

# **Results of Linking the 2006-2007 and 2005-2006 Missouri Assessment Program-Alternate Cut Points**

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## **1. Purpose**

The purpose of this document is to recommend raw score cut points for the 2006-2007 MAP-A. The recommendation is based on results of an equipercentile linking that was conducted using rescore data. The same linking procedure was used for both content areas (Communication Arts and Mathematics) and all grade spans (3-5, 6-8, and 11 for Communication Arts; 3-5, 6-8, and 10 for Mathematics) of the Missouri Assessment Program-Alternate (MAP-A). For each grade span/content area combination, three proposed cut points were calculated to separate the four achievement levels: *Below Basic*, *Basic*, *Proficient*, and *Advanced*.

## **2. Background**

Cut points along the raw score metric were defined for the 2005-2006 MAP-A at standard setting meetings held June 5-7, 2006. The cut points resulting from those meetings were based on the 2005-2006 assessment design, which specified three collection periods for each student. A change in design was implemented beginning with the 2006-2007 MAP-A assessments; the modified design called for two collection periods per student, rather than three. This modification, which was largely based on feedback from the field, was accompanied by a change in the scoring rubric. Under the old three-collection period design, all three scoring dimensions (*Level of Accuracy*, *Level of Independence*, and *Connection to the Standards*) were scored out of a possible four points within each Alternate Performance Indicator (API) Entry. Thus, each API Entry was scored out of 12 points; there were four API Entries per content area, for a total of 48

possible points. Under the new two-collection period design, the *Level of Accuracy* and *Level of Independence* dimensions maintain a maximum score of four points, while the maximum score for the *Connection to the Standards* dimension is now three points. Hence, beginning with the 2006-2007 MAP-A, the maximum score on each API Entry is 11 points; with four API Entries per content area, there is a total of 44 possible points.

Due to the fundamental changes between the 2005-2006 and 2006-2007 MAP-A designs outlined above, it would be inappropriate to apply the 2005-2006 cut points to 2006-2007 raw scores. The next three sections of this document describe the equipercentile linking procedure that was implemented to compute proposed 2006-2007 cut points. The sample used in this linking consisted of 2005-2006 students whose work was scored under the three-collection period design, then rescored under the new two-collection period design. Proposed cut points were determined so that the rescore students' impact data under the new design most closely matched the impact data of the same students under the three-collection period design. Those cut points are being recommended to become operational for the 2006-2007 MAP-A. Section 3 below describes the sampling method used to determine which students were part of the rescore group, provides information about how the selected students were rescored, and gives descriptive statistics regarding the representativeness of the sample. Section 4 introduces equipercentile linking in more detail and explains how it was applied to derive the proposed 2006-2007 MAP-A cut points. Section 5 presents the results.

### **3. Sampling Methodology, Rescoring of Students, and Sample Representativeness**

#### *3.1 Sampling*

The sampling design called for 250 students to be rescored in each of the six grade span/content area combinations. In selecting students for rescoring, it was desired that the performance of the rescore sample match the performance of the overall MAP-A student population as closely as possible. To accomplish this goal, a stratified sampling method with proportionate allocation was implemented, using student scores on the 2005-2006 MAP-A as the stratifying variable. Specifically, the 48 score points on the 2005-2006 MAP-A were divided into 12 categories, with scores of 1-4 comprising Category 1, scores of 5-8 comprising Category 2, and so forth. For a given grade span/content area combination, the population proportion of students falling into each category was calculated. Letting  $p_i$  denote the population proportion of Category  $i$ , the target number of students in Category  $i$  was defined as  $n_i = 250 * p_i$ . Targets were rounded to appropriate integers so that they summed to 250. Once the appropriate number of students in each category was computed, random number generation was used to determine which specific students in that category would be selected.

All targets were computed based on “pre-appeal data”, i.e., student scores prior to the resolution of score appeals. However, if a score appeal was submitted for a student, that student’s “post-appeal” score was considered his/her final score in the linking analysis. Table 1 below displays the number and percentage of students who appealed, whose score changed based on the appeals process, and whose achievement level changed based on the appeals process. All such percentages were below 1% for every grade span/content area combination.

**Table 1: Descriptive Statistics about Student Appeals**

<b>Grade Span</b>	<b>Content Area</b>	<b>N Appealed</b>	<b>% Appealed</b>	<b>N Score Changed</b>	<b>% Score Changed</b>	<b>N Achievement Level Changed</b>	<b>% Achievement Level Changed</b>
3-5	Math	1	0.07	1	0.07	1	0.07
3-5	CA	0	0.00	0	0.00	0	0.00
6-8	Math	9	0.59	8	0.52	7	0.46
6-8	CA	9	0.58	7	0.45	3	0.19
10	Math	4	0.87	4	0.87	3	0.65
11	CA	3	0.65	3	0.65	3	0.65

Another sampling detail of note involved decision rules for students who achieved a raw score of zero on the MAP-A. Students with an operational 2005-2006 raw score of zero did not receive a reported achievement level for the 2005-2006 school year, instead being classified into the *Level Not Determined* category. These students had no bearing on the 2005-2006 achievement level distribution; therefore, they were irrelevant to the linking and were excluded from the sampling pool. Additionally, because rescore rubrics were different from those of the original 2005-2006 assessment, it was possible for rescored students to have a positive score on the original 2005-2006 test and a point total of zero on the rescore. Such students were removed from the dataset and not included in any analyses; in each of the six grade span/content area combinations, they comprised less than 3% of the rescore population.

