4. SCALE CREATION, EQUATING AND RAW SCORES TO SCALE SCORES CONVERSION VIA ITEM RESPONSE THEORY (IRT) PROCEDURES

For the 2010 administration, there was no equating for Grades 3 to 5 as this was the first year of implementation of the Mod-MSA examinations for these grades. However, grades 6 to 8 forms were linked together by the common items non-equivalent groups (CINEG, Kolen & Brennan, 2004) design.

The Rasch model (Rasch, 1960) was used to develop, calibrate, and scale the Mod-MSA: Mathematics. The Rasch measurement model is regularly used to construct test forms, for scaling and equating, and to develop and maintain large item banks. All item and test analyses, including item-fit analysis, scaling, diagnosis, and performance prediction were accomplished within this framework. The statistical software used to calibrate and scale the Mod-MSA: Mathematics was WINSTEPS Version 3.46 (Linacre & Wright, 2000).

The Rasch Model

The most basic expression of the Rasch model is in the item characteristic curve (ICC). It shows the probability of a correct response to an item as a function of the ability, i.e., the proficiency level. The probability of a correct response is bounded by 1 (certainty of a correct response) and 0 (certainty of an incorrect response).

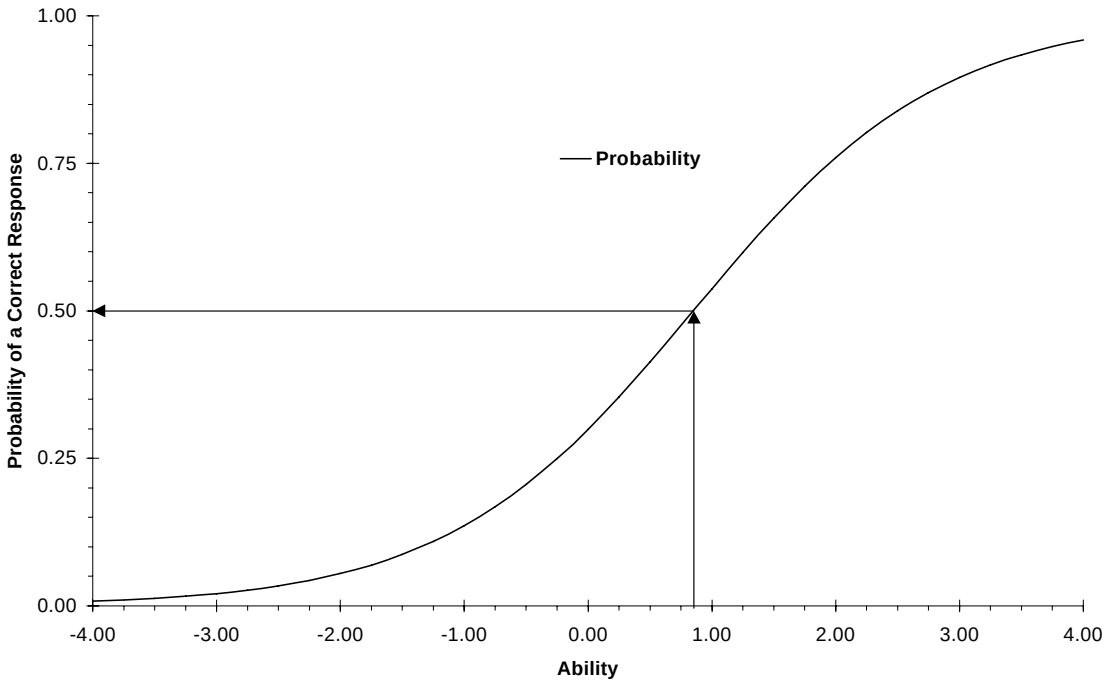

Figure 4.1 Item Characteristic Curve

As an example, consider Figure 4.1 which depicts an item that falls at approximately 0.85 on the ability, i.e., the proficiency (horizontal) scale. When a person answers an item at the same level as his or her proficiency, then that person has a probability of roughly 50% of answering the item correctly. Another way of expressing this is that if we have a group of 100 people, all of whom have a proficiency of 0.85, we would expect about 50% of them to answer the item correctly. A person whose proficiency was above 0.85 would a higher probability of getting the item right, while a person whose proficiency is below 0.85 would have a lower probability of getting the item right. This makes intuitive sense and is the basic formulation of Rasch measurement for test items having only two possible categories (i.e., wrong or right).

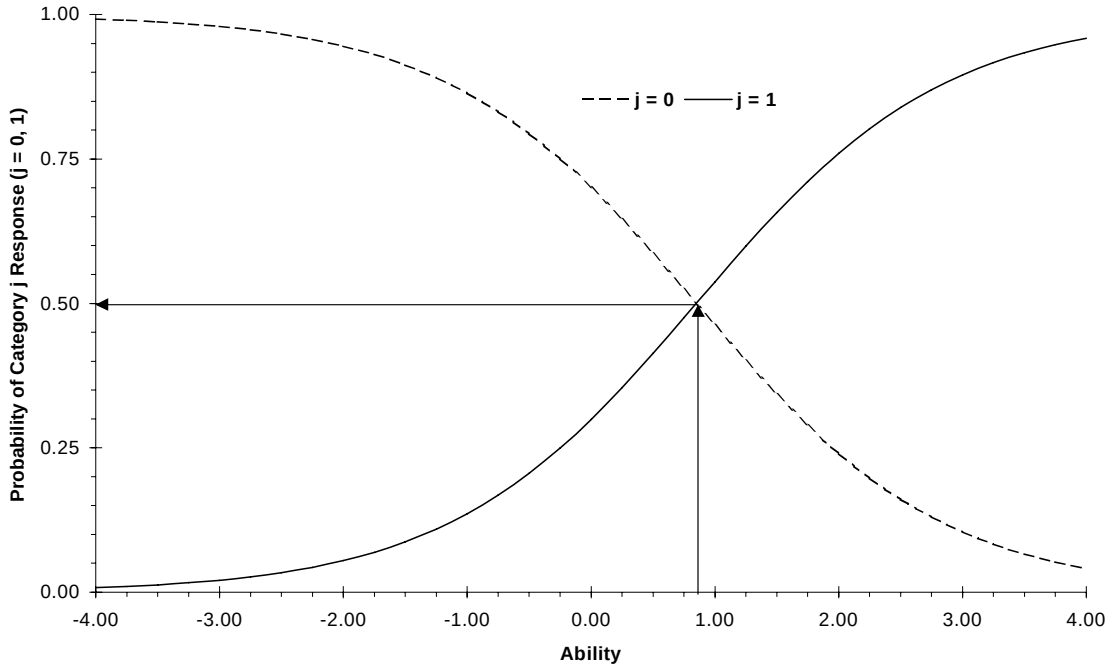

Figure 4.2 Category Response Curves for a One-Step Item

Figure 4.2 extends this formulation to show the probabilities of obtaining a wrong answer or a right answer. The curve on the left ($j = 0$) shows the probability of getting a score of "0" while the curve on the right ($j = 1$) shows the probability of getting a score of "1". The point at which the two curves cross indicates the transition point on the proficiency scale where the most likely response changes from a "0" to a "1." Here, the probability of answering the item correctly is 50%.

One important property of the Rasch model is its ability to separate the estimation of item/task parameters from the person parameters. With the Rasch model, the total score given by the sum of the categories in which a person responds is a sufficient statistic for estimating person proficiency (i.e., no additional information need be estimated). The total number of responses across examinees in a particular category is a sufficient statistic for estimating the step difficulty

for that category. Thus with the Rasch model, the same total score will yield the same proficiency estimate for different examinees.

