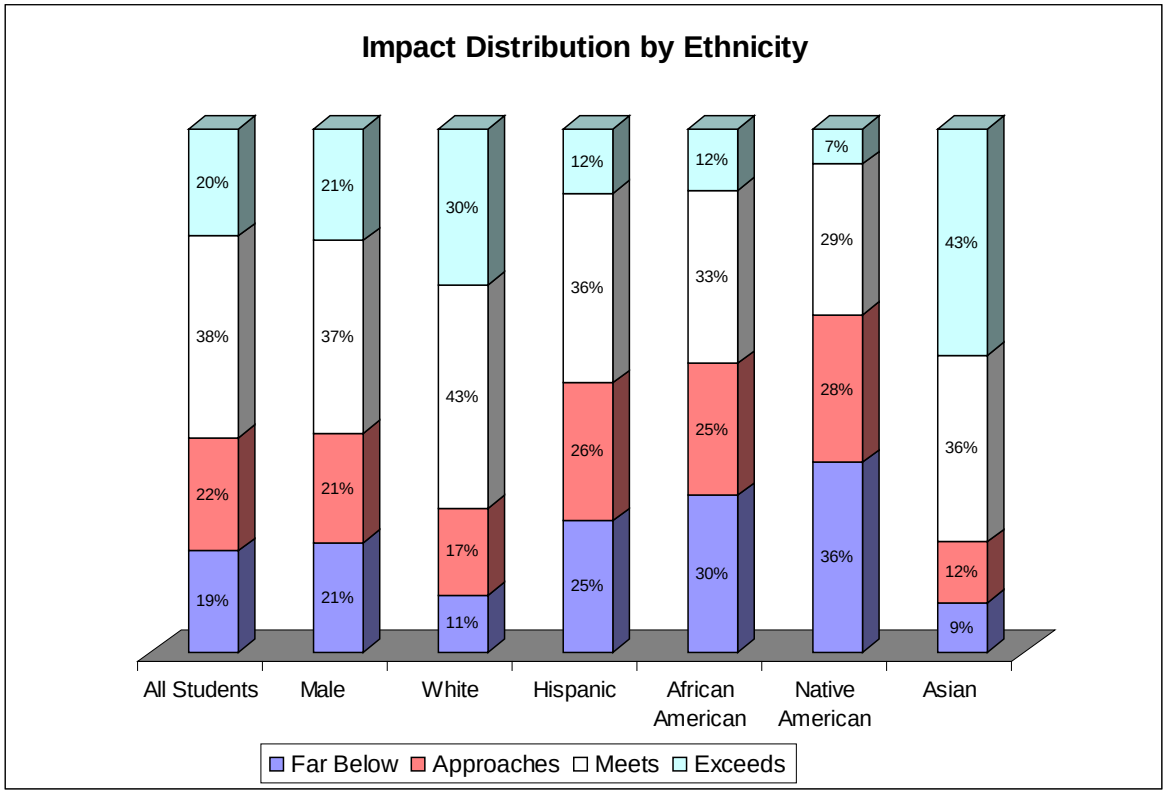
Appendix P.3: Grade 4 Impact Data after Interpolation



