APPENDIX D

REDUNDANT ANALYSIS REPORTS

Notes and Graphs for the Equating of the 2006 Massachusetts Comprehensive Assessment System Tests in ELA and Mathematics

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INTRODUCTION

In this report we will describe our work to equate the 2006 MCAS English Language Arts tests in grades 4, 7, and 10 and Mathematics tests in grades 4, 6, 8, and 10 to the corresponding 2005 MCAS tests. The analyses were uneventful with very few problems arising. Our findings were compared to the findings of the contractor, Measured Progress, most notably, the positioning of the performance standards at each of the grade levels. The positioning of the performance standards was equivalent in the UMass and Measured Progress equating solutions, and correspondingly, so would be the assignment of all students to performance categories on the seven tests.

What follows are some of our notes in completing each of the seven equatings, and the delta plots, b- and a-parameter estimate plots, the test characteristic curves, and our conversion tables.

MCAS 2006 PARSCALE RUNS

NOTES FOR ELA GRADE 4:

In the initial calibration, convergence was not achieved due to scoring item 19. Two other items, numbers 8 and 22 had c parameter estimates of 0.000. The item parameter estimates before convergence were as follows:

8 (226003, common, b=-1.833, a=0.523, and c=0.000)
19 (228135, common, b=-3.665, a=0.534, and c=0.000)
22 (244139, common, b=-2.262, a=0.742, and c=0.000)

After the c parameter estimates for all three items were fixed at 0.200, convergence was achieved. The item parameter estimates after convergence were as follows:

8 (226003, common, b=-1.164, a=0.613, and c=0.200)
19 (228135, common, b=-2.216, a=0.641, and c=0.200)
22 (244139, common, b=-1.760, a=0.834, and c=0.200)

These new parameter estimates were used in the a and b plots.

Next, the equating items were fixed by using the 2005 equating item parameter estimates to replace the 2006 equating item parameter estimates and the final calibration was run.

In the final calibration, convergence was not achieved because of item 19. Items 19 and 22 had c parameter estimates of 0.000. The c parameter estimates for both items were fixed to 0.200, and convergence was achieved. The item parameter estimates after convergence were as follows:

19 (228135, common, b=-2.203, a=0.641, and c=0.200)
22 (244139, common, b=-1.747, a=0.835, and c=0.200)

These final item parameter estimates were used to create the TCC plot.

NOTES FOR ELA GRADE 7:

In the initial calibration, convergence was not achieved due to scoring items 2, 9, and 14. Convergence was achieved with items 1, 4, 10, 11, 25, 32, and 34, but they all had c parameter estimates of 0.000. The c parameter estimates were then fixed at 0.200 for all of the above items and convergence was achieved. The item parameter estimates after convergence were as follows:

1 (244063, common, b=-1.377, a=0.772, and c=0.200)
2 (225827, common, b=-1.697, a=0.630, and c=0.200)
4 (225828, common, b=-1.266, a=0.312, and c=0.200)
9 (225936, common, b=-1.798, a=0.632, and c=0.200)
10 (225928, common, b=-1.473, a=0.615, and c=0.200)
11 (244065, common, b=-1.787, a=0.710, and c=0.200)
14 (225479, common, b=-1.556, a=0.624, and c=0.200)
25 (225508, common, b=-1.790, a=0.824, and c=0.200)
32 (225505, common, b=-1.268, a=0.665, and c=0.200)
34 (225523, common, b=-1.425, a=0.779, and c=0.200)

These new item parameter estimates were used for the a and b plots.

Next, the equating items were fixed by using the 2005 equating item parameter estimates to replace the 2006 equating item parameter estimates and the final calibration was run.

In the final calibration, items 2 and 14 had c parameter estimates of 0.000 and convergence was not achieved. After the c parameter estimates for both items were fixed to 0.200, convergence was achieved. The item parameter estimates after convergence were as follows:

2 (225827, common, b=-1.851, a=0.606, and c=0.200)
14 (225479, common, b=-1.704, a=0.600, and c=0.200)

These final parameter estimates were used to create the TCC plot.

NOTES FOR ELA GRADE 10:

For the pre-equating, we implemented the following procedure: We ran an initial calibration to obtain a .par file that was used as a template for the .ifl file that was to be used in the final calibration. In the final calibration, to place the writing prompts on the same scale as last year, only the common items were used in the analysis, with their 2005 item parameter values retrieved from the item bank. A final run was performed, skipping the common items, only the writing prompts were calibrated and convergence was achieved at cycle 24. Finally, the TCCs were plotted.

For the post-equating (FCIP), we implemented the following procedure: First, we ran an initial calibration to get initial parameter estimates for all items. We had trouble achieving convergence because of item 11 (228378), 22 (228230), 30 (228610), and 35 (228632), so we fixed these items, with c=0.20. Convergence was achieved, and parameter values for all items were then obtained.

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Next, we took this parameter estimates file and, for the equating items, replaced the a, b, and c values with the values found in the 2006 item bank received from Measured Progress. This file was used to help fix the values in the final calibration.

Next, we ran the final calibration, skipping the equating items, to place the scoring items on the same scale, but again had trouble getting it to converge. We had the same problem with item 11, 20 and 35, so we used the same strategy as the initial calibration. Also, six items 5 (228329), 6 (228335), 9 (228578), 10 (228393), 26 (228893) and 30 (228610) had to have the c parameter estimates set to 0.200 because they previously were 0.000. Finally, convergence was achieved.

Finally, we plotted the TCC. For 2005 common items, values came from the 2005 .par file sent to us by Measured Progress. For 2006, we used the item parameter estimates for the common items from the final Parscale run.

NOTES FOR MATH GRADE 4:

In both the initial and final calibrations, the scoring items 8, 15, 24, and 25 had c parameter estimates of 0.000. The final calibration item parameter estimates for these items were as follows:

8 (221967, common, b=-2.763, a=0.489, and c=0.000)
15 (221839, common, b=-3.250, a=0.523, and c=0.000)
24 (221962, common, b=-1.714, a=0.511, and c=0.000)
25 (222214, common, b=-2.522, a=0.325, and c=0.000)

Convergence was achieved without fixing the c parameters in the model. The item parameter estimates in the initial calibration were used for the a and b plots and the item parameter estimates in the final calibration were used to create the TCC plot.

NOTES FOR MATH GRADE 6:

In the initial calibration, even though the c parameter estimate was 0.000 for scoring item 16 (229799, common, b=-2.203, a=0.539, and c=0.000), convergence was still achieved. The c parameter was left at 0.000 for this calibration and the original parameter estimates were used for the a and b plots.

Next, the equating items were fixed by using the 2005 equating item parameter estimates to replace the 2006 equating item parameter estimates and the final calibration was run.

In the final calibration, convergence was achieved, but the c parameter estimate for item 16 was still 0.000. The c parameter was fixed at 0.200 and the item parameter estimates after convergence were as follows:

16 (229799, common, b=-1.147, a=0.660, and c=0.000)

These final parameter estimates were used to create the TCC plot.

NOTES FOR MATH GRADE 8:

In both the initial and final calibrations, scoring item 25 had a c parameter estimate of 0.000. The final calibration item parameter estimates for this item were as follows:

25 (248168, common, b=-1.564, a=0.577, and c=0.000)

Convergence was achieved without fixing the c parameter. The item parameter estimates in the initial calibration were used for the a and b plots, and the item parameter estimates in the final calibration were used to create the TCC plot.

NOTES FOR MATH GRADE 10:

For the pre-equating, we implemented the following procedure: The 2005 .par file was received from the contractor. A .par file for 2006 was created and populated with the item parameter values for the common items from the item bank. The TCCs were plotted and a conversion table was obtained.

For the post-equating solution (FCIP), we first ran an initial calibration to get initial item parameter estimates for all items, and after fixing item 9 (229787), convergence was achieved.

Next, we took this parameter estimates file and, for the equating items, replaced the a, b, and c values with the values found in the 2006 item bank received from CTB. This file was used to help fix the values in the final calibration.

We ran the final calibration, skipping the equating items, to place the scoring items on the same scale. We had trouble achieving convergence again because of item 9 (229787), so we fixed the c parameter value at 0.200 and achieved convergence.

Finally, we plotted the TCC. For 2005 common items, values came from the 2005 .par file sent to us by CTB. For 2006, we used the item parameters for the common items from the final PARSCALE run.

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Figure 1. MCAS ELA Grade 4 Delta-Plot: 2005 vs. 2006

	2005	2006
Mean	10.72	10.65
S.D.	1.91	1.83
Correlation	0.99	

Legend: △ Multiple Choice   ○ Open Response
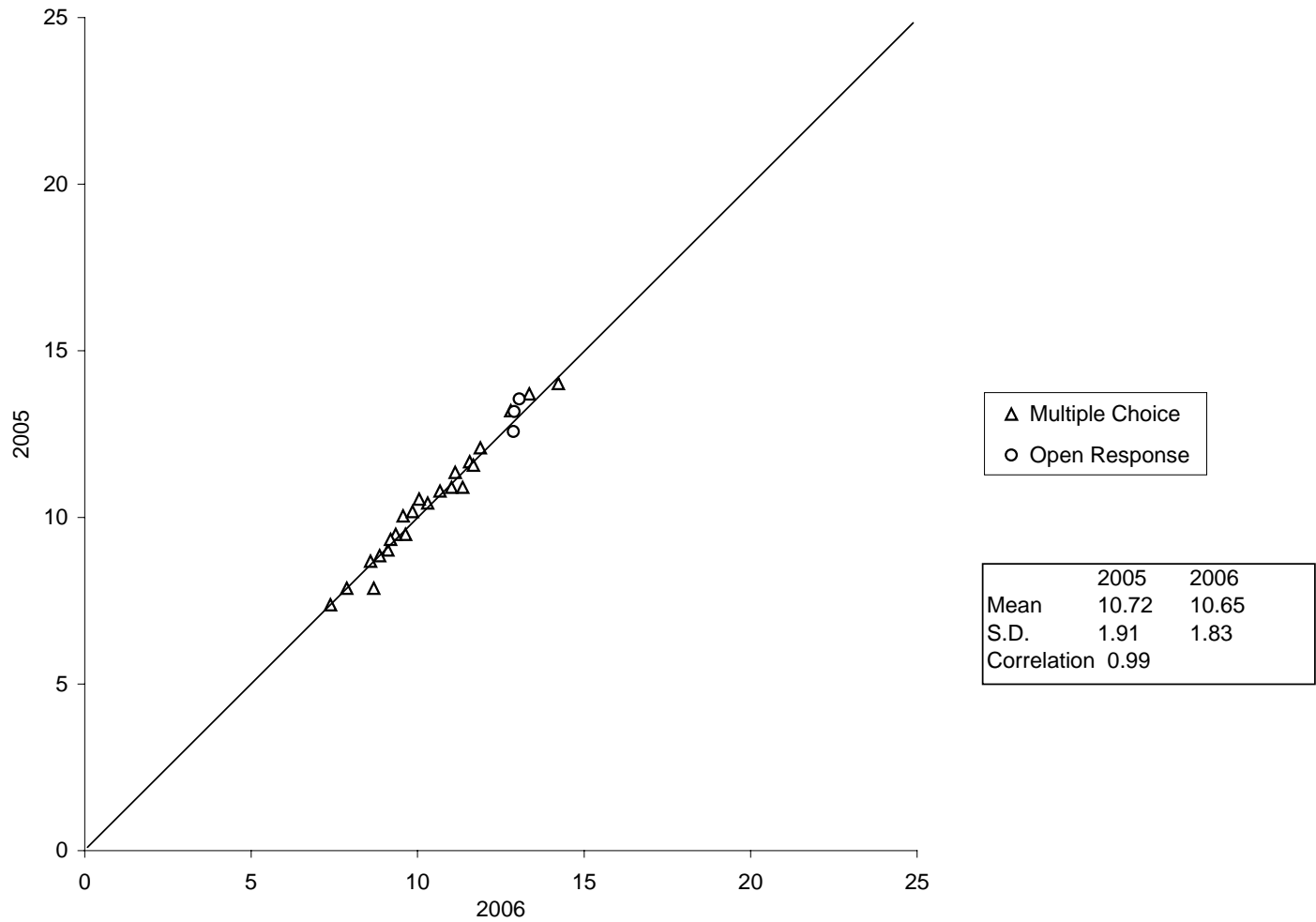
Figure 2. MCAS ELA Grade 4 b-Plot: 2005 vs. 2006

	2005	2006
Mean	-0.34	-0.42
S.D.	1.30	1.30
Correlation	0.99	

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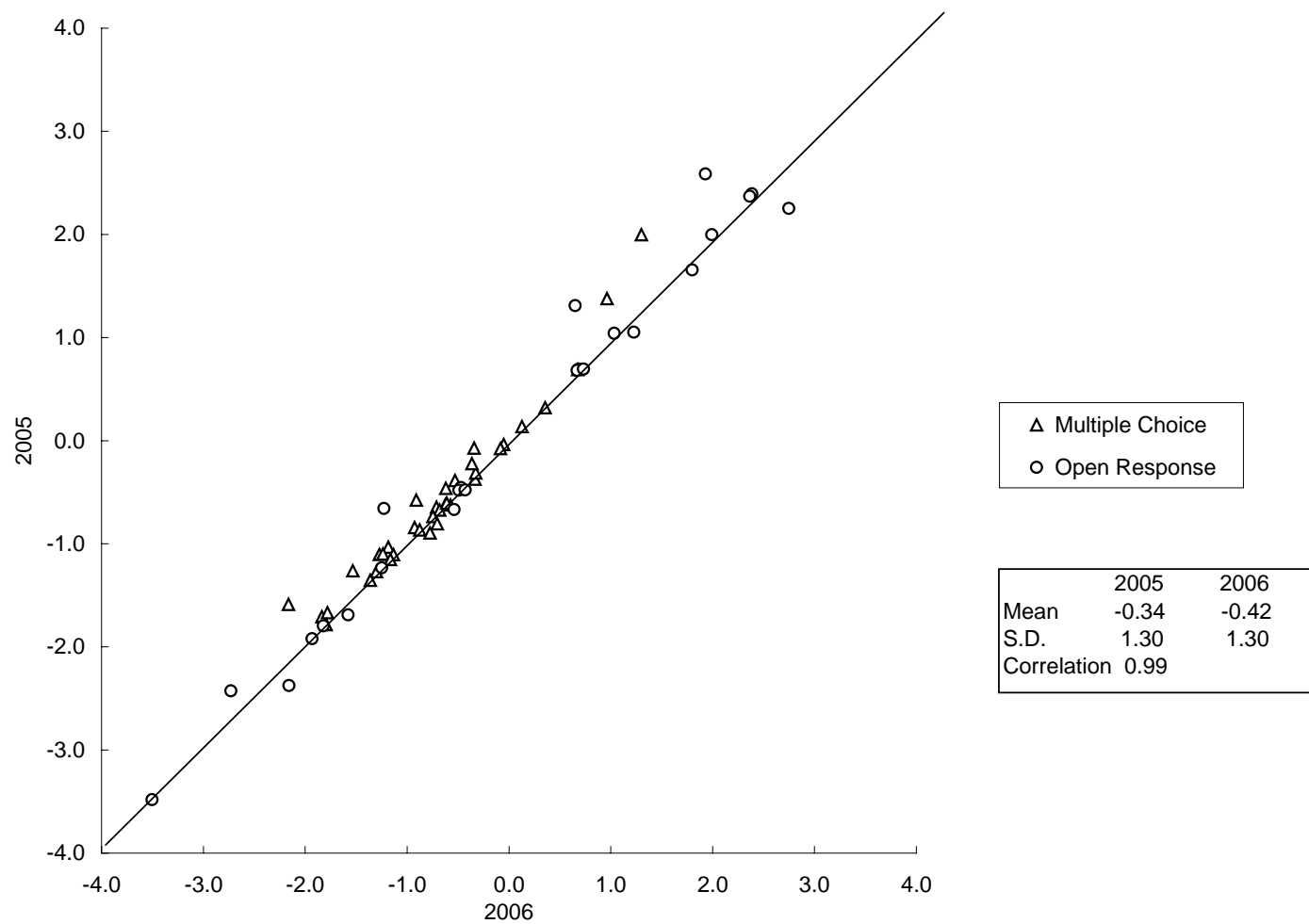
Figure 3. MCAS ELA Grade 4 a-Plot: 2005 vs. 2006
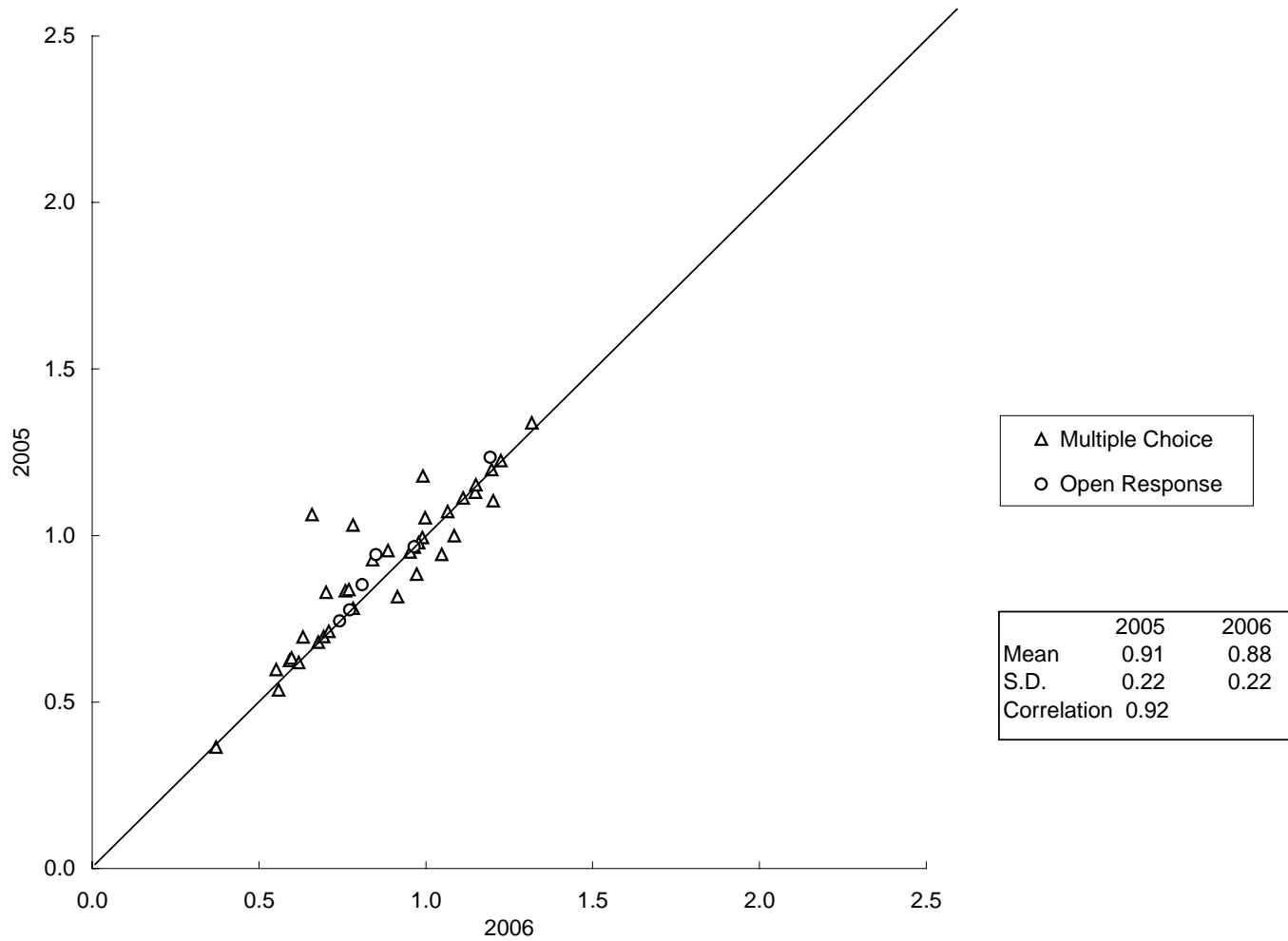
Figure 4. MCAS ELA Grade 4 TCC: 2005 vs. 2006