The parameters estimated by this model are (1) a proficiency estimate for each person, (2) m_i threshold (difficulty) estimate for each item. From these estimates, the conditional standard error estimates associated with proficiency and the standard error of the difficulty parameter estimates of each item can be calculated (See Section 8.4 for the derivation of the conditional standard error of measurement and the confidence interval set at each proficiency level)

4.1. Calibration and Scaling Procedures for Grades 3 to 5

For the 2010 administration, there was no equating for Grades 3 to 5 as this was the first year of implementation of the Mod-MSA examinations for these grades. However, for 2010, a new form of the test was created for Grades 6 to 8 and these forms were linked together by the c*ommon items non-equivalent groups* (CINEG, Kolen & Brennan, 2004) design.

The calibration of the spring 2010 administration of the Mod-MSA: Mathematics was used to establish the base scale for the assessment in the area of mathematics at grades 3–5. Item parameters were calibrated using the Rasch measurement model which placed all items on a common scale. Although the Rasch model is fairly robust, when setting the base scale for an assessment program it is desirable to minimize as many sources of error as practical during the calibration process. This calibration was, therefore, conducted using a two-phase approach. In the first phase only items with acceptable classical item statistics (i.e., non-negative point biserial correlations) and IRT model fit were included. This phase of calibration established the base scale. During the second phase of calibration the items excluded from phase one were placed on the established base scale. This was accomplished by anchoring the parameters obtained for the items included in phase one to their base scale values and only allowing the parameters of the items with less acceptable classical stats (those excluded from phase one) to be freely estimated. This method placed the parameters of the poorly functioning items on the base scale (thereby allowing these items to be selected for operational scoring if necessary) while ensuring that these items did not unduly influence the parameters of those items with acceptable statistics.

Following calibration, all items were sent to Data Review. Those items not selected as operational items, but not labeled as "do not use" (DNU) during data review, were archived in the item bank for possible future use. RS to SS tables were then created using the established scale parameters of the items selected for operational scoring.

4.2. Specifics for Creating the Base Scale for the Mod-MSA: Mathematics Grades 3-5

The base scale was created for each grade 3 to 5 and content area based on the strength of the items' classical statistics. Items that had poor classical statistics were not included in the creation of the base scale for each grade and content area (for the purposes of this calibration poor item statistics means a negative point biserial correlation).

Items selected from above were calibrated using the Rasch model. From these items, all items showing poor INFIT and OUTFIT stats (>2.00 and < 0.5) were dropped from the creation of the base scale.

All the items that were excluded from the creation of the base scale were placed on this scale by floating them (keeping their calibration values unanchored) while anchoring the base-scale items to their established calibrated values.

Operational item calibration took place after an identification of these items from Data Review. The operational form item calibrations remained the same as those established on the above scale for the creation of the RS to SS tables. The non-operational items with their respective calibrations were banked as FT items.

The specific steps in the process were as follows:

1. Conduct classical item analysis of all items on a test
2. Conduct Rasch calibration of all items on a test that do ***not*** have negative point biserial correlations (based on results of Step 1)
3. Conduct Rasch calibration of all items used in Step 2 that show acceptable infit and outfit (<=2.00 and >=0.5) – this step establishes the base scale for the test
4. Place the items excluded at Steps 2 and 3 on the base scale by conducting a Rasch calibration with all items used in Step 3 anchored to their base scale values
5. Submit items for data review with their respective calibrations obtained as outlined above.
6. Create RS to SS scales (for total scores and strand scores), using base scale parameters of the items selected for operational scoring by data review members.

4.3. Calibration and Equating the 2010 Mod-MSA: Mathematics Grades 6-8

The base scale for the Mod-MSA: Mathematics Grades 6 to 8 had been created in 2009. The procedures followed in creating the base scale were the same as those explained above in creating the scale for Grades 3 to 5 in 2010.

The 2010 Mod-MSA, Math program included Algebra, Geometry and Measurement, Statistics and Probability, Numbers and Computations, and Process as the five scoring strands. The 2010 common items selected for linking were those items that had been administered in 2009. The pool of common items followed the same proportion of strand representation on the 2010 form as they did on the 2009 form. They also were placed at the same location in 2010 as they were on the 2009 form. Consequently, these items were used to put the 2010 assessments on the same base scale created during the 2009 assessment. In terms of year-to-year linking purpose, item and structure calibration parameters of the 2010 linking items were fixed with those of 2009 linking items which were already put on the 2009 common base scale. The stability of linking common items was evaluated using generalized robust z procedures, correlation coefficients, and standard deviation ratios discussed above.

4.4. Specifics of Linking and Equating the 2010 Mod-MSA Grades 6-8: Mathematics

The 2010 Mod-MSA was calibrated and equated by fixing item parameters of common linking items. For Grades 6-8, there were 25 common items used in each of the three grades for use as linking items in the equating process. Items in these grades were first placed on the 2009 established scale through the equating process. The calibrations of these items were then sent to data review and the same process was followed as in the Grade 3 to 5 calibration process described above to select operational items, create the RS to SS tables and archive non-operational items in the item bank.

To select unstable common items (outliers) from being linking items, the Robust Z procedure was used.

4.4.1. Generalized Robust Z Procedure

Generalized robust z values were calculated by the following procedures:

- Calculate the mean and standard deviation of the linking pool's structure measure parameters (D_{ij}) for the 2010 form
- Obtain the ratio of the standard deviations between form 2009 and form 2010
- Obtain the correlation between form 2009 and form 2010 structure measure parameters
- Calculate the difference between form 2009 and 2010 structure measure parameters for each item in the linking pool
- Calculate the mean of the differences calculated above
- Calculate the median of the differences
- Calculate the interquartile range of the differences
- Calculate the robust z for each structure measure parameter in the linking pool where the robust z is defined as (the difference between form 2009 and form 2010 item measure parameters minus the median of the differences) / (interquartile range multiplied by 0.74)
- Calculate the absolute z value of each item measure parameter

4.4.2. Guidelines for Selecting Linking Items

Once the above calculations are made, the following guidelines will determine possible sets of common items to be used for the Rasch equating (SCDE, 2001):

- Try not to include those items with an averaged absolute robust z exceeding 1.645
- Consider that the ratio of the standard deviations of form 2009 and form 2010 item measure parameters should be in the 90 to 110 percent range
- The correlation coefficient of form 2009 and 2010 should be greater than .95
- Do not eliminate more than 20 percent of total score point of the linking pool items

4.4.3. Step-by-step Procedure for Selecting Linking Items

1. Calculate robust Z for all items, the correlation between the fixed Rasch difficulties and the estimated Rasch difficulties, and the ratio of the standard deviations for the fixed and estimated Rasch difficulties. .
2. Check the correlation and ratio of SD of fixed and estimated Rasch parameters. If correlation is greater than 0.95 and ratio is between 0.9 and 1.1 then stop.
3. Choose the item with the largest absolute value of robust Z that is greater than 1.645 and drop from linking set. If no items have a robust Z with an absolute value greater than 1.645 then stop.
4. If the deletion of one more item from the linking set would result in 20% or more of the linking set items being dropped, then stop.
5. Recalculate correlation and SD ratio for remaining items and return to step 1. Do NOT recalculate robust Z values.