### *3.2 Rescoring*

A critical step in the process was to assign scores, using the new two-collection period design, to all students sampled for the rescore. Data points and work samples from collection periods 1 and 2 were counted toward these scores, whereas data points and work samples from collection period 3 were not. 2005-2006 scores from collection periods 1 and 2 were used because the test windows for these periods align temporally

with the 2006-2007 test windows. Specifically, the 2005-2006 test windows for collection periods 1, 2, and 3 were during the months of January, February, and March, respectively; the 2006-2007 test windows for collection periods 1 and 2 were in January and February, respectively.

All *Level of Accuracy* and *Level of Independence* scores were determined through an averaging process analogous to the original 2005-2006 scoring; the only difference was that in the rescore, collection period 3 data points were not included in the averaging. All *Connection to the Standards* scores were attained through reader rescoring of the work samples from collection periods 1 and 2 based on the new rubric. Every team leader and scorer who participated in the rescore had also participated in the original 2005-2006 scoring of MAP-A's. The entire group was retrained under the new rubric prior to the rescore, which took place from May 2 to May 12, 2006. The read behind rate for the rescore was the same as that of the original 2005-2006 scoring.

### *3.3 Representativeness*

This subsection provides information about the representativeness of the rescore sample with respect to the overall population of MAP-A students. Table 2 displays the number and percentage of students in the rescore group, as well as in the group of students *not* selected for the rescore sample (hereafter the “non-rescore group”). The total number of students in the overall population (including both rescore and non-rescore groups) is also provided. The table indicates that for all grade span/content area combinations, the size of the rescore sample was close to the target of 250.

**Table 2: Rescore Sample Sizes**

Grade Span	Content Area	Total N	Rescore N	Rescore %	Non-rescore N	Non-rescore %
3-5	Math	1466	244	17	1222	83
3-5	CA	1474	246	17	1228	83
6-8	Math	1529	239	16	1290	84
6-8	CA	1540	250	16	1290	84
10	Math	459	243	53	216	47
11	CA	463	247	53	216	47

Tables 3-8 give information about the representativeness of the rescore sample in terms of its demographic breakdown; there is one table for each grade span/content area combination. The number and percentage of students falling into each demographic group was computed for a) rescore students; b) non-rescore students; and c) the population of students as a whole. Variables considered were primary disability status (mental retardation, autism, multiple disabilities, or other), ethnicity (Native American, Asian/Pacific Islander, Black, White, or unknown), and gender (female, male, or unknown).

**Table 3: Representativeness of Rescore Sample—Demographics (Mathematics 3-5)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	825	141	684	56	58	56
	Autism	256	40	216	17	16	18
	Multiple	159	28	131	11	11	11
	Other	226	35	191	15	14	16
<b>ETHNIC</b>	Native American	5	1	4	0	0	0
	Asian/Pacific Islander	19	3	16	1	1	1
	Black	259	44	215	18	18	18
	Hispanic	47	11	36	3	5	3
	White	1135	185	950	77	76	78
	Unknown	1	0	1	0	0	0
<b>GENDER</b>	Female	519	93	426	35	38	35
	Male	946	151	795	65	62	65
	Unknown	1	0	1	0	0	0

**Table 4: Representativeness of Rescore Sample—Demographics (CA 3-5)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	830	140	690	56	57	56
	Autism	257	47	210	17	19	17
	Multiple	163	23	140	11	9	11
	Other	224	36	188	15	15	15
<b>ETHNIC</b>	Native American	5	2	3	0	1	0
	Asian/Pacific Islander	19	5	14	1	2	1
	Black	264	44	220	18	18	18
	Hispanic	47	8	39	3	3	3
	White	1138	187	951	77	76	77
	Unknown	1	0	1	0	0	0
<b>GENDER</b>	Female	523	89	434	35	36	35
	Male	950	157	793	64	64	65
	Unknown	1	0	1	0	0	0

**Table 5: Representativeness of Rescore Sample—Demographics (Mathematics 6-8)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	929	145	784	61	61	61
	Autism	208	37	171	14	15	13
	Multiple	160	26	134	10	11	10
	Other	232	31	201	15	13	16
<b>ETHNIC</b>	Native American	6	2	4	0	1	0
	Asian/Pacific Islander	24	6	18	2	3	1
	Black	282	42	240	18	18	19
	Hispanic	33	6	27	2	3	2
	White	1182	183	999	77	77	77
	Unknown	2	0	2	0	0	0
<b>GENDER</b>	Female	552	82	470	36	34	36
	Male	975	157	818	64	66	63
	Unknown	2	0	2	0	0	0

**Table 6: Representativeness of Rescore Sample—Demographics (CA 6-8)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	938	151	787	61	60	61
	Autism	207	31	176	13	12	14
	Multiple	164	25	139	11	10	11
	Other	231	43	188	15	17	15
<b>ETHNIC</b>	Native American	6	1	5	0	0	0
	Asian/Pacific Islander	24	4	20	2	2	2
	Black	288	49	239	19	20	19
	Hispanic	33	9	24	2	4	2
	White	1188	187	1001	77	75	78
	Unknown	1	0	1	0	0	0
<b>GENDER</b>	Female	559	98	461	36	39	36
	Male	980	152	828	64	61	64
	Unknown	1	0	1	0	0	0

