APPENDIX J

MODE LINKING REPORT

Massachusetts Comprehensive Assessment System

2017 - 2018: MODE LINKING REPORT

measured progress

IRT and Mode Linking Report

The purpose of this document is to summarize the IRT calibration and mode linking results obtained from Measured Progress for Next Generation MCAS Assessment. Presented in this report are various program summary statistics and specific results related to the study.

The results of this report are organized as follows:

1. Aggregate Results
   - 1.1 Percentage of Students by Achievement Levels Categories
   - 1.2 Raw Scores Associated with Cutpoints
   - 1.3 Calibration Report
   - 1.4 Linking Item Summary Statistics
   - 1.5 Summary of Psychometric QC Activities
2. Grade Subject Results
   - 2.1 A/A, B/B, Delta, Test Characteristic Curve, Test Information Function, and Cumulative Scale Score Distribution Plots
   - 2.2 Tabled Delta Analysis Results
   - 2.3 Tabled B/B Analysis Results
   - 2.4 Final Item Parameters
3. Mode Comparability Analysis Results
   - 3.1 Propensity Score Matching Effectiveness
   - 3.2 Propensity Score Matching Population Representativeness
   - 3.3 Mode Effect Results
   - 3.4 Mode Adjustment
4. Quality Control and Pearson Replication Analyses
   - 4.1 Mode Linking Results
   - 4.2 Mode Adjustment Results

1 Aggregate Results

1.1 Percentage of Students by Achievement Levels Categories

Table 1.1.1: English Language Arts - Online

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	43046	6	41	43	10	53	501.8
6	2018	53988	10	38	42	11	53	501.3

Table 1.1.2: English Language Arts - Paper Unadjusted

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	24868	4	30	49	17	66	507.5
6	2018	15270	9	31	45	15	60	505.3

Table 1.1.3: English Language Arts - Paper Mode-adjusted

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	24868	6	42	44	9	53	503
6	2018	15270	11	38	39	12	51	500.7

Table 1.1.4: English Language Arts - Combined

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	67914	6	41	43	9	52	502.2
6	2018	69258	10	38	41	11	52	501.2

Table 1.1.5: Mathematics - Online

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	43501	11	40	40	9	49	499.1
6	2018	54582	9	43	42	6	48	498.4

Table 1.1.6: Mathematics - Paper Unadjusted

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	25009	9	35	45	11	56	501.8
6	2018	15349	12	36	44	9	53	500.1

Table 1.1.7: Mathematics - Paper Mode-adjusted

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	25009	10	37	42	11	53	501.2
6	2018	15349	12	40	39	9	48	498.7

Table 1.1.8: Mathematics - Combined

Grade	Year	Count	NM	PM	ME	EE	ME/EE	Ave.SS
3	2018	68510	11	39	40	10	50	499.9
6	2018	69931	10	42	41	7	48	498.5

1.2 Raw Scores Associated with Cutpoints

Table 1.2.1: Raw Scores Associated with Cutpoints

Subject	Grade	Online	Paper Adjusted	Paper unadjusted
ELA	3	12	12(+1)	11
		26	28(+3)	25
		35	37(+2)	35
		44	44	44
	6	13	15(+2)	13
		29	32(+3)	29
		41	42(+1)	41
		51	51	51
MAT	3	13	14(+1)	13
		29	30(+1)	29
		41	42	42
		48	48	48
	6	11	12	12
		30	31(+2)	29
		49	48	48
		54	54	54

1.3 Calibration Report

FlexMIRT 3.03 was used for the IRT calibration at Measured Progress. The Online and Paper forms were calibrated separately for ELA and Mathametics Grade 3 and 6. All command files were set up in a way following general settings. The calibration convergence criterion was set to 0.001.

A 3PLM was used for standard four-option multiple choice (MC) items, a 2PLM was used for dichotomously-scored short response items, multi-select items, and technology-enhanced items, and a Graded Response Model (GRM) was specified for the polytomously-scored multi-part items and open response items. The logistic version of the IRT models was used. The prior distribution for the guessing parameter was set to be beta(5,17), and logNormal(0,0.5^2) was used as the prior for the item discrimination. parameter. No prior was supplied for the item difficulty parameter.

The calibration went smoothly and got converged in all subjects/grades. In particular, the largest change in parameter values (from one iteration to the next) was decreasing and tended to flatten out towards the end of the calibration process. The number of cycles to convergence for both Online and Paper forms in each grade/content for the initial calibrations are listed in the Table 1.3.1.

The IRT model fit was evaluated for each of the items. The resulting parameters demonstrated excellent model fit for the majority of the items. The final watch list for IRT calibration is presented in the following Tables 1.3.2.

Table 1.3.1: Number of Cycles to Convergence

Subject	Grade	Online Initial Cycle	Paper Initial Cycle
ELA	3	48	50
	6	47	53
MAT	3	23	29
	6	56	51

1.4 Linking Item Summary Statistics

The common items between Online and Paper forms were used as linking items to put paper item parameters onto online scale, so that online and paper forms are comparable with each other. The linking item summary statistics, including classical and IRT item statistics, are presented in Table 1.4.1.

Table 1.4.1: Linking Item Summary Statistics

			P-Value		Point Biserial		a		b	
Subject	Grade	Mode	Mean	SD	Mean	SD	Mean	SD	Mean	SD
ELA	03	online	0.67	0.21	0.52	0.10	1.00	0.32	-0.40	0.95
ELA	03	paper	0.71	0.20	0.53	0.11	0.93	0.28	-0.46	1.00
ELA	06	online	0.63	0.16	0.54	0.14	0.80	0.24	-0.41	0.91
ELA	06	paper	0.65	0.14	0.55	0.15	0.78	0.34	-0.33	0.90
MAT	03	online	0.58	0.16	0.50	0.12	0.93	0.23	-0.10	0.81
MAT	03	paper	0.60	0.15	0.51	0.10	0.95	0.23	-0.08	0.73
MAT	06	online	0.56	0.21	0.55	0.13	1.14	0.26	-0.20	0.92
MAT	06	paper	0.57	0.19	0.57	0.12	1.09	0.26	-0.17	0.90

The Stocking and Lord(SL) procedure was used to transform paper parameter estimates onto the online scale. This procedure results in constants which were applied to the resulting IRT parameters for each grade/content. These transformation constants were found using the STUIRT program which can be found at the CASMA website: http://www.education.uiowa.edu/casma/. The SL transformation constants that were used in the linking process are listed in the following table. The SL slope and intercept are more different from 1 and 0 compared to those in the year-to-year equating transformation, indicating larger ability difference between testing modes. This is both due to inherent ability difference between schools taking different modes, and is possibly confounded by the construct-irrelevant variance introduced by mode. The latter is further investigated in the Mode Comparability Section in this document.

Table 1.4.2: Stocking and Lord Constants

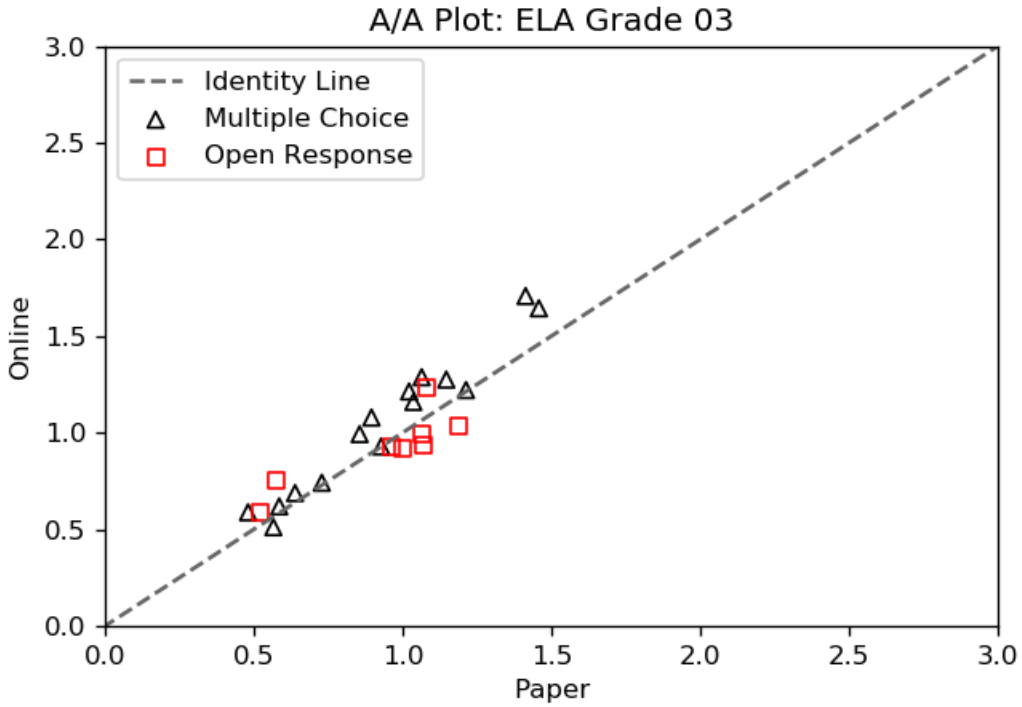
Subject	Grade	Slope	Intercept
ELA	3	1.07	0.40
	6	1.23	0.27
MAT	3	1.03	0.10
	6	1.11	0.01

1.5 Summary of Psychometric QC Activities

1. Key verification process
2. Delta analysis
   a. Crit > 3 removed
3. b/b analysis
   a. Crit > 3 removed
4. IRT and Linking Analysis
   a. Reasonableness of item parameters
   b. Low a, high SE on B, c parameter poorly estimated
   c. Fit files
   d. Normal end evaluation
   e. Delta plot
   f. a-plot, b-plots
   g. TCCs and information functions
   h. Proficiency levels and scaled score distributions
5. Watch List(items were continuously evaluated)
   a. 8 criteria (4a.-4f.)
   b. Statistical values
   c. Content