The step-by-step procedure is graphically displayed in Figure 4.4.1, below. Tables 4.4.1 to 4.4.3 provide the unequated Rasch item difficulty comparison of the core linking items between 2009 and 2010 for grades 6 to 8 together with their robust z values.

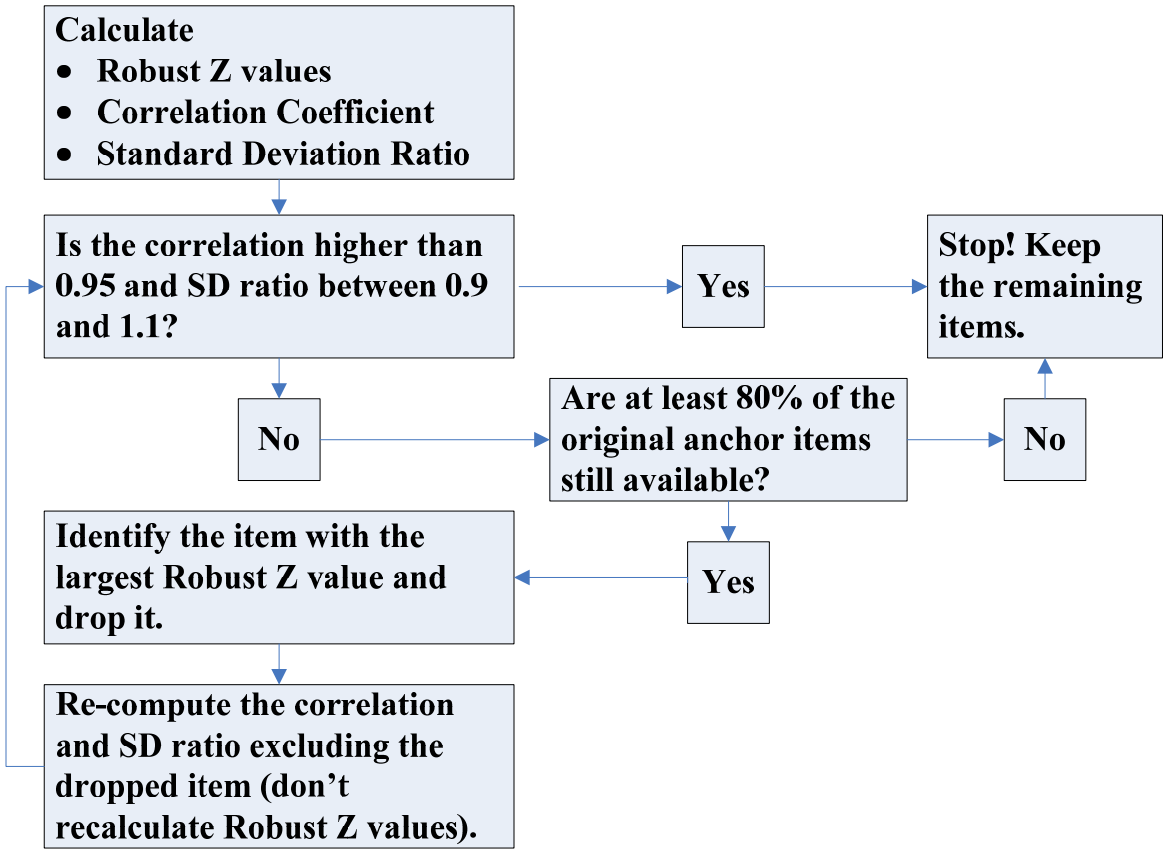

Figure 4.4.1. Anchor Evaluation Steps Chart for Mod-MSA

Table 4.4.1. Unequated Core Linking Item Difficulties of Year 2009 vs. Year 2010: Grade 6

Item No.	Item Seq. No.	Rasch Diff. 2009	Rasch Diff.2010	Robust Z*
1	6	0.3977	0.3028	0.23
2	12	-0.4626	-0.5599	0.24
3	16	0.3156	0.2080	0.29
4	18	0.6694	0.6908	-0.31
5	20	0.3908	0.5815	-1.09
6	21	-0.1220	-0.1674	0.00
7	22	-0.8737	-0.6721	-1.14
8	24	-0.5550	-0.5970	-0.02
9	41	0.0892	0.0166	0.13
10	45	0.1385	-0.0091	0.47
11	50	0.3190	0.5872	-1.44
12	52	-0.5054	-0.7925	1.11
13	59	-0.3809	-0.5283	0.47
14	61	-0.5584	-0.1776	**-1.96**
15	62	-0.4037	-0.2235	-1.04
16	63	-0.1446	-0.1266	-0.29
17	64	-0.0767	-0.5441	**1.94**
18	67	1.4827	1.2262	0.97
19	73	-0.3322	-0.6559	1.28
20	77	-0.4955	-0.6344	0.43
21	85	-0.7997	-0.8372	-0.04
22	90	1.0009	0.5815	**1.72**
23	91	-0.0184	0.1662	-1.06
24	93	0.5310	0.5929	-0.49
25	95	0.1881	0.3347	-0.88

Note: Bold, underlined values are for Robust Z > 1.645

Table 4.4.2. Unequated Core Linking Item Difficulties of Previous Year vs. Year 2010: Grade 7

Item No.	Item Seq. No.	Previous Year-2009	2010	Robust Z
1	5	-0.4387	-0.5594	0.40
2	9	0.8482	0.4942	1.35
3	12	1.4407	1.2821	0.56
4	16	-2.0862	-1.8465	-1.06
5	30	-1.0134	-0.7346	-1.22
6	31	-1.1523	-1.1412	-0.13
7	37	0.4196	0.5750	-0.72
8	38	0.4109	0.4289	-0.16
9	39	0.1404	0.2299	-0.45
10	40	0.1294	0.1945	-0.35
11	41	0.5938	0.5846	-0.05
12	43	-0.3334	-0.5461	0.78
13	66	0.3822	0.0026	1.45
14	71	0.6547	0.6430	-0.04
15	73	-0.4248	-0.7209	1.11
16	76	-0.5911	-1.0196	**1.65**
17	80	1.6427	1.3751	1.00
18	86	0.5339	0.1329	1.54
19	88	1.0713	1.0332	0.07
20	90	0.1073	-0.1050	0.77
21	91	-0.3721	-0.3932	0.00
22	92	-0.8505	-0.5506	-1.30
23	93	0.3308	0.3967	-0.35
24	94	-0.1444	-0.0405	-0.51
25	98	0.2911	0.0069	1.07

Note: Bold, underlined values are for Robust Z > 1.645

Table 4.4.3. Unequated Core Linking Item Difficulties of Previous Year vs. Year 2010: Grade 8

Item No.	Item Seq. No.	Previous Year-2009	2010	Robust Z
1	3	-0.6919	-0.5431	0.23
2	7	-1.2618	-1.1996	0.82
3	12	0.1130	0.2051	0.62
4	21	0.2121	0.4107	-0.11
5	28	0.3845	0.2656	**2.07**
6	32	0.0630	0.4601	-1.47
7	35	-1.2755	-1.1001	0.05
8	42	0.4466	0.5237	0.72
9	53	-0.1516	-0.016	0.32
10	54	0.6133	0.7956	0.00
11	55	0.7327	1.0196	-0.72
12	59	0.0583	0.3487	-0.74
13	61	-0.2045	0.1153	-0.94
14	64	-0.0053	0.4197	**-1.66**
15	66	-0.9339	-0.5869	-1.13
16	67	0.0276	0.1751	0.24
17	68	1.2281	1.5173	-0.73
18	69	-1.1337	-0.7028	**-1.70**
19	73	-0.9660	-0.8738	0.62
20	76	-0.2869	-0.0202	-0.58
21	77	-0.6825	-0.4262	-0.51
22	78	-0.2434	-0.1886	0.87
23	80	0.2761	0.5237	-0.45
24	84	-0.2686	-0.1971	0.76
25	96	0.5341	0.5932	0.84

Note: Bold, underlined values are for Robust Z > 1.645

4.5. Reporting Scale Scores for the 2010 Mod-MSA: Mathematics

The Mod-MSA reports student scores on the total performance of students on the mathematics examination (total score) as well as the reporting of their strand scores outlined in Section 2.3.