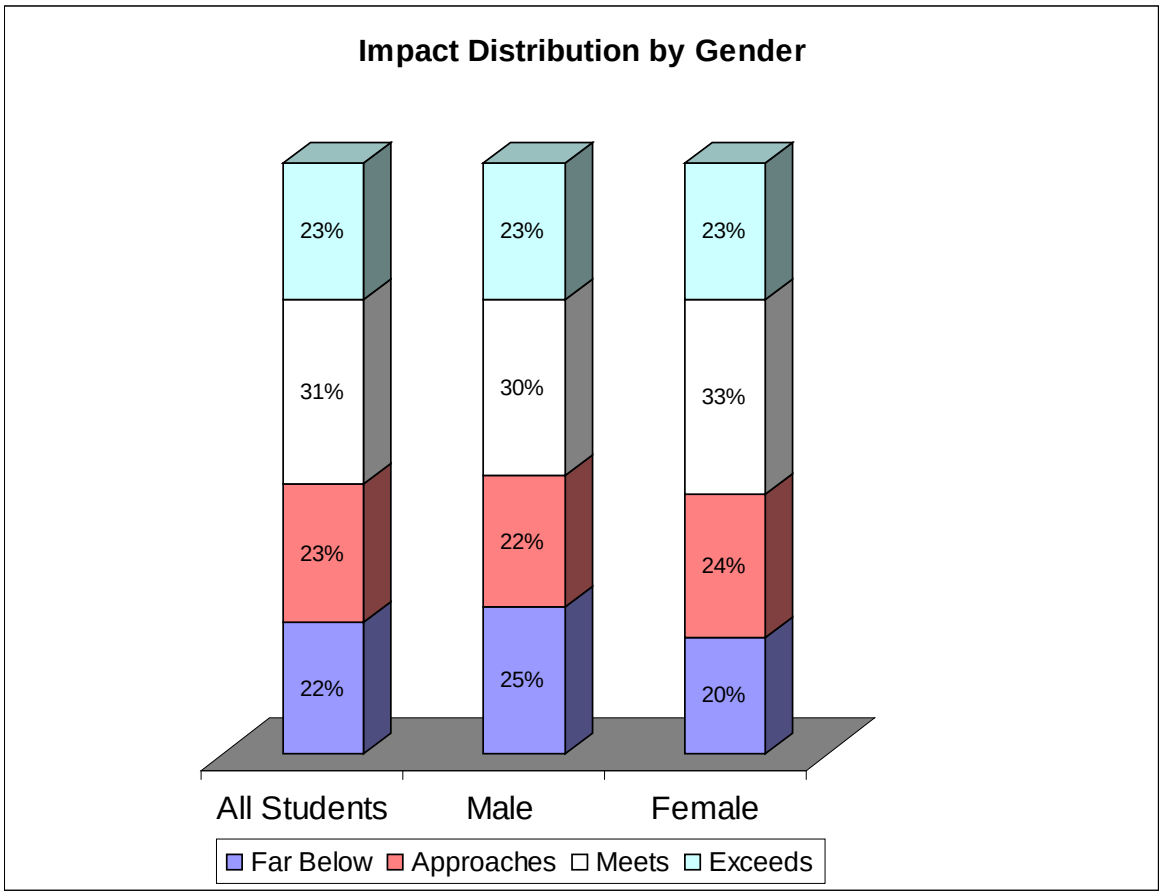


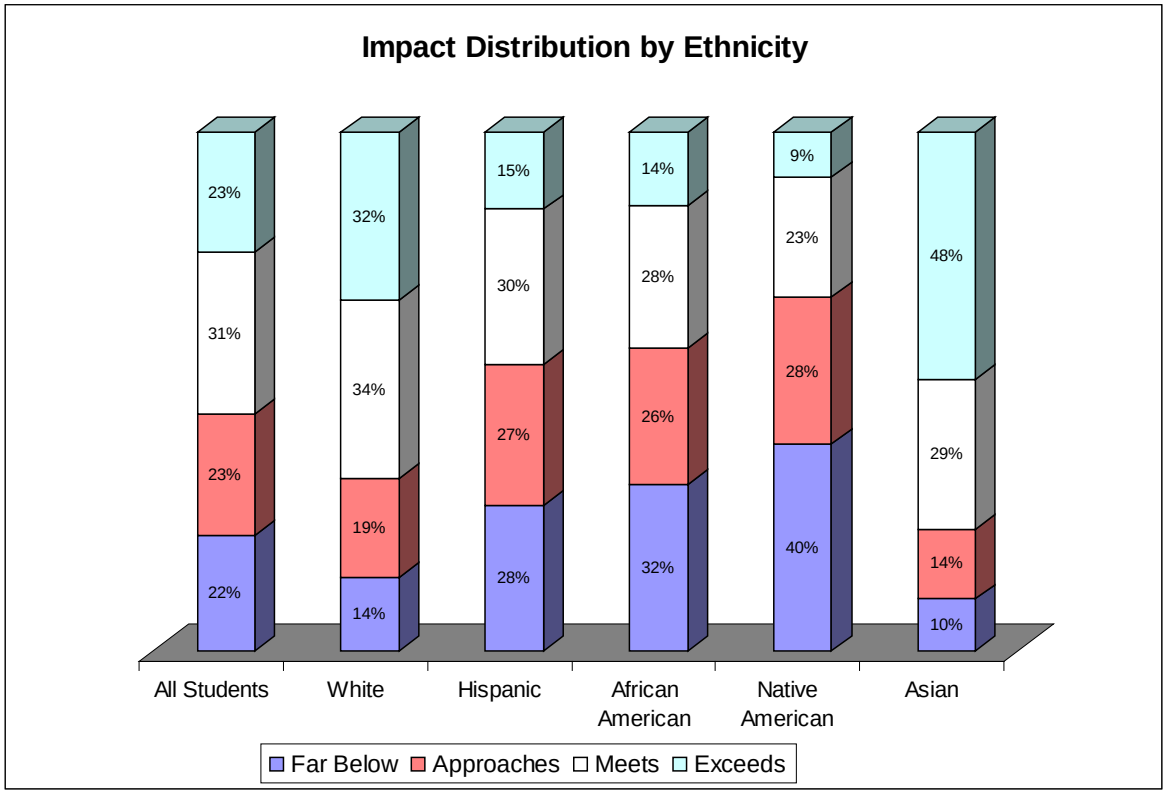
Appendix P.4: Grade 5 Impact Data after Round 3 of Standard Setting



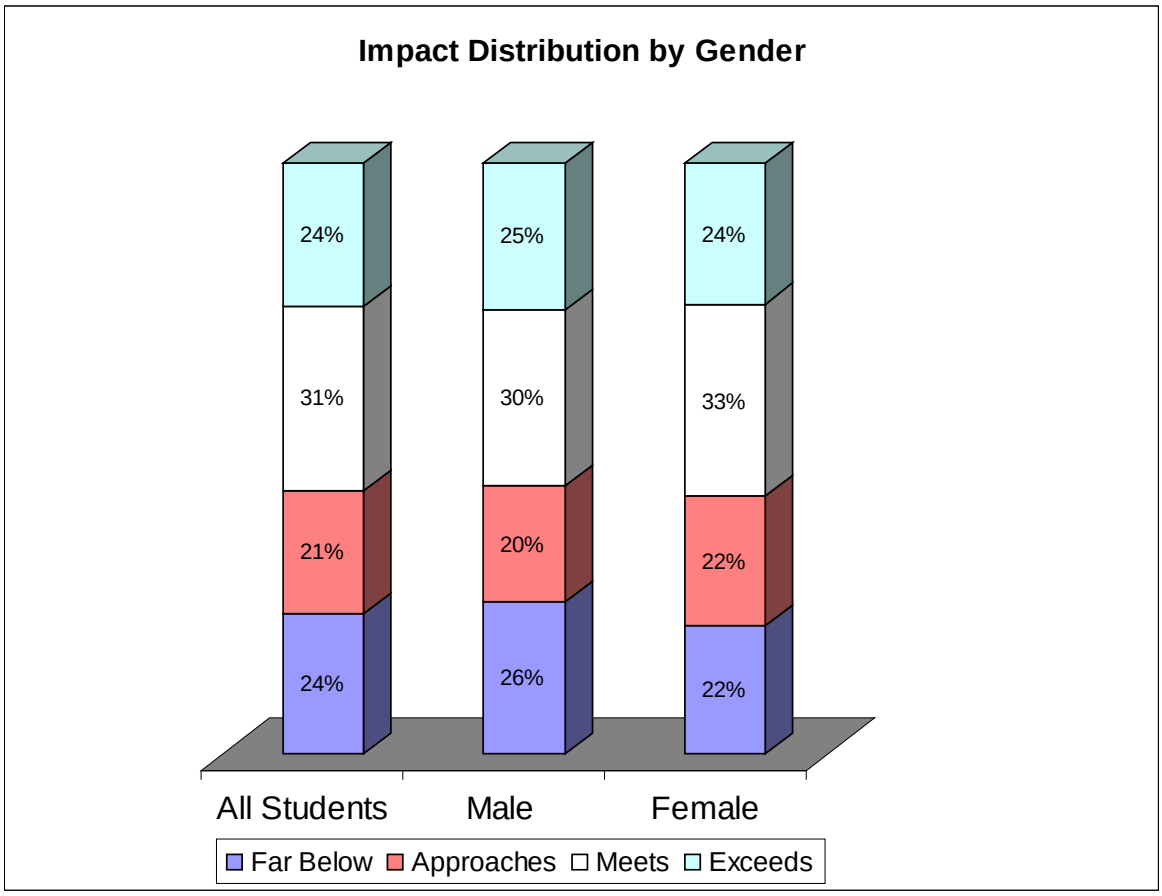


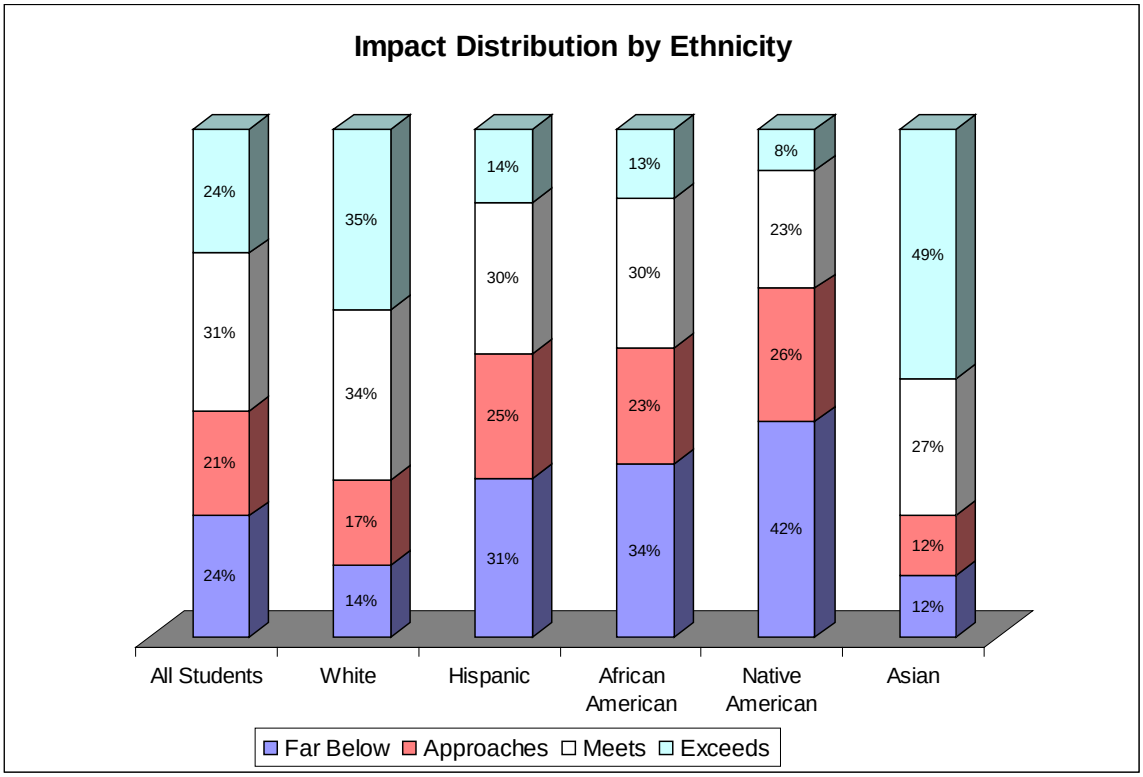
Appendix P.5: Grade 6 Impact Data after Round 3 of Standard Setting