Section 2.1

A/A, B/B, Delta, Test Characteristic Curve, Test Information Function, and Cumulative Scale Score Distribution Plots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Multiple Choice
Open Response
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Paper
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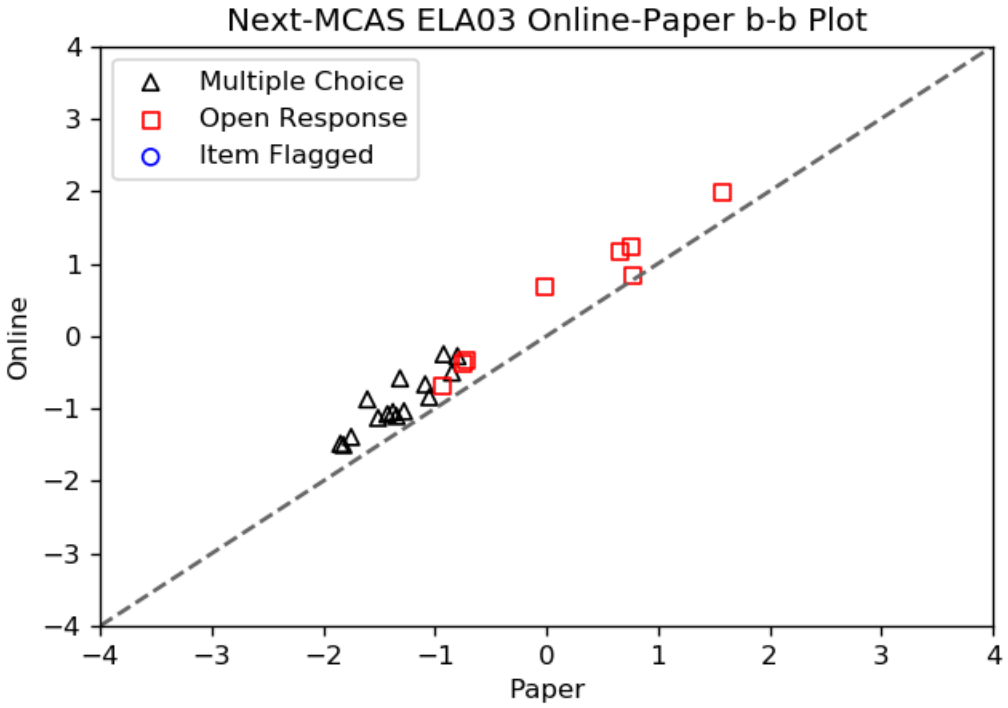
3.0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Multiple Choice
Open Response
Item Flagged
Online
Paper
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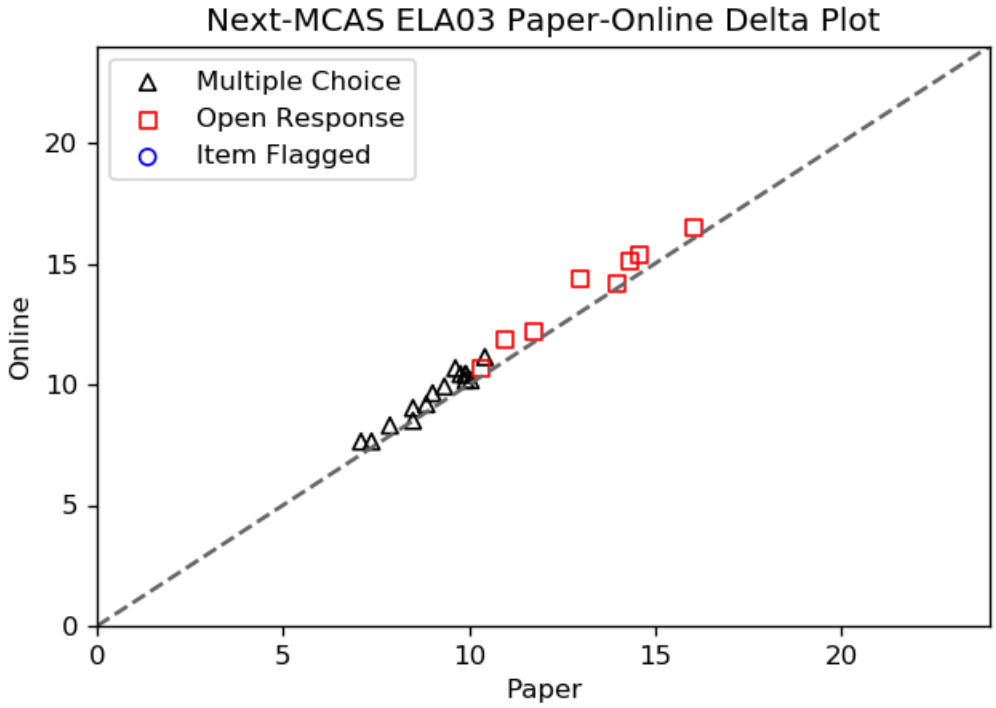
−4
−3
−2
−1
0
1
2
3
4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Open Response
Item Flagged
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Paper
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5
10
15
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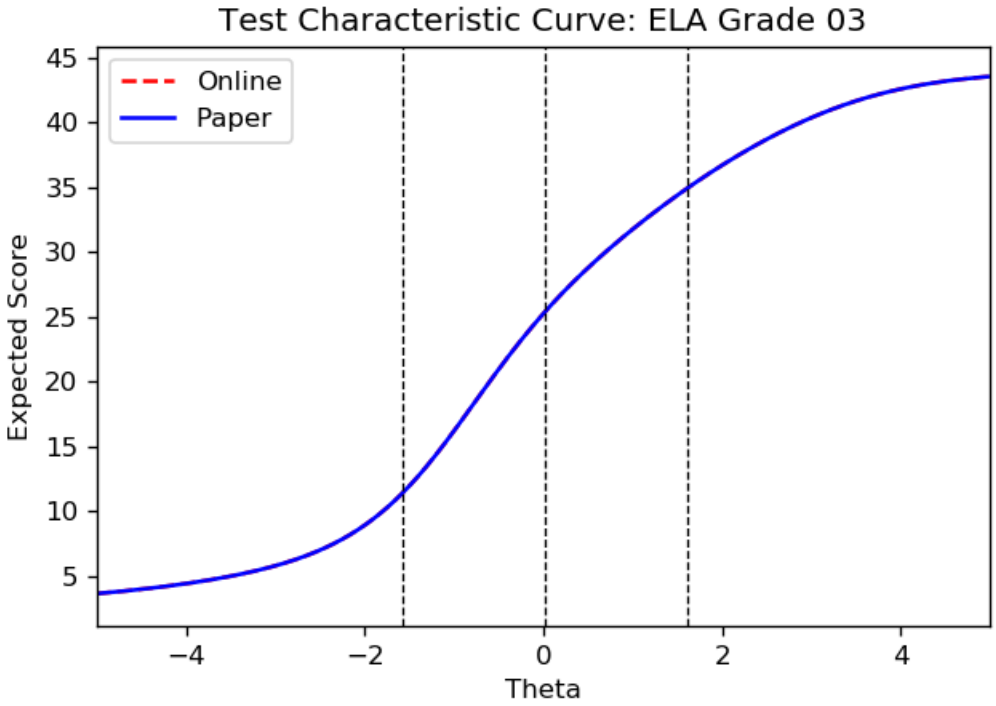
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Paper
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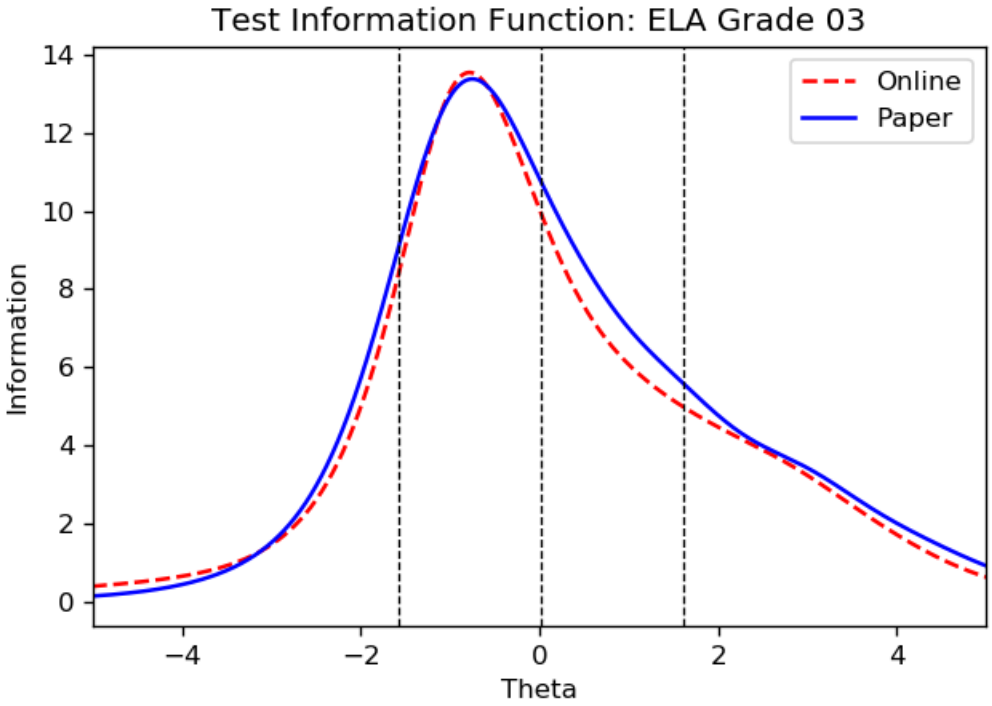
0
2
4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Paper
Information
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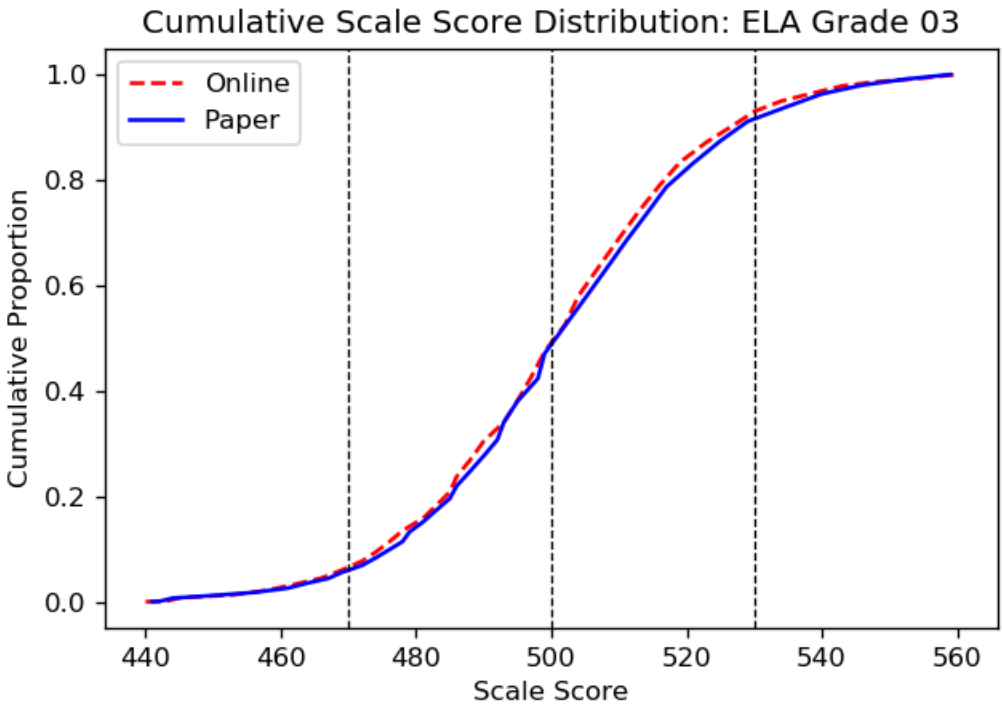
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Paper
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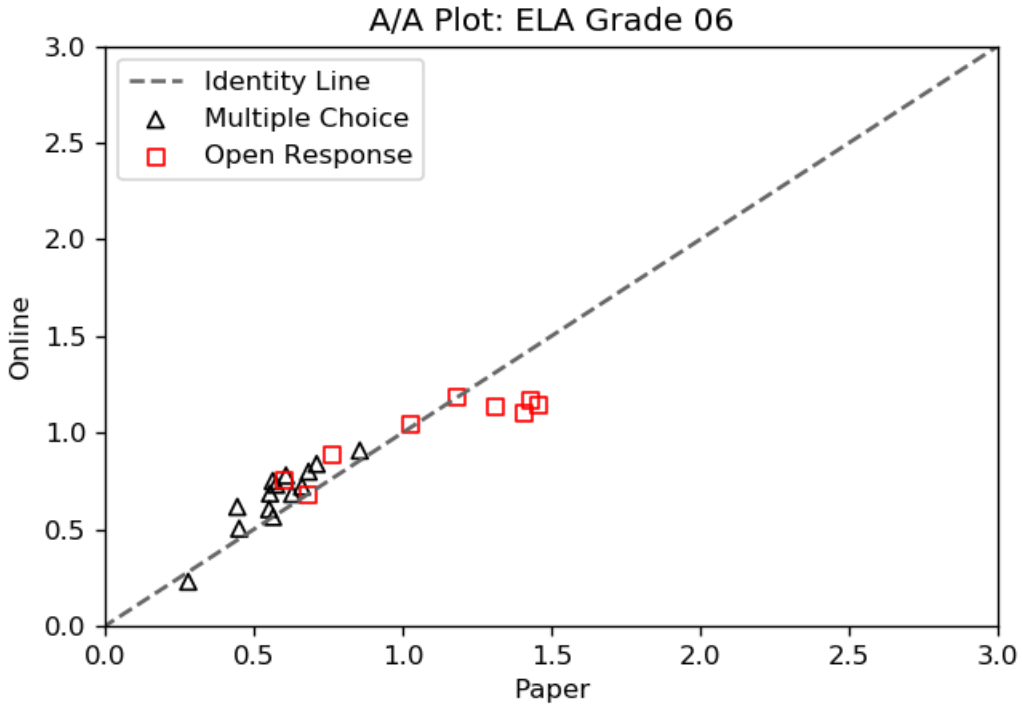
500
520
540
560
Scale Score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Multiple Choice