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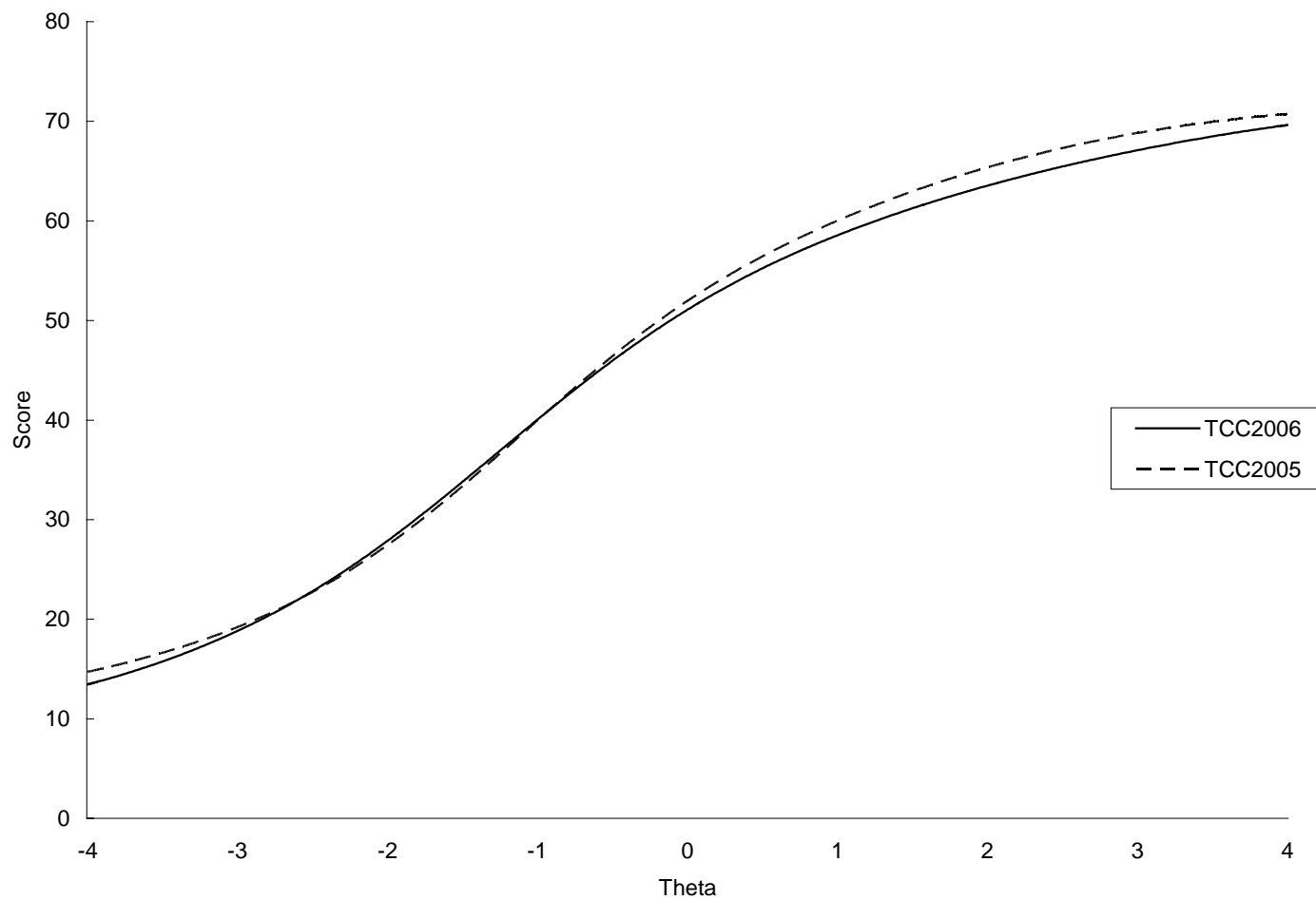
Table 1. 2006 ELA Grade 4

Conversion Table

E(2006)	Theta	E(2005)
4	-4	4.802694
5	-4	5.89049
6	-4	6.978285
7	-4	8.066081
8	-4	9.153877
9	-4	10.24167
10	-4	11.32947
11	-4	12.41726
12	-4	13.50506
13	-4	14.59286
14	-3.865	15.17902
15	-3.645	16.01777
16	-3.455	16.83205
17	-3.285	17.64217
18	-3.125	18.48504
19	-2.975	19.35511
20	-2.835	20.24473
21	-2.715	21.07235
22	-2.595	21.96448
23	-2.485	22.84219
24	-2.375	23.77969
25	-2.275	24.68535
26	-2.175	25.6426
27	-2.075	26.65149
28	-1.985	27.60303
29	-1.905	28.48254
30	-1.815	29.50833
31	-1.725	30.57037
32	-1.645	31.54248
33	-1.565	32.53847
34	-1.485	33.55554
35	-1.405	34.59057
36	-1.325	35.64017
37	-1.245	36.70071
38	-1.165	37.76843
39	-1.085	38.83946
40	-1.005	39.90987
41	-0.925	40.97581
42	-0.845	42.0335
43	-0.755	43.20908
44	-0.675	44.23757
45	-0.585	45.37214

46	-0.495	46.47923
47	-0.405	47.55561
48	-0.315	48.59872
49	-0.215	49.71644
50	-0.115	50.78924
51	-0.005	51.9168
52	0.105	52.98991
53	0.215	54.01022
54	0.335	55.06601
55	0.465	56.14675
56	0.605	57.24332
57	0.755	58.34801
58	0.905	59.38708
59	1.075	60.49276
60	1.255	61.58695
61	1.445	62.66221
62	1.655	63.76041
63	1.875	64.81409
64	2.115	65.85641
65	2.375	66.86669
66	2.655	67.82409
67	2.965	68.73352
68	3.315	69.57968
69	3.715	70.33167
70	4	72
71	4	72
72	4	72

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Figure 5. MCAS ELA Grade 7 Delta-Plot: 2005 vs. 2006

	2005	2006
Mean	10.55	10.54
S.D.	1.71	1.74
Correlation	0.98	

Legend: △ Multiple Choice, ○ Open Response

Figure 6. MCAS ELA Grade 7 b-Plot: 2005 vs. 2006

	2005	2006
Mean	-0.54	-0.54
S.D.	1.29	1.28
Correlation	0.99	
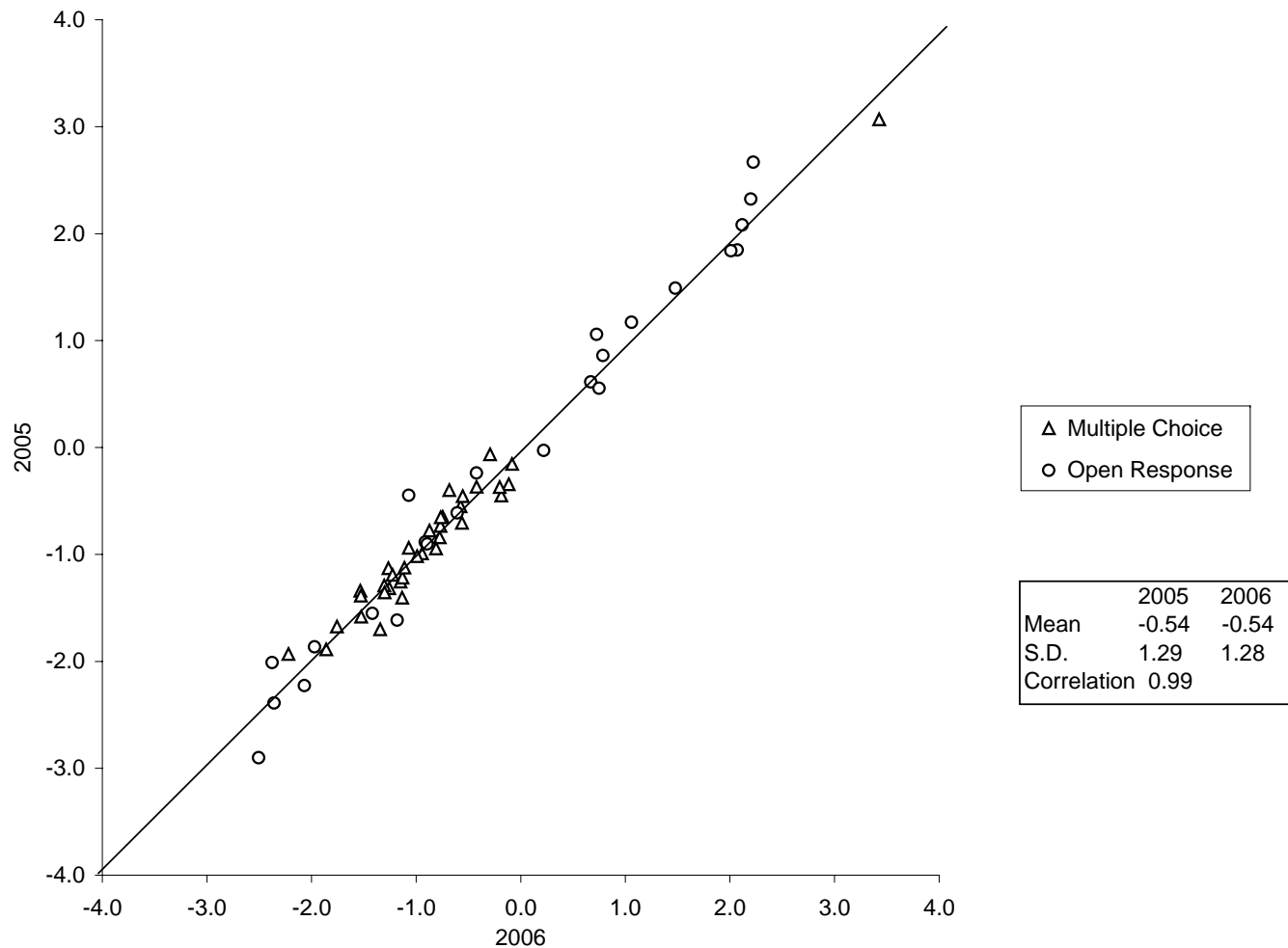
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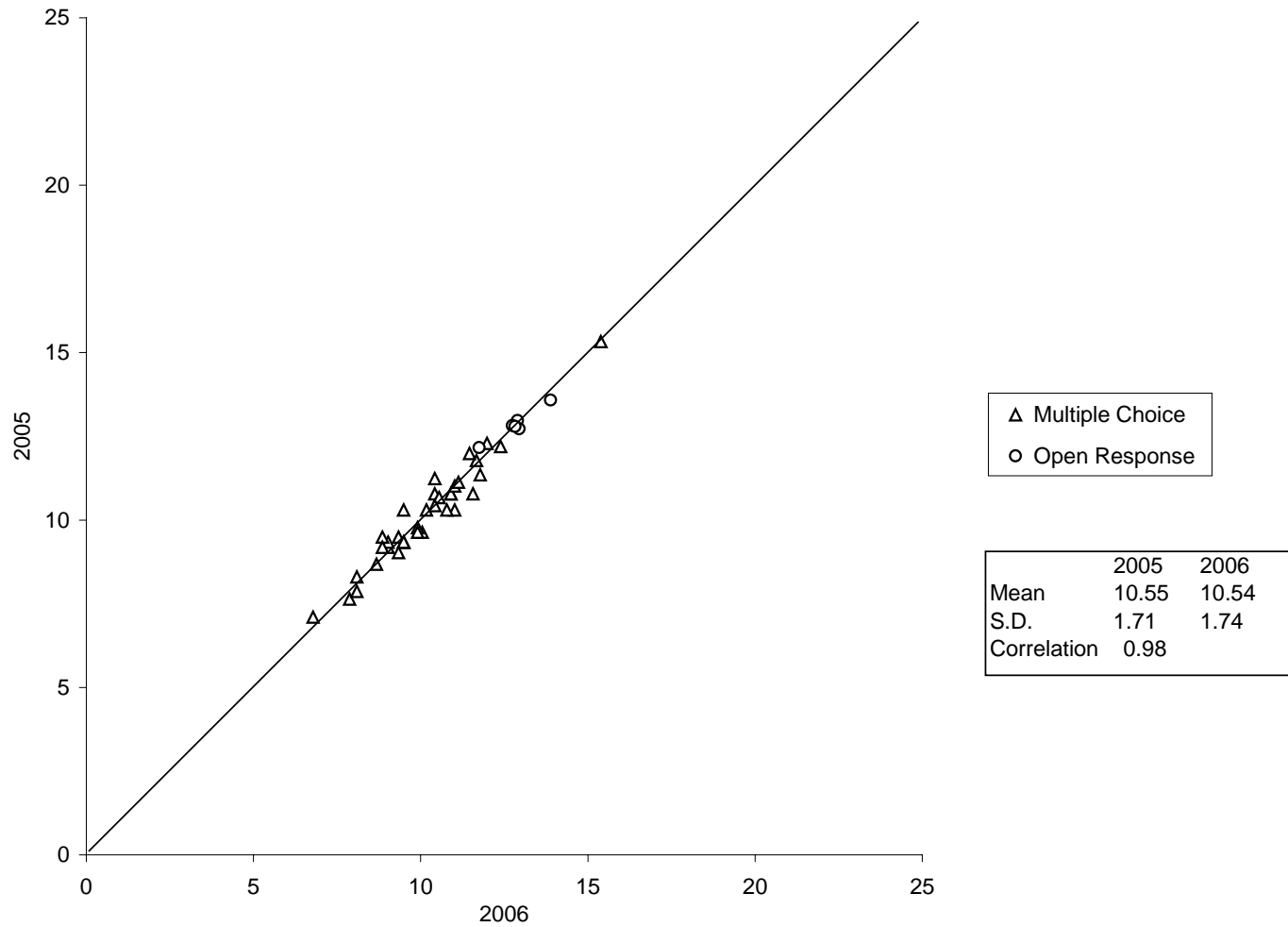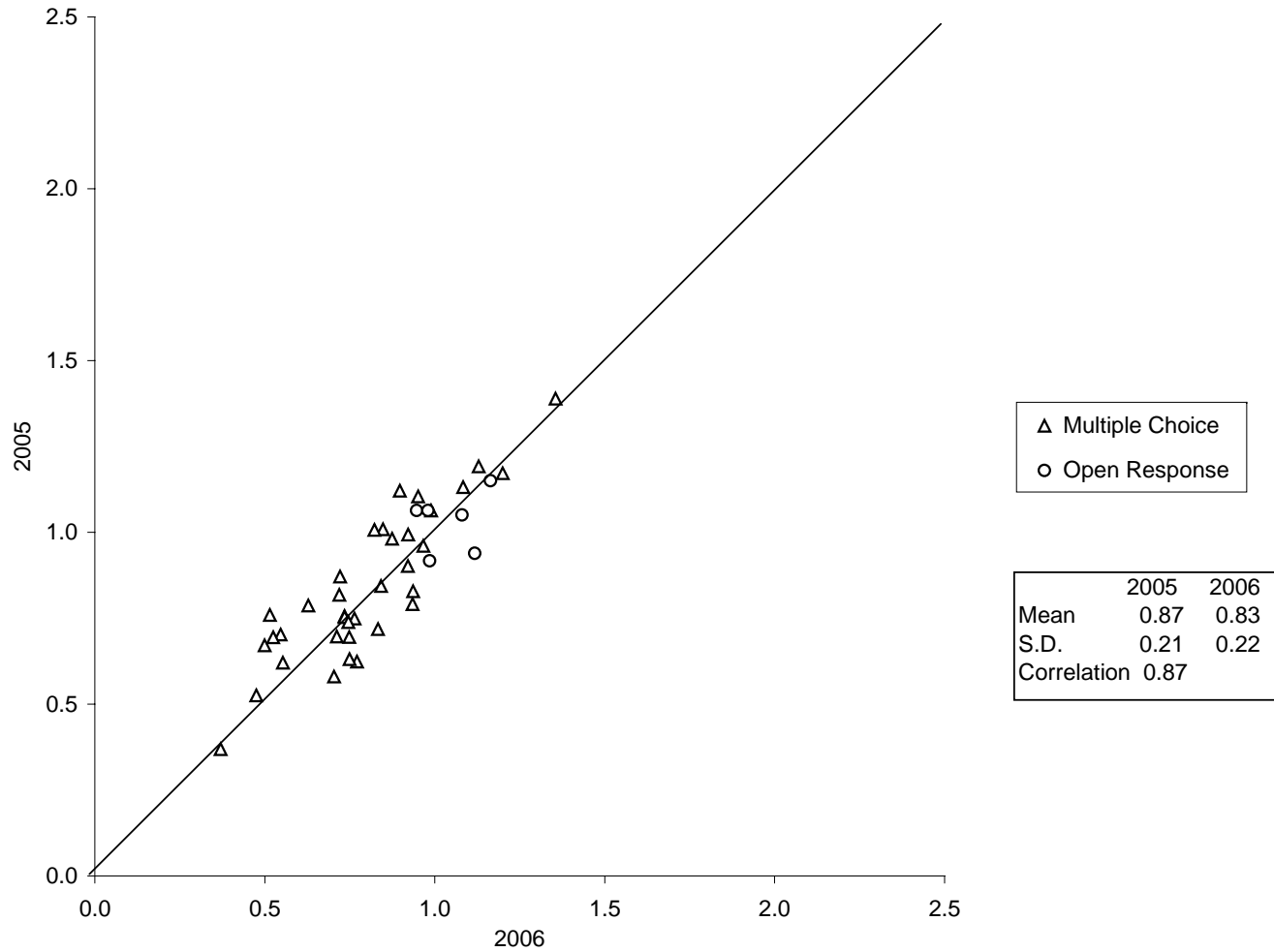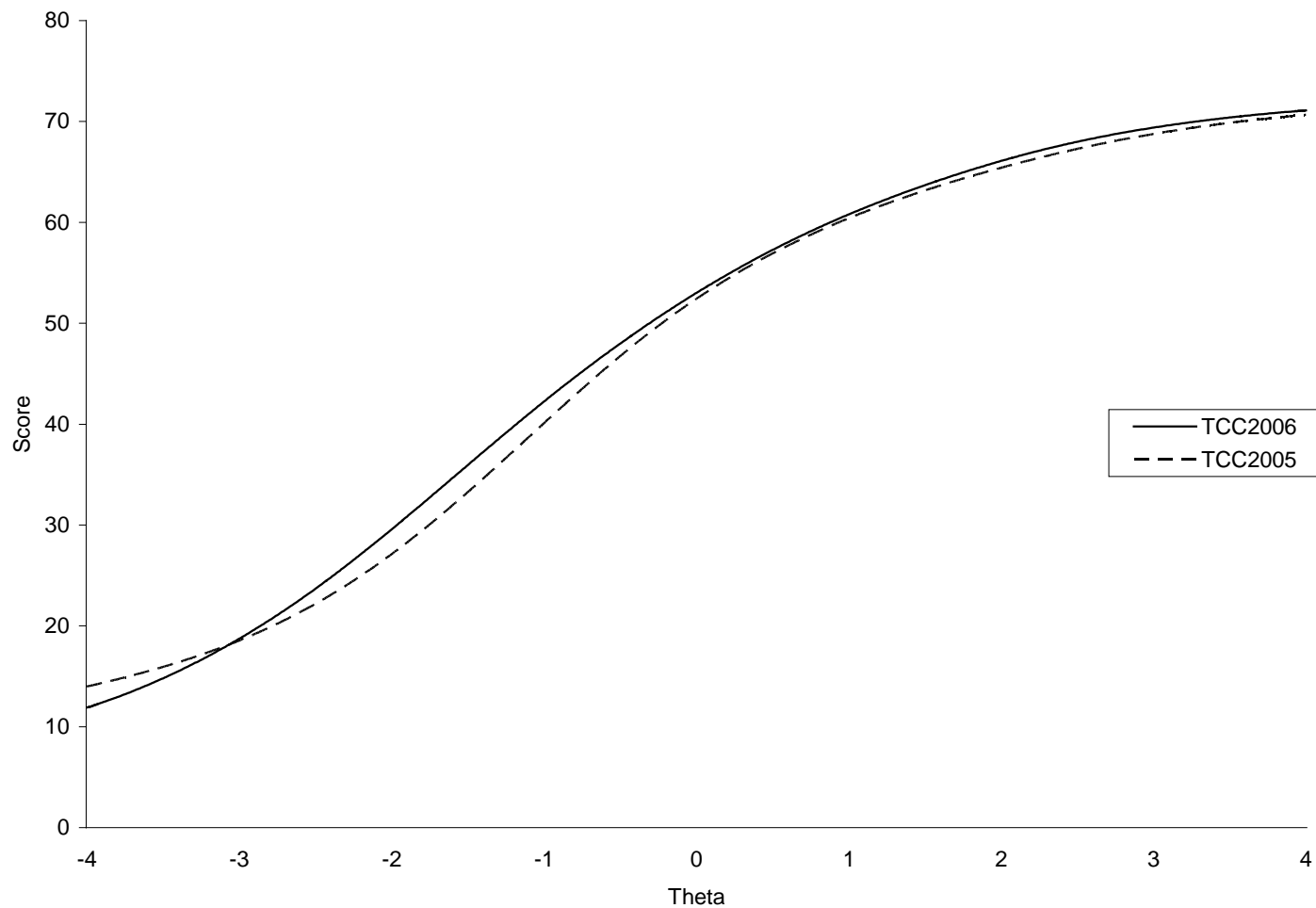**Figure 7. MCAS ELA Grade 7 a-Plot: 2005 vs. 2006**