**Table 7: Representativeness of Rescore Sample—Demographics (Mathematics 10)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	285	142	143	62	58	66
	Autism	47	32	15	10	13	7
	Multiple	64	34	30	14	14	14
	Other	63	35	28	14	14	13
<b>ETHNIC</b>	Native American	1	0	1	0	0	0
	Asian/Pacific Islander	9	5	4	2	2	2
	Black	98	40	58	21	16	27
	Hispanic	11	6	5	2	2	2
	White	339	192	147	74	79	68
	Unknown	1	0	1	0	0	0
<b>GENDER</b>	Female	187	95	92	41	39	43
	Male	272	148	124	59	61	57
	Unknown	0	0	0	0	0	0

**Table 8: Representativeness of Rescore Sample—Demographics (CA 11)**

Category	Subcategory	Pop N	Rescore N	Non-rescore N	Pop %	Rescore %	Non-rescore %
<b>DISAB.</b>	Mental Ret.	314	165	149	68	67	69
	Autism	53	30	23	11	12	11
	Multiple	51	29	22	11	12	10
	Other	45	23	22	10	9	10
<b>ETHNIC</b>	Native American	2	1	1	0	0	0
	Asian/Pacific Islander	4	2	2	1	1	1
	Black	90	44	46	19	18	21
	Hispanic	6	4	2	1	2	1
	White	361	196	165	78	79	76
	Unknown	0	0	0	0	0	0
<b>GENDER</b>	Female	180	90	90	39	36	42
	Male	283	157	126	61	64	58
	Unknown	0	0	0	0	0	0

Tables 9-14 relate to the representativeness of the rescore sample in terms of performance on the 2005-2006 operational MAP-A. There is again one table for each grade span/content area combination. The operational 2005-2006 mean score, standard deviation of scores, minimum score, maximum score, and impact data were computed for the rescore sample, as well as for the non-rescore group and the population as a whole. The appendix to this document contains results disaggregated by demographic group, i.e., analogous calculations for each gender, ethnicity, and primary disability status. Results in the appendix should be viewed with caution due to the small sample sizes associated with many of the demographic groups.

**Table 9: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (Mathematics 3-5)**

	Pop	Rescore	Non-rescore
Mean Score	39	40	39
SD of Scores	8	7	9
Min Score	3	16	3
Max Score	48	48	48
% BB	4	1	4
% B	13	13	13
% P	50	52	50
% A	33	34	33

**Table 10: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (CA 3-5)**

	Pop	Rescore	Non-rescore
Mean Score	40	40	39
SD of Scores	8	7	8
Min Score	3	15	3
Max Score	48	48	48
% BB	2	1	2
% B	16	14	16
% P	49	51	49
% A	33	34	33

**Table 11: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (Mathematics 6-8)**

	Pop	Rescore	Non-rescore
Mean Score	38	39	38
SD of Scores	8	7	9
Min Score	6	9	6
Max Score	48	48	48
% BB	6	3	6
% B	15	12	16
% P	52	55	52
% A	27	29	27

**Table 12: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (CA 6-8)**

	Pop	Rescore	Non-rescore
Mean Score	39	40	39
SD of Scores	8	7	8
Min Score	5	12	5
Max Score	48	48	48
% BB	5	3	5
% B	21	20	21
% P	51	52	51
% A	23	25	23

**Table 13: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (Mathematics 10)**

	Pop	Rescore	Non-rescore
Mean Score	38	39	37
SD of Scores	8	8	9
Min Score	8	14	8
Max Score	48	48	48
% BB	8	6	11
% B	19	19	19
% P	52	52	51
% A	21	23	19

**Table 14: Representativeness of Rescore Sample—  
Performance on Operational 2005-2006 MAP-A (CA 11)**

	Pop	Rescore	Non-rescore
Mean Score	38	39	37
SD of Scores	9	8	9
Min Score	6	7	6
Max Score	48	48	48
% BB	11	9	13
% B	23	21	26
% P	38	41	35
% A	27	28	25

#### 4. Equipercentile Linking

When two assessments are designed to measure the same underlying trait or ability, it is often necessary to determine which score  $x$  on Test B corresponds to a score of  $y$  on Test A. This task can be accomplished through the psychometric process of linking. This section describes how one particular linking procedure, called equipercentile linking, was utilized to achieve the goal outlined in the “Purpose” section of this document.

In applying equipercentile linking to the 2006-2007 and 2005-2006 MAP-A assessments, the objective was to link the achievement levels rather than the individual score points. That is, the psychometric goal was to determine a set of raw score cut points on the 2006-2007 MAP-A that corresponded to the respective raw score cut points on the 2005-2006 MAP-A. In an equipercentile linking of achievement levels for two hypothetical assessments, Test A and Test B, cut points are selected so that the impact data of the two assessments mirror one another as closely as possible. For example, consider the impact data given in Table 15 representing the hypothetical percentage of students in each achievement level for Test A:

**Table 15: Hypothetical Impact Data for Test A**

<b>Achievement Level</b>	<b>Percentage in Level</b>
<i>Below Basic</i>	10
<i>Basic</i>	35
<i>Proficient</i>	40
<i>Advanced</i>	15

An equipercentile linking would ideally define cut points for Test B so that the Test B impact data would match the percentages displayed in Table 15: 10% of students would fall into *Below Basic*, 35% of students would fall into *Basic*, and so on.