Open Response
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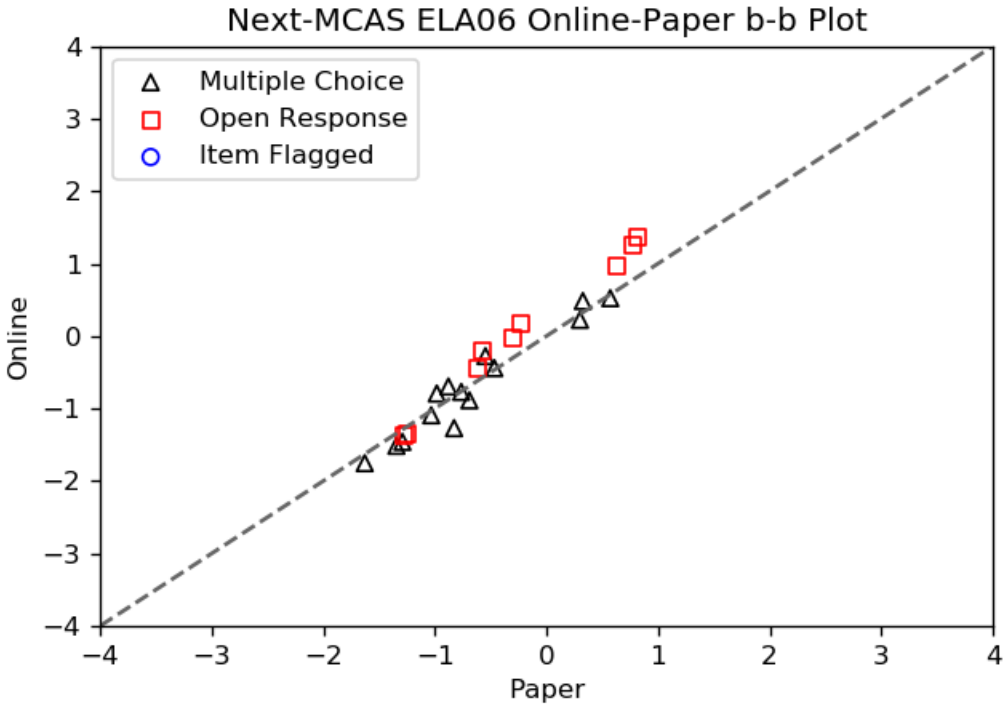
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Open Response
Item Flagged
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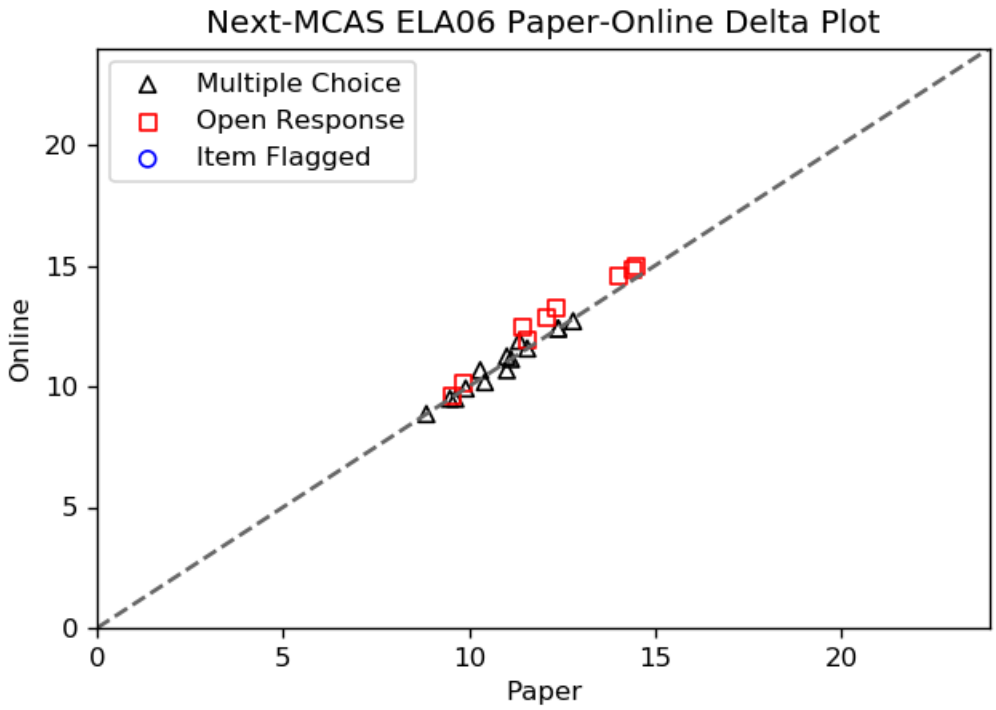
3
4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Open Response
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15
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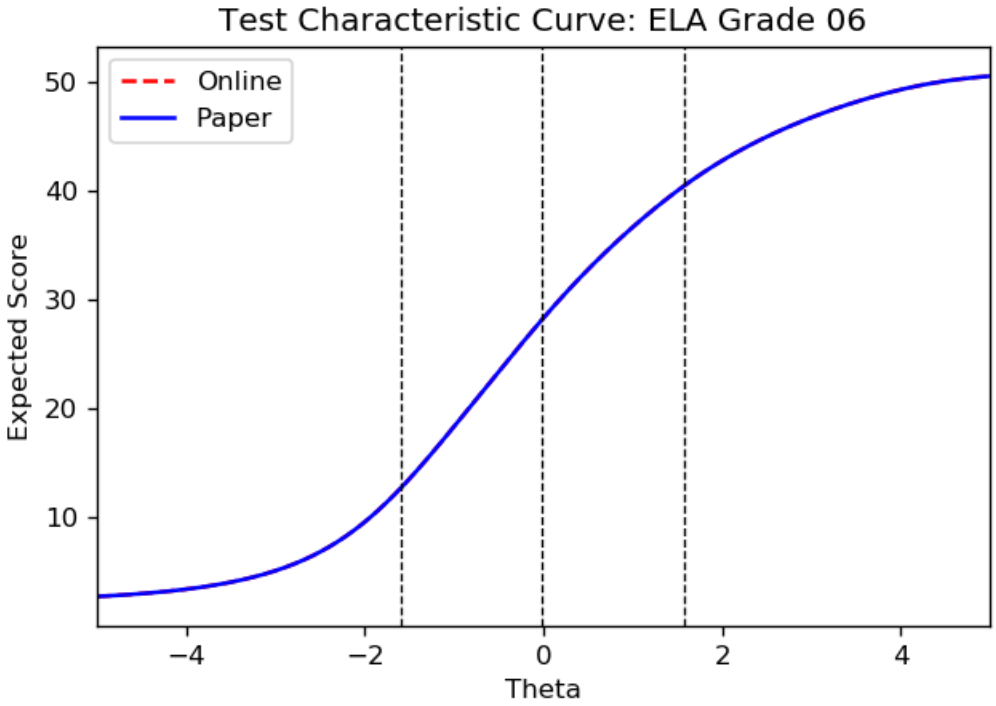
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Paper
Expected Score
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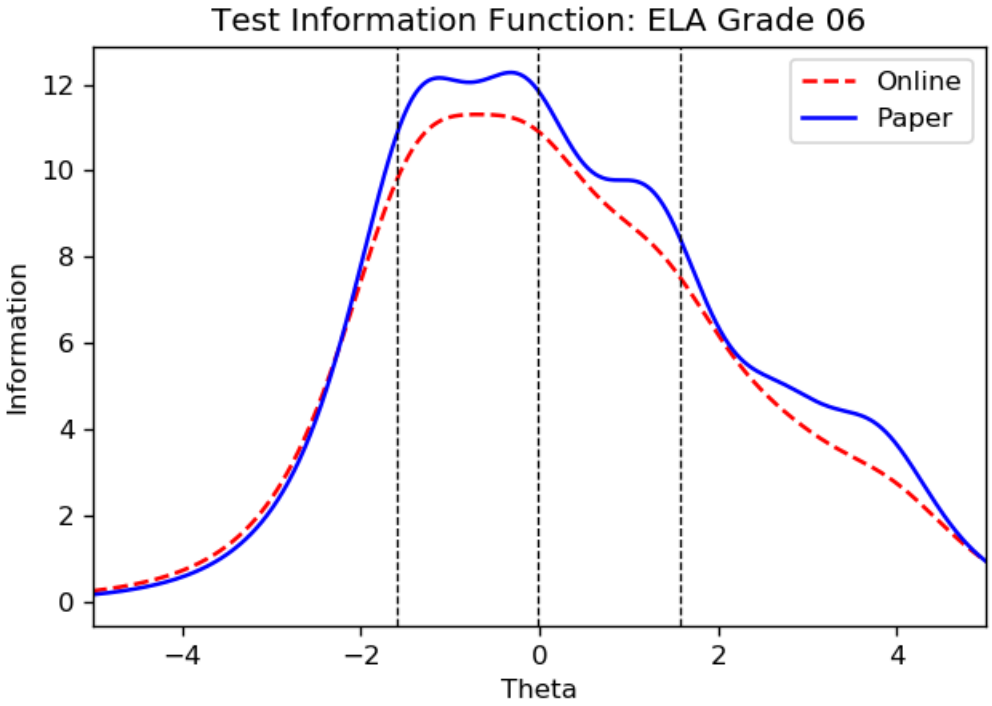
30
20
10
−4
−2
0
2
4
Theta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Paper
Information
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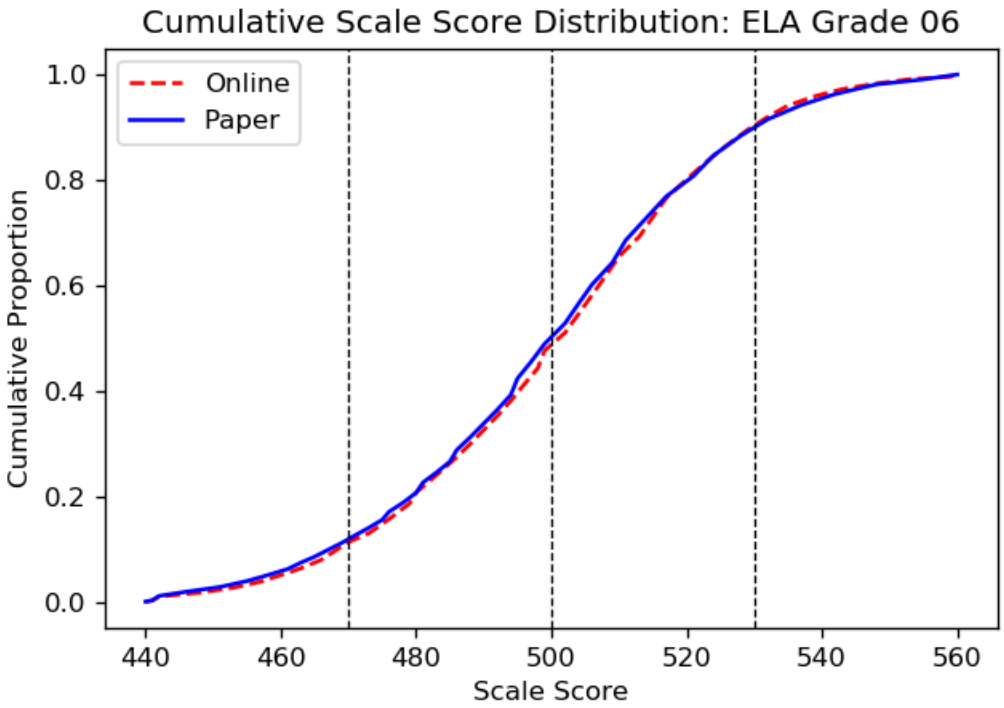
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Paper
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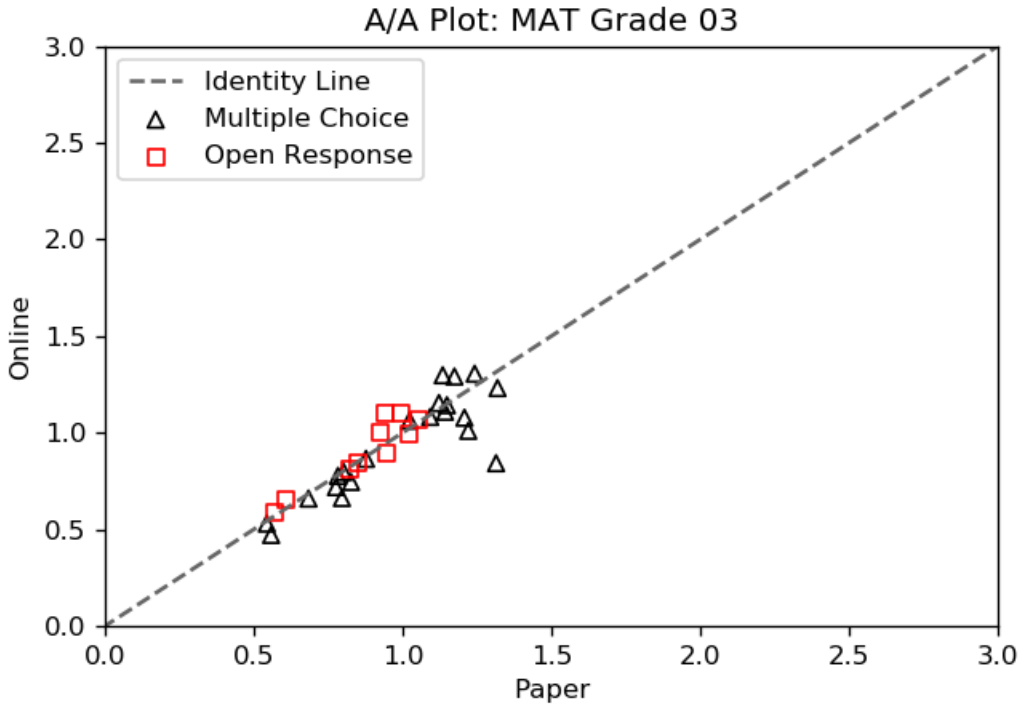
0.6
0.4
0.2
0.0
440
460
480
500
520
540
560
Scale Score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Multiple Choice
Open Response
Online
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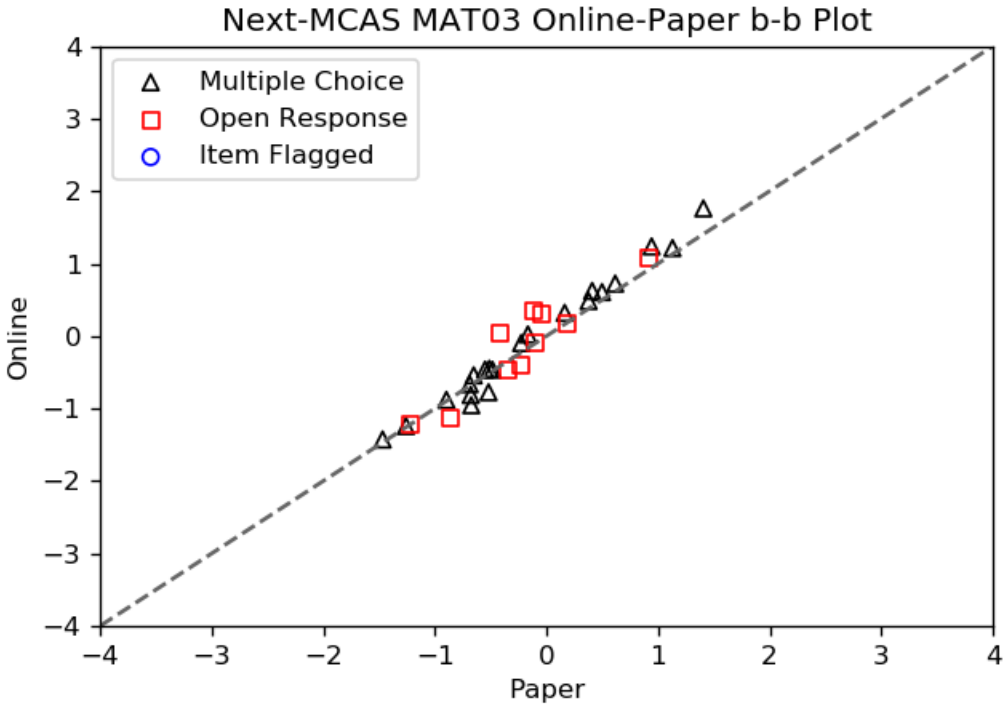
2.5
3.0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Open Response
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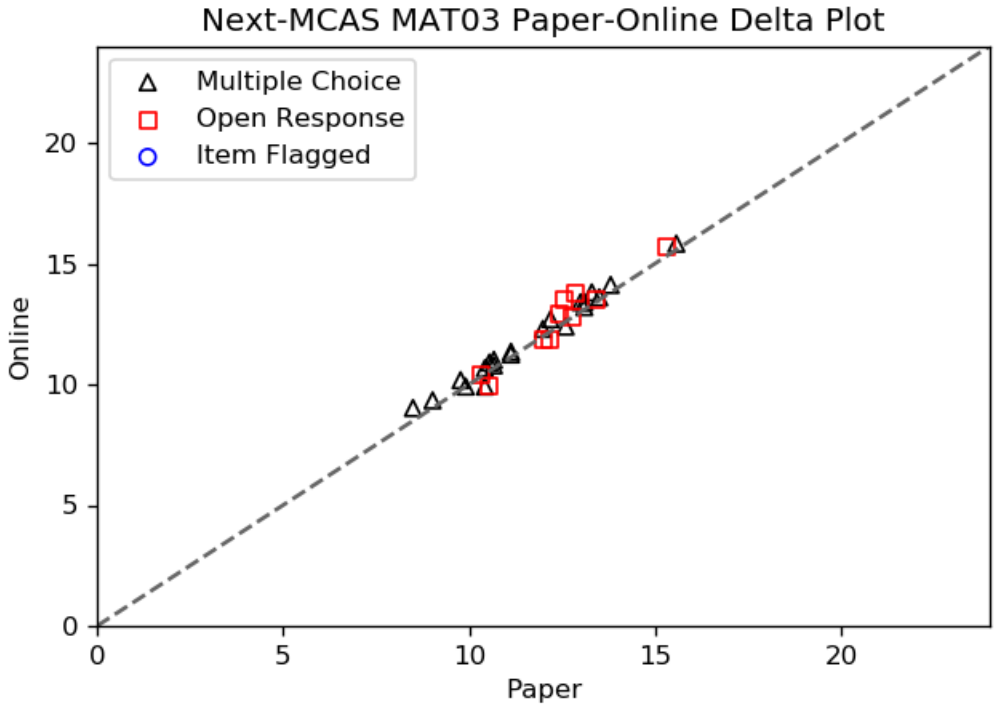