Figure 8. MCAS ELA Grade 7 TCCs: 2005 vs. 2006

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Table 2. 2006 ELA Grade 7

Conversion Table

E(2006)	Theta	E(2005)
4	-4	5.684247
5	-4	7.01064
6	-4	8.337032
7	-4	9.663424
8	-4	10.98982
9	-4	12.31621
10	-4	13.6426
11	-4	14.0752
12	-3.975	14.0752
13	-3.785	14.76191
14	-3.625	15.39582
15	-3.475	16.04378
16	-3.335	16.70303
17	-3.205	17.36941
18	-3.085	18.03689
19	-2.965	18.76016
20	-2.865	19.40929
21	-2.755	20.17565
22	-2.655	20.92268
23	-2.565	21.63791
24	-2.475	22.39515
25	-2.385	23.19542
26	-2.295	24.03934
27	-2.215	24.8263
28	-2.125	25.75283
29	-2.045	26.61245
30	-1.965	27.50509
31	-1.885	28.42952
32	-1.805	29.38416
33	-1.725	30.36708
34	-1.655	31.2486
35	-1.575	32.27829
36	-1.495	33.32904
37	-1.415	34.3978
38	-1.335	35.4813
39	-1.265	36.43873
40	-1.185	37.54035
41	-1.105	38.64626
42	-1.015	39.89063
43	-0.935	40.99253
44	-0.855	42.08627
45	-0.765	43.30209
46	-0.685	44.36563