In order to facilitate the use and interpretation of the results of the 2010 Mod-MSA Mathematics, a scale score was created for each point on the raw score tables (total scores as well as strand scores) that had a mean = 50; a standard deviation = 12; and the lowest and highest obtainable scale scores (LOSS and HOSS) as 2 and 98 respectively. Please note that no scale score was allowed to fall below 2 (the LOSS) or exceed 98 (the HOSS). As is the case with standard MSA, the lowest obtainable raw score (zero) was automatically set to the LOSS and the highest obtainable raw score (51) set to the HOSS in the event that the actual scale score associated with these raw scores fell above or below these values respectively.

Once RS to Theta tables were produced by the WINSTEPS 3.46 program after data review, theta to scale score constants were calculated using the following formula:

$$SS = Slope \times Theta + Intercept$$

$$SEM_{CSS} = Slope \times SEM_{CT}$$

where

Slope = 12 / the standard deviation of the theta values, and

Intercept = 50 – slope × mean of the theta values

Theta = the *IRT* proficiency estimate at a particular raw score on the scoring continuum

SEM_{CSS} = the standard error of the scale score, and

SEM_{CT} = the standard error conditional on proficiency (theta) estimates

Table 4.5.1 depicts the slope and intercept that were used for each grade. It should be noted that the same slopes and intercepts were used for Grades 6 to 8 as those used in 2009. Similarly, the same slopes and intercept for each of the grades 3 to 8 will be used for future administrations. Total raw score to scale score conversion tables for Grades 3-8 are provided in Tables 4.5.2 to 4.5.7, while strand level RS to SS are provided in Tables 4.5.8 to Tables 4.5.13.

Each student's total raw score for the strands was a summation of the individual item score within a strand level. The strand levels were classified as stated in section 2.3 and the item parameters within each strand was obtained using the Winsteps program in the same manner as those obtained for the total test. Once the item parameters were available, thetas (student proficiency scores) were calculated for each raw score point that could be obtained within each strand. The thetas were transferred to scale scores, using the same slope and intercept as that which were applied for the total mathematics test score.

Table 4.5.1. The 2010 Mod-MSA, Mathematics Slope and Intercept for the Transfer of RS to SS Across Grades

Grade	Slope	Intercept
3	15.5187	49.4835
4	15.0818	48.9387
5	17.8819	51.4991
6	16.7632	52.1350
7	18.6899	51.4473
8	20.7023	56.8048

Raw Score to Scale Score Conversion Tables for the Total Score

Table 4.5.2. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 3

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.4562	2.0067	2	31	-	-
1	-4.0494	1.0136	2	16	-	-
2	-3.3287	0.7264	2	11	-	-
3	-2.8954	0.6011	5	9	-	-
4	-2.5795	0.5276	9	8	2	17
5	-2.3278	0.4783	13	7	6	20
6	-2.1165	0.4425	17	7	10	24
7	-1.9329	0.4153	19	6	13	25
8	-1.7695	0.3938	22	6	16	28
9	-1.6214	0.3764	24	6	18	30
10	-1.4854	0.3620	26	6	20	32
11	-1.3586	0.3500	28	5	23	33
12	-1.2397	0.3399	30	5	25	35
13	-1.1272	0.3313	32	5	27	37
14	-1.0199	0.3239	34	5	29	39
15	-0.9170	0.3176	35	5	30	40
16	-0.8179	0.3122	37	5	32	42
17	-0.7220	0.3076	38	5	33	43
18	-0.6286	0.3036	40	5	35	45
19	-0.5374	0.3003	41	5	36	46
20	-0.4481	0.2975	43	5	38	48
21	-0.3602	0.2953	44	5	39	49
22	-0.2736	0.2935	45	5	40	50
23	-0.1878	0.2922	47	5	42	52
24	-0.1026	0.2914	48	5	43	53
25	-0.0180	0.2909	49	5	44	54
26	0.0667	0.2909	51	5	46	56
27	0.1514	0.2913	52	5	47	57
28	0.2364	0.2921	53	5	48	58
29	0.3222	0.2934	54	5	49	59
30	0.4088	0.2951	56	5	51	61
31	0.4964	0.2973	57	5	52	62
32	0.5857	0.3000	59	5	54	64
33	0.6767	0.3033	60	5	55	65
34	0.7697	0.3072	61	5	56	66
35	0.8656	0.3118	63	5	58	68
36	0.9645	0.3172	64	5	59	69
37	1.0670	0.3235	66	5	61	71
38	1.1740	0.3308	68	5	63	73
39	1.2862	0.3394	69	5	64	74
40	1.4047	0.3495	71	5	66	76
41	1.5310	0.3614	73	6	67	79
42	1.6667	0.3758	75	6	69	81
43	1.8142	0.3931	78	6	72	84
44	1.9771	0.4146	80	6	74	86

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
45	2.1601	0.4419	83	7	76	90
46	2.3707	0.4776	86	7	79	93
47	2.6218	0.5270	90	8	82	98
48	2.9369	0.6005	95	9	-	-
49	3.3695	0.7259	98	11	-	-
50	4.0894	1.0132	98	16	-	-
51	5.4954	2.0066	98	31	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.3. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 4

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.4887	2.0070	2	30	-	-
1	-4.0813	1.0139	2	15	-	-
2	-3.3599	0.7269	2	11	-	-
3	-2.9260	0.6016	5	9	-	-
4	-2.6097	0.5280	10	8	2	18
5	-2.3576	0.4786	13	7	6	20
6	-2.1460	0.4428	17	7	10	24
7	-1.9623	0.4154	19	6	13	25
8	-1.7989	0.3938	22	6	16	28
9	-1.6508	0.3763	24	6	18	30
10	-1.5147	0.3618	26	5	21	31
11	-1.3882	0.3498	28	5	23	33
12	-1.2695	0.3395	30	5	25	35
13	-1.1574	0.3308	31	5	26	36
14	-1.0504	0.3233	33	5	28	38
15	-0.9480	0.3168	35	5	30	40
16	-0.8494	0.3113	36	5	31	41
17	-0.7540	0.3065	38	5	33	43
18	-0.6614	0.3025	39	5	34	44
19	-0.5709	0.2991	40	5	35	45
20	-0.4823	0.2962	42	4	38	46
21	-0.3953	0.2938	43	4	39	47
22	-0.3096	0.2920	44	4	40	48
23	-0.2248	0.2906	46	4	42	50
24	-0.1406	0.2896	47	4	43	51
25	-0.0570	0.2891	48	4	44	52
26	0.0266	0.2890	49	4	45	53
27	0.1102	0.2893	51	4	47	55
28	0.1940	0.2901	52	4	48	56
29	0.2786	0.2913	53	4	49	57
30	0.3638	0.2929	54	4	50	58
31	0.4503	0.2951	56	4	52	60
32	0.5380	0.2977	57	4	53	61
33	0.6277	0.3010	58	5	53	63
34	0.7193	0.3048	60	5	55	65
35	0.8137	0.3094	61	5	56	66
36	0.9109	0.3147	63	5	58	68
37	1.0120	0.3210	64	5	59	69
38	1.1173	0.3283	66	5	61	71
39	1.2279	0.3369	67	5	62	72
40	1.3448	0.3470	69	5	64	74
41	1.4692	0.3590	71	5	66	76
42	1.6032	0.3734	73	6	67	79
43	1.7489	0.3908	75	6	69	81
44	1.9099	0.4123	78	6	72	84
45	2.0909	0.4397	80	7	73	87