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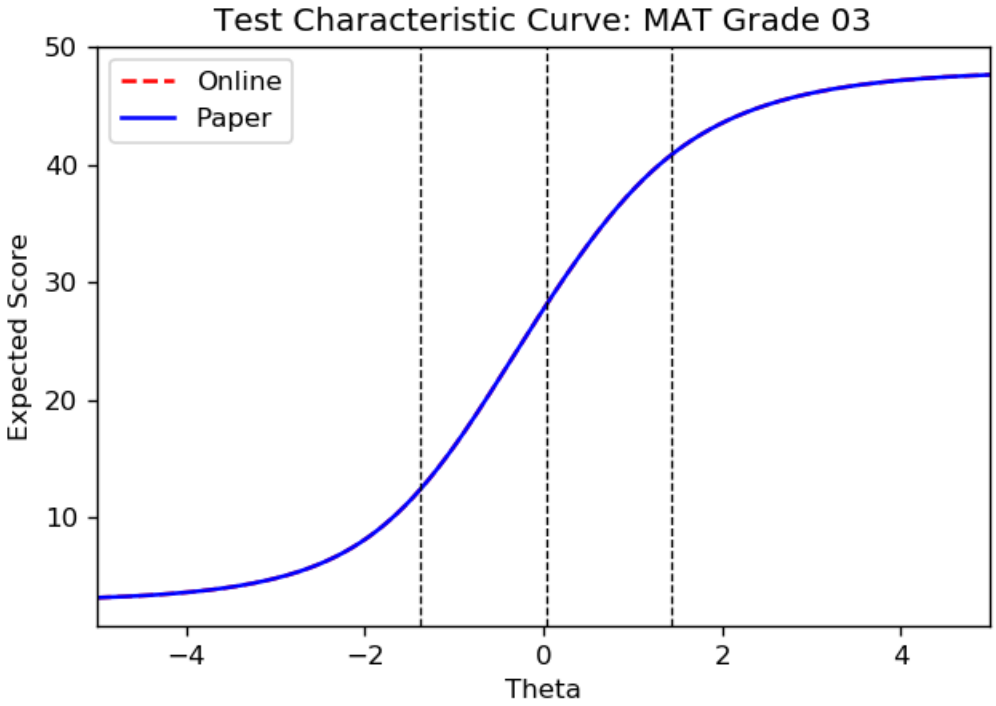
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10
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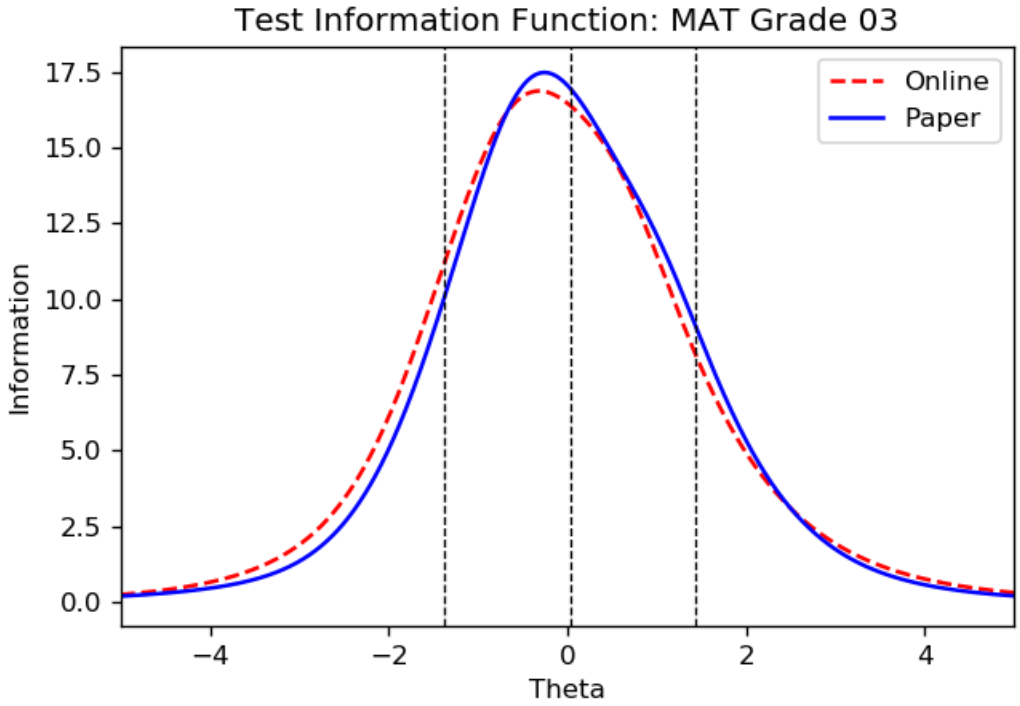
0
2
4
Theta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Online
Paper
Information
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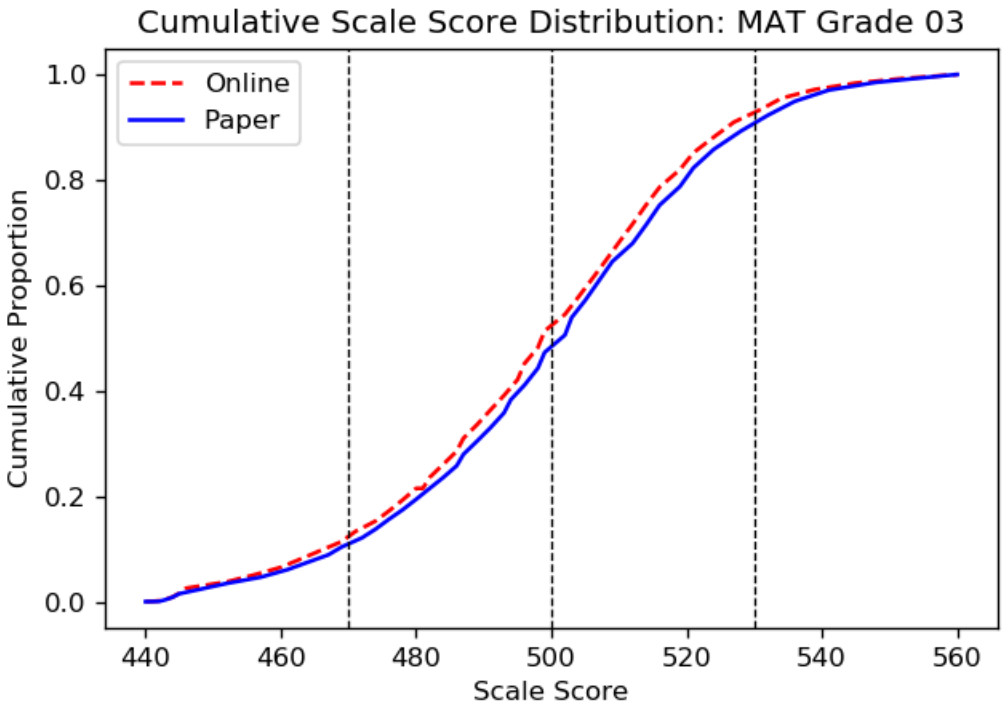
−2
0
2
4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Online
Paper
Cumulative Proportion
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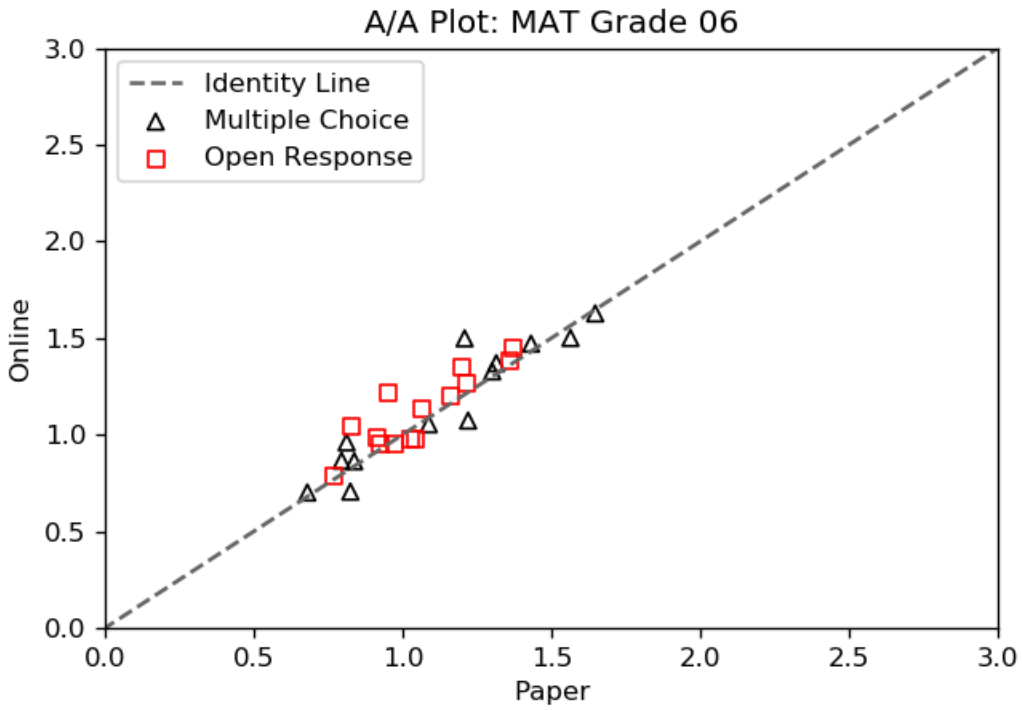
500
520
540
560
Scale Score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Open Response
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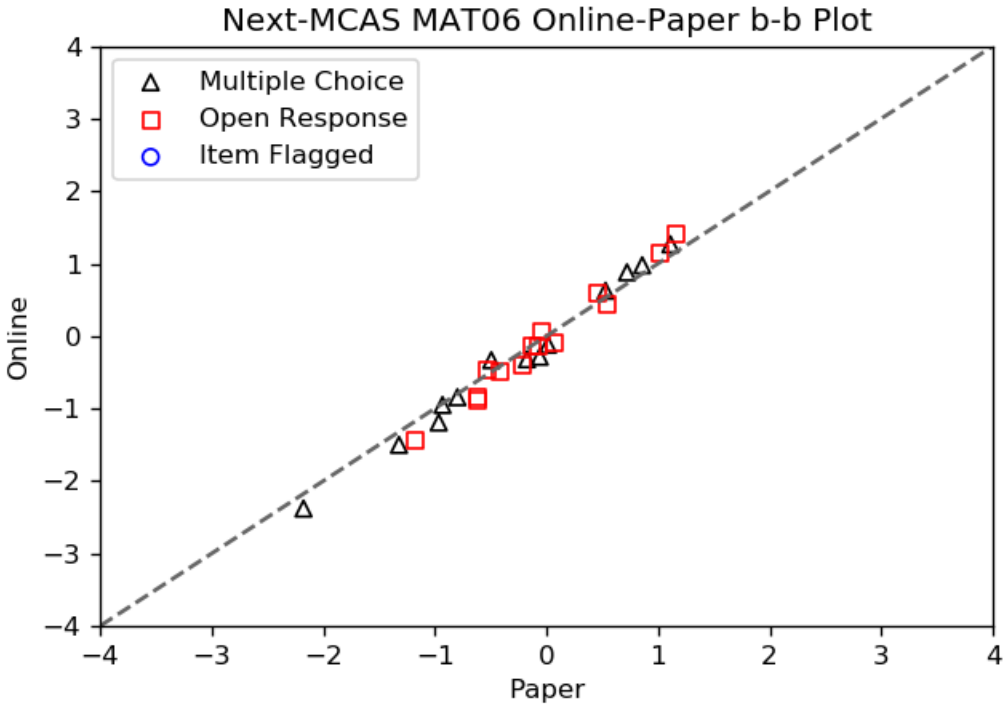
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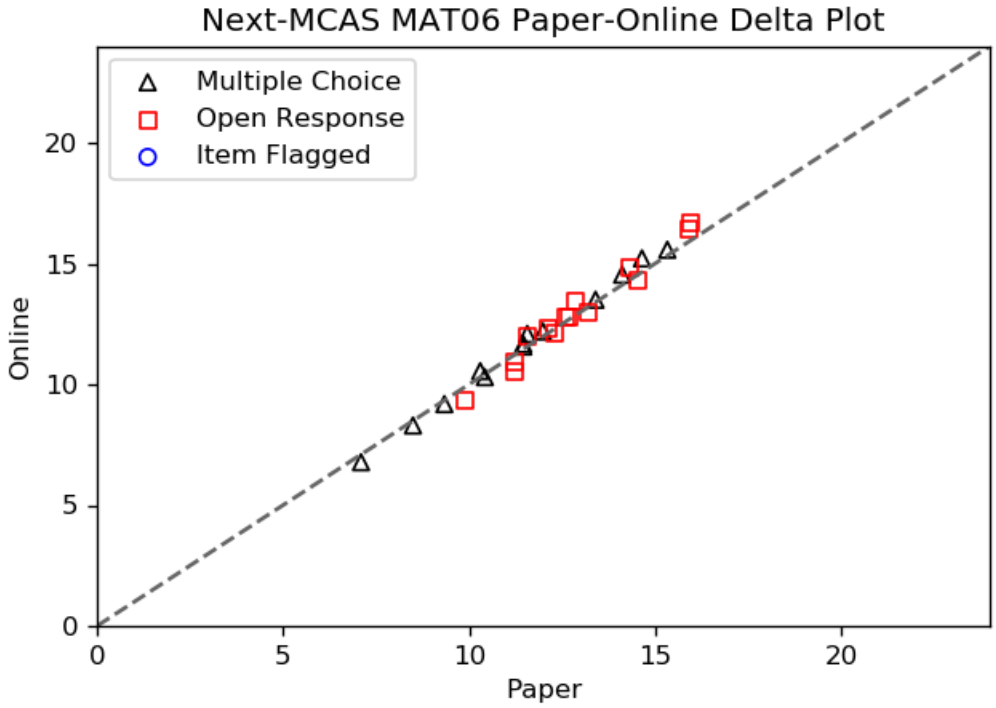
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Open Response
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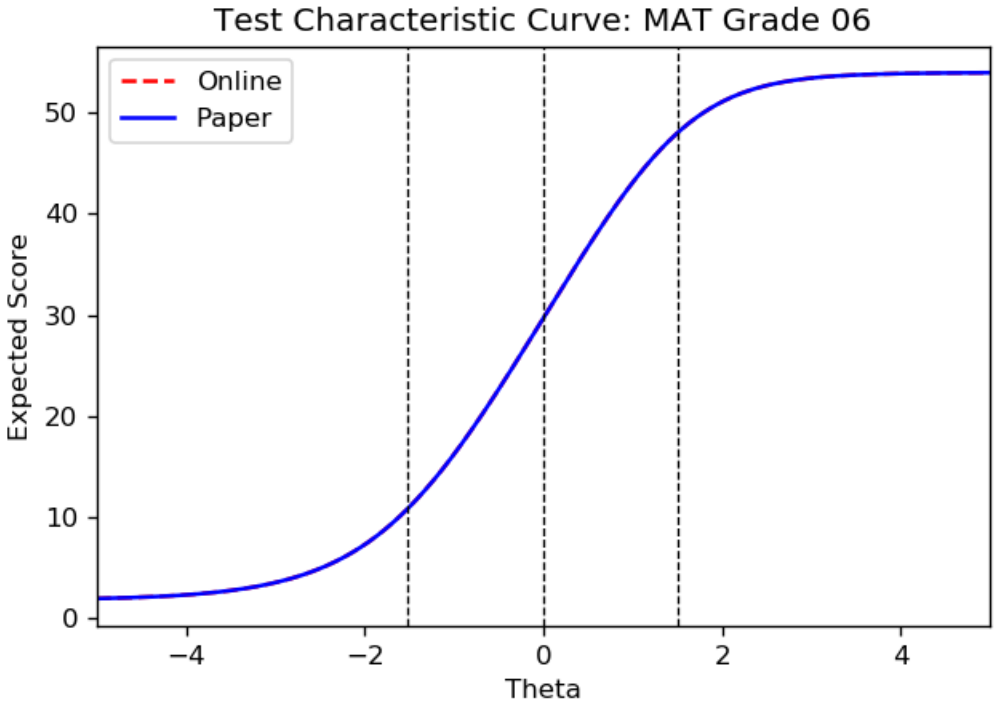
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Paper
Expected Score
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40
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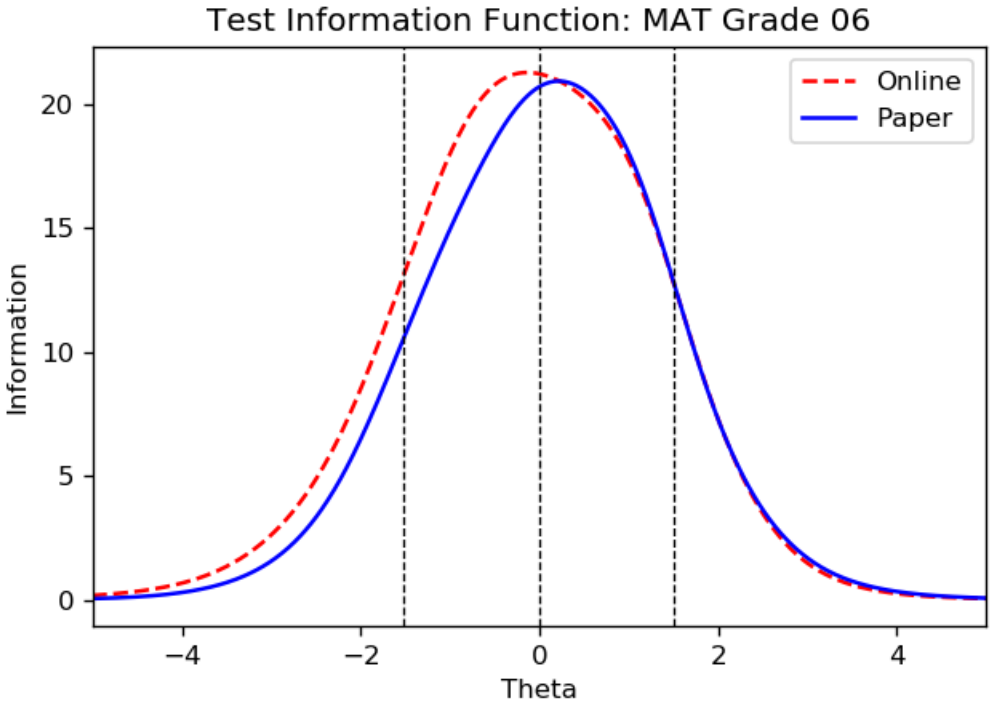
0
2
4
Theta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Online
Paper
Information
Theta
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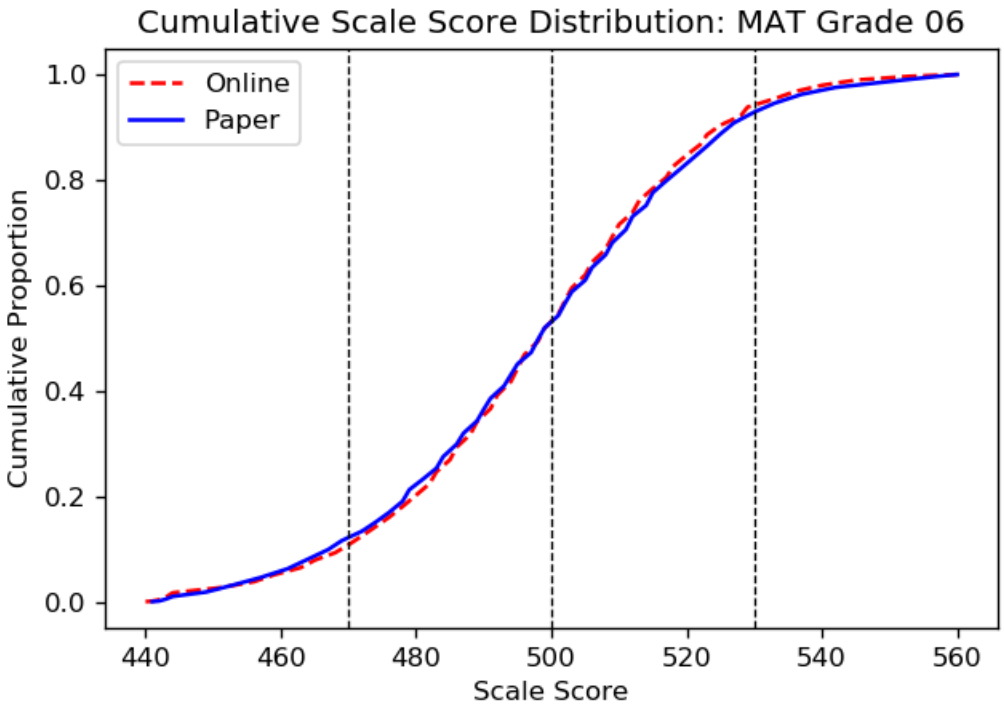
4