By matching the impact data of Test A and Test B, equipercentile linking makes a fundamental assumption that the student populations of the two tests are comparable in ability. Therefore, to link the 2006-2007 and 2005-2006 MAP-A cut points, it was desired that students in the two linking groups be as similar in ability as possible. Performing the linking based on the rescore sample was proposed because these students were scored under both the operational 2005-2006 and 2006-2007 rubrics. Hence, the two resulting sets of scores were in fact attained from identical groups of students, and even the same student work. The difference is that the original 2005-2006 MAP-A scores considered all three collection periods, while the rescore considered only the first two and utilized the new rubric.

The equipercentile linking procedure that was implemented for the MAP-A can be summarized by the following steps:

1. For the students who were part of the rescore sample, impact data under the original 2005-2006 scoring rules were calculated.
2. For each student who was part of the rescore sample, the new rubric (the 2006-2007 operational rubric) was used to assign a new student raw score.
3. The frequency distribution of scores in Step 2 was computed.
4. Using the frequency distribution in Step 3, raw score cut points were selected so that the resulting impact data most closely matched the impact data of Step 1. In particular, cuts were selected such that for  $j = 1, 2, 3$ , the

rescore proportion of students below cut  $j$  under the new design was closest to the rescore proportion of students below cut  $j$  under the operational 2005-2006 design.

5. Steps 1-4 were repeated for each of the six MAP-A grade span/content area combinations.

An exact matching of impact data was impossible due to the fact that raw score distributions are discrete rather than continuous. Specific proposed raw score cut points were thus defined through linear interpolation. The resulting values are recommended to be taken as the exact raw score cut points as the MAP-A proceeds in future years, beginning with 2006-2007.

## 5. Results

The first step in producing results was to calculate descriptive statistics about student performance on the rescore itself. Table 16 displays the following statistics for the rescore data: mean score, standard deviation of scores, minimum score, and maximum score.

**Table 16: Descriptive Statistics about the Rescore**

Grade Span	Content Area	N	Rescore Mean	Rescore SD	Rescore Min	Rescore Max
3-5	Math	244	35.3	7.1	8	44
3-5	CA	246	36.6	6.2	15	44
6-8	Math	239	35.6	6.8	11	44
6-8	CA	250	36.5	6.3	11	44
10	Math	243	34.6	7.6	9	44
11	CA	247	35.6	6.9	4	44

Next, the recommended 2006-2007 MAP-A raw score cut points were calculated via the equipercentile linking procedure described in Section 4. Table 17 displays the

resulting values, rounded to two decimal places. Table 18 gives the raw score ranges that correspond to these cut points; these are presented with actual 2005-2006 ranges in order to facilitate side-by-side comparisons. The change in scoring rubric resulted in recommended 2006-2007 raw score cut points that are lower than the corresponding 2005-2006 cuts; such a pattern is consistent with expectations, considering that the 2006-2007 scale is compressed compared to that of 2005-2006 (the maximum possible score is 44, rather than 48). Note that for Mathematics 6-8, the recommended 2006-2007 cut point between *Below Basic* and *Basic* is exactly 21.00. Because students need to *meet or exceed* the cut point in order to be classified into the higher achievement level, students with a score of 21 are recommended to be classified as *Basic* for this grade span/content area combination.

**Table 17: Recommended 2006-2007 MAP-A Raw Score Cut Points Resulting from Equipercentile Linking—Rounded to Two Decimal Places**

<b>Grade Span</b>	<b>Content Area</b>	<b>BB:B</b>	<b>B:P</b>	<b>P:A</b>
3-5	Math	15.50	26.50	39.82
3-5	CA	18.50	29.88	40.42
6-8	Math	21.00	28.30	40.06
6-8	CA	20.17	32.50	41.34
10	Math	19.50	30.75	41.38
11	CA	23.83	33.50	40.10

**Table 18: Recommended 2006-2007 MAP-A Raw Score Ranges and Actual 2005-2006 Raw Score Ranges**

Grade Span	Content Area	Ach. Level	2006-2007 RS Range (Recommended)	2005-2006 RS Range
3-5	Math	BB	3-15	3-20
		B	16-26	21-31
		P	27-39	32-44
		A	40-44	45-48
3-5	CA	BB	3-18	3-19
		B	19-29	20-33
		P	30-40	34-44
		A	41-44	45-48
6-8	Math	BB	3-20	3-22
		B	21-28	23-32
		P	29-40	33-44
		A	41-44	45-48
6-8	CA	BB	3-20	3-23
		B	21-32	24-35
		P	33-41	36-45
		A	42-44	46-48
10	Math	BB	3-19	3-25
		B	20-30	26-33
		P	31-41	34-45
		A	42-44	46-48
11	CA	BB	3-23	3-26
		B	24-33	27-37
		P	34-40	38-44
		A	41-44	45-48

Cross-tabulations of 2005-2006 student achievement levels under the old and new designs were also computed for the rescore group. That is, the joint distributions of 2005-2006 operational achievement levels and rescore achievement levels were calculated. Here, the term “rescore achievement levels” refers to the achievement levels that would have been attained by students based on their operational 2005-2006 work, the new 2006-2007 scoring design, and the recommended 2006-2007 cut points. Tables 19 to 24 give the results; there is one table for each grade span/content area combination, and both the number and percentage of students in each cell are presented. Note that the column totals (marginal values of the columns) represent the impact data of the rescore achievement

levels based on the recommended 2006-2007 cut points. For instance, 32 rescore students (13.11% of the rescore sample) in Mathematics 3-5 would fall into the *Basic* achievement level according to the new design, new rubric, and recommended cuts.