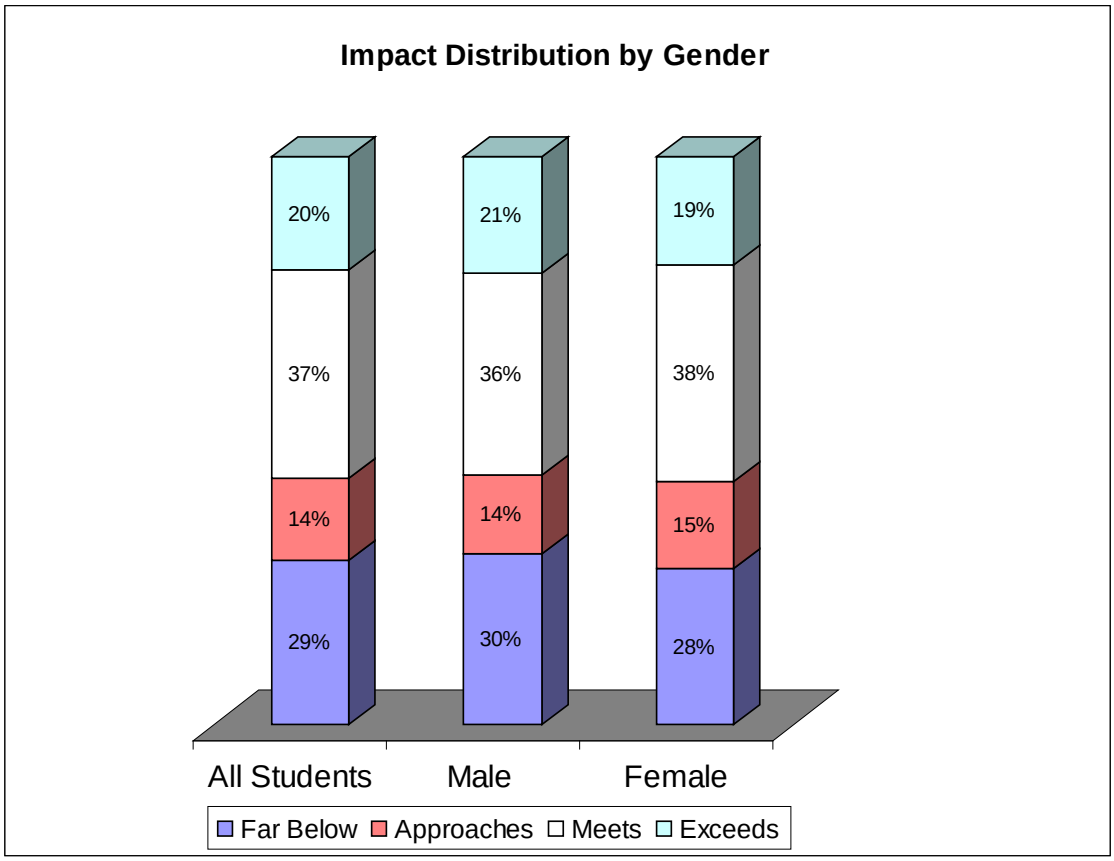


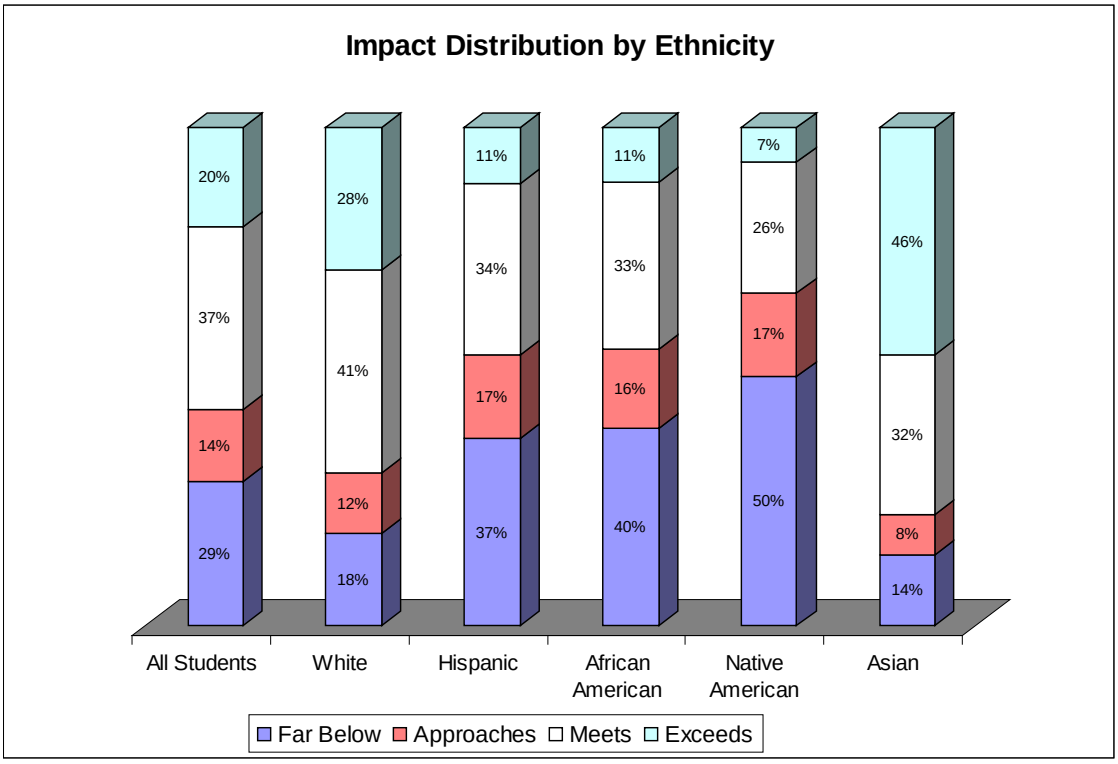
Appendix P.6: Grade 7 Impact Data after Interpolation