Cumulative Scale Score Distribution: MAT Grade 06
Online
Paper
Cumulative Proportion
1.0
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0.6
0.4
0.2
0.0
440
460
480
500
520
540
560
Scale Score

Section 2.2

Tabled Delta Analysis Results

Table 2.2.1 Delta Analysis

Ela Grade 03

Item ID	Online P	Paper P	Online Delta	Paper Delta	Max Points	Flag	Distance
IA00099	0.61	0.69	11.83	10.96	2	False	0.52
IA00101	0.76	0.78	10.17	9.91	1	False	0.15
IA00103	0.91	0.92	7.64	7.38	1	False	-0.36
IA00105	0.84	0.87	9.02	8.49	1	False	-0.73
IA00108	0.74	0.78	10.43	9.91	1	False	-1.10
IA00114	0.83	0.85	9.18	8.85	1	False	-0.42
IA00323	0.78	0.82	9.91	9.34	1	False	-0.68
IA00325	0.74	0.79	10.43	9.77	1	False	-0.36
IA00326	0.76	0.77	10.17	10.04	1	False	0.87
IA00327	0.80	0.84	9.63	9.02	1	False	-0.41
IA00331	0.58	0.62	12.19	11.73	2	False	-0.51
IA00332	0.91	0.93	7.64	7.10	1	False	-0.36
IA00338A	0.37	0.50	14.36	13.00	3	False	2.64
IA00338D	0.30	0.37	15.07	14.33	4	False	-0.88
IA00423	0.72	0.80	10.67	9.63	1	False	1.66
IA00426	0.68	0.74	11.13	10.43	1	False	-0.24
IA00429	0.88	0.90	8.30	7.87	1	False	-1.12
IA00431	0.87	0.87	8.49	8.49	1	False	1.22
IA00432	0.74	0.78	10.43	9.91	1	False	-1.10
IA00433	0.72	0.75	10.67	10.30	2	False	-0.30
IA00438	0.39	0.40	14.15	13.98	3	False	1.50
IA00640A	0.28	0.35	15.37	14.58	3	False	-0.66
IA00640D	0.19	0.22	16.47	16.06	4	False	0.67

Table 2.2.2 Delta Analysis

Ela Grade 06

Item ID	Online P	Paper P	Online Delta	Paper Delta	Max Points	Flag	Distance
IA00549	0.64	0.64	11.57	11.57	1	False	-0.09
IA00552	0.68	0.68	11.13	11.13	1	False	-0.33
IA00556	0.72	0.69	10.67	11.02	1	False	1.30
IA00557	0.78	0.78	9.91	9.91	1	False	-0.99
IA00559	0.53	0.52	12.70	12.80	1	False	1.07
IA00561	0.77	0.79	10.11	9.84	2	False	-0.17
IA00565A	0.52	0.59	12.83	12.09	3	False	0.92
IA00565D	0.33	0.36	14.80	14.41	5	False	-0.44
IA00602	0.76	0.74	10.17	10.43	1	False	0.51
IA00607	0.81	0.81	9.49	9.49	1	False	-1.22
IA00611	0.81	0.80	9.49	9.63	1	False	-0.44
IA00612	0.80	0.81	9.63	9.56	2	False	-0.96
IA00613	0.85	0.85	8.85	8.85	1	False	-0.93
IA00617A	0.55	0.65	12.46	11.46	3	False	2.54
IA00617D	0.35	0.40	14.54	14.03	5	False	-1.21
IA00667	0.56	0.56	12.40	12.40	1	False	0.36
IA00668	0.67	0.69	11.24	11.02	1	False	-1.02
IA00671	0.72	0.75	10.67	10.30	1	False	0.06
IA00673	0.56	0.56	12.40	12.40	1	False	0.36
IA00676	0.60	0.64	11.93	11.57	2	False	-0.61
IA00682A	0.47	0.57	13.27	12.33	3	False	1.74
IA00682D	0.31	0.35	14.96	14.50	5	False	-0.74
IA00685	0.61	0.66	11.88	11.35	1	False	0.30

Table 2.2.3 Delta Analysis

Mat Grade 03

Item ID	Online P	Paper P	Online Delta	Paper Delta	Max Points	Flag	Distance
IA00836	0.67	0.68	11.24	11.13	1	False	-0.87
IA00856	0.46	0.50	13.40	13.00	1	False	-0.56
IA00886	0.82	0.84	9.34	9.02	1	False	-0.02
IA00925	0.78	0.74	9.91	10.43	1	False	1.83
IA00927	0.46	0.49	13.40	13.10	1	False	-1.04
IA00996	0.24	0.26	15.83	15.57	1	False	-0.47
IA00998	0.61	0.60	11.88	11.99	1	False	0.32
IA00999	0.78	0.73	9.91	10.55	1	False	2.42
IA01000	0.45	0.46	13.50	13.40	1	False	-0.29
IA01001	0.25	0.28	15.70	15.33	1	False	-1.05
IA01252	0.51	0.56	12.93	12.43	3	False	0.04
IA02017	0.76	0.79	10.17	9.77	1	False	0.19
IA02029	0.71	0.72	10.79	10.67	1	False	-1.00
IA02048	0.48	0.49	13.20	13.10	1	False	-0.36
IA02052	0.70	0.73	10.90	10.55	1	False	-0.20
IA02103	0.57	0.60	12.29	11.99	1	False	-0.75
IA02179	0.53	0.58	12.70	12.19	1	False	0.11
IA02198	0.78	0.78	9.91	9.91	1	False	-0.64
IA02205	0.42	0.51	13.77	12.87	3	False	1.78
IA02295	0.69	0.72	11.02	10.67	1	False	-0.26
IA02297	0.72	0.74	10.67	10.43	1	False	-0.69
IA02299	0.56	0.54	12.40	12.60	1	False	0.91
IA02348	0.44	0.45	13.60	13.50	1	False	-0.27
IA02370	0.84	0.87	9.02	8.49	1	False	1.07
IA02375	0.52	0.52	12.80	12.77	3	False	-0.13
IA02379	0.42	0.47	13.81	13.30	1	False	-0.15
IA02382	0.74	0.75	10.43	10.30	1	False	-1.12
IA02506	0.66	0.68	11.35	11.13	1	False	-0.95
IA02516	0.61	0.58	11.88	12.19	1	False	1.30
IA02608	0.39	0.42	14.12	13.81	1	False	-1.15
IA03471	0.45	0.54	13.50	12.56	3	False	1.99

Table 2.2.4 Delta Analysis

Mat Grade 06

Item ID	Online P	Paper P	Online Delta	Paper Delta	Max Points	Flag	Distance
IA00788	0.60	0.64	11.99	11.57	4	False	0.88
IA00846	0.59	0.64	12.09	11.57	1	False	1.45
IA00882	0.29	0.34	15.21	14.65	1	False	-0.18
IA00896	0.59	0.57	12.09	12.29	1	False	0.45
IA00964	0.94	0.93	6.78	7.10	1	False	-0.56
IA00965	0.70	0.67	10.90	11.24	1	False	0.56
IA00967	0.83	0.82	9.18	9.34	1	False	-1.01
IA00974	0.73	0.67	10.55	11.24	1	False	2.54
IA00977	0.32	0.37	14.84	14.33	4	False	-0.26
IA01060	0.75	0.74	10.30	10.43	1	False	-1.13
IA02050	0.88	0.87	8.30	8.49	1	False	-0.72
IA02078	0.46	0.51	13.43	12.87	4	False	0.83
IA02123	0.63	0.65	11.67	11.46	1	False	-0.22
IA02125	0.45	0.46	13.50	13.40	1	False	-0.60
IA02146	0.58	0.60	12.19	11.99	1	False	-0.58
IA02213	0.52	0.53	12.80	12.70	1	False	-1.02
IA02270	0.37	0.35	14.33	14.54	1	False	1.85
IA02445	0.82	0.78	9.34	9.91	1	False	1.07
IA02465	0.26	0.28	15.57	15.33	1	False	-0.22
IA02467	0.64	0.65	11.57	11.46	1	False	-0.81
IA02486	0.73	0.75	10.55	10.30	1	False	0.66
IA02497	0.35	0.39	14.54	14.12	1	False	-0.64
IA02499	0.18	0.23	16.66	15.96	1	False	-0.17
IA02501	0.20	0.23	16.40	15.92	4	False	-1.20
IA02595	0.50	0.48	13.00	13.20	1	False	0.97
IA03463	0.52	0.54	12.80	12.60	2	False	-0.98
IA03465	0.57	0.58	12.29	12.14	2	False	-0.97

Section 2.3

Tabled B/B Analysis Results

Table 2.3.1 b/b Analysis

Ela Grade 03

Item ID	Online b	Paper b	Distance	Flag
IA00323	-0.67	-1.09	-0.95	False
IA00326	-0.50	-0.85	-0.58	False
IA00325	-0.87	-1.60	1.85	False
IA00327	-1.08	-1.42	-0.70	False
IA00332	-1.49	-1.85	-0.86	False
IA00101	-1.04	-1.28	0.27	False
IA00103	-1.50	-1.82	-0.47	False
IA00105	-1.39	-1.75	-0.83	False
IA00114	-0.84	-1.05	0.59	False
IA00108	-1.05	-1.38	-0.52	False
IA00432	-0.58	-1.31	1.77	False
IA00423	-0.25	-0.92	1.22	False
IA00431	-1.11	-1.34	0.27	False
IA00426	-0.28	-0.80	-0.11	False
IA00429	-1.13	-1.51	-0.99	False
IA00338A	0.68	-0.01	1.26	False
IA00640A	1.23	0.76	-0.81	False
IA00338D	1.17	0.66	-0.35	False
IA00640D	1.98	1.58	-0.69	False
IA00331	-0.33	-0.72	-0.91	False
IA00099	-0.37	-0.75	-0.83	False
IA00433	-0.68	-0.93	0.29	False
IA00438	0.84	0.77	2.09	False

Table 2.3.2 b/b Analysis

Ela Grade 06

Item ID	Online b	Paper b	Distance	Flag
IA00607	-1.75	-1.63	-0.68	False
IA00611	-1.09	-1.03	-1.07	False
IA00613	-1.51	-1.34	-0.82	False
IA00602	-0.70	-0.88	0.29	False
IA00559	0.52	0.57	1.82	False
IA00549	-1.27	-0.83	2.24	False
IA00556	-0.89	-0.69	0.60	False
IA00557	-1.46	-1.29	-0.71	False
IA00552	-0.44	-0.47	-0.68	False
IA00671	-0.79	-0.98	0.54	False
IA00667	0.48	0.33	-0.22	False
IA00668	-0.77	-0.76	-0.98	False
IA00685	-0.28	-0.55	0.35	False
IA00673	0.22	0.30	1.52	False
IA00617A	-0.20	-0.58	1.24	False
IA00565A	-0.02	-0.30	-0.02	False
IA00682A	0.17	-0.23	0.81	False
IA00617D	0.97	0.63	-1.10	False
IA00565D	1.25	0.77	-0.55	False
IA00682D	1.37	0.82	-0.08	False
IA00612	-1.37	-1.28	-1.04	False
IA00561	-1.34	-1.24	-1.17	False
IA00676	-0.45	-0.62	-0.27	False

Table 2.3.3 b/b Analysis

Mat Grade 03

Item ID	Online b	Paper b	Distance	Flag
IA02198	-0.95	-0.67	1.43	False
IA00886	-1.24	-1.26	-0.28	False
IA02052	-0.46	-0.55	-0.60	False
IA02370	-1.43	-1.47	0.24	False
IA00836	-0.46	-0.48	-1.16	False
IA00856	0.32	0.16	-0.95	False
IA00996	1.76	1.41	-0.81	False
IA02379	0.72	0.62	-0.45	False
IA02348	0.61	0.50	-0.63	False
IA02506	-0.45	-0.51	-0.91	False
IA02299	1.24	0.94	-0.73	False
IA02179	0.02	-0.17	-0.18	False
IA02048	0.48	0.38	-0.76	False
IA02295	-0.66	-0.69	-1.01	False
IA02029	-0.54	-0.65	-0.25	False
IA00927	0.62	0.41	-0.76	False
IA02017	-0.88	-0.90	-0.79	False
IA02297	-0.81	-0.68	0.03	False
IA02608	1.21	1.13	0.49	False
IA02103	-0.10	-0.23	-0.65	False
IA00925	-0.78	-0.52	1.41	False
IA00999	-1.13	-0.86	1.06	False
IA01001	1.07	0.92	-0.38	False
IA02516	-0.40	-0.23	0.94	False
IA01000	0.17	0.18	0.10	False
IA00998	-0.46	-0.35	0.24	False
IA02382	-1.22	-1.22	-0.44	False
IA03471	0.36	-0.12	2.50	False
IA02205	0.30	-0.04	1.08	False
IA01252	0.04	-0.41	2.66	False
IA02375	-0.10	-0.10	-0.44	False

Table 2.3.4 b/b Analysis

Mat Grade 06

Item ID	Online b	Paper b	Distance	Flag
IA02050	-1.50	-1.32	-1.11	False
IA00846	-0.33	-0.49	2.49	False
IA00882	0.98	0.86	-1.23	False
IA02486	-0.84	-0.80	-0.15	False
IA02125	0.63	0.53	-0.87	False
IA02467	-0.12	0.01	0.30	False
IA02146	-0.28	-0.06	1.60	False
IA00967	-0.95	-0.93	0.58	False
IA01060	-1.19	-0.96	-0.40	False
IA00964	-2.38	-2.18	0.45	False
IA02465	1.27	1.11	-1.23	False
IA02497	0.88	0.72	-0.30	False
IA02123	-0.32	-0.17	0.08	False
IA02445	-1.43	-1.18	-0.54	False
IA02499	1.41	1.17	0.01	False
IA02270	0.43	0.54	1.14	False
IA00974	-0.88	-0.62	1.00	False
IA02595	-0.09	0.07	0.80	False
IA00896	-0.39	-0.21	0.53	False
IA00965	-0.84	-0.62	0.21	False
IA02213	-0.15	-0.07	-0.88	False
IA03463	-0.14	-0.13	-1.18	False
IA03465	-0.49	-0.42	-1.47	False
IA02078	0.07	-0.04	0.68	False
IA00977	0.59	0.46	-0.06	False
IA00788	-0.47	-0.53	1.00	False
IA02501	1.15	1.02	-1.42	False