**Table 19: Joint Distribution of 2005-2006 Operational and Rescore Achievement Levels (Mathematics 3-5)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
2005-2006 Operational Ach. Level	BB	N	0	2	0	0	2
		%	0	0.82	0	0	0.82
	B	N	0	16	14	2	32
		%	0	6.56	5.74	0.82	13.11
	P	N	2	14	81	29	126
		%	0.82	5.74	33.2	11.89	51.64
	A	N	0	0	24	60	84
		%	0	0	9.84	24.59	34.43
	Marg.	N	2	32	119	91	244
		%	0.82	13.11	48.77	37.30	100

**Table 20: Joint Distribution of 2005-2006 Operational and Rescore Achievement Levels (CA 3-5)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
2005-2006 Operational Ach. Level	BB	N	2	1	0	0	3
		%	0.81	0.41	0	0	1.22
	B	N	1	19	11	4	35
		%	0.41	7.72	4.47	1.63	14.23
	P	N	0	12	99	14	125
		%	0	4.88	40.24	5.69	50.81
	A	N	0	0	20	63	83
		%	0	0	8.13	25.61	33.74
	Marg.	N	3	32	130	81	246
		%	1.22	13.01	52.85	32.93	100

**Table 21: Joint Distribution of 2005-2006  
Operational and Rescore Achievement Levels (Mathematics 6-8)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
2005-2006 Operational Ach. Level	BB	N	2	1	5	0	8
		%	0.84	0.42	2.09	0	3.35
	B	N	4	15	10	0	29
		%	1.67	6.28	4.18	0	12.13
	P	N	1	14	99	18	132
		%	0.42	5.86	41.42	7.53	55.23
	A	N	0	2	24	44	70
		%	0	0.84	10.04	18.41	29.29
	Marg.	N	7	32	138	62	239
		%	2.93	13.39	57.74	25.94	100

**Table 22: Joint Distribution of 2005-2006  
Operational and Rescore Achievement Levels (CA 6-8)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
2005-2006 Operational Ach. Level	BB	N	4	2	1	0	7
		%	1.6	0.8	0.4	0	2.80
	B	N	3	21	23	2	49
		%	1.2	8.4	9.2	0.8	19.60
	P	N	1	21	86	23	131
		%	0.4	8.4	34.4	9.2	52.40
	A	N	0	4	24	35	63
		%	0	1.6	9.6	14	25.20
	Marg.	N	8	48	134	60	250
		%	3.20	19.20	53.60	24.00	100

**Table 23: Joint Distribution of 2005-2006  
Operational and Rescore Achievement Levels (Mathematics 10)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
2005-2006 Operational Ach. Level	BB	N	7	4	4	0	15
		%	2.88	1.65	1.65	0	6.17
	B	N	5	21	19	0	45
		%	2.06	8.64	7.82	0	18.52
	P	N	3	17	93	14	127
		%	1.23	7	38.27	5.76	52.26
	A	N	0	1	14	41	56
		%	0	0.41	5.76	16.87	23.05
	Marg.	N	15	43	130	55	243
		%	6.17	17.70	53.50	22.63	100

**Table 24: Joint Distribution of 2005-2006  
Operational and Rescore Achievement Levels (CA 11)**

			Rescore Ach. Level				
			BB	B	P	A	Marg.
<b>2005-2006 Operational Ach. Level</b>	<b>BB</b>	N	7	11	5	0	23
		%	2.83	4.45	2.02	0	9.31
	<b>B</b>	N	10	16	21	5	52
		%	4.05	6.48	8.5	2.02	21.05
	<b>P</b>	N	5	22	59	16	102
		%	2.02	8.91	23.89	6.48	41.30
	<b>A</b>	N	0	4	25	41	70
		%	0	1.62	10.12	16.6	28.34
	<b>Marg.</b>	N	22	53	110	62	247
		%	8.91	21.46	44.53	25.10	100

## 6. Summary

This document describes the method that was used to determine recommended raw score cut points for the 2006-2007 MAP-A. The method involved performing equipercentile linking based on the frequency distributions of the following two groups: 1) a sample of 2005-2006 MAP-A students scored under the operational 2005-2006 scoring rubric; and 2) the same set of students rescored under the 2006-2007 operational rubric. The recommended cuts were presented along with information about the representativeness of the rescore sample.