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47  -0.595  45.53825
48  -0.495  46.80639
49  -0.405  47.91239
50  -0.305   49.0985
51  -0.205  50.23703
52  -0.105  51.32658
53  -0.005  52.36681
54   0.105   53.4548
55   0.225  54.57645
56   0.345    55.633
57   0.465  56.62792
58   0.595   57.6404
59   0.735  58.65976
60   0.875   59.6107
61   1.035  60.62046
62   1.195  61.55569
63   1.375  62.52912
64   1.555  63.43066
65   1.765  64.40591
66   1.975  65.31062
67   2.225  66.30345
68   2.505  67.30498
69   2.845  68.35337
70   3.285  69.43874
71   3.915  70.54978
72      4       72
```

Figure 9. MCAS ELA Grade 10 Delta-Plot: 2005 vs. 2006

	2005	2006
Mean	10.82	10.74
S.D.	1.22	1.31
Correlation	0.98	

△ Multiple Choice
o Open Response

Figure 10. MCAS ELA Grade 10 b-Plot: 2006 Pre-equating vs. 2006 Post-equating

	2005	2006
Mean	0.14	-0.60
S.D.	0.93	1.00
Correlation	0.97	

Figure 11. MCAS ELA Grade 10 a-Plot: 2006 Pre-equating vs. 2006 Post-equating

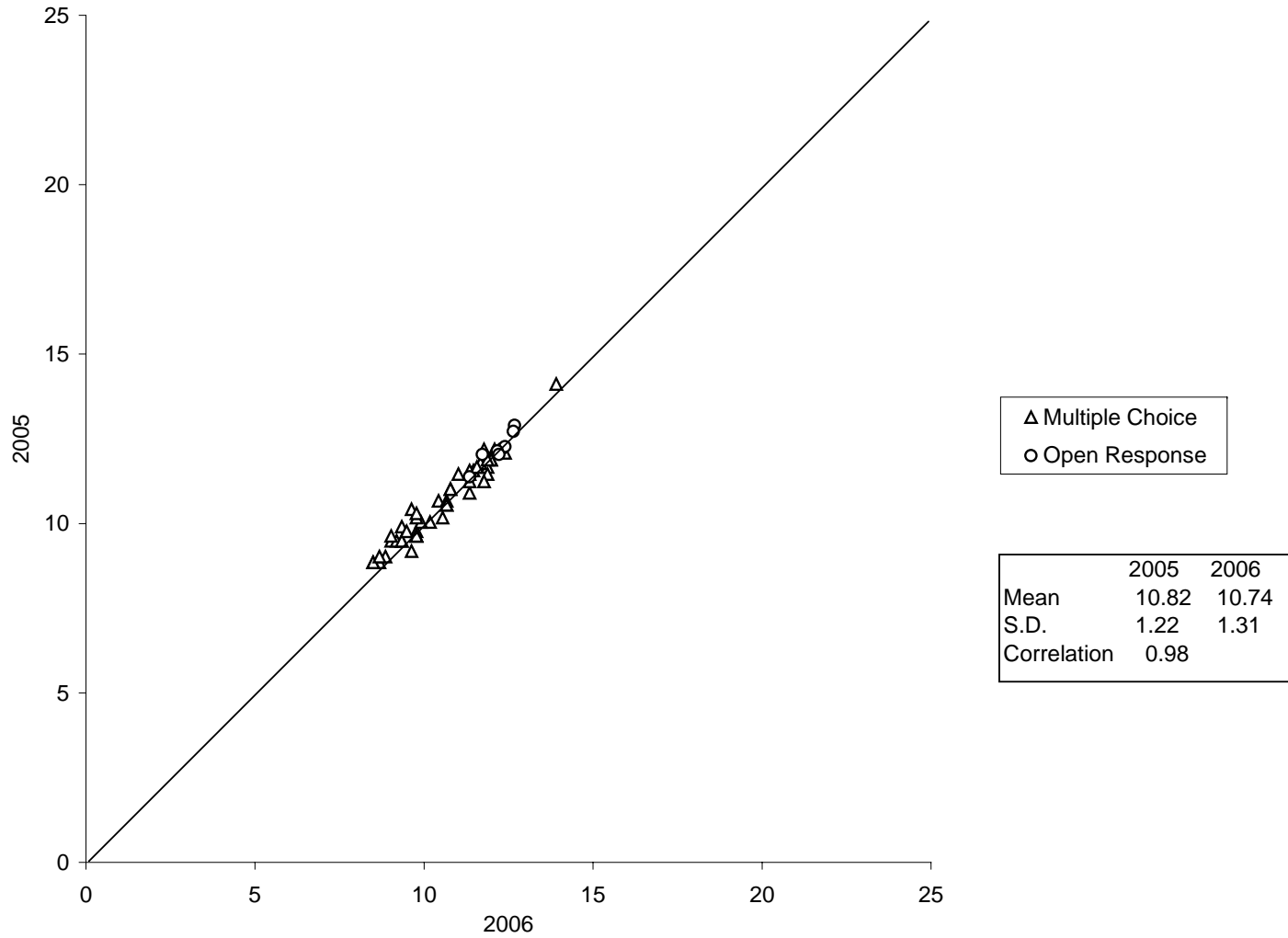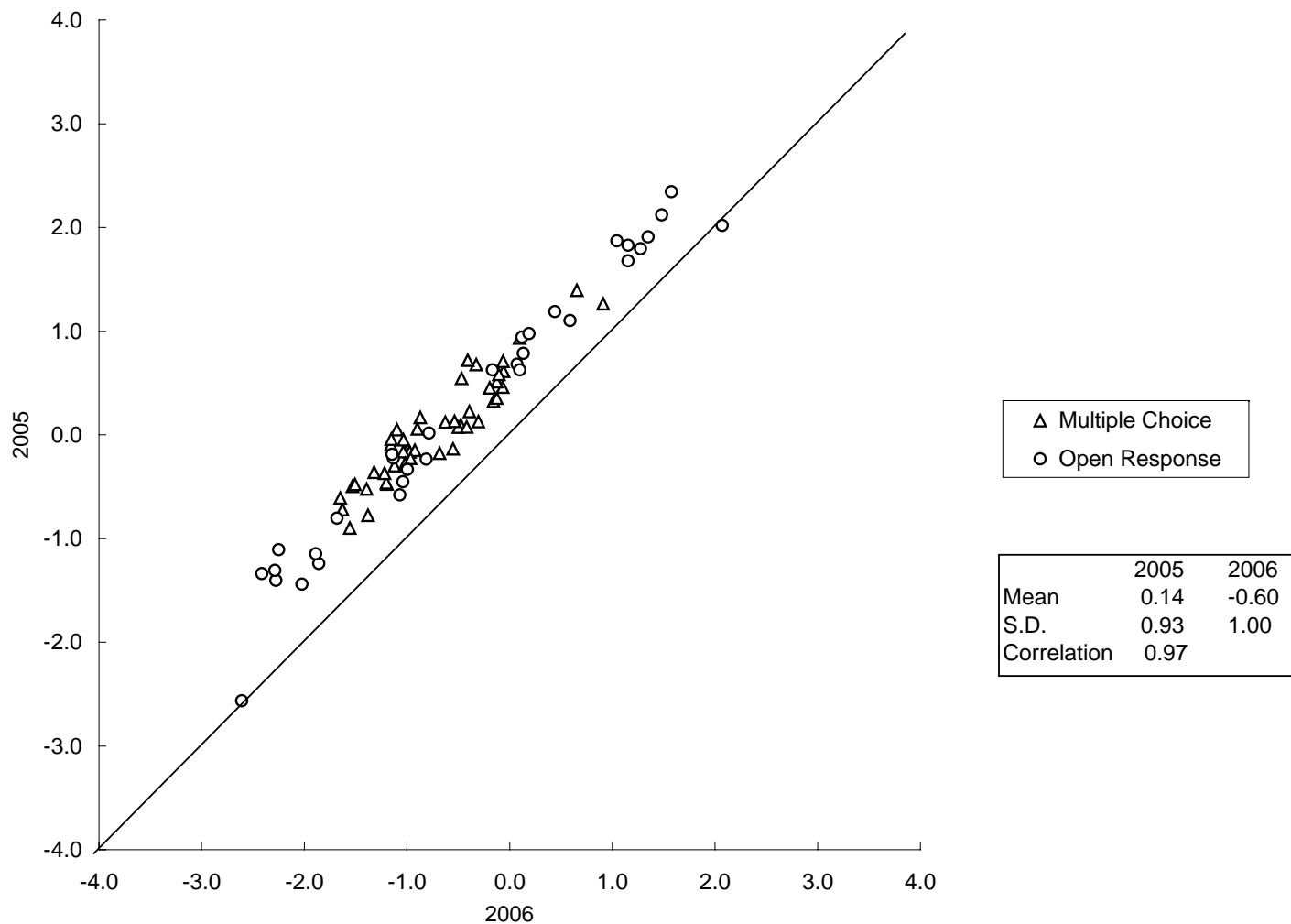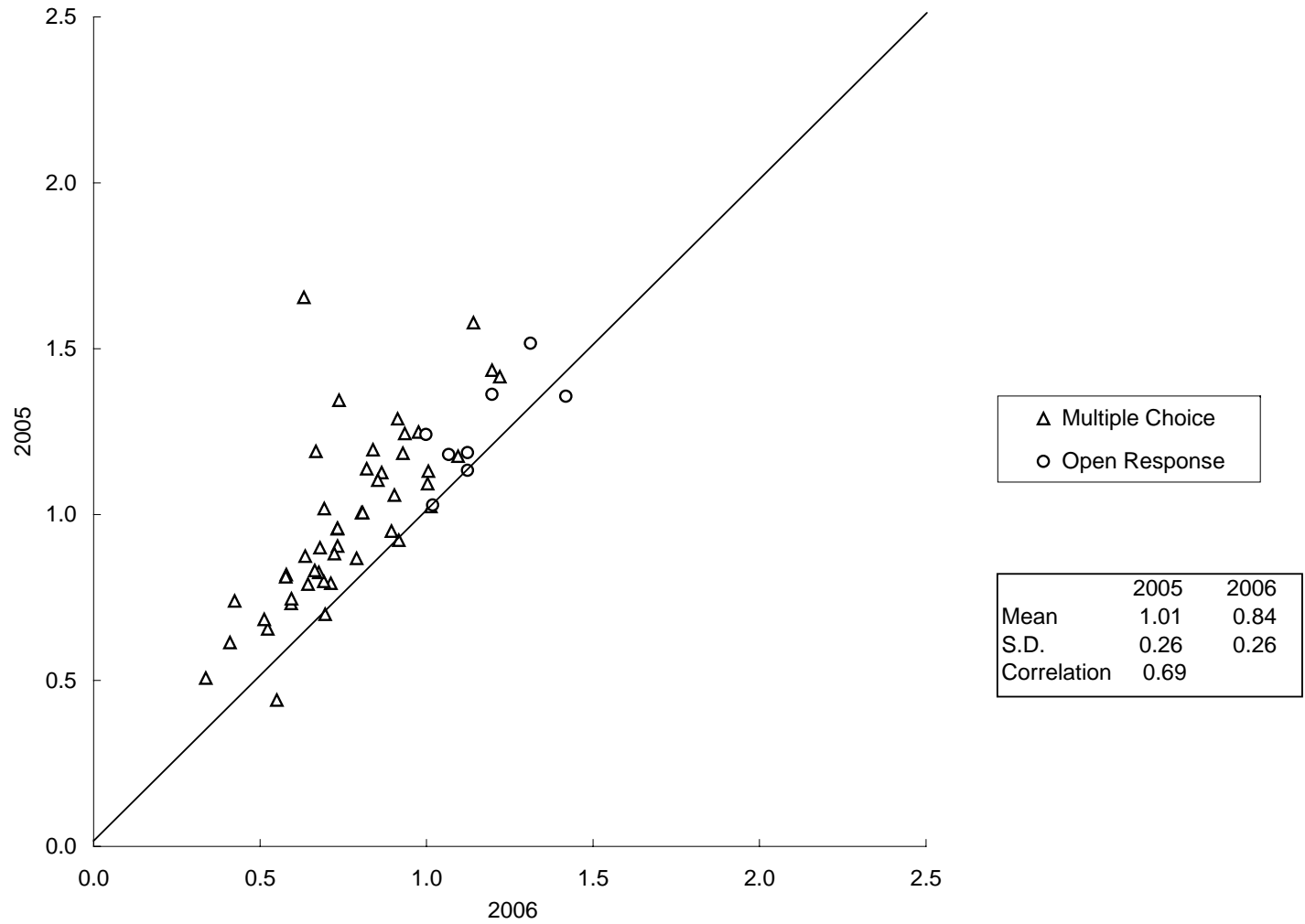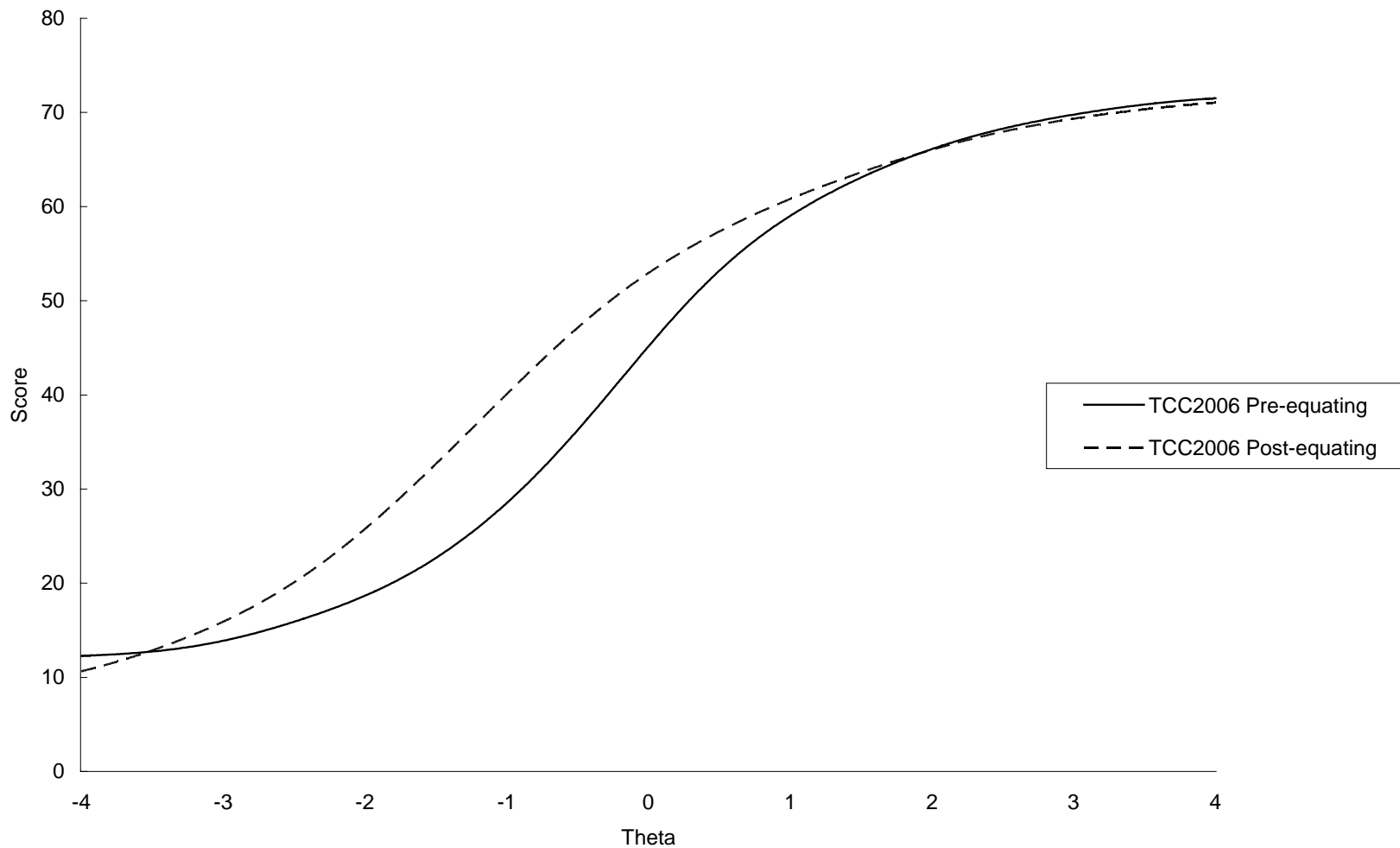|	2005	2006
Mean	1.01	0.84
S.D.	0.26	0.26
Correlation	0.69	

△ Multiple Choice

○ Open Response

Figure 12. MCAS ELA Grade 10 TCC: 2006 Pre-equating vs. 2006 Post-equating

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Table 3. ELA Grade 10 2006 Pre-equating vs. 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
4	-4	4
5	-4	4
6	-4	4
7	-4	4.129375
8	-4	4.853545
9	-4	5.577713
10	-4	6.301883
11	-4	7.026052
12	-4	7.750221
13	-3.345	13.70299
14	-2.965	16.14509
15	-2.695	18.27572
16	-2.475	20.31621
17	-2.285	22.32022
18	-2.105	24.42441
19	-1.945	26.44885
20	-1.805	28.3222
21	-1.685	29.99008
22	-1.575	31.55915
23	-1.465	33.15794
24	-1.375	34.48246
25	-1.275	35.96584
26	-1.195	37.15749
27	-1.115	38.35002
28	-1.035	39.5399
29	-0.965	40.57589
30	-0.895	41.60417
31	-0.825	42.62184
32	-0.755	43.62589
33	-0.695	44.47339
34	-0.635	45.30682
35	-0.575	46.1244
36	-0.515	46.92454
37	-0.455	47.7058
38	-0.395	48.46699
39	-0.345	49.08526
40	-0.285	49.80732
41	-0.235	50.39215
42	-0.175	51.07349

43	-0.115	51.73254
44	-0.065	52.26486
45	-0.005	52.88379
46	0.045	53.38341
47	0.105	53.96421
48	0.165	54.52538
49	0.225	55.06786
50	0.285	55.59264
51	0.355	56.18387
52	0.415	56.67376
53	0.485	57.22692
54	0.555	57.76162
55	0.635	58.3517
56	0.715	58.92093
57	0.805	59.53807
58	0.895	60.13225
59	0.995	60.76734
60	1.105	61.43763
61	1.225	62.13789
62	1.355	62.86366
63	1.485	63.55885
64	1.635	64.32648
65	1.795	65.106
66	1.975	65.93158
67	2.185	66.81594
68	2.425	67.70857
69	2.715	68.61476
70	3.095	69.55539
71	3.595	70.48796
72	4	72

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Figure 13. MCAS ELA Grade 10 TCC: 2005 vs. 2006 (Pre-equating)
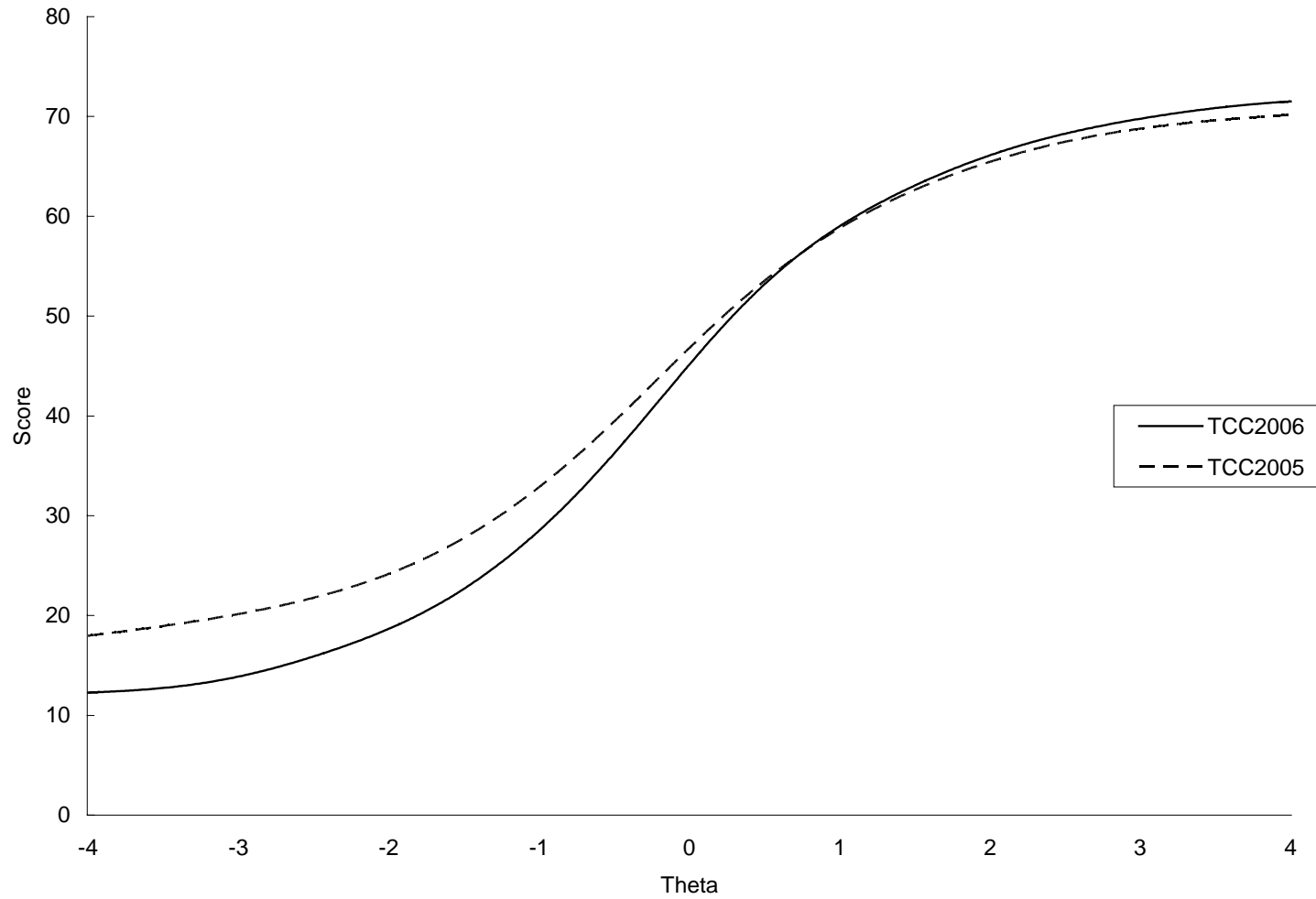
Table 4. ELA Grade 10 2005 vs 2006 (Pre-equating)

Conversion Table

E(new)	Theta	E(ref)
4	-4	4
5	-4	4.798635
6	-4	5.792497
7	-4	6.786358
8	-4	7.78022
9	-4	8.774081
10	-4	9.767942
11	-4	10.7618
12	-4	11.75566
13	-3.345	19.29147
14	-2.965	20.24656
15	-2.695	21.07015
16	-2.475	21.86895
17	-2.285	22.67902
18	-2.105	23.57271
19	-1.945	24.48812
20	-1.805	25.39448
21	-1.685	26.25655
22	-1.575	27.11997
23	-1.465	28.05622
24	-1.375	28.87783
25	-1.275	29.85036
26	-1.195	30.6739
27	-1.115	31.53794
28	-1.035	32.44224
29	-0.965	33.26612
30	-0.895	34.11983
31	-0.825	35.00252
32	-0.755	35.91301
33	-0.695	36.71441
34	-0.635	37.53389
35	-0.575	38.37
36	-0.515	39.22102
37	-0.455	40.08497
38	-0.395	40.95963
39	-0.345	41.69493
40	-0.285	42.58274
41	-0.235	43.32524
42	-0.175	44.21696

43	-0.115	45.10676
44	-0.065	45.84473
45	-0.005	46.72366