Section 2.4

Final Item Parameter

Table 2.4.1 IRT Parameters for Dichotomous Items

Ela Grade 03 Online

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA00323	1.28729	0.02939	-0.66751	0.02527	0.20740	0.01440
IA00326	1.21339	0.02814	-0.50336	0.02556	0.23990	0.01310
IA00325	0.58813	0.01967	-0.87339	0.09628	0.15530	0.03700
IA00327	0.99257	0.01824	-1.07711	0.03222	0.02610	0.02050
IA00332	1.27493	0.03173	-1.48632	0.04466	0.13170	0.03540
IA00101	0.68764	0.01782	-1.03754	0.06709	0.07160	0.03250
IA00103	1.15903	0.03125	-1.50395	0.05808	0.24780	0.03930
IA00105	0.74097	0.02028	-1.39258	0.08227	0.12770	0.04350
IA00114	1.64374	0.03791	-0.84322	0.02096	0.18100	0.01410
IA00108	0.61878	0.01565	-1.04861	0.07101	0.04610	0.03240
IA00432	0.51110	0.02460	-0.58426	0.14025	0.30860	0.03830
IA00423	0.92910	0.02700	-0.25057	0.03702	0.29970	0.01480
IA00431	1.22094	0.03083	-1.10551	0.03957	0.23280	0.02460
IA00426	1.07865	0.02345	-0.27711	0.02311	0.17570	0.01120
IA00429	1.70703	0.03989	-1.12951	0.02439	0.16700	0.01890
IA00279	1.16317	0.08452	-0.90884	0.09608	0.24480	0.05310
IA00280	0.79197	0.05566	-0.57740	0.11479	0.15200	0.05080
IA00281	0.68195	0.06526	-0.03264	0.13487	0.21900	0.04760
IA00282	0.87019	0.05447	-0.70169	0.09540	0.10960	0.04730
IA00283	0.89263	0.06521	-0.33186	0.08893	0.14660	0.04110
IA00284	1.24158	0.07337	-0.53117	0.05994	0.16600	0.03280
IA00285	1.78783	0.12951	-0.84018	0.05700	0.24620	0.03790
IA00450	1.07277	0.07462	-0.46761	0.07738	0.15350	0.03990
IA00444	1.39677	0.09616	-0.51981	0.05906	0.17310	0.03430
IA00443	0.53017	0.03636	-1.01491	0.17150	0.09620	0.06160
IA00451	0.42459	0.05513	0.51202	0.22938	0.15890	0.06110
IA00453	0.79767	0.05639	-0.48573	0.10940	0.13360	0.04840
IA00446	1.03162	0.07066	-0.18416	0.06631	0.12370	0.03230

Table 2.4.2 IRT Parameters for Polytomous Items

Ela Grade 03 Online

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)
IA00338A	1.03828	0.01458	0.68322	0.00951	1.33996	0.01332	-0.13830	0.01283	-1.20167	0.02174	0.00000	0.00000	nan	nan
IA00640A	0.99688	0.01446	1.22926	0.01274	1.55387	0.01205	-0.13467	0.01665	-1.41920	0.03222	0.00000	0.00000	nan	nan
IA00338D	0.93288	0.01331	1.17221	0.01226	2.14755	0.01596	0.26685	0.01391	-0.65715	0.02214	-1.75725	0.03830	0.00000	0.00000
IA00640D	0.91578	0.01373	1.97938	0.01863	1.98294	0.01175	0.64875	0.01734	-0.75880	0.03497	-1.87289	0.06239	0.00000	0.00000
IA00331	0.58417	0.00726	-0.33147	0.01150	0.96582	0.01881	-0.96582	0.01322	0.00000	0.00000	nan	nan	nan	nan
IA00333	0.42388	0.00720	-1.68034	0.03241	2.27238	0.06259	-2.27238	0.01685	0.00000	0.00000	nan	nan	nan	nan
IA00099	0.92639	0.00989	-0.37412	0.00753	0.58653	0.01214	-0.58653	0.00891	0.00000	0.00000	nan	nan	nan	nan
IA00106	0.41380	0.00660	-1.03250	0.02216	1.57262	0.04104	-1.57262	0.01675	0.00000	0.00000	nan	nan	nan	nan
IA00433	1.23738	0.01464	-0.68279	0.00673	0.16024	0.01009	-0.16024	0.00891	0.00000	0.00000	nan	nan	nan	nan
IA00434	0.46293	0.00762	-2.34449	0.03630	1.92713	0.07091	-1.92713	0.01557	0.00000	0.00000	nan	nan	nan	nan
IA00438	0.75657	0.00840	0.83810	0.01247	2.39983	0.01734	-0.29987	0.01371	-2.09997	0.03017	0.00000	0.00000	nan	nan
IA00458A	1.21734	0.04871	1.19028	0.04067	1.30666	0.02635	-0.12713	0.05681	-1.17953	0.10470	0.00000	0.00000	nan	nan
IA00458D	1.30391	0.05639	1.74126	0.04372	1.45049	0.02605	0.49887	0.05260	-0.48173	0.09432	-1.46763	0.13506	0.00000	0.00000
IA00452	0.78878	0.03071	-0.41962	0.02445	0.34329	0.03839	-0.34329	0.03026	0.00000	0.00000	nan	nan	nan	nan
IA00445	0.74049	0.02802	-0.41256	0.03430	1.13497	0.05788	-1.13497	0.03683	0.00000	0.00000	nan	nan	nan	nan
IA00287	0.99196	0.03263	0.31708	0.02586	1.66070	0.04417	0.02338	0.02654	-1.68406	0.05798	0.00000	0.00000	nan	nan
IA00288	0.97331	0.03311	0.79657	0.03122	1.92687	0.04084	-0.21114	0.03497	-1.71574	0.07669	0.00000	0.00000	nan	nan

Table 2.4.3 IRT Parameters for Dichotomous Items

Ela Grade 03 Paper

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA00323	1.06404	0.02880	-0.76098	0.04292	0.13650	0.02450
IA00326	1.02188	0.02661	-0.50333	0.03820	0.15100	0.01980
IA00325	0.48066	0.01560	-1.31728	0.13113	0.07240	0.04940
IA00327	0.85566	0.01894	-1.12369	0.04861	0.02740	0.02830
IA00332	1.14677	0.03296	-1.57558	0.06117	0.10960	0.04680
IA00334	0.46101	0.01506	-0.30673	0.08918	0.02950	0.02970
IA00337	0.53339	0.02206	-0.20425	0.10420	0.16500	0.03400
IA00101	0.63873	0.01834	-0.96498	0.08091	0.05800	0.03720
IA00103	1.03623	0.02798	-1.54714	0.06439	0.09940	0.04660
IA00105	0.72847	0.02026	-1.47256	0.08467	0.07190	0.04670
IA00114	1.45787	0.04095	-0.72128	0.03123	0.20590	0.01910
IA00108	0.58546	0.01571	-1.07197	0.08134	0.03950	0.03580
IA00102	0.68286	0.02250	-0.45772	0.07351	0.15740	0.02980
IA00109	0.55923	0.01747	-0.67524	0.08757	0.05250	0.03480
IA00691	0.60719	0.01402	-0.60849	0.05205	0.01350	0.02170
IA00432	0.56575	0.02480	-1.00286	0.13983	0.11760	0.05530
IA00423	0.92815	0.04013	-0.58370	0.07415	0.23820	0.03420
IA00424	0.43768	0.02885	0.53179	0.13747	0.11400	0.03890
IA00431	1.21307	0.04451	-1.03613	0.05677	0.13380	0.03780
IA00426	0.89546	0.02283	-0.45096	0.04121	0.11520	0.02010
IA00429	1.41324	0.03761	-1.21394	0.03852	0.11580	0.02900

Table 2.4.4 IRT Parameters for Polytomous Items

Ela Grade 03 Paper

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)
IA00338A	1.18959	0.01637	0.39673	0.01095	1.35334	0.01696	-0.11200	0.01459	-1.24134	0.02404	0.00000	0.00000	nan	nan
IA00640A	1.06716	0.01434	1.22370	0.01291	1.62176	0.01406	-0.02579	0.01653	-1.59597	0.03209	0.00000	0.00000	nan	nan
IA00338D	1.07198	0.01484	1.10840	0.01201	2.04344	0.01738	0.44794	0.01588	-0.51507	0.02490	-1.97632	0.03370	0.00000	0.00000
IA00640D	1.00162	0.01380	2.10278	0.01755	1.94228	0.01277	0.80317	0.01738	-0.65969	0.03209	-2.08575	0.05859	0.00000	0.00000
IA00331	0.52162	0.00849	-0.36280	0.01784	1.05975	0.03091	-1.05975	0.01781	0.00000	0.00000	nan	nan	nan	nan
IA00099	0.96439	0.01314	-0.39800	0.01070	0.51343	0.01749	-0.51343	0.01234	0.00000	0.00000	nan	nan	nan	nan
IA00433	1.08030	0.01604	-0.58826	0.01056	0.25202	0.01631	-0.25202	0.01341	0.00000	0.00000	nan	nan	nan	nan
IA00438	0.57451	0.00925	1.23540	0.02532	3.45206	0.03734	-0.36919	0.02329	-3.08287	0.06192	0.00000	0.00000	nan	nan

Table 2.4.5 IRT Parameters for Dichotomous Items

Ela Grade 06 Online

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA00607	0.50362	0.01366	-1.75346	0.12160	0.11300	0.04640
IA00602	0.75013	0.01835	-0.69580	0.04760	0.28390	0.01690
IA00611	0.83816	0.01922	-1.09300	0.04703	0.22550	0.02060
IA00613	0.90744	0.01774	-1.51429	0.04484	0.10340	0.02600
IA00549	0.22897	0.00994	-1.27050	0.27652	0.06260	0.04980
IA00559	0.68514	0.01789	0.52243	0.02755	0.20910	0.00870
IA00556	0.79851	0.01402	-0.88667	0.03204	0.05240	0.01490
IA00557	0.60394	0.00907	-1.46000	0.04219	0.00930	0.01870
IA00552	0.72174	0.01621	-0.44199	0.03827	0.18320	0.01410
IA00671	0.73076	0.01498	-0.79204	0.04103	0.12340	0.01710
IA00667	0.61617	0.01815	0.48347	0.03631	0.24210	0.01060
IA00668	0.56403	0.01183	-0.77049	0.05210	0.03870	0.01970
IA00685	0.68295	0.01422	-0.27554	0.03273	0.09560	0.01230
IA00673	0.77862	0.01779	0.22389	0.02444	0.17650	0.00860
IA00674	1.03028	0.02243	-0.87941	0.03250	0.28570	0.01420
IA00173	0.79417	0.04333	-1.65675	0.12840	0.14800	0.06330
IA00174	0.46320	0.03038	-0.75205	0.17486	0.08650	0.05320
IA00175	0.50021	0.03650	-0.80472	0.19606	0.14990	0.05990
IA00176	0.42961	0.02650	-1.52235	0.21439	0.10720	0.06430
IA00177	0.90346	0.04317	-2.06594	0.10258	0.09480	0.06030
IA00179	0.44893	0.02987	-0.67516	0.17970	0.08910	0.05240
IA00178	0.86334	0.04848	-0.97635	0.09429	0.14720	0.04220
IA00180	0.56489	0.05082	0.17030	0.13924	0.22180	0.03940
IA00515	0.60144	0.03293	-2.16149	0.16506	0.11740	0.06890
IA00520	0.26399	0.04078	0.85485	0.40239	0.16330	0.07110
IA00517	0.68060	0.03991	-1.33713	0.13797	0.11850	0.05910
IA00518	0.53884	0.03574	-0.98603	0.17105	0.12060	0.05860
IA00523	0.45729	0.03787	-0.64474	0.22592	0.16130	0.06370
IA00522	0.92538	0.05781	-0.96632	0.10132	0.21410	0.04600

Table 2.4.6 IRT Parameters for Polytomous Items

Ela Grade 06 Online

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)	d5	SE(d5)
IA00617A	1.18544	0.01320	-0.19616	0.00701	1.21577	0.01441	-0.07957	0.00991	-1.13619	0.01164	0.00000	0.00000	nan	nan	nan	nan
IA00565A	1.16429	0.01310	-0.02196	0.00757	1.37429	0.01464	0.04576	0.01003	-1.42005	0.01418	0.00000	0.00000	nan	nan	nan	nan
IA00682A	1.09982	0.01248	0.17283	0.00783	1.42420	0.01418	-0.04219	0.01026	-1.38201	0.01568	0.00000	0.00000	nan	nan	nan	nan
IA00617D	1.04644	0.01117	0.97237	0.00889	2.11435	0.01372	1.25022	0.01083	0.02370	0.01210	-1.16375	0.01971	-2.22452	0.03366	0.00000	0.00000
IA00565D	1.13116	0.01208	1.24633	0.01276	2.91495	0.01602	1.25354	0.01014	-0.14104	0.01395	-1.35338	0.02444	-2.67408	0.05406	0.00000	0.00000
IA00682D	1.14242	0.01234	1.36676	0.01296	2.74987	0.01429	1.39276	0.01003	-0.15881	0.01487	-1.44804	0.02755	-2.53578	0.05394	0.00000	0.00000
IA00612	0.88225	0.00973	-1.37130	0.00951	0.11428	0.01406	-0.11428	0.01279	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00615	0.47839	0.00560	-0.70582	0.01385	1.37475	0.02374	-1.37475	0.01429	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00561	0.67948	0.00775	-1.34104	0.01103	0.23952	0.01717	-0.23952	0.01383	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00562	0.46672	0.00566	-0.61384	0.01669	1.76458	0.02870	-1.76458	0.01706	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00676	0.75502	0.00780	-0.44931	0.00734	0.20776	0.01072	-0.20776	0.01003	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00680	0.69518	0.00678	-0.42885	0.00961	1.11771	0.01579	-1.11771	0.01095	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00181A	1.42595	0.06718	-0.19455	0.02667	1.19318	0.04576	0.07523	0.04011	-1.26840	0.05198	0.00000	0.00000	nan	nan	nan	nan
IA00531A	1.33398	0.06999	-0.42919	0.03448	1.18364	0.05763	0.01913	0.05198	-1.20278	0.06835	0.00000	0.00000	nan	nan	nan	nan
IA00181D	1.38134	0.06162	0.95248	0.03819	2.58283	0.05164	1.31943	0.04080	-0.02501	0.04968	-1.27032	0.06605	-2.60692	0.15906	0.00000	0.00000
IA00531D	1.29489	0.06392	0.75899	0.03626	2.54542	0.06340	1.23660	0.05360	-0.00226	0.06766	-1.19881	0.06224	-2.58094	0.13244	0.00000	0.00000
IA00528	0.84667	0.03558	-1.74228	0.03661	0.15238	0.05544	-0.15238	0.04783	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00530	0.72016	0.02421	-1.43487	0.03647	0.84258	0.06547	-0.84258	0.03216	0.00000	0.00000	nan	nan	nan	nan	nan	nan

Table 2.4.7 IRT Parameters for Dichotomous Items

Ela Grade 06 Paper

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA00607	0.45113	0.01859	-1.72468	0.18084	0.11250	0.06030
IA00611	0.71125	0.02779	-0.99407	0.09330	0.18470	0.03680
IA00608	0.46517	0.01634	-1.32609	0.12457	0.05050	0.04230
IA00609	0.33176	0.02655	0.76605	0.18710	0.13570	0.04090
IA00613	0.85626	0.02856	-1.37685	0.07503	0.11140	0.03790
IA00602	0.56375	0.02430	-0.80563	0.11795	0.15520	0.03980
IA00559	0.55464	0.03115	0.97276	0.06657	0.22510	0.01800
IA00564	0.33329	0.01864	-0.67052	0.22400	0.09250	0.05290
IA00560	0.46671	0.02339	0.12997	0.10569	0.10820	0.03000
IA00549	0.27972	0.01500	-0.74347	0.23687	0.06200	0.04940
IA00556	0.68418	0.02152	-0.57452	0.06008	0.05480	0.02320
IA00557	0.55162	0.01620	-1.31027	0.08791	0.03210	0.03400
IA00552	0.66184	0.02511	-0.30111	0.06903	0.14250	0.02410
IA00671	0.57535	0.02257	-0.93326	0.10875	0.11130	0.03950
IA00667	0.44471	0.02966	0.67164	0.11807	0.21360	0.02900
IA00668	0.56476	0.02569	-0.66427	0.10728	0.06220	0.03750
IA00666	0.55043	0.02434	-1.51331	0.13830	0.07540	0.05250
IA00685	0.62892	0.02842	-0.39883	0.08460	0.05940	0.03030
IA00673	0.60817	0.04203	0.63964	0.08791	0.21510	0.02560