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
46	2.2997	0.4756	84	7	77	91
47	2.5488	0.5251	87	8	79	95
48	2.8619	0.5988	92	9	-	-
49	3.2924	0.7244	98	11	-	-
50	4.0101	1.0121	98	15	-	-
51	5.4145	2.0061	98	30	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.4. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 5

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.4277	2.0065	2	36	-	-
1	-4.0219	1.0130	2	18	-	-
2	-3.3024	0.7256	2	13	-	-
3	-2.8703	0.6001	2	11	-	-
4	-2.5557	0.5265	6	9	-	-
5	-2.3051	0.4771	10	9	2	19
6	-2.0951	0.4412	14	8	6	22
7	-1.9126	0.4139	17	7	10	24
8	-1.7504	0.3924	20	7	13	27
9	-1.6034	0.3749	23	7	16	30
10	-1.4683	0.3605	25	6	19	31
11	-1.3428	0.3485	27	6	21	33
12	-1.2249	0.3384	30	6	24	36
13	-1.1134	0.3297	32	6	26	38
14	-1.0071	0.3224	33	6	27	39
15	-0.9053	0.3160	35	6	29	41
16	-0.8072	0.3106	37	6	31	43
17	-0.7121	0.3060	39	5	34	44
18	-0.6197	0.3020	40	5	35	45
19	-0.5296	0.2987	42	5	37	47
20	-0.4413	0.2959	44	5	39	49
21	-0.3544	0.2937	45	5	40	50
22	-0.2686	0.2919	47	5	42	52
23	-0.1838	0.2907	48	5	43	53
24	-0.0996	0.2898	50	5	45	55
25	-0.0158	0.2894	51	5	46	56
26	0.0680	0.2894	53	5	48	58
27	0.1519	0.2898	54	5	49	59
28	0.2360	0.2907	56	5	51	61
29	0.3209	0.2920	57	5	52	62
30	0.4067	0.2937	59	5	54	64
31	0.4935	0.2959	60	5	55	65
32	0.5819	0.2987	62	5	57	67
33	0.6721	0.3020	64	5	59	69
34	0.7645	0.3060	65	5	60	70

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
35	0.8595	0.3106	67	6	61	73
36	0.9577	0.3161	69	6	63	75
37	1.0595	0.3224	70	6	64	76
38	1.1658	0.3298	72	6	66	78
39	1.2774	0.3385	74	6	68	80
40	1.3954	0.3487	76	6	70	82
41	1.5211	0.3607	79	6	73	85
42	1.6563	0.3751	81	7	74	88
43	1.8035	0.3926	84	7	77	91
44	1.9659	0.4142	87	7	80	94
45	2.1486	0.4415	90	8	82	98
46	2.3590	0.4774	94	9	-	-
47	2.6099	0.5269	98	9	-	-
48	2.9249	0.6005	98	11	-	-
49	3.3575	0.7259	98	13	-	-
50	4.0775	1.0133	98	18	-	-
51	5.4837	2.0067	98	36	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.5. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 6

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.3923	2.0065	2	34	-	-
1	-3.9866	1.0129	2	17	-	-
2	-3.2672	0.7255	2	12	-	-
3	-2.8352	0.6001	5	10	-	-
4	-2.5205	0.5266	10	9	-	-
5	-2.2699	0.4772	14	8	6	22
6	-2.0596	0.4414	18	7	11	25
7	-1.8770	0.4142	21	7	14	28
8	-1.7145	0.3927	23	7	16	30
9	-1.5672	0.3753	26	6	20	32
10	-1.4318	0.3610	28	6	22	34
11	-1.3059	0.3490	30	6	24	36
12	-1.1877	0.3390	32	6	26	38
13	-1.0757	0.3304	34	6	28	40
14	-0.9690	0.3231	36	5	31	41
15	-0.8667	0.3168	38	5	33	43
16	-0.7681	0.3114	39	5	34	44
17	-0.6725	0.3069	41	5	36	46
18	-0.5796	0.3030	42	5	37	47
19	-0.4888	0.2997	44	5	39	49
20	-0.3997	0.2970	45	5	40	50
21	-0.3123	0.2948	47	5	42	52
22	-0.2259	0.2931	48	5	43	53
23	-0.1404	0.2918	50	5	45	55
24	-0.0554	0.2910	51	5	46	56
25	0.0291	0.2906	53	5	48	58
26	0.1135	0.2906	54	5	49	59
27	0.1981	0.2911	55	5	50	60
28	0.2831	0.2920	57	5	52	62
29	0.3687	0.2933	58	5	53	63
30	0.4551	0.2950	60	5	55	65
31	0.5428	0.2973	61	5	56	66
32	0.6321	0.3001	63	5	58	68
33	0.7231	0.3034	64	5	59	69
34	0.8163	0.3073	66	5	61	71

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
35	0.9122	0.3120	67	5	62	72
36	1.0111	0.3174	69	5	64	74
37	1.1138	0.3237	71	5	66	76
38	1.2209	0.3311	73	6	67	79
39	1.3335	0.3397	74	6	68	80
40	1.4522	0.3499	76	6	70	82
41	1.5787	0.3619	79	6	73	85
42	1.7149	0.3763	81	6	75	87
43	1.8628	0.3936	83	7	76	90
44	2.0261	0.4152	86	7	79	93
45	2.2096	0.4424	89	7	82	96
46	2.4208	0.4782	93	8	-	-
47	2.6725	0.5276	97	9	-	-
48	2.9883	0.6011	98	10	-	-
49	3.4217	0.7264	98	12	-	-
50	4.1423	1.0136	98	17	-	-
51	5.5490	2.0068	98	34	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.6. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 7

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.5025	2.0096	2	38	-	-
1	-4.0877	1.0186	2	19	-	-
2	-3.3574	0.7327	2	14	-	-
3	-2.9155	0.6078	2	11	-	-
4	-2.5919	0.5345	3	10	-	-
5	-2.3333	0.4851	8	9	-	-
6	-2.1158	0.4493	12	8	4	20
7	-1.9264	0.4220	15	8	7	23
8	-1.7577	0.4003	19	7	12	26
9	-1.6045	0.3828	21	7	14	28
10	-1.4637	0.3683	24	7	17	31
11	-1.3325	0.3562	27	7	20	34
12	-1.2094	0.3459	29	6	23	35
13	-1.0927	0.3372	31	6	25	37
14	-0.9817	0.3297	33	6	27	39
15	-0.8750	0.3233	35	6	29	41
16	-0.7723	0.3178	37	6	31	43
17	-0.6728	0.3131	39	6	33	45
18	-0.5761	0.3091	41	6	35	47
19	-0.4817	0.3057	42	6	36	48
20	-0.3891	0.3028	44	6	38	50
21	-0.2981	0.3005	46	6	40	52
22	-0.2083	0.2987	48	6	42	54
23	-0.1195	0.2974	49	6	43	55
24	-0.0314	0.2965	51	6	45	57
25	0.0563	0.2960	52	6	46	58
26	0.1439	0.2959	54	6	48	60
27	0.2315	0.2963	56	6	50	62
28	0.3195	0.2971	57	6	51	63
29	0.4080	0.2983	59	6	53	65
30	0.4975	0.3000	61	6	55	67
31	0.5881	0.3022	62	6	56	68
32	0.6802	0.3048	64	6	58	70
33	0.7742	0.3081	66	6	60	72
34	0.8702	0.3120	68	6	62	74