46	0.045	47.44878
47	0.105	48.30798
48	0.165	49.15311
49	0.225	49.98216
50	0.285	50.79339
51	0.355	51.71534
52	0.415	52.48327
53	0.485	53.35189
54	0.555	54.19017
55	0.635	55.11028
56	0.715	55.98962
57	0.805	56.93034
58	0.895	57.82051
59	0.995	58.75208
60	1.105	59.70993
61	1.225	60.67988
62	1.355	61.64938
63	1.485	62.54226
64	1.635	63.48716
65	1.795	64.4043
66	1.975	65.3334
67	2.185	66.28712
68	2.425	67.2114
69	2.715	68.10743
70	3.095	68.97285
71	3.595	69.73714
72	4	72

Figure 14. MCAS ELA Grade 10 TCC: 2005 Pre-equating vs. 2006 Post-equating
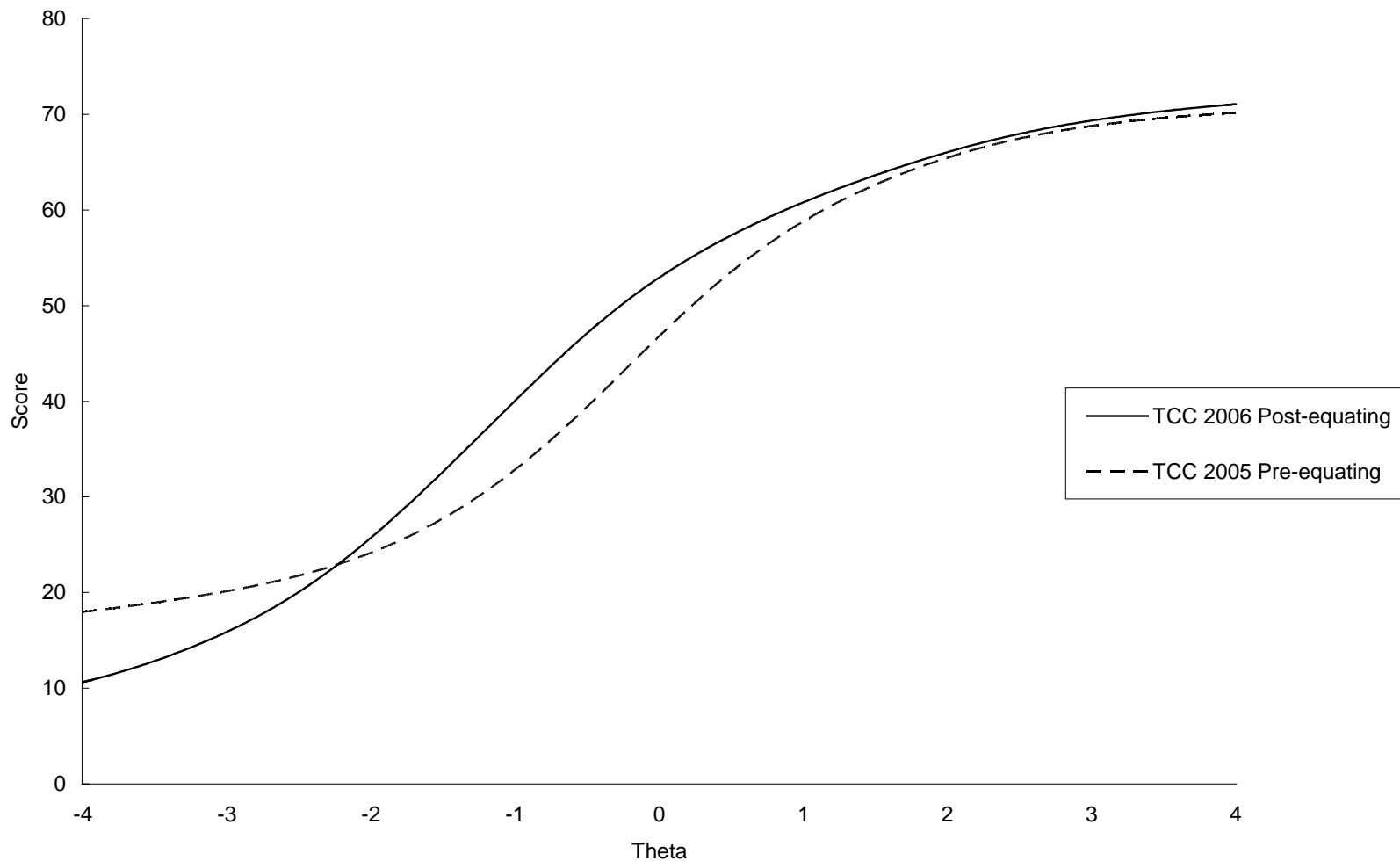
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Table 5. ELA Grade 10 2005 Pre-equating vs 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
4	-4	6.6088
5	-4	7.981217
6	-4	9.353634
7	-4	10.72605
8	-4	12.09847
9	-4	13.47088
10	-4	14.8433
11	-3.905	18.14652
12	-3.675	18.58915
13	-3.475	19.0036
14	-3.295	19.40672
15	-3.135	19.79514
16	-2.985	20.19109
17	-2.855	20.56436
18	-2.725	20.97097
19	-2.615	21.34542
20	-2.505	21.75195
21	-2.405	22.15302
22	-2.315	22.54264
23	-2.225	22.96215
24	-2.145	23.36235
25	-2.055	23.84577
26	-1.975	24.30707
27	-1.905	24.73659
28	-1.825	25.25861
29	-1.755	25.7438
30	-1.685	26.25655
31	-1.615	26.7977
32	-1.545	27.36799
33	-1.475	27.96804
34	-1.405	28.59834
35	-1.345	29.16297
36	-1.275	29.85036
37	-1.205	30.56874
38	-1.135	31.31814
39	-1.075	31.98508
40	-1.005	32.79164
41	-0.935	33.62839

42	-0.865	34.49464
43	-0.795	35.3894
44	-0.725	36.31137
45	-0.655	37.2588
46	-0.585	38.22956
47	-0.505	39.36417
48	-0.435	40.37545
49	-0.355	41.54749
50	-0.265	42.87955
51	-0.185	44.06839
52	-0.095	45.40244
53	0.005	46.86927
54	0.105	48.30798
55	0.215	49.84518
56	0.335	51.45473
57	0.455	52.9833
58	0.585	54.53998
59	0.725	56.09667
60	0.875	57.627
61	1.035	59.1083
62	1.205	60.52341
63	1.385	61.86194
64	1.575	63.11957
65	1.775	64.2945
66	1.995	65.43019
67	2.235	66.49403
68	2.515	67.51421
69	2.855	68.46265
70	3.315	69.35054
71	3.955	70.12542
72	4	72

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Figure 15. MCAS ELA Grade 10 TCC: 2005 Post-equating vs. 2006 Post-equating
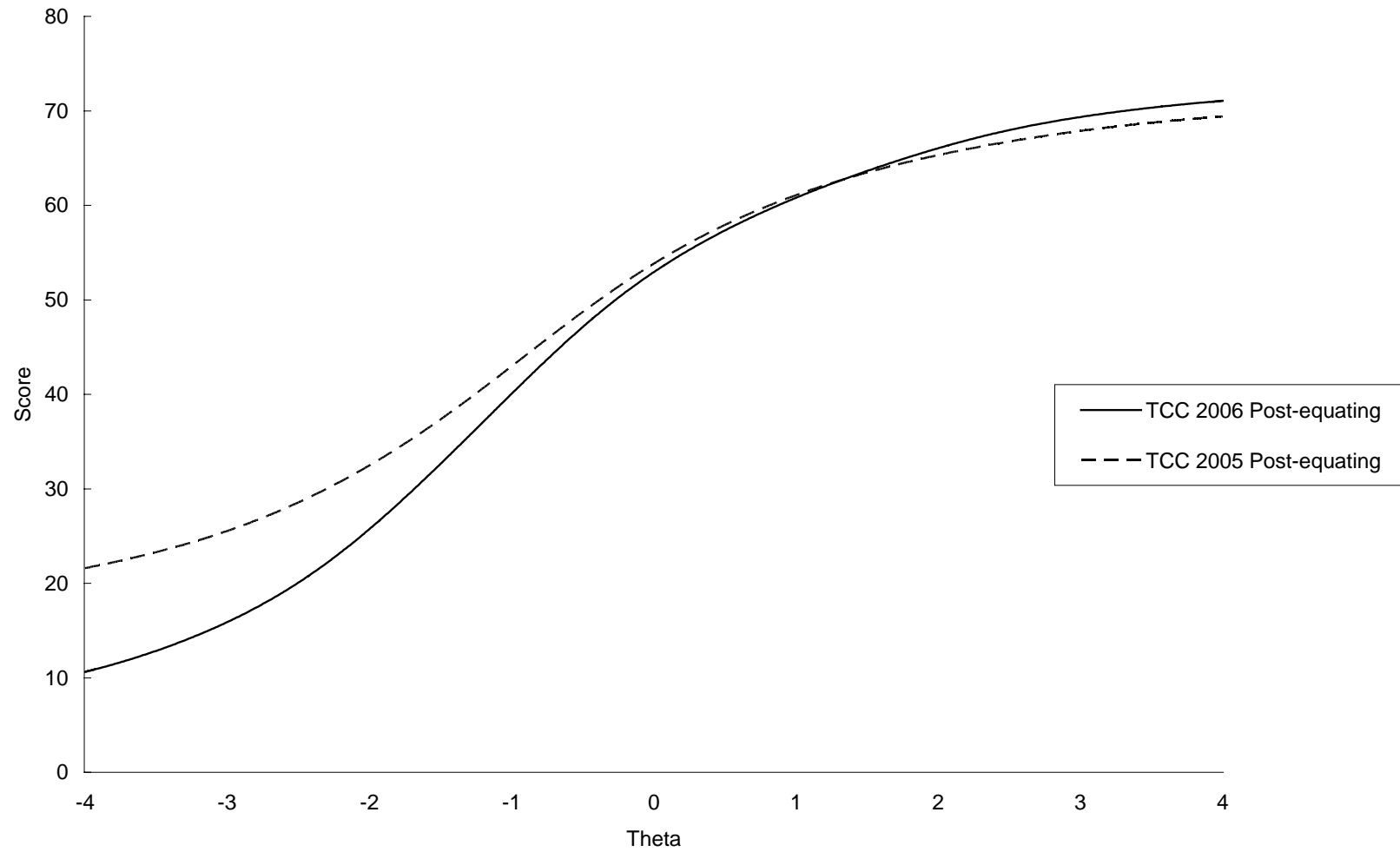
Table 6. ELA Grade 10 2005 Post-equating vs 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
4	-4	6.411537
5	-4	7.680373
6	-4	8.949209
7	-4	10.21805
8	-4	11.48688
9	-4	12.75572
10	-4	14.02455
11	-3.905	21.89436
12	-3.675	22.64949
13	-3.475	23.3877
14	-3.295	24.12942
15	-3.135	24.85928
16	-2.985	25.61065
17	-2.855	26.31874
18	-2.725	27.08299
19	-2.615	27.77549
20	-2.505	28.51138
21	-2.405	29.21889
22	-2.315	29.88757
23	-2.225	30.58683
24	-2.145	31.23429
25	-2.055	31.99196
26	-1.975	32.69152
27	-1.905	33.32374
28	-1.825	34.0691
29	-1.755	34.74104
30	-1.685	35.43108
31	-1.615	36.13879
32	-1.545	36.86354
33	-1.475	37.60455
34	-1.405	38.36082
35	-1.345	39.02027
36	-1.275	39.80147
37	-1.205	40.59383
38	-1.135	41.39551
39	-1.075	42.08851
40	-1.005	42.90187
41	-0.935	43.71823

42	-0.865	44.53516
43	-0.795	45.3502
44	-0.725	46.16089
45	-0.655	46.96486
46	-0.585	47.75984
47	-0.505	48.65467
48	-0.435	49.4235
49	-0.355	50.28372
50	-0.265	51.2254
51	-0.185	52.03735
52	-0.095	52.92081
53	0.005	53.86367
54	0.105	54.7647
55	0.215	55.70717
56	0.335	56.6777
57	0.455	57.58965
58	0.585	58.51414
59	0.725	59.43991
60	0.875	60.35677
61	1.035	61.25576
62	1.205	62.12918
63	1.385	62.9707
64	1.575	63.77552
65	1.775	64.54053
66	1.995	65.29672
67	2.235	66.03303
68	2.515	66.79021
69	2.855	67.57977
70	3.315	68.44986
71	3.955	69.35353
72	4	72

Figure 16. MCAS Math Grade 4 Delta-Plot: 2005 vs. 2006

	2005	2006
Mean	11.25	11.47
S.D.	1.75	1.77
Correlation	0.98	

△ Multiple Choice
○ Short Answer
□ Open Response