Table 2.4.8 IRT Parameters for Polytomous Items

Ela Grade 06 Paper

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)	d5	SE(d5)
IA00617A	1.18299	0.02458	-0.43524	0.01484	1.21931	0.03237	-0.08325	0.02256	-1.13606	0.02060	0.00000	0.00000	nan	nan	nan	nan
IA00565A	1.42816	0.03067	-0.10044	0.01406	1.23962	0.02722	0.05525	0.02048	-1.29488	0.02489	0.00000	0.00000	nan	nan	nan	nan
IA00682A	1.40971	0.02300	-0.01487	0.01165	1.34384	0.02182	0.03833	0.01655	-1.38217	0.02170	0.00000	0.00000	nan	nan	nan	nan
IA00617D	1.02801	0.01548	1.04078	0.01450	2.19400	0.02268	1.53107	0.01913	0.28516	0.01729	-1.32649	0.02967	-2.68373	0.05652	0.00000	0.00000
IA00565D	1.31425	0.01965	1.21885	0.01526	2.72113	0.02317	1.33924	0.01643	-0.02229	0.01974	-1.43703	0.03090	-2.60105	0.06057	0.00000	0.00000
IA00682D	1.45499	0.02319	1.27793	0.01515	2.58710	0.02097	1.50743	0.01655	-0.13585	0.02170	-1.53110	0.03372	-2.42759	0.05848	0.00000	0.00000
IA00612	0.76545	0.01567	-1.30096	0.02057	0.11733	0.03028	-0.11733	0.02783	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00561	0.68360	0.01438	-1.25473	0.02184	0.21885	0.03347	-0.21885	0.02808	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00676	0.60281	0.01256	-0.49047	0.01768	0.23412	0.02648	-0.23412	0.02342	0.00000	0.00000	nan	nan	nan	nan	nan	nan
IA00679	0.66764	0.01270	-0.80036	0.01844	0.46676	0.02992	-0.46676	0.02158	0.00000	0.00000	nan	nan	nan	nan	nan	nan

Table 2.4.9 IRT Parameters for Dichotomous Items

Mat Grade 03 Online

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA02198	1.00982	0.02223	-0.95466	0.03322	0.15160	0.01740
IA00886	1.10838	0.02034	-1.24169	0.02807	0.06770	0.01730
IA02052	1.30525	0.02360	-0.46145	0.01676	0.17560	0.00840
IA02370	1.07753	0.01577	-1.42721	0.02478	0.01060	0.01570
IA00836	1.15345	0.01977	-0.46423	0.01687	0.09440	0.00830
IA00856	1.14214	0.02126	0.32032	0.01255	0.09710	0.00490
IA00996	0.66206	0.02537	1.76119	0.02900	0.09590	0.00540
IA02379	1.29732	0.03085	0.72417	0.01285	0.18380	0.00440
IA02348	1.08181	0.02434	0.60693	0.01440	0.16370	0.00520
IA02506	1.29051	0.01994	-0.45137	0.01316	0.05790	0.00630
IA02299	0.84214	0.04107	1.23723	0.02828	0.43690	0.00660
IA02179	0.86477	0.01645	0.02312	0.01841	0.06790	0.00750
IA02048	0.71845	0.01965	0.48312	0.02561	0.15960	0.00920
IA02295	0.79614	0.01720	-0.66374	0.03507	0.10340	0.01570
IA02029	1.06221	0.02126	-0.54208	0.02304	0.16360	0.01110
IA00927	0.53002	0.01959	0.62318	0.04309	0.12880	0.01410
IA02017	1.23104	0.01943	-0.88052	0.01728	0.04650	0.00950
IA02297	0.74501	0.01782	-0.81223	0.04648	0.12470	0.02040
IA02608	0.47100	0.02245	1.21419	0.04288	0.13650	0.01380
IA02103	0.65908	0.01766	-0.09576	0.03887	0.10870	0.01460
IA00925	0.77643	0.02308	-0.77521	0.05666	0.31420	0.02070
IA00999	1.00531	0.01251	-1.12610	0.01213	0.00000	0.00000
IA01991	0.84540	0.01011	-0.23727	0.00987	0.00000	0.00000
IA01979	0.69588	0.00942	-0.96248	0.01388	0.00000	0.00000
IA01074	0.55402	0.00800	0.67121	0.01491	0.00000	0.00000
IA00851	0.71154	0.00908	0.04194	0.01059	0.00000	0.00000
IA01001	0.81351	0.01109	1.06641	0.01388	0.00000	0.00000
IA02516	1.07022	0.01206	-0.39996	0.00884	0.00000	0.00000
IA01981	0.80808	0.01257	-1.72359	0.01985	0.00000	0.00000
IA01000	0.99583	0.01137	0.16699	0.00895	0.00000	0.00000
IA00997	0.42872	0.00755	0.35776	0.01594	0.00000	0.00000
IA00998	0.84397	0.01011	-0.45868	0.01028	0.00000	0.00000

IA01993	1.02342	0.01166	-0.22482	0.00895	0.00000	0.00000
IA01076	0.64897	0.01051	-2.10584	0.02787	0.00000	0.00000
IA01070	1.51099	0.01920	0.62061	0.00843	0.00000	0.00000
IA02382	0.65018	0.00920	-1.21783	0.01717	0.00000	0.00000
IA00805	0.81752	0.04011	-0.07550	0.03959	0.06560	0.01530
IA00811	0.91955	0.06176	0.43890	0.04186	0.22800	0.01270
IA00916	0.77820	0.06827	0.25687	0.08998	0.08150	0.03710
IA00834	1.11186	0.09102	-0.91559	0.10232	0.14160	0.05640
IA00799	1.16905	0.10992	0.11557	0.06839	0.17600	0.03210
IA00852	0.95241	0.08170	-0.18811	0.08988	0.10260	0.04410
IA00838	0.72318	0.06616	-1.11458	0.17421	0.16850	0.07360
IA00857	0.97514	0.07370	-0.69798	0.10130	0.11620	0.05190
IA00854	1.11272	0.09513	-0.04064	0.07291	0.13160	0.03630
IA00932	1.09786	0.13032	0.62411	0.07065	0.25440	0.02860
IA00924	0.69793	0.10930	0.78227	0.14079	0.30570	0.04270
IA00994	1.37507	0.14123	0.27394	0.06633	0.30350	0.02840
IA01019	0.48340	0.04880	-1.29907	0.26738	0.17390	0.08160
IA00993	1.01542	0.08861	0.00780	0.08453	0.17890	0.03840
IA00769	0.61938	0.02182	-2.15016	0.04556	0.00000	0.00000
IA00930	0.93167	0.05267	-0.58568	0.04299	0.00000	0.00000
IA00850	1.17077	0.06571	-0.93173	0.04299	0.00000	0.00000
IA01071	0.68519	0.04371	-1.03087	0.06736	0.00000	0.00000

Table 2.4.10 IRT Parameters for Polytomous Items

Mat Grade 03 Online

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)
IA03471	0.89322	0.00868	0.35742	0.00819	1.23948	0.01121	0.54851	0.00915	-1.78798	0.01985	0.00000	0.00000
IA02205	1.10175	0.00994	0.29842	0.00607	1.16187	0.00987	-0.09410	0.00874	-1.06777	0.01255	0.00000	0.00000
IA01252	0.58755	0.00691	0.04212	0.01689	2.99616	0.03270	0.25028	0.01193	-3.24643	0.03682	0.00000	0.00000
IA02375	1.09912	0.00994	-0.09538	0.00582	1.09931	0.01111	-0.06544	0.00833	-1.03386	0.01059	0.00000	0.00000
IA01080	1.08832	0.04045	0.95727	0.03286	1.38345	0.02931	-0.05124	0.04278	-1.33220	0.08381	0.00000	0.00000
IA01081	1.27709	0.05302	0.75715	0.02258	0.97117	0.03003	-0.14298	0.03404	-0.82819	0.05029	0.00000	0.00000

Table 2.4.11 IRT Parameters for Dichotomous Items

Mat Grade 03 Paper

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA02198	1.22062	0.03769	-0.59302	0.03437	0.24050	0.01680
IA00886	1.14262	0.02886	-1.19675	0.04004	0.08490	0.02540
IA02081	0.91694	0.02790	-1.54341	0.07358	0.13830	0.04350
IA02052	1.24208	0.02966	-0.46516	0.02456	0.16370	0.01240
IA02196	1.53949	0.04754	1.01517	0.01445	0.12620	0.00420
IA02370	1.20781	0.02471	-1.41296	0.03313	0.01990	0.02330
IA00836	1.12224	0.02539	-0.39766	0.02384	0.09760	0.01170
IA02301	1.20006	0.03809	0.33383	0.02250	0.26990	0.00890
IA00856	1.14894	0.02755	0.27088	0.01693	0.08220	0.00710
IA00996	0.79608	0.03154	1.55326	0.02632	0.08610	0.00590
IA02033	1.12292	0.02921	-0.63028	0.03251	0.18920	0.01630
IA02379	1.13476	0.03666	0.73828	0.01981	0.20530	0.00710
IA02348	1.09275	0.03097	0.61619	0.01847	0.14230	0.00700
IA02506	1.17416	0.02528	-0.42615	0.02105	0.05370	0.01050
IA02299	1.31410	0.06354	1.07471	0.02270	0.40630	0.00630
IA02179	0.87703	0.02101	-0.06917	0.02590	0.05760	0.01110
IA02048	0.77592	0.02431	0.49255	0.02879	0.12720	0.01080
IA02295	0.80217	0.02437	-0.60768	0.05160	0.14530	0.02270
IA02029	1.02323	0.02613	-0.57042	0.03241	0.12250	0.01610
IA02230	1.13926	0.03467	-0.50644	0.03540	0.21770	0.01670
IA02368	0.94843	0.02408	-0.55112	0.03385	0.08370	0.01660
IA00927	0.54376	0.02391	0.52496	0.05686	0.11130	0.01900
IA02017	1.31899	0.02943	-0.82306	0.02487	0.08350	0.01430
IA02297	0.82665	0.02551	-0.59777	0.05243	0.19480	0.02250
IA02608	0.55822	0.03245	1.26780	0.04613	0.19300	0.01470
IA00928	1.25130	0.02516	-0.10694	0.01589	0.04840	0.00680
IA02103	0.68381	0.02249	-0.13151	0.05088	0.10050	0.01950
IA02200	1.02978	0.03205	-0.07155	0.03271	0.29280	0.01300
IA00925	0.78293	0.02921	-0.43316	0.06223	0.29180	0.02260
IA00999	0.92673	0.01452	-0.78209	0.01507	0.00000	0.00000
IA01001	0.82357	0.01492	1.05283	0.01682	0.00000	0.00000
IA02516	1.05586	0.01554	-0.14048	0.01146	0.00000	0.00000

IA01000	1.01959	0.01543	0.28976	0.01166	0.00000	0.00000
IA00998	0.84811	0.01332	-0.25937	0.01331	0.00000	0.00000
IA02177	0.53886	0.01082	-0.93730	0.02363	0.00000	0.00000
IA02382	0.60649	0.01161	-1.16022	0.02456	0.00000	0.00000

Table 2.4.12 IRT Parameters for Polytomous Items

Mat Grade 03 Paper

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)
IA03471	0.94820	0.01173	-0.02232	0.00933	1.09858	0.01620	0.52168	0.01280	-1.62026	0.01889	0.00000	0.00000
IA02205	0.99249	0.01207	0.05897	0.00834	1.19256	0.01589	-0.01964	0.01146	-1.17292	0.01558	0.00000	0.00000
IA01252	0.56818	0.00900	-0.32074	0.02224	2.83993	0.04995	0.28043	0.01858	-3.12037	0.04015	0.00000	0.00000
IA02375	0.93869	0.01190	0.00255	0.01021	1.63378	0.01961	0.01104	0.01187	-1.64483	0.02033	0.00000	0.00000

Table 2.4.13 IRT Parameters for Dichotomous Items

Mat Grade 06 Online

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA02050	1.36984	0.02558	-1.50099	0.02461	0.11360	0.01680
IA00846	0.86537	0.01403	-0.33236	0.01822	0.05680	0.00790
IA00882	1.47084	0.03030	0.97762	0.01037	0.11160	0.00260
IA02486	0.86285	0.01639	-0.84400	0.03079	0.14770	0.01430
IA02125	1.32798	0.02587	0.62505	0.01183	0.21470	0.00390
IA02467	1.05429	0.02098	-0.11948	0.01874	0.25780	0.00760
IA02146	0.70568	0.01470	-0.28472	0.02953	0.08130	0.01190
IA00967	1.49849	0.02806	-0.95050	0.01906	0.31960	0.01020
IA01060	0.70085	0.01397	-1.19197	0.04566	0.04090	0.02170
IA00964	0.96041	0.01885	-2.37955	0.05927	0.07170	0.04550
IA02465	1.62732	0.03871	1.26643	0.01141	0.14380	0.00230
IA02497	1.07291	0.02121	0.87982	0.01246	0.13180	0.00360
IA02123	1.50057	0.02278	-0.31969	0.01068	0.11520	0.00520
IA01997	0.76386	0.00853	-1.05794	0.01204	0.00000	0.00000
IA02445	1.04020	0.01105	-1.42852	0.01236	0.00000	0.00000
IA02499	0.78821	0.01050	1.40737	0.01592	0.00000	0.00000
IA02270	0.95491	0.00999	0.43289	0.00869	0.00000	0.00000
IA01123	0.68132	0.00886	-1.86906	0.01990	0.00000	0.00000
IA01127	1.03897	0.01071	-0.37142	0.00806	0.00000	0.00000
IA03469	0.63072	0.00814	-1.20454	0.01456	0.00000	0.00000
IA01129	0.56664	0.00701	-0.36598	0.01141	0.00000	0.00000
IA00974	1.21789	0.01251	-0.88484	0.00880	0.00000	0.00000
IA00966	1.15467	0.01200	0.47667	0.00806	0.00000	0.00000
IA02595	0.97433	0.00937	-0.08733	0.00806	0.00000	0.00000
IA01128	0.91766	0.00976	0.70767	0.00984	0.00000	0.00000
IA00896	0.95340	0.00970	-0.39477	0.00848	0.00000	0.00000
IA00965	0.98375	0.01010	-0.83803	0.00974	0.00000	0.00000
IA02460	1.17559	0.01206	0.45436	0.00796	0.00000	0.00000
IA01126	0.88231	0.00925	-0.31488	0.00859	0.00000	0.00000
IA02314	0.79405	0.00859	-0.63604	0.01005	0.00000	0.00000
IA02011	0.58274	0.00819	-2.12760	0.02545	0.00000	0.00000
IA02003	1.07050	0.01212	-1.45638	0.01215	0.00000	0.00000