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
35	0.9690	0.3166	70	6	64	76
36	1.0708	0.3219	71	6	65	77
37	1.1765	0.3282	73	6	67	79
38	1.2865	0.3355	75	6	69	81
39	1.4019	0.3440	78	6	72	84
40	1.5236	0.3541	80	7	73	87
41	1.6532	0.3660	82	7	75	89
42	1.7923	0.3803	85	7	78	92
43	1.9433	0.3976	88	7	81	95
44	2.1097	0.4190	91	8	83	98
45	2.2964	0.4461	94	8	-	-
46	2.5109	0.4817	98	9	-	-
47	2.7658	0.5308	98	10	-	-
48	3.0851	0.6040	98	11	-	-
49	3.5220	0.7289	98	14	-	-
50	4.2463	1.0155	98	19	-	-
51	5.6557	2.0076	98	38	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.7. The 2010 Mod-MSA, Mathematics: Total Raw Score to Scale Score Conversion Table: Grade 8

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
0	-5.6620	2.0078	2	42	-	-
1	-4.2524	1.0156	2	21	-	-
2	-3.5278	0.7290	2	15	-	-
3	-3.0907	0.6043	2	13	-	-
4	-2.7710	0.5312	2	11	-	-
5	-2.5155	0.4823	5	10	-	-
6	-2.3004	0.4468	9	9	-	-
7	-2.1131	0.4197	13	9	4	22
8	-1.9461	0.3985	17	8	9	25
9	-1.7943	0.3812	20	8	12	28
10	-1.6545	0.3670	23	8	15	31
11	-1.5242	0.3551	25	7	18	32
12	-1.4017	0.3451	28	7	21	35
13	-1.2857	0.3366	30	7	23	37
14	-1.1749	0.3293	32	7	25	39
15	-1.0686	0.3230	35	7	28	42
16	-0.9660	0.3176	37	7	30	44
17	-0.8666	0.3130	39	6	33	45
18	-0.7699	0.3091	41	6	35	47
19	-0.6754	0.3058	43	6	37	49
20	-0.5828	0.3030	45	6	39	51
21	-0.4917	0.3008	47	6	41	53
22	-0.4018	0.2990	48	6	42	54
23	-0.3128	0.2977	50	6	44	56
24	-0.2245	0.2968	52	6	46	58
25	-0.1365	0.2964	54	6	48	60
26	-0.0486	0.2963	56	6	50	62
27	0.0393	0.2967	58	6	52	64
28	0.1276	0.2976	59	6	53	65
29	0.2165	0.2988	61	6	55	67
30	0.3062	0.3005	63	6	57	69
31	0.3972	0.3027	65	6	59	71
32	0.4895	0.3054	67	6	61	73
33	0.5839	0.3087	69	6	63	75
34	0.6804	0.3126	71	6	65	77
35	0.7794	0.3172	73	7	66	80

Raw Score	Proficiency Estimate	SE	SS[1]	SE(SS)	SS-1SE (SS)[2]	SS+1SE (SS)[2]
36	0.8817	0.3226	75	7	68	82
37	0.9878	0.3289	77	7	70	84
38	1.0984	0.3362	80	7	73	87
39	1.2142	0.3448	82	7	75	89
40	1.3366	0.3549	84	7	77	91
41	1.4667	0.3669	87	8	79	95
42	1.6064	0.3811	90	8	82	98
43	1.7581	0.3985	93	8	-	-
44	1.9254	0.4199	97	9	-	-
45	2.1128	0.4470	98	9	-	-
46	2.3282	0.4827	98	10	-	-
47	2.5841	0.5318	98	11	-	-
48	2.9045	0.6050	98	13	-	-
49	3.3427	0.7297	98	15	-	-
50	4.0683	1.0162	98	21	-	-
51	5.4789	2.0081	98	42	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Raw Score to Scale Score Conversion Tables for the Subscales

Table 4.5.8. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 3

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	32	-	-
Algebra	1	13	17	-	-
Algebra	2	27	13	14	40
Algebra	3	36	11	25	47
Algebra	4	44	11	33	55
Algebra	5	51	11	40	62
Algebra	6	59	11	48	70
Algebra	7	68	13	55	81
Algebra	8	82	17	-	-
Algebra	9	98	32	-	-
Geometry and Measurement	0	2	32	-	-
Geometry and Measurement	1	11	17	-	-
Geometry and Measurement	2	24	12	12	36
Geometry and Measurement	3	32	11	21	43
Geometry and Measurement	4	39	10	29	49
Geometry and Measurement	5	46	10	36	56
Geometry and Measurement	6	52	10	42	62
Geometry and Measurement	7	58	10	48	68
Geometry and Measurement	8	65	11	54	76
Geometry and Measurement	9	74	12	62	86
Geometry and Measurement	10	86	16	-	-
Geometry and Measurement	11	98	32	-	-
Statistics and Probability	0	2	32	-	-
Statistics and Probability	1	17	16	-	-
Statistics and Probability	2	30	12	18	42
Statistics and Probability	3	39	11	28	50
Statistics and Probability	4	46	10	36	56
Statistics and Probability	5	52	10	42	62
Statistics and Probability	6	59	10	49	69
Statistics and Probability	7	66	11	55	77
Statistics and Probability	8	75	12	63	87
Statistics and Probability	9	88	17	-	-
Statistics and Probability	10	98	32	-	-
Numbers and Computation	0	2	32	-	-
Numbers and Computation	1	9	17	-	-
Numbers and Computation	2	22	12	10	34
Numbers and Computation	3	31	11	20	42
Numbers and Computation	4	38	10	28	48
Numbers and Computation	5	44	10	34	54
Numbers and Computation	6	50	10	40	60
Numbers and Computation	7	57	10	47	67
Numbers and Computation	8	64	11	53	75
Numbers and Computation	9	72	12	60	84

Table 4.5.8. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 3 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Numbers and Computation	10	85	17	-	-
Numbers and Computation	11	98	32	-	-
Process	0	2	32	-	-
Process	1	17	17	-	-
Process	2	31	13	18	44
Process	3	39	11	28	50
Process	4	47	10	37	57
Process	5	54	10	44	64
Process	6	60	10	50	70
Process	7	68	11	57	79
Process	8	77	13	64	90
Process	9	90	17	-	-
Process	10	98	32	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.9. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 4