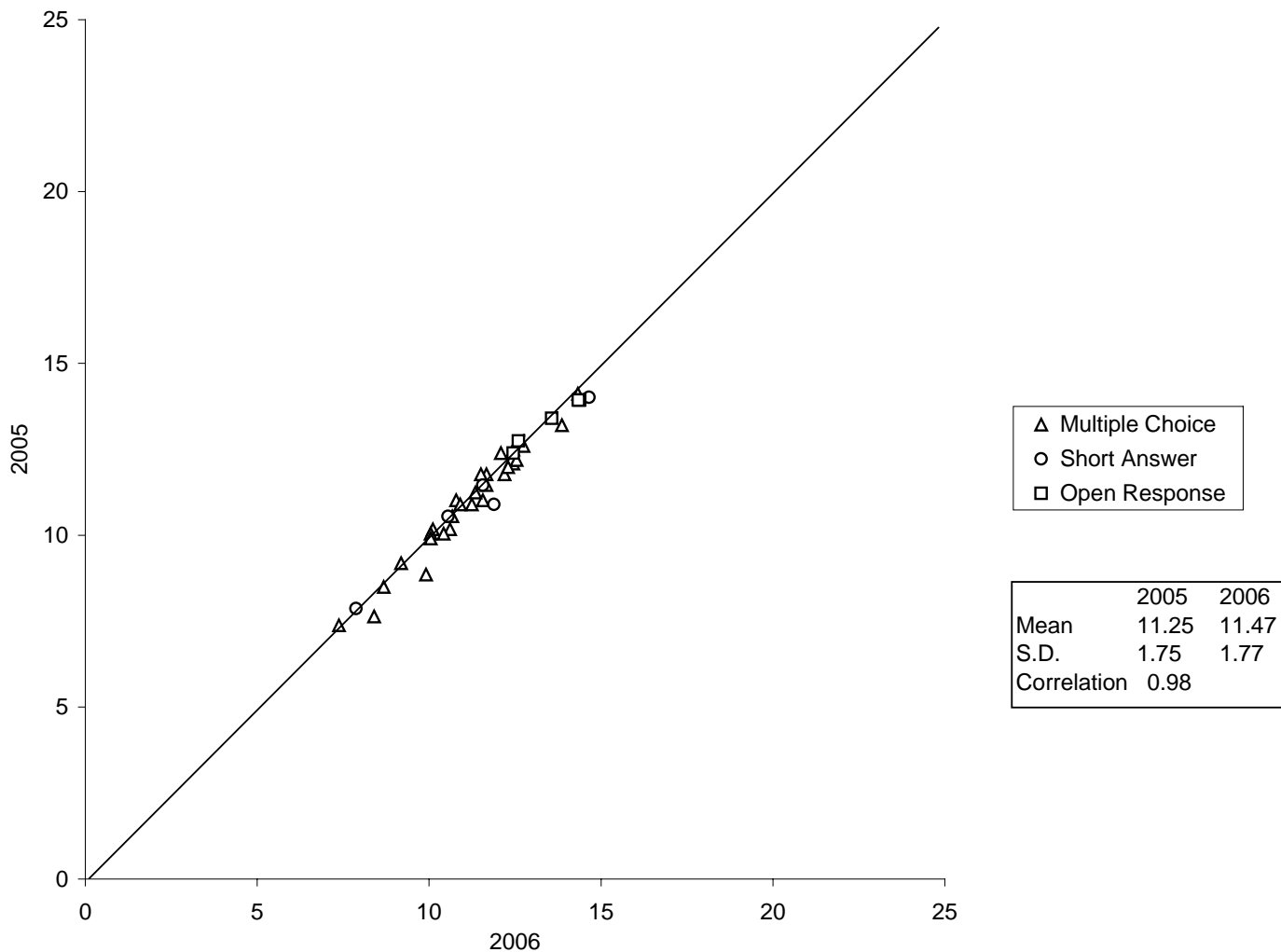
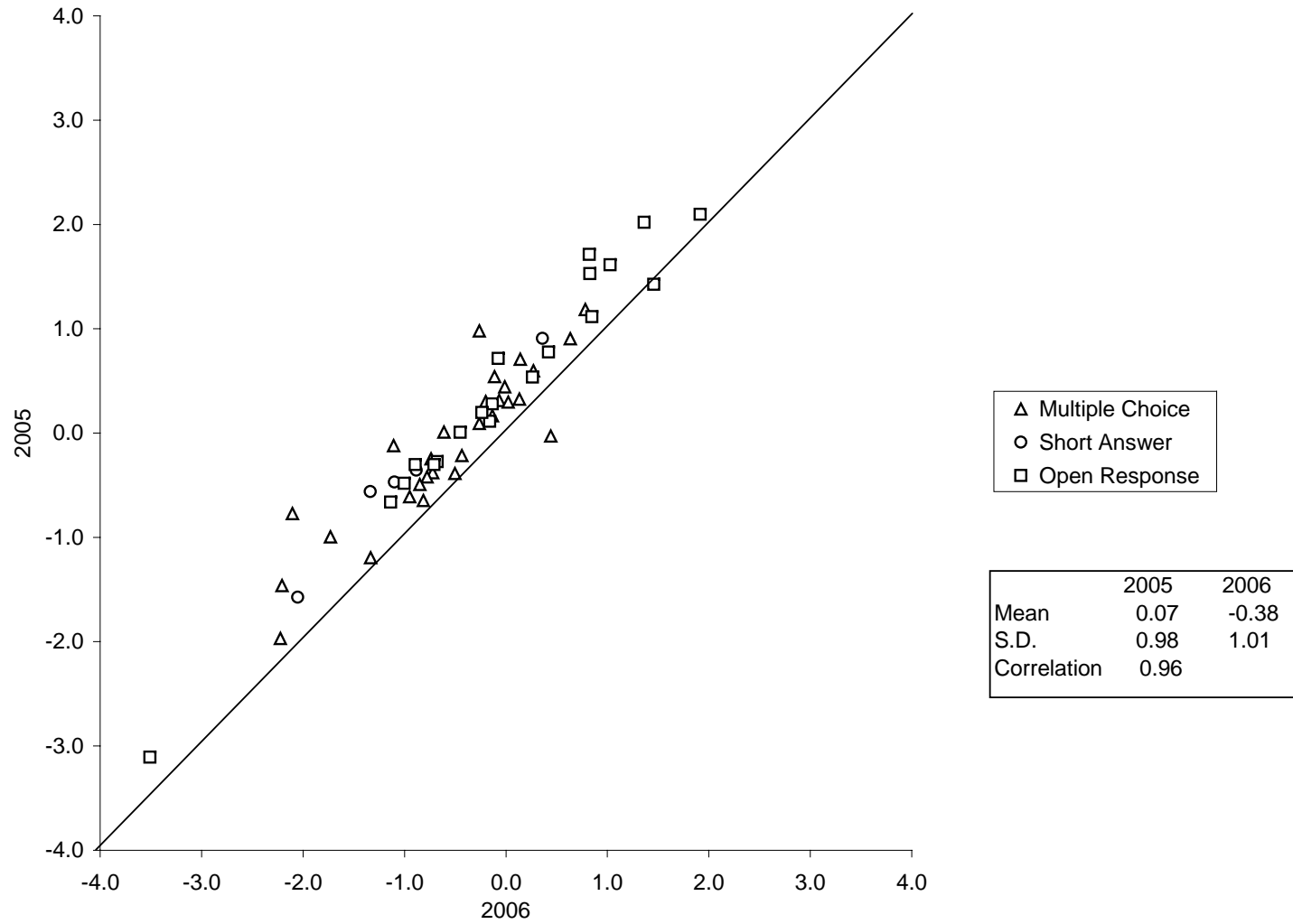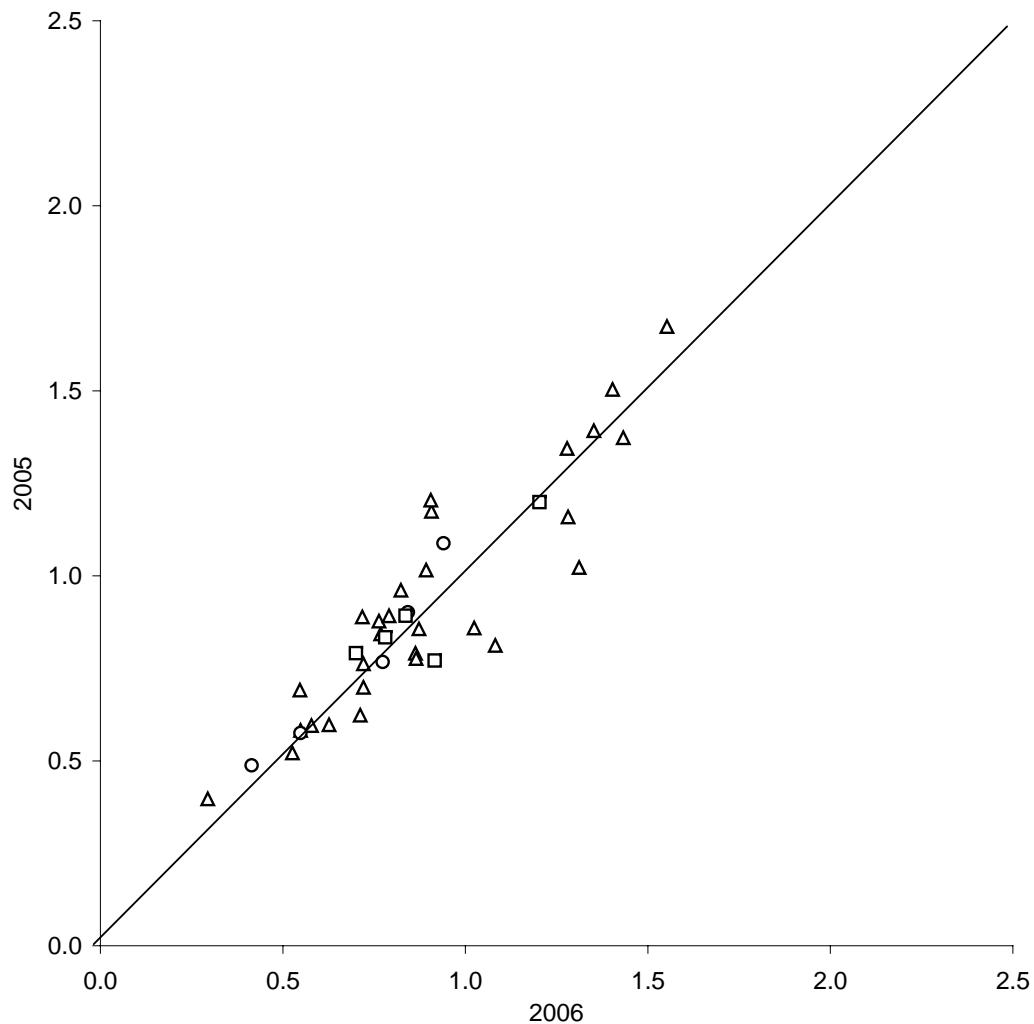**Figure 17. MCAS Math Grade 4 b-Plot: 2005 vs. 2006**

Figure 18. MCAS Math Grade 4 a-Plot: 2005 vs. 2006
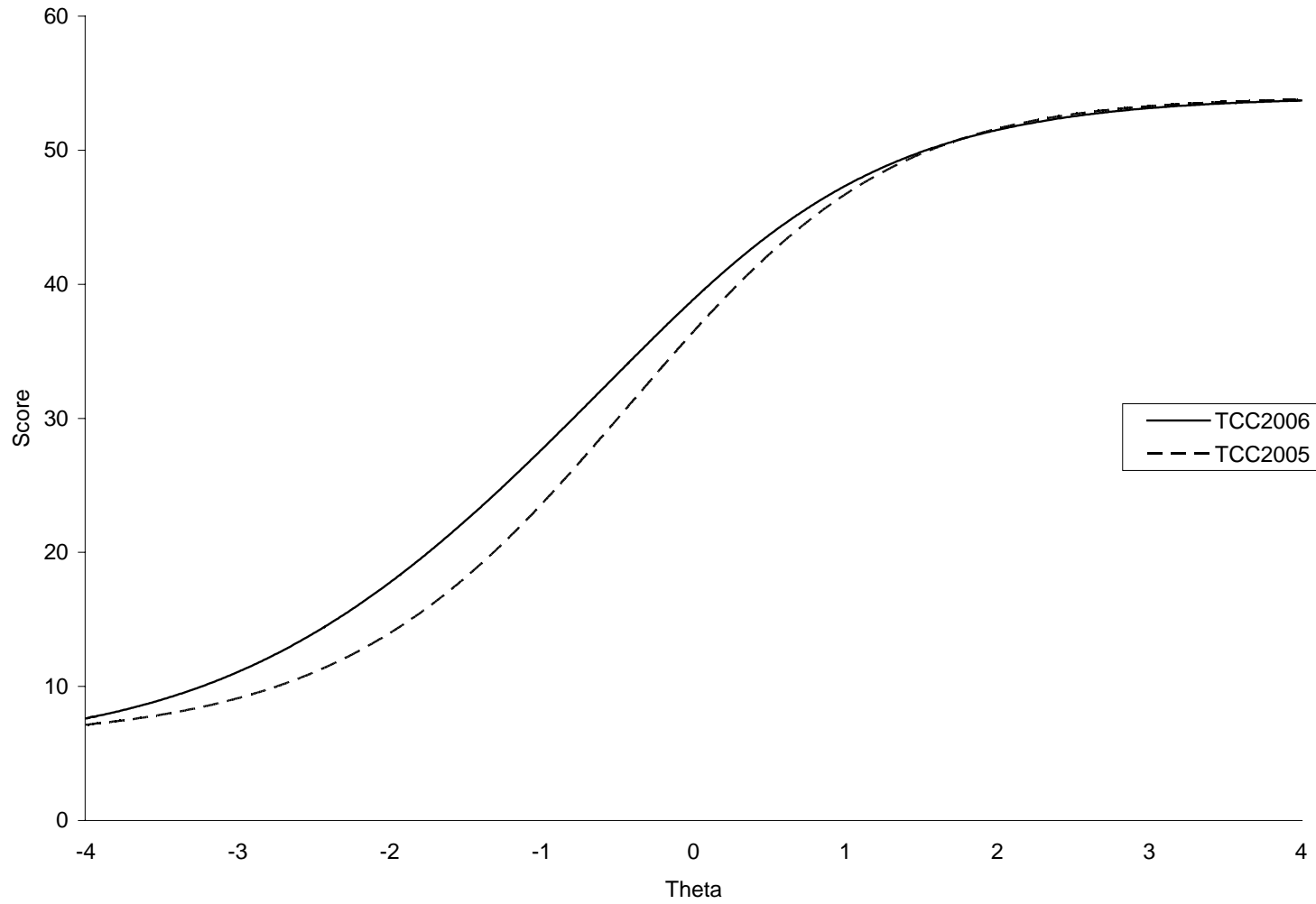
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Figure 19. MCAS Math Grade 4 TCCs: 2005 vs. 2006

Table 7. 2006 Math Grade 4

Conversion Table

E(2006)	Theta	E(2005)
0	-4	0.337453
1	-4	1.426856
2	-4	2.516259
3	-4	3.605662
4	-4	4.695065
5	-4	5.784468
6	-4	6.873871
7	-4	7.334934
8	-3.845	7.334934
9	-3.505	7.88147
10	-3.235	8.463854
11	-3.015	9.06268
12	-2.825	9.688086
13	-2.645	10.38788
14	-2.495	11.06083
15	-2.345	11.82388
16	-2.215	12.56411
17	-2.085	13.38266
18	-1.965	14.21158
19	-1.855	15.0359
20	-1.745	15.92378
21	-1.635	16.87643
22	-1.535	17.79906
23	-1.435	18.77524
24	-1.345	19.69868
25	-1.245	20.77288
26	-1.155	21.7808
27	-1.065	22.82503
28	-0.965	24.02396
29	-0.885	25.00912
30	-0.795	26.14114
31	-0.705	27.2939
32	-0.615	28.46259
33	-0.525	29.6422
34	-0.445	30.69576
35	-0.355	31.88195
36	-0.265	33.06411
37	-0.175	34.23704
38	-0.085	35.39561
39	0.015	36.65998
40	0.105	37.77193
41	0.205	38.97282
42	0.315	40.245
43	0.425	41.45951
44	0.535	42.61075
45	0.665	43.88401

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46	0.795	45.05854
47	0.945	46.28892
48	1.115	47.52346
49	1.305	48.71097
50	1.535	49.8993
51	1.815	51.02549
52	2.215	52.1485
53	2.865	53.15773
54	4	54

Figure 20. MCAS Math Grade 6 Delta-Plot: 2005 vs. 2006
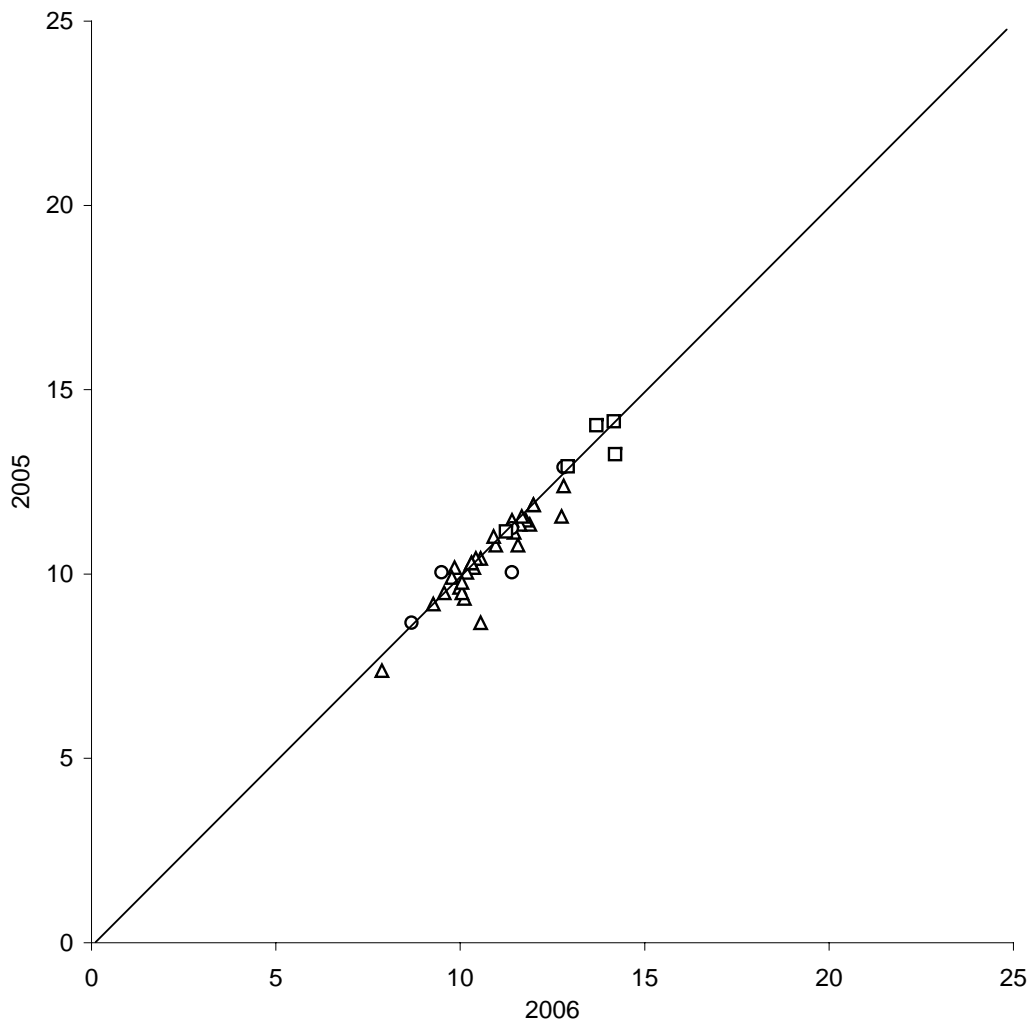
	Multiple Choice
△	Multiple Choice
○	Short Answer
□	Open Response

	2005	2006
Mean	10.82	11.07
S.D.	1.45	1.43
Correlation	0.95	

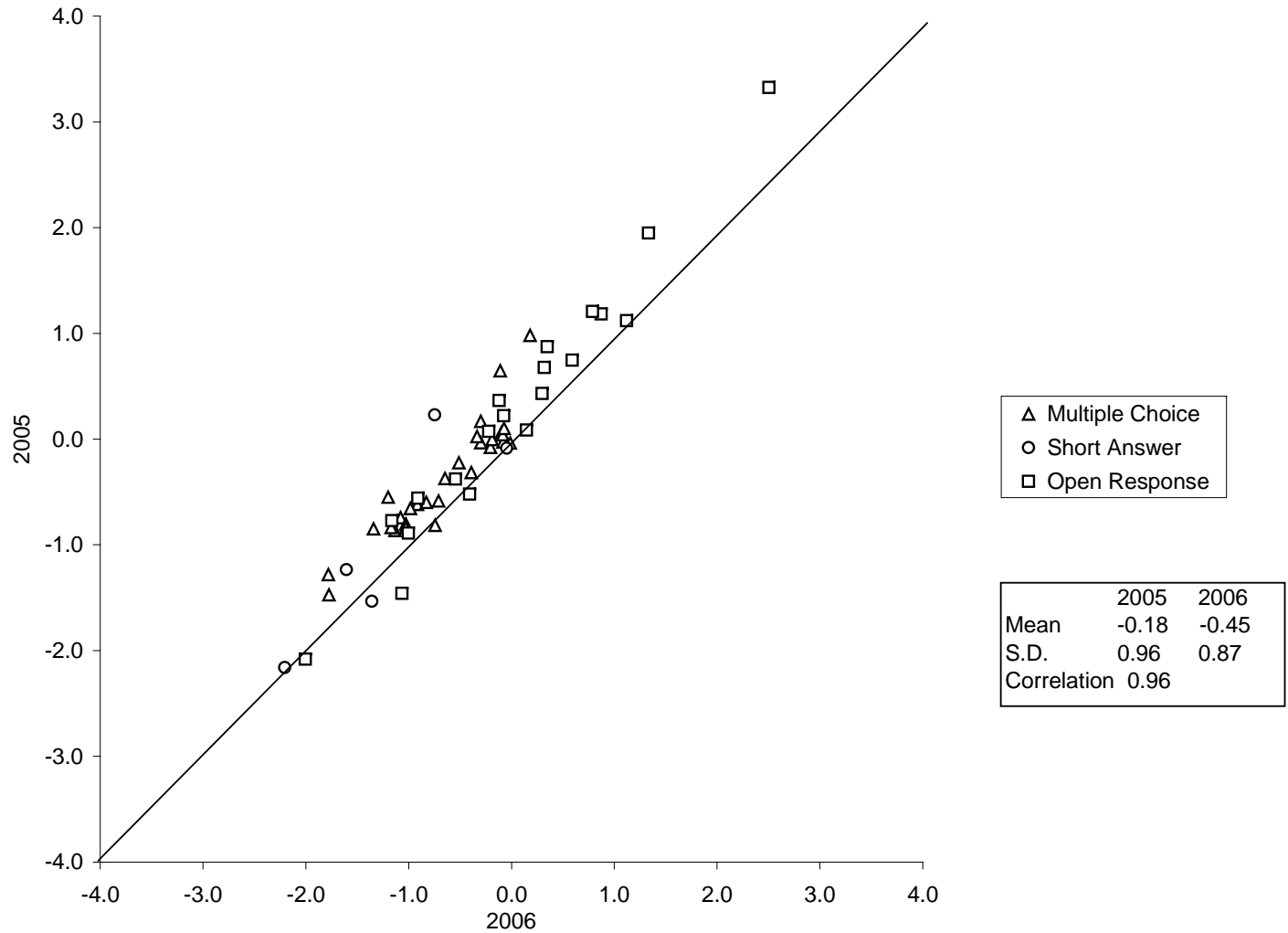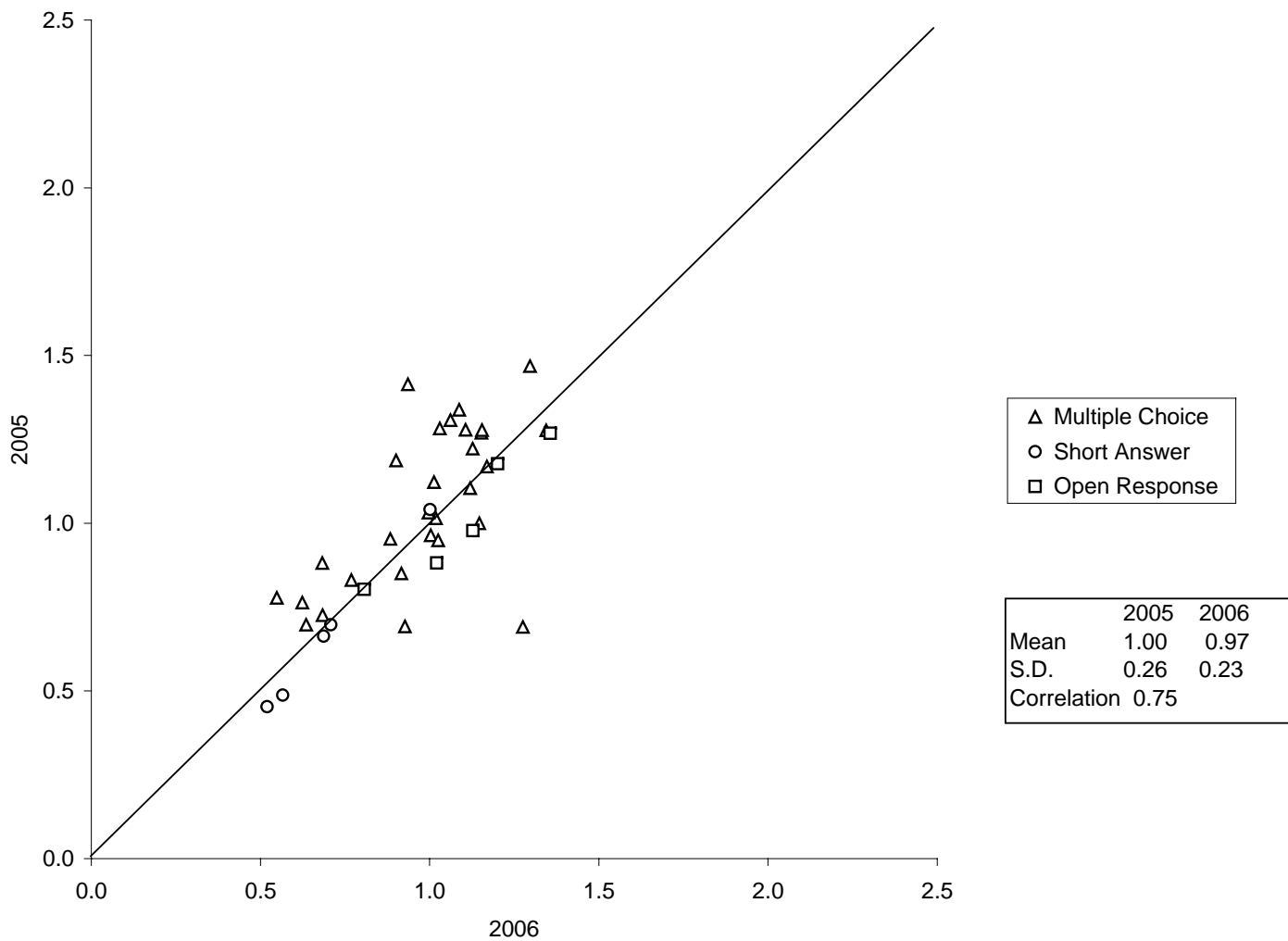**Figure 21. MCAS Math Grade 6 b-Plot: 2005 vs. 2006**

Figure 22. MCAS Math Grade 6 a-Plot: 2005 vs. 2006
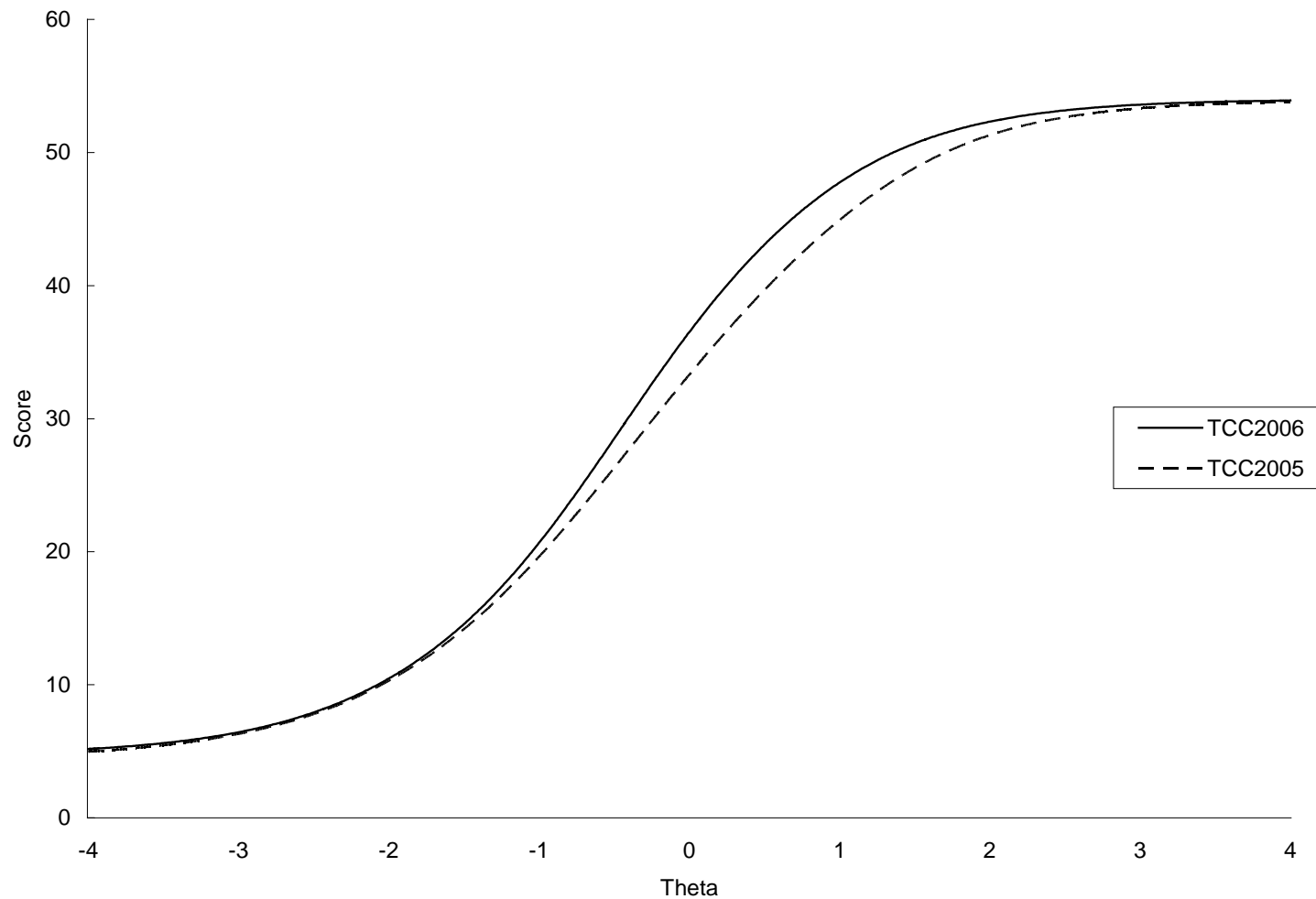
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Figure 23. MCAS Math Grade 6 TCC: 2005 vs. 2006

Table 8. 2006 Math Grade 6

Conversion Table

E(2006)	Theta	E(2005)
0	-4	0
1	-4	0.647334
2	-4	1.618231
3	-4	2.589129
4	-4	3.560026
5	-4	4.530924
6	-3.225	5.864471
7	-2.775	6.874994
8	-2.475	7.888729
9	-2.255	8.864007
10	-2.075	9.83519
11	-1.925	10.77716
12	-1.785	11.77342
13	-1.665	12.72196
14	-1.555	13.6707
15	-1.455	14.60013
16	-1.365	15.49134
17	-1.275	16.43393
18	-1.195	17.314
19	-1.125	18.11562
20	-1.045	19.06619
21	-0.975	19.92639
22	-0.905	20.81121
23	-0.845	21.58764
24	-0.775	22.51238
25	-0.715	23.31939
26	-0.655	24.13784
27	-0.595	24.9659
28	-0.525	25.94162
29	-0.465	26.78402
30	-0.405	27.62996
31	-0.345	28.4775
32	-0.285	29.32472
33	-0.225	30.16977
34	-0.165	31.01082
35	-0.095	31.98476
36	-0.035	32.81147
37	0.035	33.76448
38	0.105	34.70316

39	0.175	35.62571
40	0.245	36.53057
41	0.325	37.54144
42	0.405	38.52604
43	0.495	39.60078
44	0.585	40.63932
45	0.685	41.74926
46	0.785	42.81118
47	0.905	44.01929
48	1.035	45.24234
49	1.185	46.53645
50	1.355	47.84446
51	1.575	49.283
52	1.875	50.80318
53	2.375	52.3965
54	4	54

Figure 24. MCAS Math Grade 8 Delta-Plot: 2005 vs. 2006
(Equating item 243892 was removed from the delta plot because no 2005 item parameters or p-values were made available to us.)
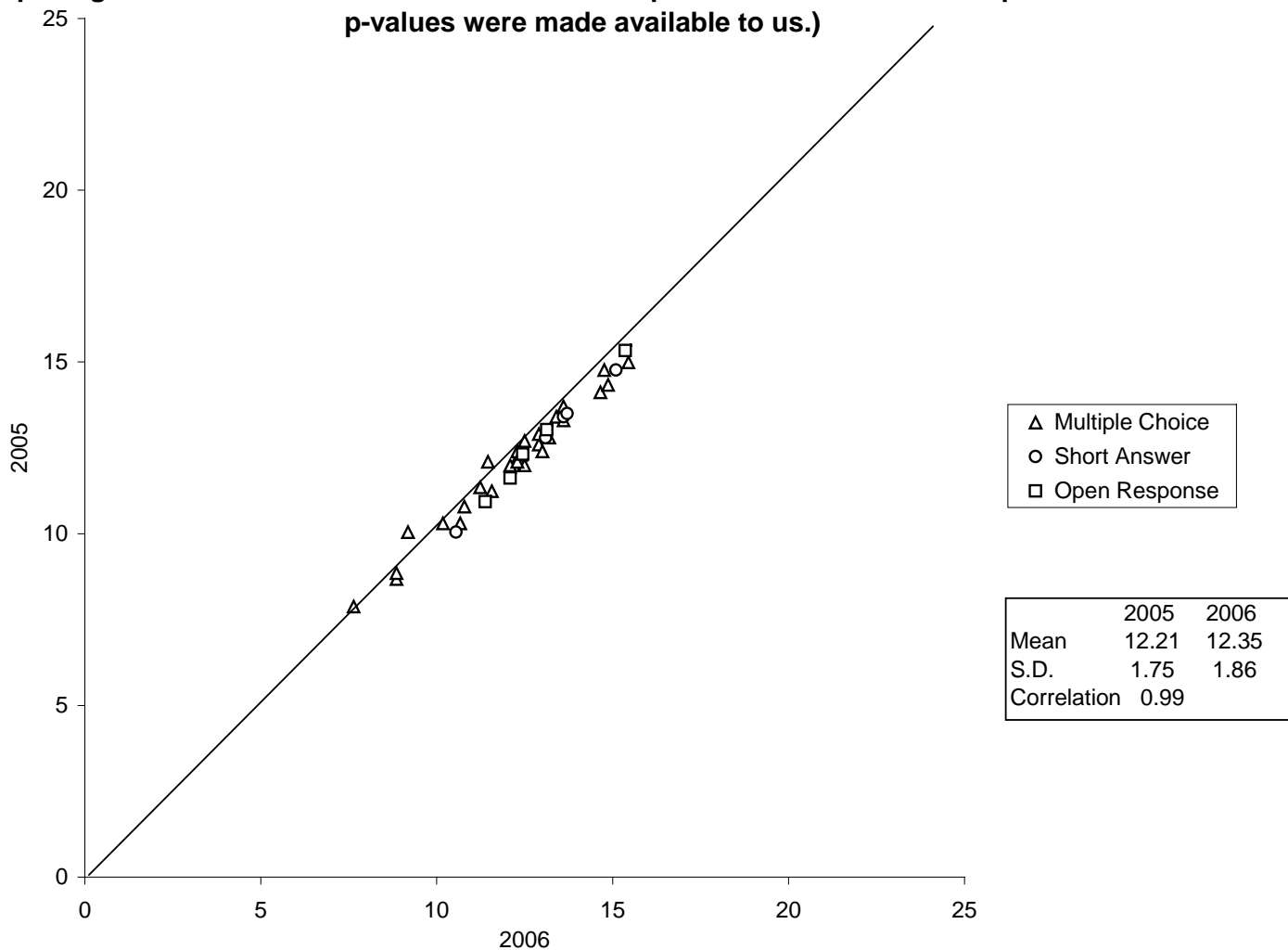
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Figure 25. MCAS Math Grade 8 b-Plot: 2005 vs. 2006
(Equating item 243892 was removed from the b-plot because no 2005 item parameters were made available to us.)

	2005	2006
Mean	0.15	-0.05
S.D.	0.88	0.91
Correlation	0.99	

Legend:
- △ Multiple Choice
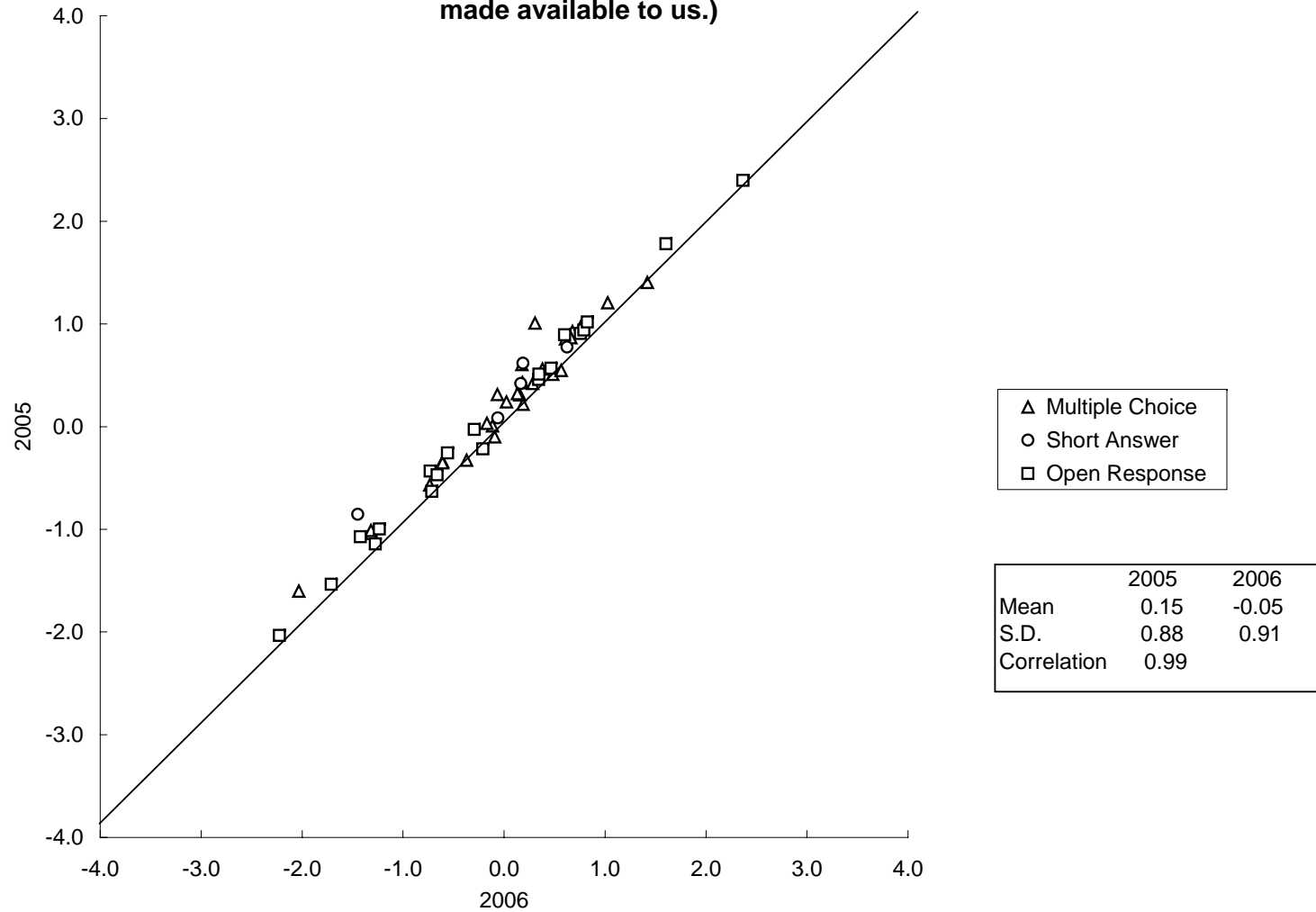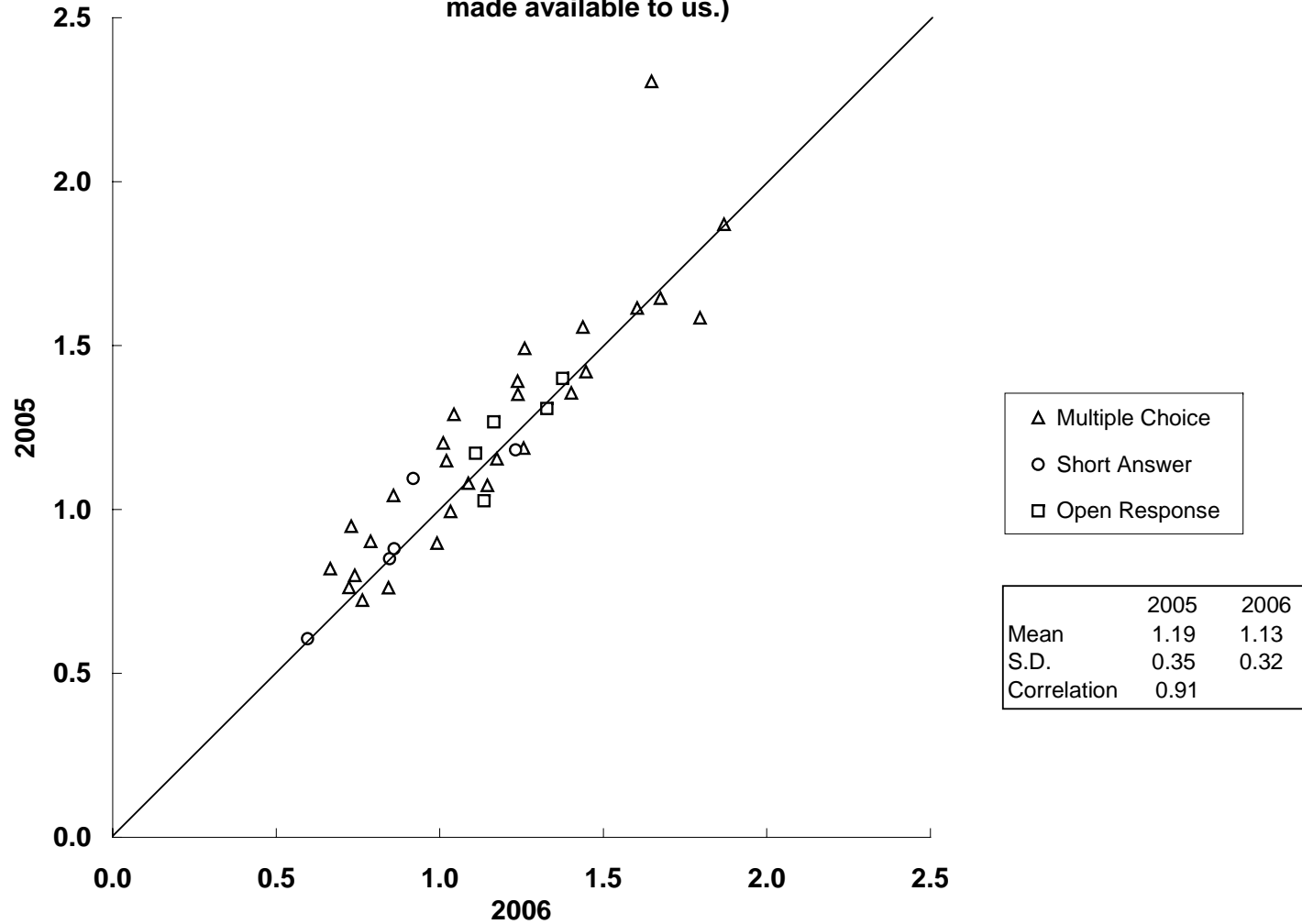- ○ Short Answer