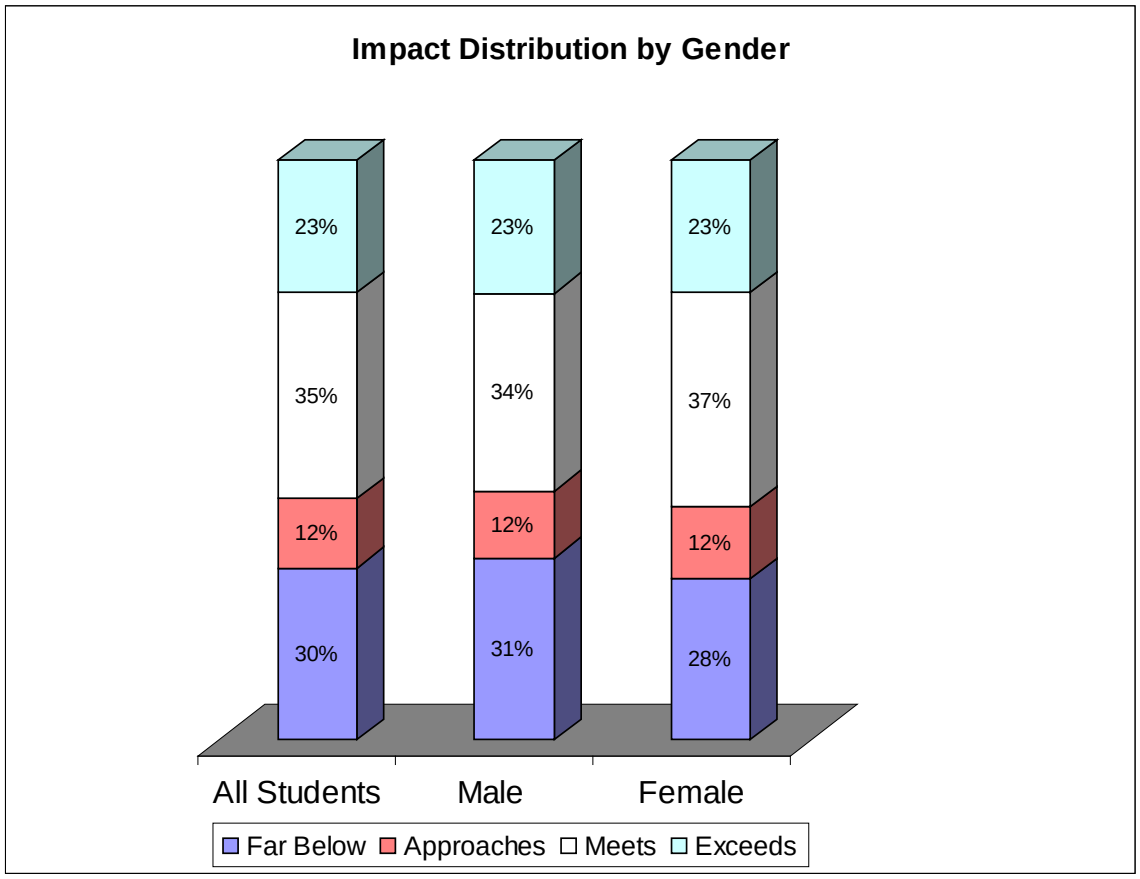


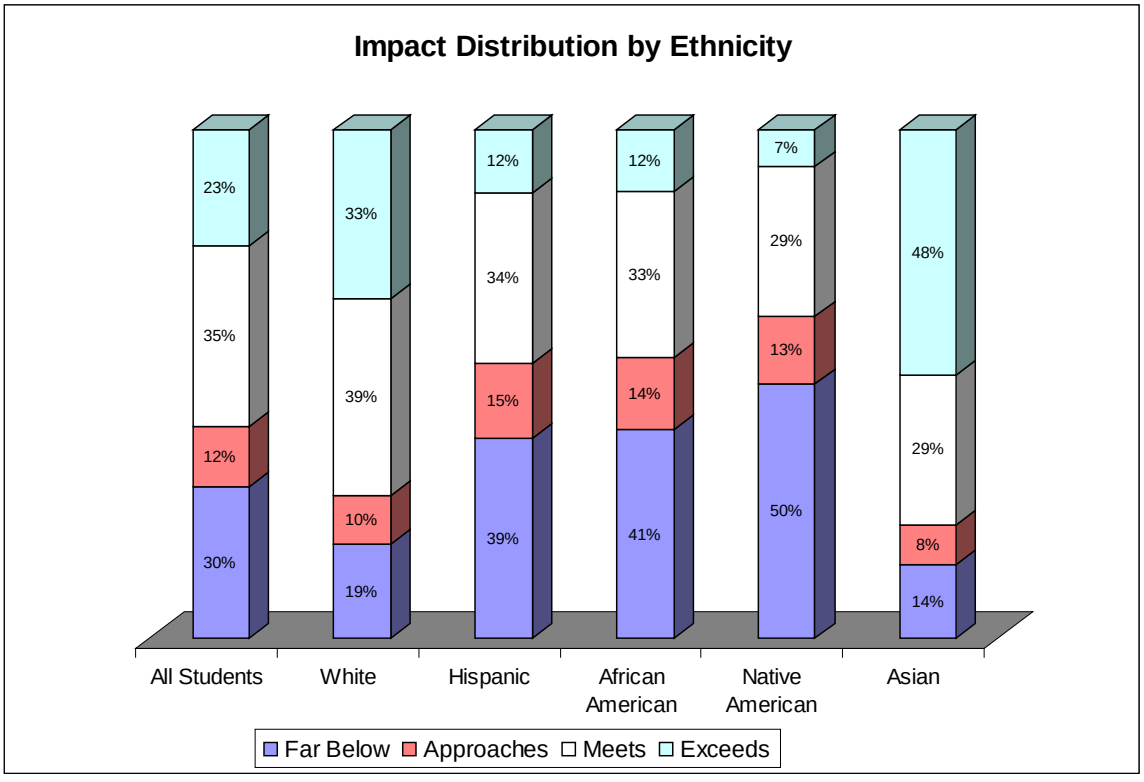
Appendix P.7: Grade 8 Impact Data after Round 3 of Standard Setting





Appendix P.8: High School Impact Data after Round 4 of Standard Setting





Appendix Q: Mathematics Test Blueprints

AIMS Mathematics Blueprints (beginning with the 2010 Assessments)

Strand/Concept	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	HS
1. Number and Operations	**42%**	**40%**	**37%**	**34%**	**25%**	**18%**	**6%**
1.1 Number Sense	17%	16%	16%	13%	7%	6%	6%
1.2 Numerical Operations	20%	18%	15%	15%	12%	6%	
1.3 Estimation	6%	6%	6%	6%	6%	6%	
2. Data Analysis/Prob/Discrete	**12%**	**12%**	**18%**	**18%**	**19%**	**18%**	**14%**
2.1 Data Analysis (Statistics)	6%	6%	6%	6%	6%	6%	5%
2.2 Probability	0%	5%	6%	6%	7%	6%	5%
2.3 Systematic Listing and Counting	6%		6%	6%	6%	5%	5%
2.4 Vertex-Edge Graphs							
3. Patterns/Algebra/Functions	**17%**	**18%**	**16%**	**16%**	**19%**	**26%**	**33%**
3.1 Patterns	6%	7%	6%	6%	6%	9%	5%
3.2 Functions and Relationships	11%	0%	0%				7%
3.3 Algebraic Representations		10%	10%	10%	13%	12%	16%
3.4 Analysis of Change	0%					6%	5%
4. Geometry and Measurement	**18%**	**19%**	**15%**	**19%**	**22%**	**24%**	**33%**
4.1 Geometric Properties	9%	7%	7%	6%	13%	6%	13%
4.2 Transformation of Shapes		0%	0%			6%	5%
4.3 Coordinate Geometry	0%	6%	0%	6%	0%	6%	8%
4.4 Measurement	9%	6%	7%	7%	9%	6%	7%
5. Structure and Logic	**11%**	**12%**	**13%**	**13%**	**15%**	**15%**	**14%**
5.1 Algorithms and Algorithmic Thinking	11%	12%	13%	13%	15%	15%	14%
5.2 Logic, Reasoning, Prob Solving, & Proof							

The **0%** indicates the lack of the Concept and Performance Objectives in the Mathematics Standard for the specified grade level. 11-21-2008

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Panelist Info.