**Appendix: Performance on Operational 2005-2006 MAP-A—  
Disaggregated by Demographic Group<sup>1</sup>**

**Table A.1: Results for Mathematics 3-5**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	7	19	7	48	48	48
	Autism	12	23	12	48	48	48
	Multiple	8	21	8	48	48	48
	Other	3	16	3	48	48	48
ETHNIC	Native American	18	45	18	48	45	48
	Asian/Pacific Islander	24	27	24	48	48	48
	Black	8	19	8	48	48	48
	Hispanic	8	32	8	48	47	48
	White	3	16	3	48	48	48
	Unknown	48	N/A	48	48	N/A	48
GENDER	Female	3	21	3	48	48	48
	Male	6	16	6	48	48	48
	Unknown	48	N/A	48	48	N/A	48
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	39	40	39	8	7	8
	Autism	39	41	39	8	7	9
	Multiple	37	37	37	9	8	9
	Other	39	38	40	9	7	9
ETHNIC	Native American	35	45	33	13	N/A	13
	Asian/Pacific Islander	39	39	39	7	11	7
	Black	38	40	38	9	7	9
	Hispanic	39	40	39	9	6	9
	White	39	40	39	8	7	8
	Unknown	48	N/A	48	N/A	N/A	N/A
GENDER	Female	39	40	39	8	7	8
	Male	39	40	39	9	7	9
	Unknown	48	N/A	48	N/A	N/A	N/A

<sup>1</sup> Due to small sample sizes for some demographic groups, the results of these tables should be viewed with caution. Note that a value of “N/A” was inputted for all fields if the demographic group in question had a sample size of 0. Additionally, “N/A” was inputted for the standard deviation field if the demographic group in question had a sample size of 1. Sample sizes of the different demographic groups are provided in Tables 3-8 of the main text.

**Table A.1: Results for Mathematics 3-5, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	4	1	4	12	11	12
	Autism	4	0	5	13	13	13
	Multiple	4	0	5	21	25	20
	Other	4	3	5	12	14	11
ETHNIC	Native American	20	0	25	20	0	25
	Asian/Pacific Islander	0	0	0	21	33	19
	Black	6	2	7	12	11	12
	Hispanic	4	0	6	9	0	11
	White	3	1	4	13	14	13
	Unknown	0	N/A	0	0	N/A	0
GENDER	Female	2	0	3	13	17	13
	Male	5	1	5	13	11	13
	Unknown	0	N/A	0	0	N/A	0
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	52	51	53	32	38	31
	Autism	47	45	47	36	43	35
	Multiple	54	54	54	21	21	21
	Other	45	60	42	39	23	42
ETHNIC	Native American	20	0	25	40	100	25
	Asian/Pacific Islander	53	33	56	26	33	25
	Black	49	50	49	32	36	32
	Hispanic	51	73	44	36	27	39
	White	51	51	51	33	34	33
	Unknown	0	N/A	0	100	N/A	100
GENDER	Female	52	51	53	32	32	32
	Male	49	52	49	33	36	33
	Unknown	0	N/A	0	100	N/A	100

**Table A.2: Results for CA 3-5**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	3	15	3	48	48	48
	Autism	10	17	10	48	48	48
	Multiple	8	18	8	48	48	48
	Other	3	26	3	48	48	48
ETHNIC	Native American	25	25	25	44	41	44
	Asian/Pacific Islander	24	39	24	48	46	48
	Black	8	22	8	48	48	48
	Hispanic	21	32	21	48	48	48
	White	3	15	3	48	48	48
	Unknown	45	N/A	45	45	N/A	45
GENDER	Female	9	17	9	48	48	48
	Male	3	15	3	48	48	48
	Unknown	45	N/A	45	45	N/A	45
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	40	40	40	7	7	8
	Autism	40	41	39	8	6	8
	Multiple	39	38	39	7	7	7
	Other	40	42	39	8	5	9
ETHNIC	Native American	34	33	35	9	11	10
	Asian/Pacific Islander	39	42	38	8	3	8
	Black	39	40	39	8	6	9
	Hispanic	42	43	41	6	5	6
	White	40	40	40	7	7	8
	Unknown	45	N/A	45	N/A	N/A	N/A
GENDER	Female	40	40	40	7	7	7
	Male	39	40	39	8	6	8
	Unknown	45	N/A	45	N/A	N/A	N/A

**Table A.2: Results for CA 3-5, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	2	1	2	16	17	16
	Autism	3	2	3	16	11	17
	Multiple	2	4	1	20	17	20
	Other	3	0	4	13	6	14
ETHNIC	Native American	0	0	0	40	50	33
	Asian/Pacific Islander	0	0	0	21	0	29
	Black	3	0	3	18	16	18
	Hispanic	0	0	0	11	13	10
	White	2	2	2	15	14	16
	Unknown	0	N/A	0	0	N/A	0
GENDER	Female	1	2	1	15	13	15
	Male	3	1	3	16	15	17
	Unknown	0	N/A	0	0	N/A	0
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	50	50	50	32	32	32
	Autism	48	49	48	33	38	32
	Multiple	56	65	54	23	13	24
	Other	42	47	41	42	47	40
ETHNIC	Native American	60	50	67	0	0	0
	Asian/Pacific Islander	53	80	43	26	20	29
	Black	48	55	46	32	30	32
	Hispanic	49	50	49	40	38	41
	White	50	49	50	33	35	32
	Unknown	0	N/A	0	100	N/A	100
GENDER	Female	50	51	50	34	34	34
	Male	49	51	49	32	34	32
	Unknown	0	N/A	0	100	N/A	100