- □ Open Response

Figure 26. MCAS Math Grade 8 a-Plot: 2005 vs. 2006
(Equating item 243892 was removed from the a-plot because no 2005 item parameters were
made available to us.)

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Figure 27. MCAS Math Grade 8 TCC: 2005 vs. 2006
(Equating item 243892 was removed from equating because no 2005 item parameters were
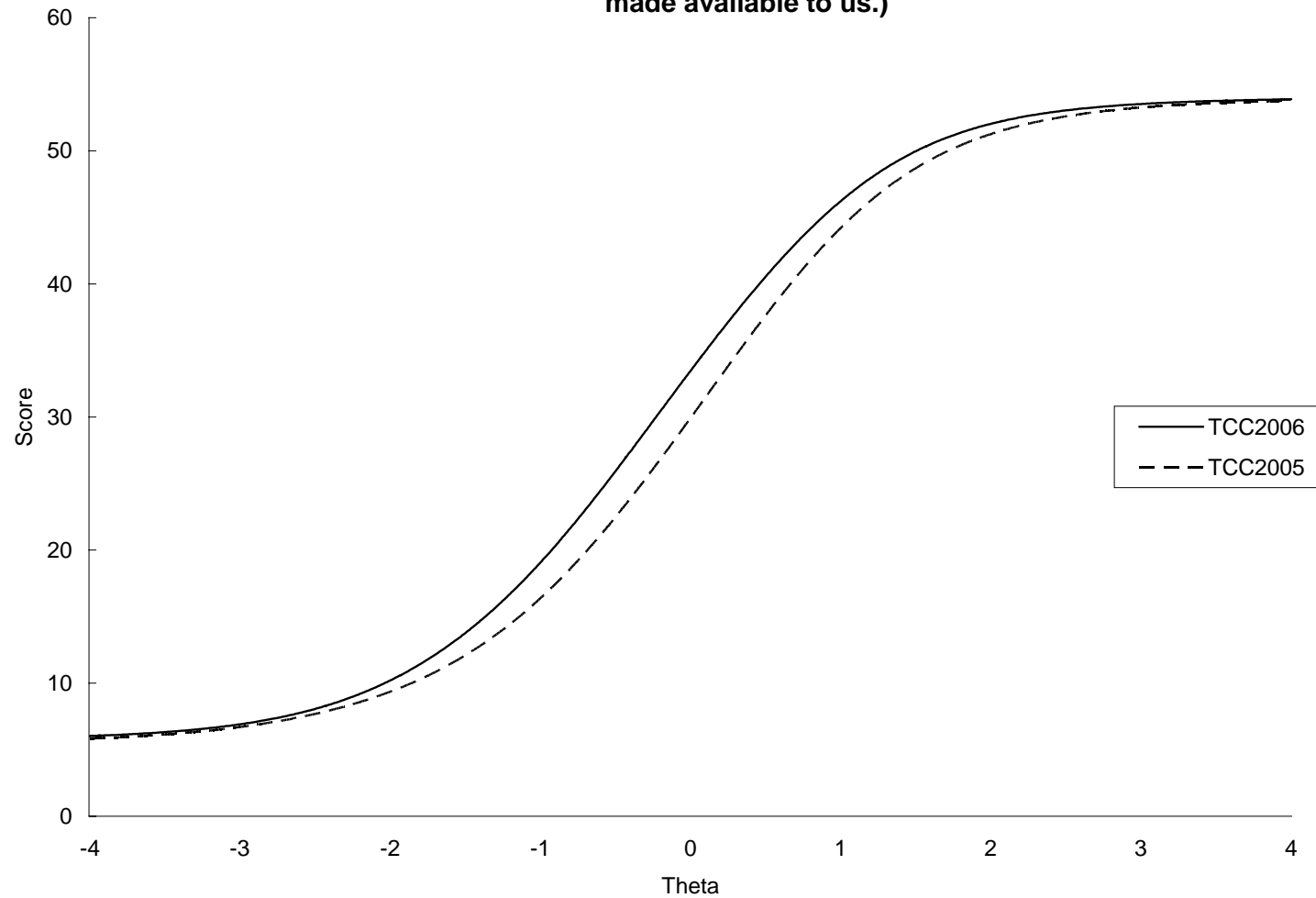**made available to us.)**

Table 9. 2006 Math Grade 8

Conversion Table

E(2006)	Theta	E(2005)
0	-4	0
1	-4	0.766785
2	-4	1.759716
3	-4	2.752648
4	-4	3.745579
5	-4	4.738511
6	-4	5.731442
7	-2.945	6.787488
8	-2.515	7.650037
9	-2.245	8.427975
10	-2.035	9.200063
11	-1.865	9.95655
12	-1.715	10.73882
13	-1.585	11.51538
14	-1.475	12.25108
15	-1.365	13.06424
16	-1.265	13.87448
17	-1.175	14.66394
18	-1.085	15.51215
19	-1.005	16.31628
20	-0.925	17.16795
21	-0.845	18.06695
22	-0.775	18.89183
23	-0.705	19.75149
24	-0.635	20.64468
25	-0.565	21.56977
26	-0.495	22.52477
27	-0.425	23.50736
28	-0.365	24.36957
29	-0.295	25.39628
30	-0.225	26.4425
31	-0.165	27.35238
32	-0.095	28.42631
33	-0.035	29.35504
34	0.035	30.44514
35	0.105	31.53904
36	0.175	32.63318
37	0.245	33.72391
38	0.315	34.80743

39	0.385	35.87976
40	0.455	36.93679
41	0.535	38.12062
42	0.615	39.27259
43	0.695	40.38652
44	0.785	41.58722
45	0.875	42.72569
46	0.975	43.91123
47	1.085	45.11334
48	1.205	46.30006
49	1.345	47.52211
50	1.505	48.71527
51	1.705	49.93066
52	1.995	51.23611
53	2.475	52.542
54	4	54

Figure 28. MCAS Math Grade 10 Delta-Plot: 2005 vs. 2006

	2005	2006
Mean	13.18	13.19
S.D.	1.29	1.32
Correlation	0.96	

△ Multiple Choice
○ Short Answer
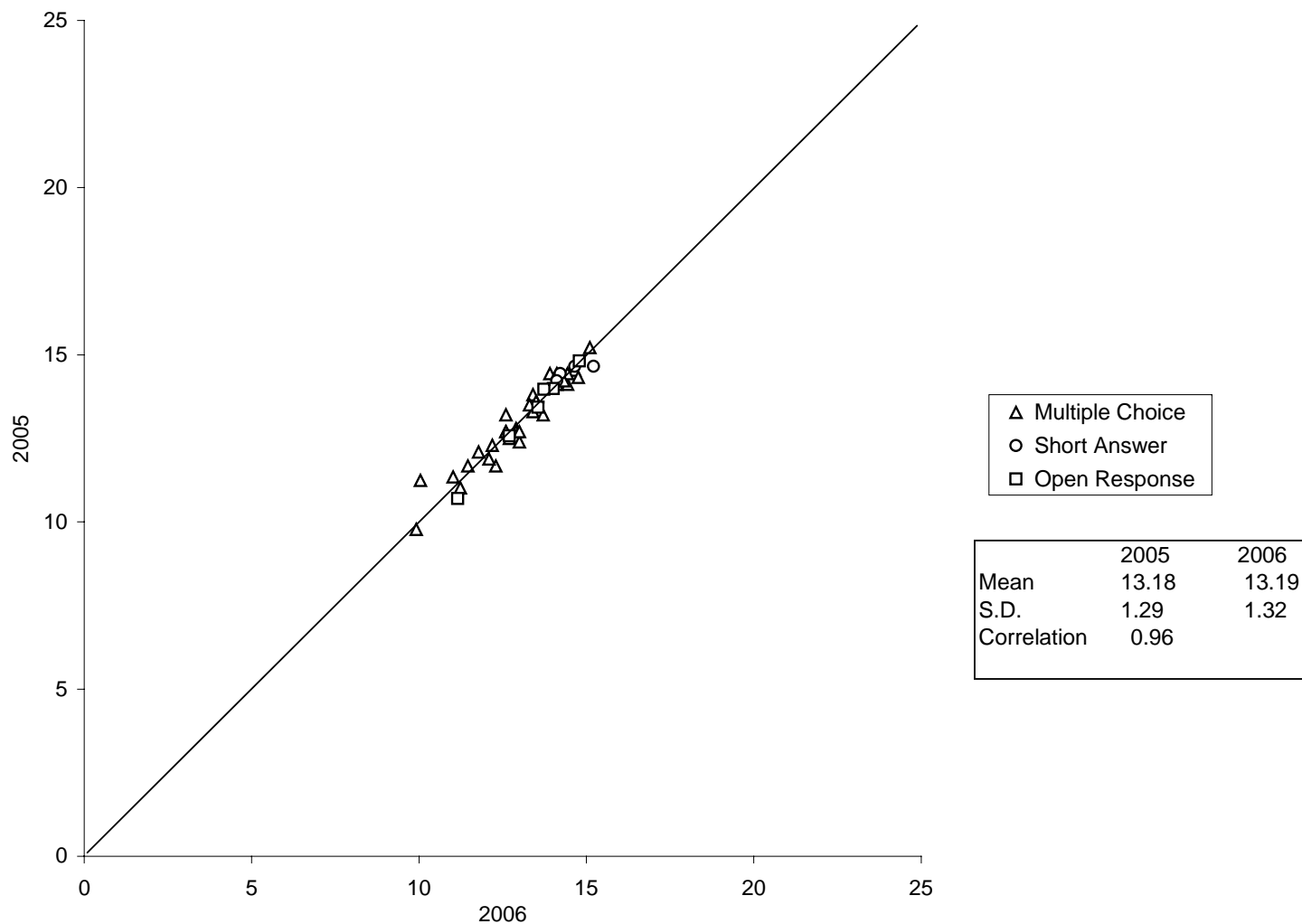□ Open Response

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Figure 29. MCAS Math Grade 10 b-Plot: 2006 Pre-equating vs. 2006 Post-equating

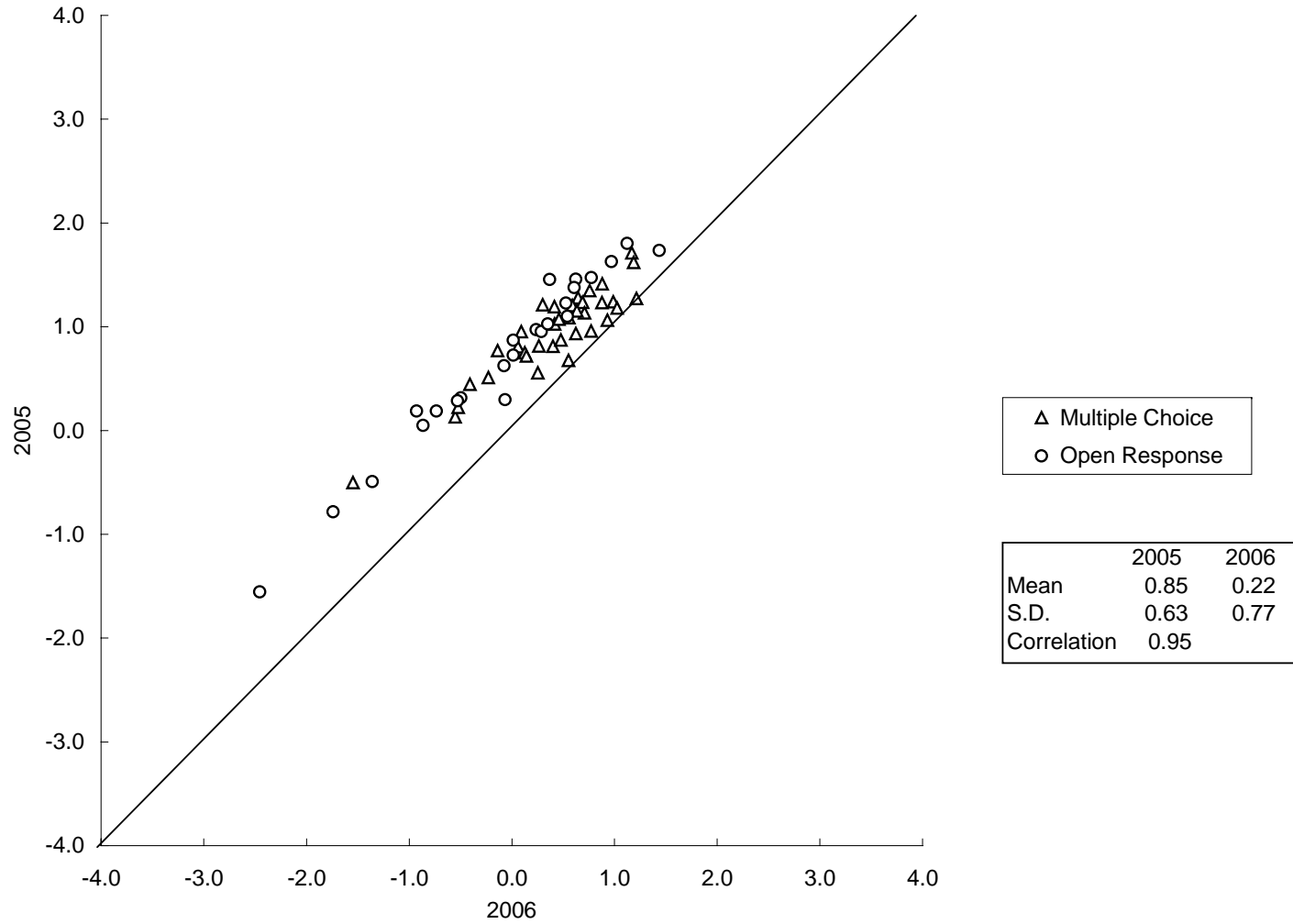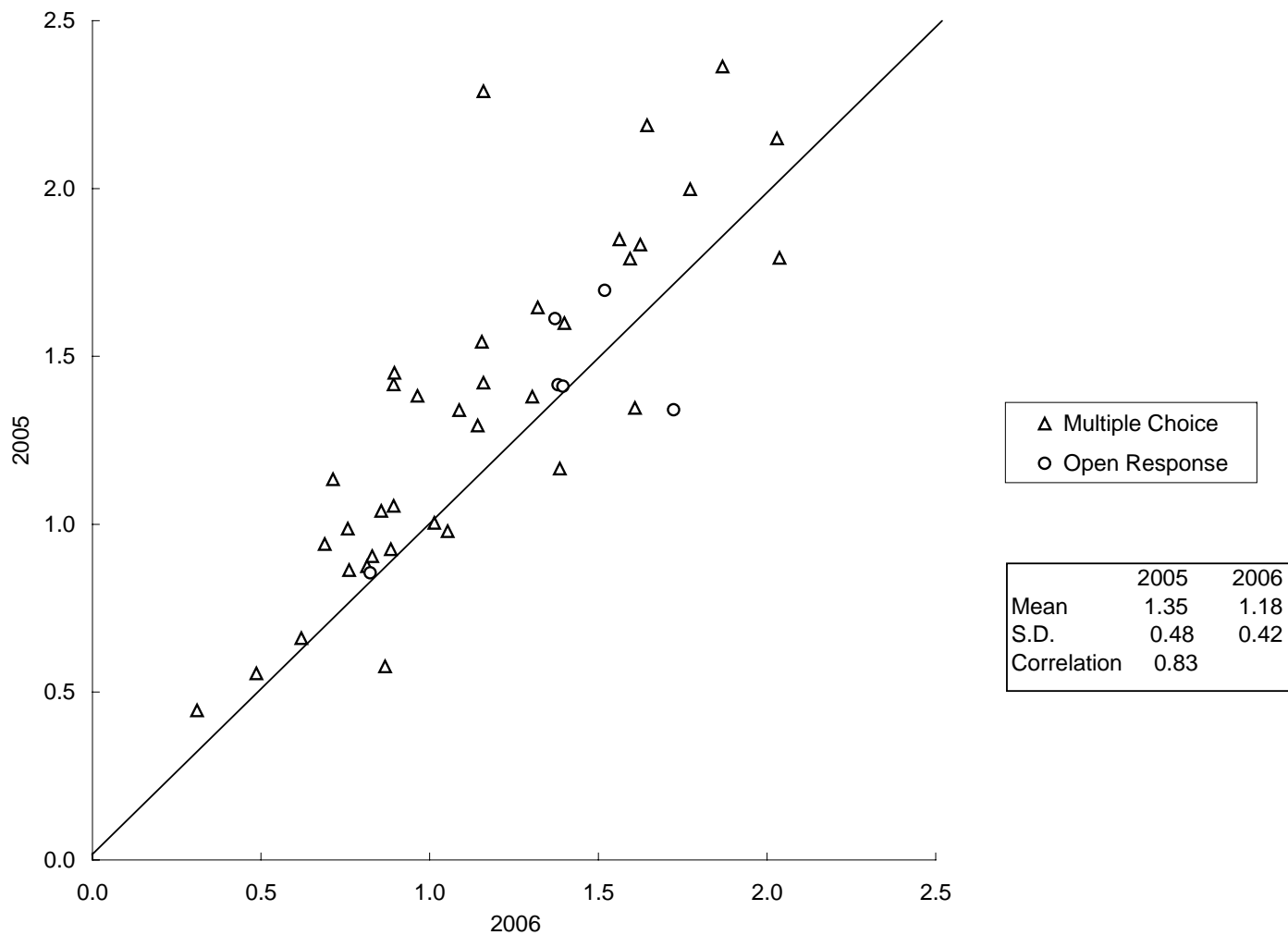**Figure 30. MCAS Math Grade 10 a-Plot: 2006 Pre-equating vs. 2006 Post-equating**

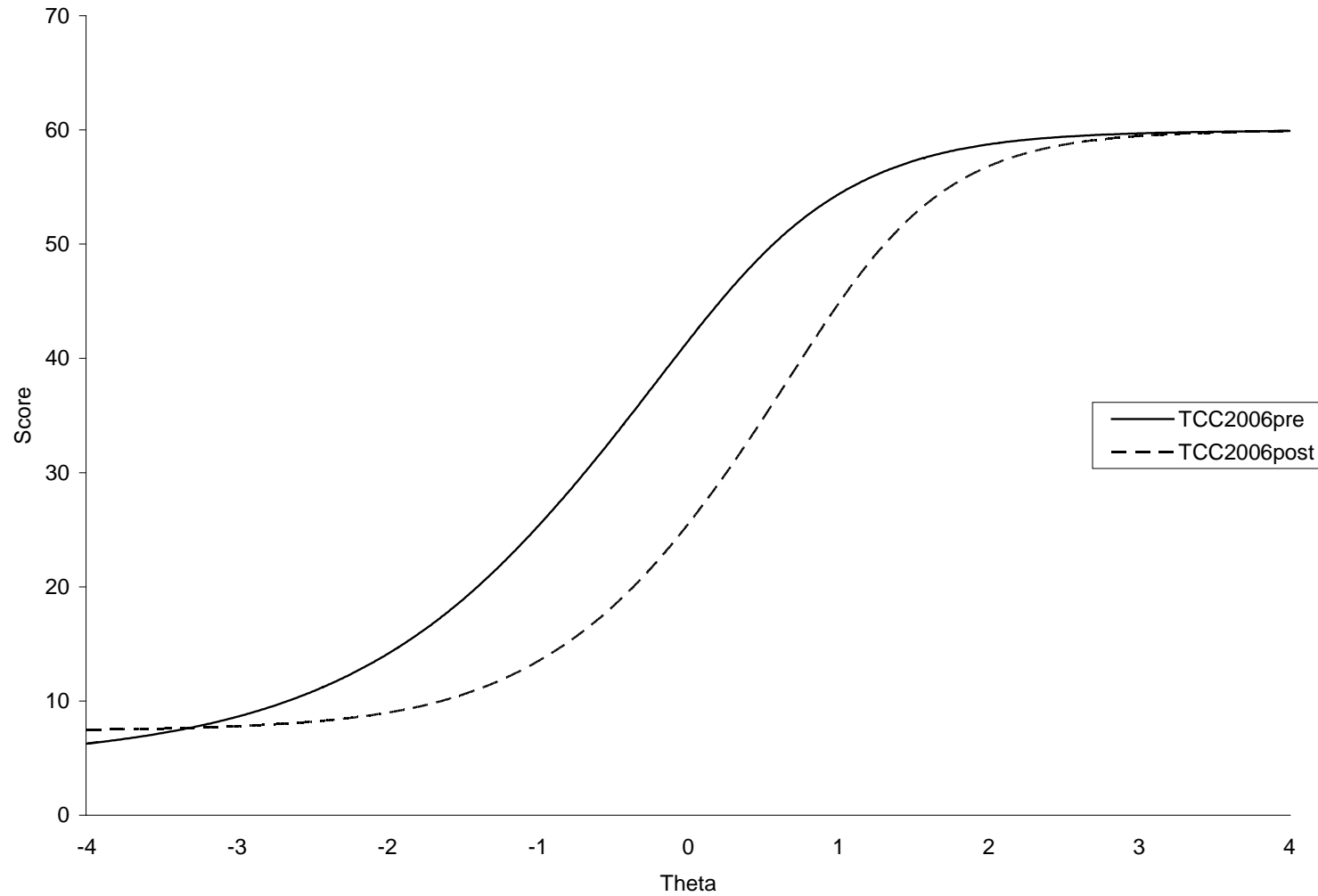**Figure 31. MCAS Math Grade 10 TCC: 2006 Pre-equating vs. 2006 Post-equating**

Table 10. Math Grade 10 2006 Pre-equating vs 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
0	-4	1.650526
1	-4	2.890447
2	-4	4.130368
3	-4	5.370288
4	-4	6.610209
5	-4	7.573787
6	-4	7.573787
7	-3.585	7.573787
8	-3.195	7.706538
9	-2.895	7.863644
10	-2.665	8.034047
11	-2.465	8.232531
12	-2.295	8.450702
13	-2.145	8.691856
14	-2.015	8.946561
15	-1.895	9.226884
16	-1.785	9.52839
17	-1.675	9.878757
18	-1.575	10.24499
19	-1.485	10.61757
20	-1.405	10.9858
21	-1.315	11.44477
22	-1.245	11.83645
23	-1.165	12.32327
24	-1.095	12.78513
25	-1.025	13.28195
26	-0.955	13.81521
27	-0.885	14.38645
28	-0.815	14.99733
29	-0.755	15.55384
30	-0.685	16.24315
31	-0.625	16.86968
32	-0.565	17.53037
33	-0.505	18.22622
34	-0.445	18.95799
35	-0.385	19.7261
36	-0.325	20.53057
37	-0.265	21.37095
38	-0.205	22.24639
39	-0.145	23.15575
40	-0.095	23.9385
41	-0.035	24.90661
42	0.025	25.90501
43	0.085	26.93264
44	0.155	28.16729

45	0.215	29.25523
46	0.275	30.36952
47	0.345	31.70104
48	0.415	33.06359
49	0.485	34.45293
50	0.565	36.06621
51	0.655	37.90067
52	0.745	39.73815
53	0.845	41.75827
54	0.955	43.91952
55	1.085	46.33926
56	1.245	49.03974
57	1.435	51.76339
58	1.695	54.60411
59	2.155	57.58713
60	4	60

Figure 32. MCAS Math Grade 10 TCC: 2005 vs. 2006 (Pre-equating)
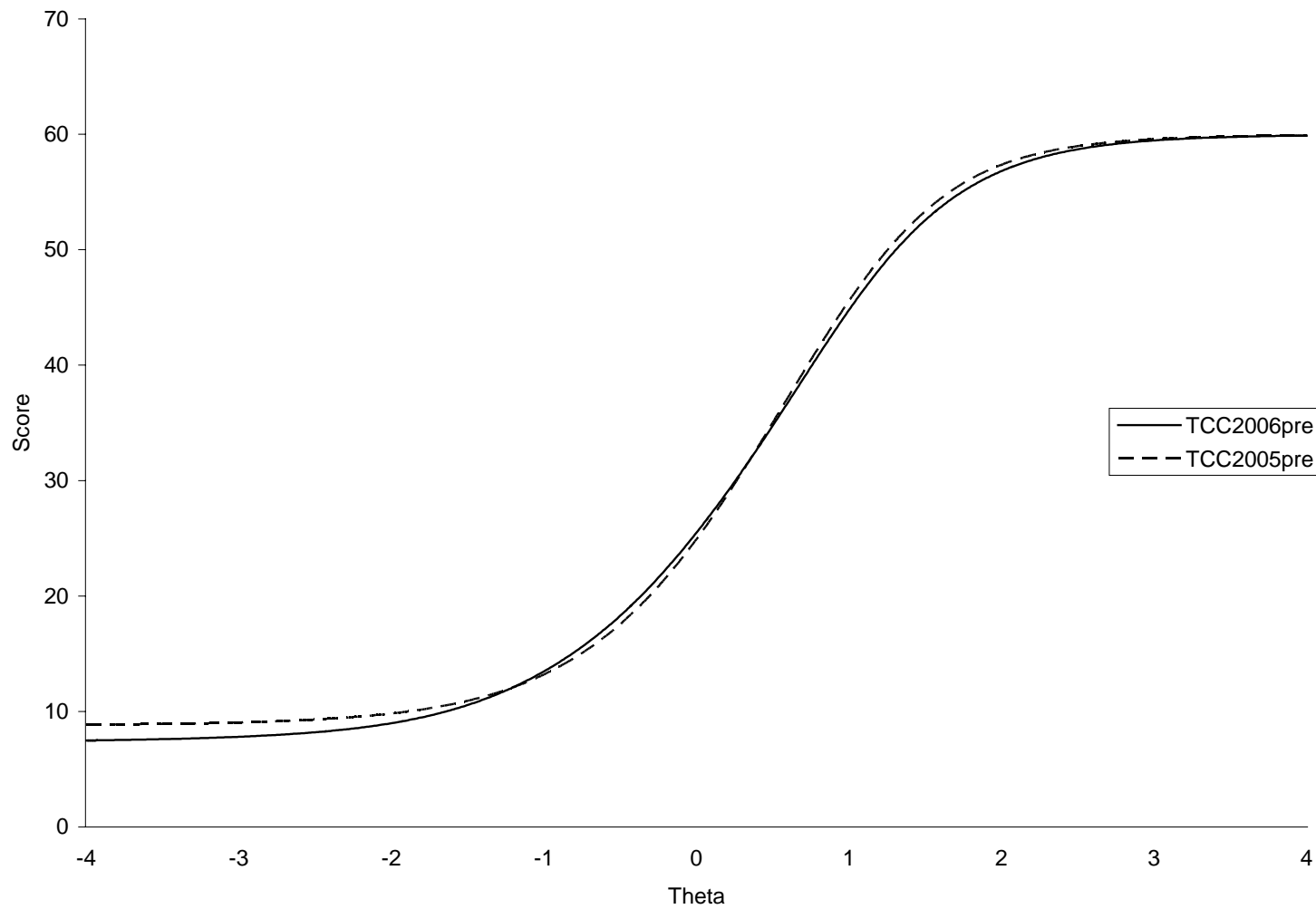
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Table 11. Math Grade 10 2005 vs 2006 (Pre-equating)

Conversion Table

E(new)	Theta	E(ref)
0	-4	1.049291
1	-4	2.099053
2	-4	3.148814
3	-4	4.198576
4	-4	5.248338
5	-4	6.298099
6	-4	7.347861