Standard Setting Gr 3-8 Mathematics

June 1-4, 2010

First	Last	Occupation	Title Current Position	Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	District	Dist Ur/Sub/Rur	SI/M/L	Taught SpEd or ESL? Y/N
Steve	Bauer	Teacher	7th and 8th math/ H.S. Algebra	14	Intel Teach to the future teacher training. 9 yrs 4-7th grade teaching Washington & AZ.	Masters	Math, Science, Technology, ESL, Spanish Bilingual Educ	Bilingual, Mathematics	w	m	Townsend Middle School	Tucson Unified School District	u	L	N
Rebecca	Beauregard	Teacher	Math Teacher, Grade 6	7	Teaching Math improvement class. Has served as an advocate for struggling students	Masters	Secondary	Mathematics, School Counseling	w	f	Safford Engineering & Technology Magnet Middle School	Tucson Unified School District	u	L	N
Bridget	Betterton	Teacher	6th Grade	6	5th-6th combo class of ELL. Instructional Coordinator.	Masters	Elementary Education	SEI	w	f	Walter Douglas School	Flowing Wells Unified District	u	M	N
Ryen	Borden	Administrator	Instructional Specialist	10	District facilitator to develop new benchmark assessments and curriculum maps aligned to the new math standards.	Masters	Principal certificate; Standard Elementary Education, K-8	SEI K-12. Reading Specialist K-12	o	f	William R. Sullivan School	Murphy Elementary District	u	L	N
Janelle	Chisholm	Teacher	Math Teacher – Pre-alg, Alg, Geometry	19	District curriculum committees. Presenter at WESD & around state.	Masters	Elementary and Secondary	Middle School Math, Gifted, SEI	w	f	Palo Verde Middle School	Washington Elementary District	u	L	N
Becky	Cuperus	Teacher	3-4-5 ELL, Gifted/Spec. Ed. Included	25	Rodel Exemplary Teacher finalist. AZ Teacher of the Year finalist. Achieved AZ Master Teacher status. Mentor Teacher.	Masters	NBCT, Basic Elementary (K-8), Early Childhood	Math Specialist, Reading Specialist, ESL, Gifted	w	f	Smith Elementary School	Glendale Elementary District	u	L	N
Mary	Dorn	Administrator	Math Coach/Interventionist for Connolly Middle School.	12	Data analysis aimed at improving mathematics instruction.	Masters	Secondary - Mathematics, Social Studies, Geography, Physical Science	Gifted Endorsement, SEI Endorsement	w	f	Connolly Middle School	Tempe Elementary District	u	L	N
Eileen	Estes	Teacher	Fifth Grade Teacher	19	District Math committee.	Masters	Principal K-8; Elementary Education	ESL	w	f	Booker T. Washington Elementary School	Mesa Unified District	u	L	N

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Panelist Info.

Standard Setting Gr 3-8 Mathematics

June 1-4, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	*District*	Urb/Sub/Rur	Dist S/M/L	Taught SpEd or ESL? Y/N
Derek	***Etheridge***	Administrator	Mathematics Content Specialist	3	Teaching math 7th & 8th grades, and ELL classrooms. Experience curriculum mapping.	Masters	Secondary Education 7-12 - Mathematics	Full SEI endorsement	w	m	Cartwright School District	Cartwright School District	u	L	N
Shannon	***Ferguson***	Administrator	K-12 Mathematics Coordinator	15+	2nd thru 9th. Math resource teacher & middle school math. 5 yrs Math Spec. Member State Math Network.	Masters	Elementary; Middle School Math; Middle School Science, Administrative	ESL, Math Specialist	w	f	Peoria Unified School District	Peoria Unified School District	u	L	N
Michele	***Garlit***	Teacher	freshman Algebra Teacher, department chair	18	Middle school Math. NCTM Standards.	Masters	Secondary - Mathematics 7-12	Mathematics-Algebra	w	f	Yuma High School	Yuma Union High School District	r	M	N
Casey	***George***	Administrator	Principal	13	Taught math:13 yrs @ 7 & 8th grade and 3 at H.S. level. Created benchmark assessment for a school at Madison S.D.	Masters	Secondary 7-12, administrative	Mathematics endorsement	w	m	Madison Traditional Academy	Madison School District	s	L	N
Erin	***Gonzales***	Administrator	Elementary Math Curriculum Specialist	6	Taught 1 yr 4th & 5 yrs 3rd grade. Elem Math curriculum Specialist. Work on district's math committee.	Bachelor	Elementary	SEI Provisional, Music K-12	w	f	Peoria Unified District	Peoria Unified District	u	L	N
Wayne	***Gorry***	Teacher	5th Grade Math, Reading, Writing, Science, Social Studies	19	Career Ladder Facilitator. 2005 Payson Walmart Teacher of Year. Develped lessons for ELL students.	Masters	Elementary, Secondary	SEI	w	m	Julia Randall Elementary School	Payson Unified District	r	M	N
Roger	***Healy***	Administrator	7th & 8th/Algebra I, Algebra II, Science, Social St./Technology Coordinator	16		Bachelor	Elementary	Mathematics Specialist / SEI	w	m	Mesa Arts Academy	Mesa Arts Academy	u	S	N

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Standard Setting Gr 3-8 Mathematics

June 1-4, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	District	Urb/Sub/Rur	Dist S/M/L	Taught SpEd or ESL? Y/N
Linda	***Heck***	Teacher	5th grade all subjects	17	Mentor teacher. Served as Test Coord. Taught 4th 5 yrs. & 5th grade for 11 yrs. Rodel Exemplary Teacher 2010.	Masters	Elementary	ESL	w	f	Dysart Elementary School	Dysart Unified District	r	L	N
Kristen	***Henninger***	Teacher	6th Grade Math Teacher	18	Taught @ 3 different states & different state assessments. Title 1	Bachelor	Math, Reading & Language		w	f	Apache Elementary School	Peoria Unified School District	u	L	N
Kimberly	***Hertzog***	Administrator	Director of General Studies	4.5	Math consultant. Math Coach (K-8). Director Mathematics.	Masters	K-8 Elementary. Principal	ESL	w	f	Phoenix Elementary District	Phoenix Elementary District	u	L	N
Becky	***Howell***	Administrator	Math and Behavior Coach, K-6	7	4th grade 2 yrs; 1 yr @ 3rd grade. Gifted program. Special Educ @ Maryland. Math/Behavior Coach. Math Staff Development.	Bachelor	Elementary	SEI	w	f	Pima Elementary	Pima Unified School District	r	S	N
Lisa	***Hunt***	Administrator	Instructional Specialist	8	2nd grade 2 yrs; 3 yr @ 3rd grade. Instructional Specialist. District assessment creation, and formative assessments.	Bachelor	Elementary	SEI	w	f	Arthur M. Hamilton School	Murphy Elementary District	u	L	N
Linda	***James***	Teacher	Gifted, Language Arts & Mathematics	32	School & district written assessments-15 yrs. Written Math assessment items for other States and AZ schools.	Bachelor	Gifted. K-8	EL, Gifted	w	f	Greenbrier Elementary School	Deer Valley Unified District	s	L	N
Noah	***Kaplan***	Teacher	4th Grade Teacher	3	4th grade Math,Sc,SS, for a Reading interv.strand class. District Math committee.	Masters	Elementary	None	w	m	Challenger School	Glendale Elementary District	u	L	N

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Standard Setting Gr 3-8 Mathematics