**Table A.3: Results for Mathematics 6-8**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	6	12	6	48	48	48
	Autism	11	25	11	48	48	48
	Multiple	9	24	9	48	48	48
	Other	6	9	6	48	48	48
ETHNIC	Native American	21	28	21	47	47	41
	Asian/Pacific Islander	26	35	26	48	48	48
	Black	6	25	6	48	48	48
	Hispanic	11	12	11	48	48	48
	White	6	9	6	48	48	48
	Unknown	10	N/A	10	40	N/A	40
GENDER	Female	6	9	6	48	48	48
	Male	6	12	6	48	48	48
	Unknown	10	N/A	10	40	N/A	40
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	38	39	38	8	7	8
	Autism	39	40	39	8	6	8
	Multiple	37	39	36	8	7	9
	Other	38	39	38	9	10	9
ETHNIC	Native American	33	38	31	9	13	8
	Asian/Pacific Islander	41	43	40	7	5	7
	Black	36	39	36	9	7	10
	Hispanic	39	37	39	10	14	10
	White	39	39	39	8	7	8
	Unknown	25	N/A	25	21	N/A	21
GENDER	Female	38	39	38	8	7	8
	Male	38	39	38	8	8	9
	Unknown	25	N/A	25	21	N/A	21

**Table A.3: Results for Mathematics 6-8, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	5	4	6	15	12	16
	Autism	4	0	5	13	11	14
	Multiple	7	0	8	18	19	18
	Other	7	6	7	15	10	15
ETHNIC	Native American	17	0	25	33	50	25
	Asian/Pacific Islander	0	0	0	13	0	17
	Black	10	0	11	20	19	20
	Hispanic	9	17	7	12	17	11
	White	5	4	5	14	10	15
	Unknown	50	N/A	50	0	N/A	0
GENDER	Female	5	2	5	18	13	19
	Male	6	4	7	14	11	14
	Unknown	50	N/A	50	0	N/A	0
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	52	57	51	27	27	27
	Autism	52	51	52	30	38	29
	Multiple	57	62	56	18	19	18
	Other	49	45	49	30	39	28
ETHNIC	Native American	33	0	50	17	50	0
	Asian/Pacific Islander	50	50	50	38	50	33
	Black	50	57	49	21	24	20
	Hispanic	39	33	41	39	33	41
	White	53	56	53	28	30	28
	Unknown	50	N/A	50	0	N/A	0
GENDER	Female	51	56	50	27	28	26
	Male	53	55	52	27	30	27
	Unknown	50	N/A	50	0	N/A	0

**Table A.4: Results for CA 6-8**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	5	12	5	48	48	48
	Autism	13	19	13	48	48	48
	Multiple	8	15	8	48	48	48
	Other	7	27	7	48	48	48
ETHNIC	Native American	27	27	35	44	27	44
	Asian/Pacific Islander	25	28	25	48	47	48
	Black	8	12	8	48	48	48
	Hispanic	16	36	16	48	48	48
	White	5	15	5	48	48	48
	Unknown	28	N/A	28	28	N/A	28
GENDER	Female	5	12	5	48	48	48
	Male	7	15	7	48	48	48
	Unknown	28	N/A	28	28	N/A	28
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	39	40	39	8	7	8
	Autism	40	42	40	7	6	7
	Multiple	39	38	39	8	7	8
	Other	40	41	39	8	6	8
ETHNIC	Native American	38	27	40	6	N/A	3
	Asian/Pacific Islander	40	41	40	8	9	8
	Black	37	37	37	10	9	10
	Hispanic	40	41	40	8	3	9
	White	40	41	40	7	6	8
	Unknown	28	N/A	28	N/A	N/A	N/A
GENDER	Female	39	40	39	8	7	8
	Male	39	40	39	8	7	8
	Unknown	28	N/A	28	N/A	N/A	N/A

**Table A.4: Results for CA 6-8, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	6	3	6	20	22	20
	Autism	2	3	2	21	10	23
	Multiple	6	4	6	22	20	22
	Other	4	0	5	22	19	22
ETHNIC	Native American	0	0	0	33	100	20
	Asian/Pacific Islander	0	0	0	25	25	25
	Black	10	10	10	27	33	26
	Hispanic	6	0	8	12	0	17
	White	4	1	4	19	17	20
	Unknown	0	N/A	0	100	N/A	100
GENDER	Female	5	3	5	21	18	22
	Male	5	3	6	21	20	21
	Unknown	0	N/A	0	100	N/A	100
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	51	52	50	23	23	23
	Autism	55	55	55	22	32	20
	Multiple	54	64	52	18	12	19
	Other	48	44	49	26	37	24
ETHNIC	Native American	67	0	80	0	0	0
	Asian/Pacific Islander	42	50	40	33	25	35
	Black	45	37	47	17	20	16
	Hispanic	58	89	46	24	11	29
	White	53	55	52	24	27	24
	Unknown	0	N/A	0	0	N/A	0
GENDER	Female	53	58	51	21	20	22
	Male	51	49	51	24	28	23
	Unknown	0	N/A	0	0	N/A	0