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	31	-	-
Algebra	1	13	16	-	-
Algebra	2	26	12	14	38
Algebra	3	35	11	24	46
Algebra	4	43	10	33	53
Algebra	5	49	10	39	59
Algebra	6	56	10	46	66
Algebra	7	63	11	52	74
Algebra	8	72	12	60	84
Algebra	9	85	16	-	-
Algebra	10	98	31	-	-
Geometry and Measurement	0	2	31	-	-
Geometry and Measurement	1	14	16	-	-
Geometry and Measurement	2	27	12	15	39
Geometry and Measurement	3	35	11	24	46
Geometry and Measurement	4	43	10	33	53
Geometry and Measurement	5	49	10	39	59
Geometry and Measurement	6	56	10	46	66
Geometry and Measurement	7	63	11	52	74
Geometry and Measurement	8	71	12	59	83
Geometry and Measurement	9	84	16	-	-
Geometry and Measurement	10	98	31	-	-
Statistics and Probability	0	2	31	-	-
Statistics and Probability	1	13	16	-	-
Statistics and Probability	2	25	12	13	37
Statistics and Probability	3	33	10	23	43
Statistics and Probability	4	40	10	30	50
Statistics and Probability	5	46	9	37	55
Statistics and Probability	6	52	9	43	61
Statistics and Probability	7	58	10	48	68
Statistics and Probability	8	64	10	54	74
Statistics and Probability	9	73	12	61	85
Statistics and Probability	10	85	16	-	-
Statistics and Probability	11	98	31	-	-
Numbers and Computation	0	2	31	-	-
Numbers and Computation	1	11	16	-	-
Numbers and Computation	2	24	12	12	36
Numbers and Computation	3	33	11	22	44
Numbers and Computation	4	40	10	30	50
Numbers and Computation	5	46	10	36	56
Numbers and Computation	6	53	10	43	63
Numbers and Computation	7	60	11	49	71
Numbers and Computation	8	69	12	57	81
Numbers and Computation	9	81	16	65	97
Numbers and Computation	10	98	31	-	-

Table 4.5.9. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 4 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Process	0	2	31	-	-
Process	1	16	16	-	-
Process	2	28	12	16	40
Process	3	37	10	27	47
Process	4	43	10	33	53
Process	5	50	10	40	60
Process	6	56	10	46	66
Process	7	63	10	53	73
Process	8	71	12	59	83
Process	9	83	16	-	-
Process	10	98	31	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.10. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 5

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	36	-	-
Algebra	1	7	19	-	-
Algebra	2	22	14	8	36
Algebra	3	32	13	19	45
Algebra	4	40	12	28	52
Algebra	5	47	11	36	58
Algebra	6	55	12	43	67
Algebra	7	63	13	50	76
Algebra	8	73	14	59	87
Algebra	9	88	19	-	-
Algebra	10	98	36	-	-
Geometry and Measurement	0	2	36	-	-
Geometry and Measurement	1	11	19	2	30
Geometry and Measurement	2	26	15	11	41
Geometry and Measurement	3	37	13	24	50
Geometry and Measurement	4	46	12	34	58
Geometry and Measurement	5	54	12	42	66
Geometry and Measurement	6	62	12	50	74
Geometry and Measurement	7	70	13	57	83
Geometry and Measurement	8	81	15	66	96
Geometry and Measurement	9	96	19	-	-
Geometry and Measurement	10	98	36	-	-
Statistics and Probability	0	2	36	-	-
Statistics and Probability	1	12	19	-	-
Statistics and Probability	2	28	15	13	43
Statistics and Probability	3	39	13	26	52
Statistics and Probability	4	48	13	35	61
Statistics and Probability	5	57	13	44	70
Statistics and Probability	6	66	13	53	79
Statistics and Probability	7	77	15	62	92
Statistics and Probability	8	92	19	-	-
Statistics and Probability	9	98	36	-	-
		98	42	-	-
Numbers and Computation	0	2	36	-	-
Numbers and Computation	1	14	19	-	-
Numbers and Computation	2	28	14	14	42
Numbers and Computation	3	38	13	25	51
Numbers and Computation	4	47	12	35	59
Numbers and Computation	5	54	12	42	66
Numbers and Computation	6	62	12	50	74
Numbers and Computation	7	70	13	57	83
Numbers and Computation	8	80	14	66	94
Numbers and Computation	9	95	19	-	-
Numbers and Computation	10	98	36	-	-

Table 4.5.10. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 5 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Process	0	2	36	-	-
Process	1	8	19	-	-
Process	2	23	14	9	37
Process	3	32	12	20	44
Process	4	40	11	29	51
Process	5	46	11	35	57
Process	6	52	11	41	63
Process	7	59	11	48	70
Process	8	65	11	54	76
Process	9	73	12	61	85
Process	10	82	14	68	96
Process	11	96	19	-	-
Process	12	98	36	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

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Table 4.5.11. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 6

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	34	-	-
Algebra	1	11	18	-	-
Algebra	2	25	14	11	39
Algebra	3	35	12	23	47
Algebra	4	43	11	32	54
Algebra	5	50	11	39	61
Algebra	6	57	11	46	68
Algebra	7	65	12	53	77
Algebra	8	75	14	61	89
Algebra	9	89	18	-	-
Algebra	10	98	34	-	-
Geometry and Measurement	0	2	34	-	-
Geometry and Measurement	1	21	18	3	39
Geometry and Measurement	2	35	13	22	48
Geometry and Measurement	3	44	12	32	56
Geometry and Measurement	4	52	11	41	63
Geometry and Measurement	5	59	11	48	70
Geometry and Measurement	6	66	11	55	77
Geometry and Measurement	7	74	12	62	86
Geometry and Measurement	8	83	14	69	97
Geometry and Measurement	9	97	18	-	-
Geometry and Measurement	10	98	34	-	-
Statistics and Probability	0	2	34	-	-
Statistics and Probability	1	14	18	-	-
Statistics and Probability	2	28	13	15	41
Statistics and Probability	3	38	12	26	50
Statistics and Probability	4	45	11	34	56
Statistics and Probability	5	53	11	42	64
Statistics and Probability	6	60	11	49	71
Statistics and Probability	7	67	12	55	79
Statistics and Probability	8	77	13	64	90
Statistics and Probability	9	91	18	-	-
Statistics and Probability	10	98	34	-	-
Numbers and Computation	0	2	34	-	-
Numbers and Computation	1	12	18	-	-
Numbers and Computation	2	27	14	13	41
Numbers and Computation	3	36	12	24	48
Numbers and Computation	4	45	11	34	56
Numbers and Computation	5	52	11	41	63
Numbers and Computation	6	60	11	49	71
Numbers and Computation	7	68	12	56	80
Numbers and Computation	8	78	14	64	92
Numbers and Computation	9	93	18	-	-
Numbers and Computation	10	98	34	-	-

Table 4.5.11. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 6 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Process	0	-	-	-	-
Process	1	13	18	-	-
Process	2	26	13	13	39
Process	3	36	12	24	48
Process	4	43	11	32	54
Process	5	50	10	40	60
Process	6	56	10	46	66
Process	7	63	11	52	74
Process	8	70	12	58	82
Process	9	79	13	66	92
Process	10	93	18	-	-
Process	11	98	34	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.12. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 7