7	-4	8.397622
8	-2.705	9.172925
9	-1.995	9.828815
10	-1.645	10.51438
11	-1.405	11.23821
12	-1.215	12.01927
13	-1.065	12.80109
14	-0.935	13.61946
15	-0.815	14.50792
16	-0.705	15.44764
17	-0.615	16.31372
18	-0.525	17.2734
19	-0.445	18.209
20	-0.365	19.22517
21	-0.295	20.18189
22	-0.225	21.2023
23	-0.155	22.28627
24	-0.095	23.2653
25	-0.025	24.4643
26	0.035	25.53891
27	0.085	26.46594
28	0.145	27.61403
29	0.205	28.79816
30	0.255	29.80996
31	0.305	30.84205
32	0.365	32.10372
33	0.415	33.1711
34	0.465	34.24976
35	0.515	35.3364
36	0.565	36.42758
37	0.615	37.5197
38	0.655	38.39157
39	0.705	39.47596
40	0.755	40.55075
41	0.805	41.61215
42	0.855	42.65645
43	0.905	43.68006
44	0.955	44.67958

45	1.015	45.8427
46	1.065	46.77834
47	1.125	47.8569
48	1.185	48.88373
49	1.245	49.85582
50	1.305	50.77096
51	1.375	51.76484
52	1.455	52.80248
53	1.535	53.73636
54	1.635	54.76267
55	1.745	55.7219
56	1.865	56.58544
57	2.035	57.53102
58	2.255	58.3792
59	2.645	59.21693
60	4	60

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Figure 33. MCAS Math Grade 10 TCC: 2005 Pre-equating vs. 2006 Post-equating
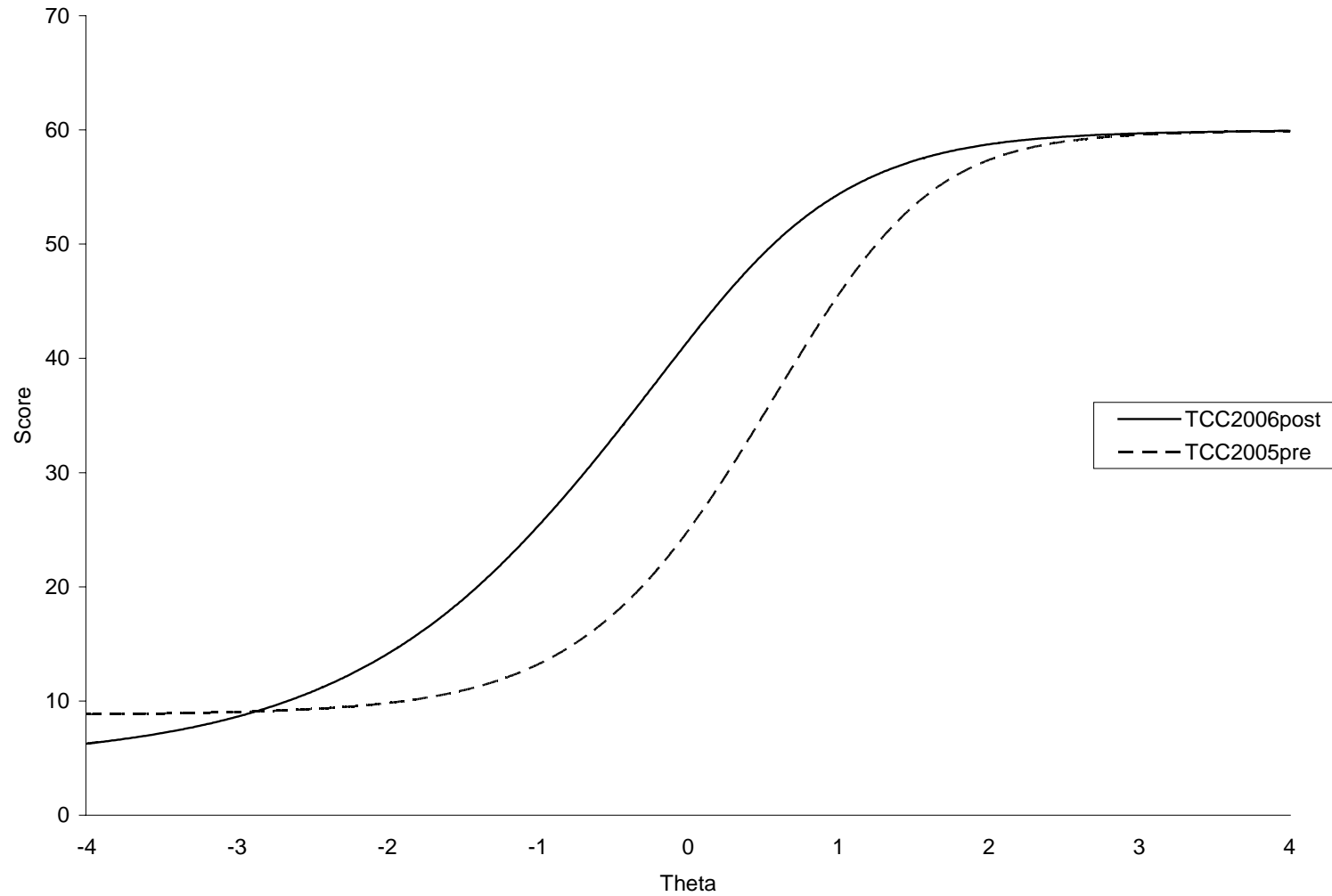
Table 12. Math Grade 10 2005 Pre-equating vs 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
0	-4	2.78195
1	-4	4.083571
2	-4	5.385192
3	-4	6.686813
4	-4	7.988435
5	-4	8.901503
6	-4	8.901503
7	-3.585	8.901503
8	-3.195	8.984734
9	-2.895	9.084741
10	-2.665	9.194676
11	-2.465	9.324179
12	-2.295	9.467952
13	-2.145	9.628375
14	-2.015	9.799432
15	-1.895	9.989655
16	-1.785	10.19667
17	-1.675	10.44062
18	-1.575	10.6998
19	-1.485	10.96813
20	-1.405	11.23821
21	-1.315	11.58189
22	-1.245	11.88151
23	-1.165	12.26212
24	-1.095	12.6316
25	-1.025	13.03801
26	-0.955	13.48424
27	-0.885	13.97322
28	-0.815	14.50792
29	-0.755	15.00487
30	-0.685	15.6323
31	-0.625	16.21297
32	-0.565	16.83499
33	-0.505	17.49988
34	-0.445	18.209
35	-0.385	18.96345
36	-0.325	19.76408
37	-0.265	20.6114
38	-0.205	21.50555
39	-0.145	22.44627
40	-0.095	23.2653
41	-0.035	24.28935
42	0.025	25.35689
43	0.085	26.46594
44	0.155	27.80897
45	0.215	28.99879

Appendix D

46	0.275	30.2205
47	0.345	31.68062
48	0.415	33.1711
49	0.485	34.68364
50	0.565	36.42758
51	0.655	38.39157
52	0.745	40.33674
53	0.845	42.44913
54	0.955	44.67958
55	1.085	47.14339
56	1.245	49.85582
57	1.435	52.55287
58	1.695	55.30696
59	2.155	58.03811
60	4	60

Figure 34. MCAS Math Grade 10 TCC: 2005 Post-equating vs. 2006 Post-equating
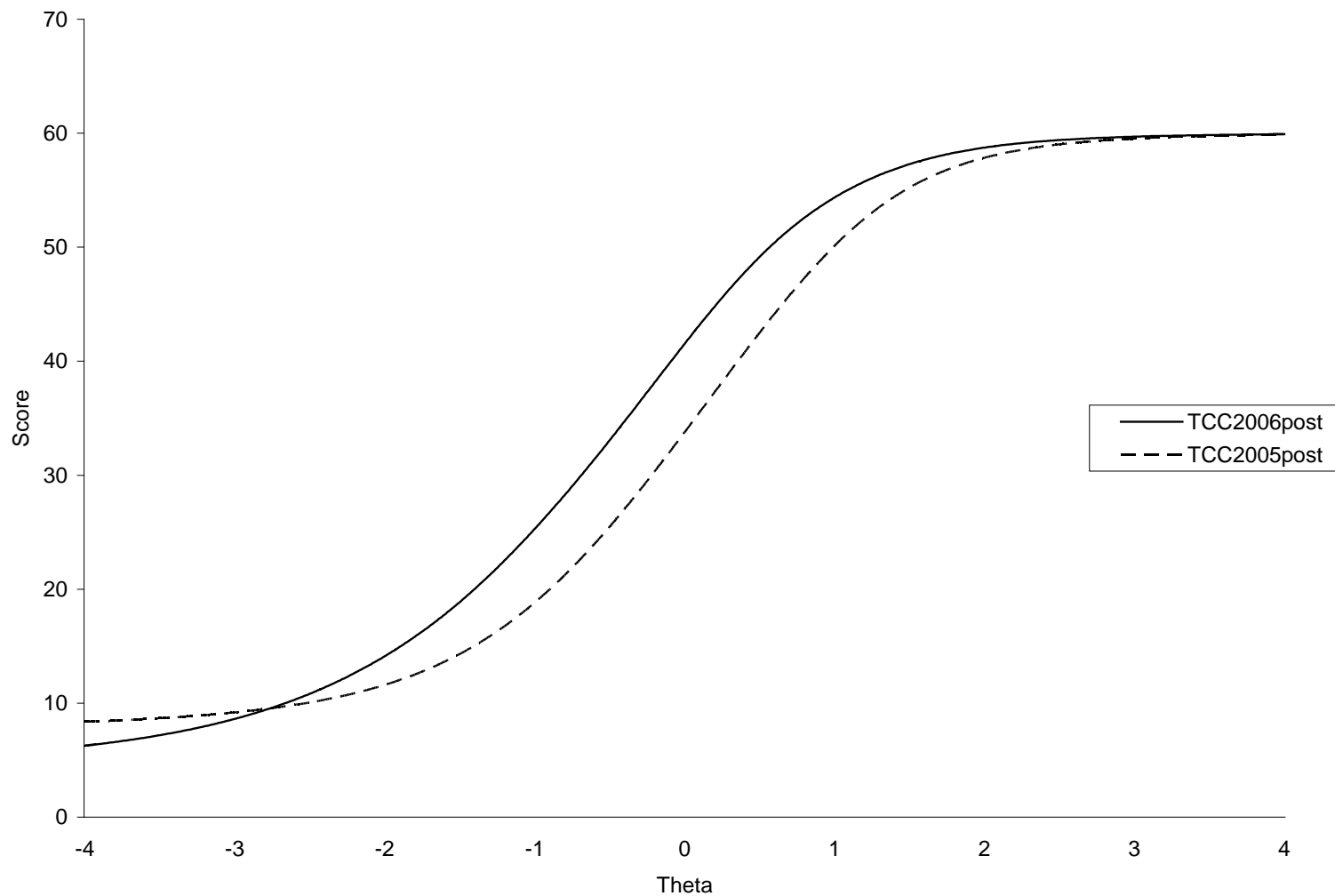
Appendix G

Table 13. Math Grade 10 2005 Post-equating vs 2006 Post-equating

Conversion Table

E(new)	Theta	E(ref)
0	-4	2.260187
1	-4	3.486624
2	-4	4.713062
3	-4	5.939499
4	-4	7.165936
5	-4	8.392374
6	-4	8.616087
7	-3.585	8.616087
8	-3.195	8.959916
9	-2.895	9.3387
10	-2.665	9.724233
11	-2.465	10.14878
12	-2.295	10.59269
13	-2.145	11.06243
14	-2.015	11.54022
15	-1.895	12.04906
16	-1.785	12.58061
17	-1.675	13.18201
18	-1.575	13.79566
19	-1.485	14.40719
20	-1.405	15.00117
21	-1.315	15.72937
22	-1.245	16.34162
23	-1.165	17.09225
24	-1.095	17.79469
25	-1.025	18.54041
26	-0.955	19.32968
27	-0.885	20.16237
28	-0.815	21.03797
29	-0.755	21.8219
30	-0.685	22.77431
31	-0.625	23.62185
32	-0.565	24.49683
33	-0.505	25.3978
34	-0.445	26.32312
35	-0.385	27.27106
36	-0.325	28.23971
37	-0.265	29.22706
38	-0.205	30.23103
39	-0.145	31.24943
40	-0.095	32.10749
41	-0.035	33.14648
42	0.025	34.19341
43	0.085	35.24596
44	0.155	36.47786
45	0.215	37.5344

46	0.275	38.58895
47	0.345	39.81342
48	0.415	41.02759
49	0.485	42.22706
50	0.565	43.57379
51	0.655	45.04912
52	0.745	46.47158
53	0.845	47.97658
54	0.955	49.52439
55	1.085	51.18923
56	1.245	52.97485
57	1.435	54.71481
58	1.695	56.4849
59	2.155	58.31844
60	4	60