**Table A.5: Results for Mathematics 10**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	9	14	9	48	48	48
	Autism	17	30	17	48	48	48
	Multiple	8	19	8	48	48	48
	Other	17	17	18	48	48	48
ETHNIC	Native American	47	N/A	47	47	N/A	47
	Asian/Pacific Islander	24	41	24	48	48	47
	Black	14	20	14	48	48	48
	Hispanic	31	31	36	48	48	45
	White	8	14	8	48	48	48
	Unknown	39	N/A	39	39	N/A	39
GENDER	Female	8	14	8	48	48	48
	Male	9	19	9	48	48	48
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	38	39	37	8	7	8
	Autism	41	41	41	7	6	9
	Multiple	36	37	35	10	9	11
	Other	37	37	37	9	9	9
ETHNIC	Native American	47	N/A	47	N/A	N/A	N/A
	Asian/Pacific Islander	40	44	36	8	3	10
	Black	36	39	34	9	9	9
	Hispanic	40	39	41	6	8	4
	White	39	39	38	8	7	9
	Unknown	39	N/A	39	N/A	N/A	N/A
GENDER	Female	38	38	37	8	8	9
	Male	38	39	37	8	8	9
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A

**Table A.5: Results for Mathematics 10, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	7	4	10	18	18	17
	Autism	2	0	7	9	9	7
	Multiple	16	12	20	20	24	17
	Other	11	14	7	27	23	32
ETHNIC	Native American	0	N/A	0	0	N/A	0
	Asian/Pacific Islander	11	0	25	11	0	25
	Black	15	10	19	26	23	28
	Hispanic	0	0	0	18	33	0
	White	7	6	8	17	18	16
	Unknown	0	N/A	0	0	N/A	0
GENDER	Female	9	6	12	17	18	15
	Male	8	6	10	20	19	21
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	56	56	55	19	21	17
	Autism	55	56	53	34	34	33
	Multiple	47	47	47	17	18	17
	Other	35	37	32	27	26	29
ETHNIC	Native American	0	N/A	0	100	N/A	100
	Asian/Pacific Islander	44	60	25	33	40	25
	Black	38	35	40	21	33	14
	Hispanic	64	33	100	18	33	0
	White	55	56	54	21	20	22
	Unknown	100	N/A	100	0	N/A	0
GENDER	Female	59	61	58	15	15	15
	Male	46	47	46	26	28	23
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A

**Table A.6: Results for CA 11**

		<b>Pop Min</b>	<b>Rescore Min</b>	<b>Non-rescore Min</b>	<b>Pop Max</b>	<b>Rescore Max</b>	<b>Non-rescore Max</b>
DISAB.	Mental Ret.	6	14	6	48	48	48
	Autism	15	23	15	48	48	48
	Multiple	17	18	17	48	48	47
	Other	7	7	15	48	48	48
ETHNIC	Native American	39	43	39	43	43	39
	Asian/Pacific Islander	29	32	29	48	48	43
	Black	6	14	6	48	48	48
	Hispanic	38	38	38	48	48	47
	White	7	7	9	48	48	48
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
GENDER	Female	6	14	6	48	48	48
	Male	7	7	10	48	48	48
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
		<b>Pop Mean</b>	<b>Rescore Mean</b>	<b>Non-rescore Mean</b>	<b>Pop SD</b>	<b>Rescore SD</b>	<b>Non-rescore SD</b>
DISAB.	Mental Ret.	38	39	37	9	8	9
	Autism	39	38	39	8	7	8
	Multiple	37	38	36	8	7	9
	Other	39	39	39	10	9	10
ETHNIC	Native American	41	43	39	3	N/A	N/A
	Asian/Pacific Islander	38	40	36	9	11	10
	Black	36	37	35	10	9	10
	Hispanic	44	44	43	5	5	6
	White	39	39	38	8	8	9
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
GENDER	Female	38	40	37	9	8	10
	Male	38	39	38	8	8	9
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A

**Table A.6: Results for CA 11, Continued**

		<b>Pop % BB</b>	<b>Rescore % BB</b>	<b>Non-rescore % BB</b>	<b>Pop % B</b>	<b>Rescore % B</b>	<b>Non-rescore % B</b>
DISAB.	Mental Ret.	12	10	13	23	20	26
	Autism	8	7	9	30	30	30
	Multiple	10	7	14	27	21	36
	Other	13	9	18	13	17	9
ETHNIC	Native American	0	0	0	0	0	0
	Asian/Pacific Islander	0	0	0	50	50	50
	Black	19	18	20	23	18	28
	Hispanic	0	0	0	0	0	0
	White	10	8	12	24	22	25
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
GENDER	Female	11	8	13	21	19	23
	Male	12	10	13	25	22	28
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
		<b>Pop % P</b>	<b>Rescore % P</b>	<b>Non-rescore % P</b>	<b>Pop % A</b>	<b>Rescore % A</b>	<b>Non-rescore % A</b>
DISAB.	Mental Ret.	37	37	36	29	33	24
	Autism	34	40	26	28	23	35
	Multiple	51	66	32	12	7	18
	Other	42	43	41	31	30	32
ETHNIC	Native American	100	100	100	0	0	0
	Asian/Pacific Islander	25	0	50	25	50	0
	Black	31	32	30	27	32	22
	Hispanic	50	50	50	50	50	50
	White	40	43	36	27	27	27
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A
GENDER	Female	43	48	39	25	26	24
	Male	35	38	33	28	30	26
	Unknown	N/A	N/A	N/A	N/A	N/A	N/A