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	38	-	-
Algebra	1	5	20	-	-
Algebra	2	21	15	6	36
Algebra	3	32	13	19	45
Algebra	4	41	13	28	54
Algebra	5	49	12	37	61
Algebra	6	58	13	45	71
Algebra	7	67	13	54	80
Algebra	8	78	15	63	93
Algebra	9	94	20	-	-
Algebra	10	98	38	-	-
Geometry and Measurement	0	2	38	-	-
Geometry and Measurement	1	14	20	-	-
Geometry and Measurement	2	31	16	15	47
Geometry and Measurement	3	42	14	28	56
Geometry and Measurement	4	52	13	39	65
Geometry and Measurement	5	61	13	48	74
Geometry and Measurement	6	71	14	57	85
Geometry and Measurement	7	83	16	-	-
Geometry and Measurement	8	98	20	-	-
Geometry and Measurement	9	98	38	-	-
Statistics and Probability	0	2	38	-	-
Statistics and Probability	1	11	20	-	-
Statistics and Probability	2	27	15	12	42
Statistics and Probability	3	39	14	25	53
Statistics and Probability	4	48	13	35	61
Statistics and Probability	5	57	13	44	70
Statistics and Probability	6	65	13	52	78
Statistics and Probability	7	75	14	61	89
Statistics and Probability	8	86	16	-	-
Statistics and Probability	9	98	20	-	-
Statistics and Probability	10	98	38	-	-
Numbers and Computation	0	2	38	-	-
Numbers and Computation	1	2	21	-	-
Numbers and Computation	2	16	16	-	-
Numbers and Computation	3	28	14	14	42
Numbers and Computation	4	37	13	24	50
Numbers and Computation	5	46	13	33	59
Numbers and Computation	6	55	13	42	68
Numbers and Computation	7	64	14	50	78
Numbers and Computation	8	75	15	60	90
Numbers and Computation	9	91	20	-	-
Numbers and Computation	10	98	38	-	-

Table 4.5.12. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 7 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Process	0	2	38	-	-
Process	1	11	20	-	-
Process	2	26	15	11	41
Process	3	36	13	23	49
Process	4	44	12	32	56
Process	5	51	11	40	62
Process	6	57	11	46	68
Process	7	64	11	53	75
Process	8	71	12	59	83
Process	9	78	13	65	91
Process	10	88	15	-	-
Process	11	98	20	-	-
Process	12	98	38	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

Table 4.5.13. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 8

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Algebra	0	2	42	-	-
Algebra	1	2	22	-	-
Algebra	2	16	17	-	-
Algebra	3	28	15	13	43
Algebra	4	37	14	23	51
Algebra	5	46	13	33	59
Algebra	6	54	13	41	67
Algebra	7	62	13	49	75
Algebra	8	72	14	58	86
Algebra	9	83	17	-	-
Algebra	10	98	22	-	-
Algebra	11	98	42	-	-
Geometry and Measurement	0	2	42	-	-
Geometry and Measurement	1	15	22	-	-
Geometry and Measurement	2	33	17	16	50
Geometry and Measurement	3	45	15	30	60
Geometry and Measurement	4	56	15	41	71
Geometry and Measurement	5	66	15	51	81
Geometry and Measurement	6	77	15	62	92
Geometry and Measurement	7	90	17	-	-
Geometry and Measurement	8	98	23	-	-
Geometry and Measurement	9	98	42	-	-
Statistics and Probability	0	2	42	-	-
Statistics and Probability	1	8	23	-	-
Statistics and Probability	2	26	17	9	43
Statistics and Probability	3	39	15	24	54
Statistics and Probability	4	49	14	35	63
Statistics and Probability	5	59	14	45	73
Statistics and Probability	6	68	14	54	82
Statistics and Probability	7	78	15	63	93
Statistics and Probability	8	90	17	-	-
Statistics and Probability	9	98	22	-	-
Statistics and Probability	10	98	42	-	-
Numbers and Computation	0	2	42	-	-
Numbers and Computation	1	3	23	-	-
Numbers and Computation	2	22	18	4	40
Numbers and Computation	3	36	16	20	52
Numbers and Computation	4	48	16	32	64
Numbers and Computation	5	60	16	44	76
Numbers and Computation	6	73	18	55	91
Numbers and Computation	7	91	23	-	-
Numbers and Computation	8	98	42	-	-

Table 4.5.13. The 2010 Mod-MSA, Mathematics: Raw Score to Scale Score Conversion by Sub-Scales/Strands: Grade 8 (Continued)

Subscale Strand	Raw Score	Scale Score (SS)[1]	Standard Error (*SEM*)	SS – 1*SEM*[2]	SS + 1*SEM*[2]
Process	0	2	42	-	-
Process	1	2	22	-	-
Process	2	18	16	2	34
Process	3	29	14	15	43
Process	4	38	13	25	51
Process	5	46	12	34	58
Process	6	53	12	41	65
Process	7	60	12	48	72
Process	8	67	12	55	79
Process	9	75	13	62	88
Process	10	84	14	70	98
Process	11	95	17	-	-
Process	12	98	22	-	-
Process	13	98	42	-	-

Note. 1. LOSS was set to 2 while the HOSS was set at 98

2. Because of the ceiling effect set by the LOSS and HOSS, the confidence intervals set by the standard errors may not follow the expected pattern of equal or progressively larger bandwidth as one moves up and down the extreme ends of the scoring continuum. This would also be the case when the standard error is larger than the estimated scale score, and one would have to force the ceiling effect to counter negative score values at the lower end or higher than the ceiling values at the upper end of the bandwidth. These values are, therefore, left blank.

4.6. Score Interpretation

Interpretation of the 2010 Mod-MSA: Mathematics test scores depends primarily on the understanding of the scale score and the performance level descriptors.

Scale Scores

As explained in section 4.5, Reporting Scale Scores for the 2010 Mod-MSA: Mathematics, the test produced scale scores that ranged between 2 and 98. These scale scores have the same meaning within the same grade, but are not comparable across grade levels.

It should be noted that for scale scores, a higher score simply means a higher performance on the mathematics tests. Performance levels and descriptions can then be used to give specific interpretation to the scale scores because they are developed to bring meaning to those scale scores.

Performance Level Descriptors

As explained previously, performance level descriptors provide specific information about students' performance levels and help interpret the 2010 Mod-MSA: Mathematics scale scores. They describe what students at a particular level generally know and can be applicable to all students within each grade level.

Maryland standards are divided into three levels of achievement (http://mdk12.org/instruction/curriculum/index.html):

- Advanced is a highly challenging and exemplary level of achievement indicating outstanding accomplishment in meeting students' needs.
- Proficient is a realistic and rigorous level of achievement indicating proficiency in meeting students' needs.
- Basic is a level of achievement indicating that more work is needed to attain proficiency in meeting students' needs.

The proficient levels described above were translated as classification scale score cuts through a standard setting procedure discussed in Appendix D.

4.7. Final Performance Level Cut Points for the Mod-MSA: Mathematics

For grade 3-5 a standard setting procedure was undertaken (see Appendix D) to obtain the cuts at the performance levels. The final cut points adopted by MSDE for the 2010 administration of the Mod-MSA: Mathematics test, grades 3-5 in raw score points, scale score, and theta metric were adjusted by the executive committee. There are two cut points that correspond to the three performance levels discussed above. Any score below the proficient cut point is the basic performance level.

Table 4.7.1 contains information about the cutoff scale score of each performance level. It should be noted that the same cutoff scores set by the standard setting procedure in 2009 for grades 6-8 were applied in 2010.

Table 4.7.1 Mod-MSA: Mathematics Scale Score Cuts by Grades

Grade	Cut Score at Performance Level	
	Proficient	Advanced
3	54	66
4	53	67
5	54	69
6	56	69
7	54	71
8	60	73