June 1-4, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	District	Urb/Sub/Rur	Dist S/M/L	Taught SpEd or ESL? Y/N
Leyla	***Kayumova***	Teacher	Department Chair, Mathematics and Science, 5th Grade Teacher (Leader)	5	3rd, 4th grade teacher. Math Department Chair.	Masters	K-8		w	f	Sonoran Science Academy	Sonoran Science Academy	s	S	N
Victoria	***Lautsch***	Teacher	7th Grade Math Teacher, Advanced Algebra Teacher	3	6th grade math, pre-algebra. Professional Develop. Leader Teach for America. District's math committee.	Masters	Elementary, Middle School Mathematics	Middle Grades Mathematics, SEI, working on Gifted provisional endorsement	w	f	Mensendick School	Glendale Elementary District	s	L	N
Jacque	***LeSueur***	Teacher	Third/Fourth Grade Teacher	13	4th and 3rd grade for 13 yrs. Teaching educ @ Comm College. District's math committee.	Masters	Elementary	ESL, Early childhood, SEI State Trainer	w	f	Frontier Elementary School	Payson Unified District	r	M	N
Cimarron	***Ludwig***	Teacher	6th Grade Teacher	13	Grades 2,3,4,5, &6. District Committees: 6th-7th grade Math Transition; and Math Benchmark.	Masters	Elementary	ESL, National Board Certification	w	m	Hawthorne Elementary School	Mesa Unified District	u	L	N
Janelle	***Neumann***	Teacher	4th Grade Teacher	5	4th grade. Math Team Leader and Site Council.	Bachelor	Elementary Education	SEI	w	f	Maryland Elementary School	Washington Elementary District	u	L	N
Sabrina	***Pandher***	Administrator	District Math Coach	7	Grades 6, 7, and 8 Seven years. District Math Coach.	Masters	Elementary Educ., Principal	Math Specialist, Bilingual Endorsement	h	f	Roosevelt School District	Roosevelt Elementary District	u	L	N
JerriLee	***Pendleton***	Teacher	Third Grade Teacher (I teach all subjects)	30	Grades: primary and intermediate. Created a 5th grade Math hands-on Manipulative classroom/lab.	Masters	Standard Elementary Education K-8	Reading Spec. K-12, ESL, Early Childhood	w	f	O'Connor Elementary	Mesa Unified District	u	L	N

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Standard Setting Gr 3-8 Mathematics

June 1-4, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	*District*	Urb/Sub/Rur	Dist S/M/L	Taught SpEd or ESL? Y/N
Dalma	***Rose***	Teacher	6th & 7th Grade Math Teacher	26	Math District Standards committee. Wrote district math CRT Test 6-8 grades. Math Dept. Head.	Masters	Elementary	Math Gifted	w	f	Granite Mountain Middle School	Prescott Unified District	u	L	N
Tracy	***Ryan***	Teacher	Math Teacher, Grades 6 and 7	8	Responsible aligning curriculum with State requirements.	Bachelor	Elementary	MS Math, SEI	w	f	Arizona School for the Arts	Arizona School for the Arts	u	S	N
Yolanda	***Siordia***	Teacher	8th Grade Math & Science Teacher	15	Even Start Program experience. Alternative High School experience. Bilingual Multicultural Education.	Masters	Secondary	ESL/Bilingual, Business, SEI, Mathematics	h	f	Desert Shadows Middle School	Nogales Unified District	r	S	N
Stefaney	***Sotomayor***	Administrator	Instructional Specialist for K-8	5	Teacher Collaboration. District committees developing benchmark assessments in math.	Bachelor	Elementary	SEI	w	f	Simis Elementary and Madison Meadows Middle	Madison School District	u	L	N
Philip	***Stephens***	Teacher	7th & 8th Math Teacher	11	Taught 2-8 grades. Elem education and middle school math.	Masters	Elementary	Middle School Math, SEI	w	m	Deer Valley Middle School	Deer Valley Unified District	u	L	N
Crystal	***Udall***	Administrator	Title 1 Math Specialist for grades 1st-6th	7	Grades: Kindergarten, 2, and 3. Title 1 Math Spec. Lead Teacher.	Bachelor	Standard Elementary K-8, Substitute certificate	Reading Spec K-12, SEI K-12, Middle grades (Math in progress)	w	f	Boulder Creek School	Gilbert Unified District	u	L	N
Dwight	***Valencia***	Teacher	5th Grade Teacher	11	Worked in bilingual settings 3rd & 5th grades. Grade level Coordinator for 2,3,4 & 5 grades. Bilingual & Multicultural education.	Masters	K-8 Certified. Bilingual endosement	ESL	h	m	Robert M. Bracker	Nogales Unified District	r	S	N

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Standard Setting H.S. Mathematics

May 13-14, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	District	Urb/Sub/Rur	Dist S/ M/ L	Taught SpEd or ESL? Y/N
James	***Bender***	Teacher	H.S. Math Teacher	24	Department Chair. HS. Math. Taught Summer School 21 times for Math, Test Coordinator for school.	Bachelors	Secondary certification	Mathematics & History	w	m	Nogales High School	*Nogales Unified District*	r	S	N
Kelly	***Berg***	Teacher	Grades 10-12, Pre-Calculus and Geometry/Algebra Skill Builder	16	Department Chair. Teach dual enrol@ RioSalado CC/ Pre-Calculus courses	Masters	Secondary Math Education	Math Education and SEI. Community College	w	f	Dobson High School	*Mesa Unified District*	s	L	Y
Mirko	***Chokel***	Teacher	Math ITL, 9-11 Geometry; Alg I	42	Department Chair. Math Formative Assessment, AP Computer Science, Computer Programming, Adult Ed.	Masters	Mathematics Secondary	SEI	w	m	Cienega High School	*Vail School District*	s	L	N
Sharon	***Costantino***	Teacher	Math Teacher - Algebra 1 and Honors; Algebra 2; 9th and 10 grade	13	7th Gr Math, Honors Algebra, Pre-Calc & Honors Calc & Com. College Algebra, AIMS Math Tutorial.	Masters	Secondary Education	Mathematics (30+ Hours Upper Division) SEI (60 hrs)	w	f	Campo Verde	*Gilbert Unified District*	u	L	Y
Tim	***Evans***	Teacher	H.S. Math, Algebra 1, Geometry, College Algebra -grades 9-12	26	Local team leader in both the Algebra 1 and Geometry curriculum areas .		Secondary 7-12	Mathematics, SEI K-12	w	m	Greenway High School	*Glendale Union High School District*	u	L	N
Donald	***Guess***	Administrator	9-12, High School Math,	15	Department Chair..H.S. Math. AP Calculus BC. Adjunct staff at Chandler Gilbert Community College	Masters	Secondary	Gifted, SEI	w	m	Corona Del Sol	*Tempe Union High School District*	u	L	N
Jeremy	***Hendrix***	Teacher	H.S. Math Teacher	5	Presented own AIMS study @ NECC	Masters	Secondary Education	Mathematics, SEI	w	m	Moon Valley High School	*Glendale Union High School District*	u	M	N
Mary	***Hendrix***	Teacher	H.S. Math Teacher	20	All Stars Faculty Advisor. HS and College Mathematics	Masters	Mathematics		b	f	Desert Ridge High School	*Gilbert Unified District*	u	L	Y
Robert	***Hesselton***	Teacher	H.S. Math Teacher	31	11 years @ middle school level. 20 years @ H.S. level. Former Department Chair.		Secondary	Music, Mathematics	w	m	Alchesay High School	*Whiteriver Unified District*	r	S	N

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Standard Setting H.S. Mathematics

May 13-14, 2010

First	Last	Occupation	Title Current Position	Years Experience	Describe Experience (courses/grades taught)	Highest Educ- Bachelor/ Masters/ Doctorate	Certification	Endorsement	Ethnicity	Gender	School or Affiliation	District	Urb/Sub/Rur	Dist S/ M/L	Taught SpEd or ESL? Y/N
Jane	***Martin***	Teacher	H.S. Teacher, Aims Math, Algebra I and II	22	7th, 8th and 9th grade math, H.S. Algebra I and II.	Masters	Elementary, and Secondary Math		w	f	Ray High School	*Ray Unified District*	r	S	N
Diane	***McCarthy***	Administrator	Teacher K-12	30	Department Chair. Teacher K-12. Member AZ Town Hall "Who Will Teach Our Children"	Masters	Secondary	Mathematics	w	f	Metro Tech High School	*Phoenix Union High School District*	u	L	N
Indika	***Morris***	Teacher	Gr 9-12 Algebra 1, Algrebra 2, Pre-Calc Dual enrolment courses @ CGCC	23	Department Chair. Teacher K-12	Masters	Secondary Mathematics	SEI	w	f	Queen Creek High School	*Queen Creek Unified District*	s	M	N
Judith	***Reihard***	Teacher	Mathematics Teacher - Geometry/Algebra	46	Mathematics teacher, Geometry. AP Math, Voc Ed math. Co-authored Barons AIMS Math, 2006.	Masters	Secondary	Gifted, SEI	w	f	Marcos De Niza High School	*Tempe Union High School District*	u	L	N
Martin	***Sade***	Teacher	H.S. Teacher Mathematics	5	Department Chair. Math [AP Calculus AB, AP Calculus BC, AP Statistics, Precalculus, Algebra, Geometry]	Ph.D.	Secondary	Mathematics	w	m	Sonoran Science Academy	*Sonoran Science Academy*	s	S	Y
Deborah	***Sather***	Administrator	School Improvement Director	15	NAU Instructor, Adjunct Professor, NPC and Ottawa University.	Ph.D.	Secondary	Curriculum Instruction, Gifted, SEI	na	f	Alchesay High School	*Whiteriver Unified School District*	r	M	Y
James	***Shinkle***	Administrator	Curriculum & Instruction Coordinator for Mathematics	12	HS Algebra and Geometry.	Masters	Secondary	SEI	w	m	Glendale Union High School District	*Glendale Union High School District*	u	M	N
Kimberley	***Thomas***	Teacher	H.S. Math Teacher	14	Taught all H.S. math classes,, all levels. Solutions Team member	Masters	Secondary	Mathematics, SEI	w	f	Valley Vista High School	*Dysart Unified District*	s	M	Y

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Appendix S: Standard Setting Evaluation Forms

ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
FINAL STANDARD SETTING EVALUATION
MATHEMATICS: GRADES 3-8

*****HIGH SCHOOL*****

Please indicate the panel that you served on: _____ Grades 3-5 _____ Grades 6-8

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion. If you have any additional comments, please write them in the space provided at the end of this form.

NOTE: SD=Strongly Disagree; D=Disagree; A=Agree; SA=Strongly Agree

TOTAL: 17

	Statement	SD	D	A	SA
1	The workshop was well organized.	1	1	2	13
2	The training materials were helpful.	1	0	5	11
3	The method for providing the rating was conceptually clear.	1	1	10	5
4	I had a good understanding of what the test was intended to measure.	1	0	5	11
5	I could clearly distinguish between student performance levels.	1	2	7	7
6	After the first round of ratings, I felt comfortable with the standard setting procedure.	1	0	11	5
7	I found the feedback on p-values useful.	1	0	5	11
8	I found the feedback reports on the ratings of panelists useful.	1	0	7	8
9	I found the feedback on the percentage of the students tested that would be classified at each performance level useful.	1	0	4	12
10	Table discussion was open and honest.	1	0	1	15
11	I believe that my opinions were considered and valued by my group.	1	0	2	14
12	I am confident that my round 3 ratings for "*Approaches the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	1	0	4	12
13	I am confident that my round 3 ratings for "*Meets the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	1	1	3	12
14	I am confident that my round 3 ratings for "*Exceeds the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	1	0	3	13
15	I would defend the standards recommended by our committee.	1	1	2	13
16	Overall, I valued the workshop as a professional development experience.	1	0	1	15

Please feel free to add comments on any of your responses above, make suggestions to improve future standard settings, and/ or tell us what you liked and did not like about this workshop. Thank you.

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ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
DECISION MAKING FACTOR SURVEY
HIGH SCHOOL MATHEMATICS

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion.

How much did each of the following factors influence your decisions on the cut score recommendations for the Arizona's Instrument to Measure Standards for Mathematics?		Not at All	Somewhat	Moderately	Strongly	Very Strongly
1	Your experience in education	0	0	1	5	9
2	Prior to this item mapping standard setting, your perceptions about students in each of the three performance levels	2	0	2	6	6
3	Your prior knowledge about standard setting	3	0	1	6	6
4	The orientation on standard setting	1	0	2	9	4
5	Your perception of the high stakes versus low stakes context of the Arizona's Instrument to Measure Standards for Mathematics	2	0	2	7	4
6	Your thinking about students in each performance level with whom you have had experience	1	1	1	8	4
7	The consequences of your decisions for No Child Left Behind (NCLB)	3	4	2	6	1
8	Your concerns about district or state political or economic issues	3	4	6	3	0
9	Your understanding of the performance level descriptors	0	0	1	8	7
10	The item p-values that were presented after round 1	0	1	6	5	3
11	The impact data presented after rounds 2 and 3	0	1	2	6	7
12	The feedback report on the page number cut scores	0	1	2	6	7
13	Your interactions with your fellow panelists in your group before **round 2**	0	0	3	6	7
14	Your interactions with your fellow panelists in your group before **round 3**	0	0	2	7	7
15	Your interactions with your fellow panelists in the large group discussion	0	0	5	5	6

Directions: Please respond to each statement by placing an "X" next to the category that best describes your school.

1. In general, my school/educational institution **mostly** serves students in the following socioeconomic status (choose one):

   4__ Lower 5__ Lower/Middle 4__ Middle 3__ Upper Middle 0__ Upper

2. My educational institution is a charter school (choose one): 1__ Yes 15_No

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- At times I had difficulty relating "content" to "ranking pages" as to how they relate to each other and how they related to approaches, meets and exceeds. Overall, I found it extremely worth while and would hope to be involved again at sometime.
- This was valuable to me to be here. Thanks for the opportunity to participate.
- The whole group conversation that we had after Round 3 should have occurred after Round 2. Everyone was professional and made decisions based on students and content in Arizona.
- It would have been very helpful to see an example of how a page number would be converted to a raw score. There were 85 pages and the raw score was also based on 85. This caused a great deal of confusion. Example: A page of 20 could hypothetically be equal to a raw score of 40. This way the teachers would not think that they were drastically lowering the standard.
- Tracy was great!
- Tracy did an excellent job. This was a very positive experience for me and I hope to serve again on other committees.

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ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
FINAL STANDARD SETTING EVALUATION
MATHEMATICS: GRADES 3-8

Please indicate the panel that you served on: __X__ Grades 3-5 _____ Grades 6-8

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion. If you have any additional comments, please write them in the space provided at the end of this form.

NOTE: SD=Strongly Disagree; D=Disagree; A=Agree; SA=Strongly Agree

TOTAL: 18

	Statement	SD	D	A	SA
1	The workshop was well organized.	0	0	6	12
2	The training materials were helpful.	0	0	8	10
3	The method for providing the rating was conceptually clear.	0	1	8	9
4	I had a good understanding of what the test was intended to measure.	0	0	5	12
5	I could clearly distinguish between student performance levels.	0	1	8	9
6	After the first round of ratings, I felt comfortable with the standard setting procedure.	0	0	11	7
7	I found the feedback on p-values useful.	0	3	7	8
8	I found the feedback reports on the ratings of panelists useful.	0	0	7	11
9	I found the feedback on the percentage of the students tested that would be classified at each performance level useful.	0	0	5	13
10	Table discussion was open and honest.	0	0	4	13
11	I believe that my opinions were considered and valued by my group.	0	1	6	12
12	I am confident that my round 3 ratings for "*Approaches the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	0	6	12
13	I am confident that my round 3 ratings for "*Meets the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	0	6	12
14	I am confident that my round 3 ratings for "*Exceeds the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	0	6	12
15	I would defend the standards recommended by our committee.	0	1	6	11
16	Overall, I valued the workshop as a professional development experience.	0	0	2	16

Please feel free to add comments on any of your responses above, make suggestions to improve future standard settings, and/ or tell us what you liked and did not like about this workshop. Thank you.

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ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
DECISION MAKING FACTOR SURVEY
HIGH SCHOOL MATHEMATICS

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion.

How much did each of the following factors influence your decisions on the cut score recommendations for the Arizona's Instrument to Measure Standards for Mathematics?		Not at All	Somewhat	Moderately	Strongly	Very Strongly
1	Your experience in education	0	0	1	7	8
2	Prior to this item mapping standard setting, your perceptions about students in each of the three performance levels	0	0	8	4	4
3	Your prior knowledge about standard setting	2	1	5	3	2
4	The orientation on standard setting	1	2	1	6	5
5	Your perception of the high stakes versus low stakes context of the Arizona's Instrument to Measure Standards for Mathematics	3	1	6	2	4
6	Your thinking about students in each performance level with whom you have had experience	1	0	4	6	5
7	The consequences of your decisions for No Child Left Behind (NCLB)	5	4	3	1	3
8	Your concerns about district or state political or economic issues	7	2	2	0	5
9	Your understanding of the performance level descriptors	0	1	1	7	7
10	The item p-values that were presented after round 1	1	4	4	5	2
11	The impact data presented after rounds 2 and 3	0	1	4	5	6
12	The feedback report on the page number cut scores	0	0	3	9	4
13	Your interactions with your fellow panelists in your group before **round 2**	0	1	1	7	7
14	Your interactions with your fellow panelists in your group before **round 3**	0	1	2	5	8
15	Your interactions with your fellow panelists in the large group discussion	0	1	5	6	4

Directions: Please respond to each statement by placing an "X" next to the category that best describes your school.

1. In general, my school/educational institution **mostly** serves students in the following socioeconomic status (choose one):

   5__ Lower 7__ Lower/Middle 4__ Middle 0__ Upper Middle 0__ Upper

2. My educational institution is a charter school (choose one): 1__ Yes 15_No

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- It would have been helpful for each participant to have a copy of the grade level standard (3 column document), as it was difficult to share the table copy. The K-6 standard document also would have been very helpful – many of us wanted to look at grade levels above and below ours!
- Lots of downtime. Work could have been more efficient or more could have been done in the same amount of time.
- The configuration of the meeting of both groups (3-5 and 6-8) made discussion very difficult. (Too loud, too difficult to talk to others seated across the room.)
- I enjoyed the interaction and discussion and felt that this was important to the overall process.
- More copies of the standards for the table to view would be helpful. 2 was too few.
- This workshop has influenced my opinion about standards/AIMS and how I will better use them to assess/teach my kiddos. This has been a truly valuable experience.
- Having 2nd grade standards available would have been nice.
- For training materials: copies of grade level standards compendium and standards from previous grade level would help. A copy for each member. Leader "LOL"
- Additional copies of the grade level standards would have been helpful.
- I value this process but I really feel that at the end we were "pushing the bell curve" and not necessarily considering what kids "should" be able to do.
- I learned so much. I was a bit disappointed that my table leader made derogatory comments when other tables disagreed with her.
- Thank you for the opportunity to impact Arizona education.

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ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
FINAL STANDARD SETTING EVALUATION
MATHEMATICS: GRADES 3-8

Please indicate the panel that you served on: _____ Grades 3-5 __X__ Grades 6-8

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion. If you have any additional comments, please write them in the space provided at the end of this form.

NOTE: SD=Strongly Disagree; D=Disagree; A=Agree; SA=Strongly Agree

TOTAL: 18

	Statement	SD	D	A	SA
1	The workshop was well organized.	0	0	3	15
2	The training materials were helpful.	0	0	5	13
3	The method for providing the rating was conceptually clear.	0	1	6	10
4	I had a good understanding of what the test was intended to measure.	0	0	6	12
5	I could clearly distinguish between student performance levels.	0	0	13	5
6	After the first round of ratings, I felt comfortable with the standard setting procedure.	0	0	8	10
7	I found the feedback on p-values useful.	0	1	10	7
8	I found the feedback reports on the ratings of panelists useful.	0	0	8	8
9	I found the feedback on the percentage of the students tested that would be classified at each performance level useful.	0	1	8	9
10	Table discussion was open and honest.	0	1	4	13
11	I believe that my opinions were considered and valued by my group.	0	1	6	11
12	I am confident that my round 3 ratings for "*Approaches the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	1	9	8
13	I am confident that my round 3 ratings for "*Meets the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	1	8	9
14	I am confident that my round 3 ratings for "*Exceeds the Standard*" reflect the knowledge, skills, and abilities described in the performance level descriptors.	0	1	8	9
15	I would defend the standards recommended by our committee.	0	0	9	9
16	Overall, I valued the workshop as a professional development experience.	0	0	3	15

Please feel free to add comments on any of your responses above, make suggestions to improve future standard settings, and/ or tell us what you liked and did not like about this workshop. Thank you.

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ARIZONA'S INSTRUMENT TO MEASURE STANDARDS
STANDARD SETTING
DECISION MAKING FACTOR SURVEY
HIGH SCHOOL MATHEMATICS

Directions: Please respond to each statement by placing an "X" in the box corresponding to your opinion.

How much did each of the following factors influence your decisions on the cut score recommendations for the Arizona's Instrument to Measure Standards for Mathematics?		Not at All	Somewhat	Moderately	Strongly	Very Strongly
1	Your experience in education	0	1	0	5	12
2	Prior to this item mapping standard setting, your perceptions about students in each of the three performance levels	0	1	5	7	5
3	Your prior knowledge about standard setting	5	2	5	4	2
4	The orientation on standard setting	1	0	4	8	5
5	Your perception of the high stakes versus low stakes context of the Arizona's Instrument to Measure Standards for Mathematics	3	0	6	5	3
6	Your thinking about students in each performance level with whom you have had experience	0	2	1	8	7
7	The consequences of your decisions for No Child Left Behind (NCLB)	6	3	4	2	3
8	Your concerns about district or state political or economic issues	7	4	4	2	1
9	Your understanding of the performance level descriptors	0	1	1	10	6
10	The item p-values that were presented after round 1	1	4	7	4	2
11	The impact data presented after rounds 2 and 3	0	5	4	6	3
12	The feedback report on the page number cut scores	2	2	7	5	2
13	Your interactions with your fellow panelists in your group before **round 2**	1	1	1	8	7
14	Your interactions with your fellow panelists in your group before **round 3**	0	0	3	7	8
15	Your interactions with your fellow panelists in the large group discussion	0	0	4	8	6

Directions: Please respond to each statement by placing an "X" next to the category that best describes your school.

1. In general, my school/educational institution **mostly** serves students in the following socioeconomic status (choose one):

   10_ Lower 2__ Lower/Middle 4__ Middle 0__ Upper Middle 1__ Upper

2. My educational institution is a charter school (choose one): 2__ Yes 15_No

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- Thanks for the opportunity to do this. Very valuable.
- Tracy was fantastic in informing us and helping with our group discussions.
- Thank you for letting me be part of this process!
- Wonderful presentations. PLD page a bit confusing. Left to right would be better for Approach, Meet, Exceed as we read left to right so improve left to right.
- Tracy was a fantastic facilitator. She kept the group on task, but ensured all voices were heard. She went above and beyond to explain the process and statistics behind our job! This was awesome!
- The facilitator and table leader were excellent. Clear explanations of all tasks, all opinions were valued/heard, questions were patiently answered.
- This experience was valuable for me. I gained insight into the process and how scores are derived. I especially enjoyed the mini-lessons from Tracy on the statistics she shared (item analyses, kids who score better than we expect, etc.)
- Our facilitator and discussion leader were great. Steve did a great job helping the group focus. Tracy was wonderful with her clarity of the process.
- I enjoyed that we did not move cut score to show better results. I believe that this will be the beginning of raising student achievement across the state by helping to hold us as educators responsible for our students' learning. ☺
- Excellent explanation of the statistical process.

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