IA02213	1.26918	0.01235	-0.14587	0.00723	0.00000	0.00000
IA01124	0.81032	0.00841	-0.38734	0.00911	0.00000	0.00000
IA00975	1.73196	0.13606	0.97888	0.03037	0.18670	0.00560
IA00992	1.71838	0.51401	1.60570	0.07058	0.32950	0.01460
IA00818	1.40418	0.12366	0.64798	0.04461	0.20320	0.01790
IA01063	1.56678	0.23476	1.23847	0.05215	0.29050	0.01530
IA01064	1.37085	0.10571	0.40295	0.04147	0.12610	0.01880
IA00827	0.97466	0.06689	-0.44137	0.08021	0.11050	0.04110
IA00777	0.76179	0.04601	-1.59533	0.13027	0.09290	0.06140
IA00778	1.01400	0.07827	-1.20977	0.12231	0.19550	0.06520
IA01058	1.39800	0.12586	0.43080	0.04995	0.25410	0.02100
IA00817	1.09570	0.08192	0.13529	0.05686	0.13060	0.02640
IA00845	0.58830	0.06918	-0.12482	0.20231	0.24660	0.06240
IA00819	0.87372	0.02312	-0.05298	0.02262	0.00000	0.00000
IA00782	0.74675	0.03889	-0.12021	0.03686	0.00000	0.00000
IA00899	0.88012	0.04074	0.55614	0.03707	0.00000	0.00000
IA01117	0.80454	0.04337	-1.78853	0.07822	0.00000	0.00000
IA00884	0.98420	0.05555	1.37690	0.05246	0.00000	0.00000
IA00804	0.51042	0.03524	-1.31815	0.08932	0.00000	0.00000

Table 2.4.14 IRT Parameters for Polytomous Items

Mat Grade 06 Online

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)
IA03463	1.13182	0.00965	-0.14183	0.00562	0.47860	0.00806	-0.47860	0.00785	0.00000	0.00000	nan	nan	nan	nan
IA03465	0.97618	0.00903	-0.49446	0.00879	1.29962	0.01476	-1.29962	0.00953	0.00000	0.00000	nan	nan	nan	nan
IA02078	1.38533	0.01038	0.06783	0.00392	0.98984	0.00817	0.12636	0.00702	-0.17762	0.00712	-0.93859	0.00890	0.00000	0.00000
IA00977	1.44805	0.01089	0.59384	0.00432	1.20600	0.00743	0.09445	0.00733	-0.35676	0.00848	-0.94369	0.01089	0.00000	0.00000
IA00788	1.20202	0.00876	-0.46506	0.00449	1.05194	0.01100	0.48889	0.00859	-0.32799	0.00723	-1.21283	0.00869	0.00000	0.00000
IA02501	1.34582	0.01145	1.14766	0.00533	0.83676	0.00712	0.37371	0.00817	-0.36181	0.01131	-0.84863	0.01445	0.00000	0.00000
IA01131	1.07414	0.02283	-0.42661	0.01323	0.44546	0.01655	-0.44546	0.02063	0.00000	0.00000	nan	nan	nan	nan
IA00881	1.41574	0.04483	0.06548	0.01314	0.83994	0.02712	0.19627	0.02482	-0.34480	0.02545	-0.69140	0.02764	0.00000	0.00000
IA00972	1.46730	0.05038	-1.07375	0.02065	1.12087	0.06032	0.52808	0.04230	-0.21980	0.02869	-1.42915	0.02398	0.00000	0.00000

Table 2.4.15 IRT Parameters for Dichotomous Items

Mat Grade 06 Paper

Item ID	a	SE(a)	b	SE(b)	c	SE(c)
IA02050	1.31480	0.04772	-1.46083	0.04931	0.11970	0.03200
IA00846	0.79494	0.02397	-0.54025	0.04374	0.04120	0.01880
IA02273	0.80407	0.02566	-0.94929	0.05754	0.06840	0.02690
IA00882	1.43157	0.05617	0.96488	0.01992	0.13180	0.00550
IA02486	0.83754	0.02903	-0.87839	0.06144	0.14940	0.02740
IA02455	0.71919	0.04645	1.51694	0.04274	0.22270	0.01030
IA02153	1.09895	0.03210	-1.60018	0.05454	0.08250	0.03500
IA02125	1.30134	0.04344	0.59926	0.02182	0.18240	0.00710
IA02467	1.08797	0.04086	0.02494	0.03473	0.30000	0.01270
IA02146	0.82445	0.03199	-0.05720	0.04463	0.16420	0.01710
IA02449	1.30065	0.04893	-0.16517	0.03183	0.32730	0.01260
IA00967	1.20843	0.03843	-1.02675	0.04319	0.22900	0.02240
IA01060	0.67981	0.02476	-1.06437	0.08403	0.09010	0.03600
IA00964	0.81178	0.02729	-2.41336	0.10373	0.10810	0.06380
IA02465	1.64721	0.06804	1.24670	0.02037	0.13650	0.00440
IA02156	1.39467	0.03927	0.29173	0.02015	0.14980	0.00720
IA02497	1.22015	0.04492	0.81307	0.02182	0.14480	0.00660
IA02462	0.96244	0.03389	0.08549	0.03328	0.18530	0.01270
IA01061	1.17422	0.05976	0.65379	0.03205	0.40580	0.00930
IA02312	1.00556	0.03025	-0.62707	0.03940	0.14890	0.01800
IA02105	0.85797	0.02951	0.54160	0.02827	0.10940	0.00970
IA02123	1.56417	0.04762	-0.18409	0.02170	0.19350	0.00980
IA02275	1.17443	0.03906	0.48372	0.02315	0.17320	0.00810
IA02151	1.45902	0.03975	-0.58678	0.02426	0.14230	0.01200
IA02445	0.82666	0.01658	-1.30367	0.02560	0.00000	0.00000
IA02499	0.76986	0.01842	1.30858	0.02671	0.00000	0.00000
IA02270	0.92353	0.01863	0.61484	0.01759	0.00000	0.00000
IA02284	0.76263	0.01552	-0.51989	0.01992	0.00000	0.00000
IA02472	0.84530	0.02106	1.39573	0.02738	0.00000	0.00000
IA00974	0.95230	0.01795	-0.67949	0.01803	0.00000	0.00000
IA02595	1.02916	0.01842	0.08660	0.01536	0.00000	0.00000
IA00896	0.97410	0.01826	-0.22983	0.01614	0.00000	0.00000

IA00965	0.91218	0.01768	-0.68161	0.01903	0.00000	0.00000
IA02213	1.21735	0.02212	-0.07334	0.01447	0.00000	0.00000

Table 2.4.16 IRT Parameters for Polytomous Items
Mat Grade 06 Paper

Item ID	a	SE(a)	b	SE(b)	d0	SE(d0)	d1	SE(d1)	d2	SE(d2)	d3	SE(d3)	d4	SE(d4)
IA03463	1.06273	0.01726	-0.13011	0.01126	0.51266	0.01636	-0.51266	0.01547	0.00000	0.00000	nan	nan	nan	nan
IA03465	1.04241	0.01758	-0.45633	0.01531	1.19739	0.02538	-1.19739	0.01714	0.00000	0.00000	nan	nan	nan	nan
IA02078	1.35888	0.01932	-0.03928	0.00764	1.00194	0.01681	0.11765	0.01391	-0.14325	0.01380	-0.97634	0.01636	0.00000	0.00000
IA00977	1.37218	0.01958	0.51923	0.00824	1.21275	0.01525	0.10128	0.01425	-0.34760	0.01580	-0.96644	0.02003	0.00000	0.00000
IA00788	1.16129	0.01594	-0.57871	0.00904	1.02470	0.02237	0.54889	0.01825	-0.31871	0.01447	-1.25487	0.01625	0.00000	0.00000
IA02501	1.20051	0.01863	1.14255	0.01013	0.84615	0.01436	0.37545	0.01603	-0.33655	0.02104	-0.88505	0.02716	0.00000	0.00000

3 Mode Comparability Analysis Results

Executive Summary

The mode comparability analysis was conducted for Grade 3 and 6 to examine the comparability of student test performance across modes of administration, to evaluate the mode effects and differences if any, and to make statistical adjustments accordingly. The Propensity Score Matching (PSM) method was used to generate matched samples between online and paper groups, based upon the following matching variables, including students' prior test score in 2017, and demographic variables which were race, gender, special education status (SPED), economically disadvantaged status (ECODIS), limited English proficiency status (LEP), and years in Massachusetts. The propensity scores were calculated on the above matching variables using logistic regression. Nearest neighbor matching with a caliper size of 0.02 on the propensity scores was used.

For students in Grade 3 who did not have a prior test core, a pseudo prior score approach was adopted. To do so, the scale score of the Grade-3 students in 2017 of a certain percentile was assigned as the pseudo prior score to the Grade-3 student of the same raw score percentile in 2018 in the same school, assuming that students' ability distribution within the same school across the two years are equivalent. The standardized group differences in the matching variables before and after matching are presented in the tables in Section 3.1. All the standard differences after matching were very small and well below 0.1.

To make the matched samples between modes statewide population representative, a bi-directional matching procedure was used. The procedure consists of two steps, first, a sample from paper group was drawn to match online group, called "online-equivalent" group. Second, a sample from online group was drawn to match paper group, called "paper-equivalent" group. The final online group includes samples from both online and paper-equivalent groups, and the final paper group includes paper and online-equivalent groups. Because the final matched samples are a combination of the original group in one mode, and an equivalent group to the other mode, it is population wide representative. The population representativeness for both online and paper groups after matching is presented in the tables in Section 3.2.

The mode effects in Grades 3 and 6 were evaluated as the standardized test score differences between online and paper matched groups. They are summarized in Section 3.3, along with significance test results. We observed from small to moderate mode effects across the subject/grade before adjustment. The equipercentile linking approach was used to make test-level statistical adjustments to ensure comparable test scores across mode administrations. Specifically, theta scores in paper matched sample with a certain percentile were adjusted so that they are equivalent to theta scores which had the same percentile in online matched sample. The equipercentile linking function can be nonlinear and differential conditional on students' ability level. A larger adjustment was made to a test which had greater mode effects, and vice versa. More details of mode adjustment results can be found in Section 3.4, followed by the final lookup tables for online form and paper form (after mode adjustment) in Section 3.5.

3.1 Propensity Score Matching Effectiveness

Table 3.1.1: Group Difference in Matching Variables Before and After Matching: ELA03

	Unmatched Sample					Matched Sample				
	Mean P.	Mean O.	SD P.	SD O.	Std. Diff	Mean P.	Mean O.	SD P.	SD O.	Std. Diff
N	24375	42322	NA	NA	NA	66694	66694	NA	NA	NA
ScaleScore2017	500.033	498.505	21.357	21.106	-0.072	498.898	499.093	21.170	21.195	0.009
LEP2018	0.150	0.126	0.357	0.331	-0.074	0.137	0.135	0.344	0.342	-0.007
ecodis2018	0.329	0.348	0.470	0.476	0.041	0.344	0.340	0.475	0.474	-0.007
sped2018	0.164	0.163	0.371	0.369	-0.004	0.164	0.164	0.370	0.370	0.000
yrs5inmass2018	0.046	0.048	0.210	0.214	0.010	0.048	0.048	0.214	0.213	-0.002
Race_White	0.548	0.604	0.498	0.489	0.116	0.583	0.584	0.493	0.493	0.003
Race_Black	0.100	0.082	0.300	0.275	-0.066	0.090	0.089	0.287	0.284	-0.006
Race_Hispanic	0.207	0.211	0.405	0.408	0.010	0.209	0.210	0.407	0.407	0.001
Race_Multiple	0.046	0.042	0.210	0.201	-0.020	0.043	0.043	0.202	0.203	0.003
Race_Pacific	0.001	0.001	0.037	0.029	-0.018	0.001	0.001	0.029	0.034	0.011
Race_Asian	0.095	0.057	0.294	0.232	-0.165	0.071	0.070	0.257	0.255	-0.004
Gender_M	0.516	0.510	0.500	0.500	-0.011	0.514	0.512	0.500	0.500	-0.003
Gender_F	0.484	0.490	0.500	0.500	0.012	0.486	0.488	0.500	0.500	0.003

Table 3.1.2: Group Difference in Matching Variables Before and After Matching: ELA06

	Unmatched Sample					Matched Sample				
	Mean P.	Mean O.	SD P.	SD O.	Std. Diff	Mean P.	Mean O.	SD P.	SD O.	Std. Diff
N	14570	52150	NA	NA	NA	65825	65825	NA	NA	NA
ScaleScore2017	498.860	498.805	21.152	20.237	-0.003	498.817	498.817	20.294	20.294	0.000
LEP2018	0.067	0.054	0.249	0.225	-0.058	0.053	0.054	0.224	0.226	0.004
ecodis2018	0.349	0.306	0.477	0.461	-0.093	0.328	0.316	0.469	0.465	-0.025
sped2018	0.202	0.172	0.402	0.378	-0.079	0.168	0.176	0.374	0.381	0.021
yrs5inmass2018	0.925	0.930	0.264	0.255	0.021	0.929	0.931	0.256	0.254	0.005
Race_White	0.524	0.637	0.499	0.481	0.235	0.612	0.614	0.487	0.487	0.004
Race_Black	0.121	0.075	0.326	0.264	-0.173	0.083	0.084	0.276	0.278	0.004
Race_Hispanic	0.227	0.189	0.419	0.392	-0.096	0.205	0.199	0.403	0.399	-0.014
Race_Multiple	0.034	0.037	0.182	0.188	0.013	0.032	0.036	0.175	0.187	0.025
Race_Pacific	0.001	0.001	0.035	0.025	-0.024	0.001	0.000	0.027	0.021	-0.011
Race_Asian	0.091	0.059	0.288	0.235	-0.139	0.067	0.065	0.250	0.246	-0.009
Gender_M	0.502	0.512	0.500	0.500	0.020	0.493	0.507	0.500	0.500	0.029
Gender_F	0.498	0.488	0.500	0.500	-0.019	0.507	0.493	0.500	0.500	-0.029

Table 3.1.3: Group Difference in Matching Variables Before and After Matching: MAT03

	Unmatched Sample					Matched Sample				
	Mean P.	Mean O.	SD P.	SD O.	Std. Diff	Mean P.	Mean O.	SD P.	SD O.	Std. Diff
N	24593	42370	NA	NA	NA	66962	66962	NA	NA	NA
ScaleScore2017	500.818	498.528	22.386	22.320	-0.103	499.226	499.409	22.346	22.396	0.008
LEP2018	0.155	0.128	0.362	0.335	-0.080	0.141	0.139	0.348	0.346	-0.005
ecodis2018	0.330	0.349	0.470	0.477	0.038	0.343	0.342	0.475	0.474	-0.003
sped2018	0.164	0.162	0.370	0.368	-0.006	0.162	0.164	0.368	0.370	0.006
yrs5inmass2018	0.046	0.048	0.210	0.214	0.008	0.049	0.048	0.215	0.213	-0.004
Race_White	0.545	0.604	0.498	0.489	0.121	0.580	0.583	0.494	0.493	0.006
Race_Black	0.101	0.083	0.301	0.275	-0.067	0.091	0.088	0.287	0.284	-0.008
Race_Hispanic	0.209	0.211	0.407	0.408	0.004	0.212	0.211	0.409	0.408	-0.003
Race_Multiple	0.046	0.042	0.209	0.201	-0.019	0.043	0.044	0.202	0.205	0.007
Race_Pacific	0.001	0.001	0.037	0.029	-0.018	0.001	0.001	0.032	0.031	-0.004
Race_Asian	0.096	0.057	0.294	0.232	-0.166	0.071	0.070	0.258	0.256	-0.004
Gender_M	0.515	0.510	0.500	0.500	-0.011	0.511	0.512	0.500	0.500	0.001
Gender_F	0.485	0.490	0.500	0.500	0.011	0.489	0.488	0.500	0.500	-0.001

Table 3.1.4: Group Difference in Matching Variables Before and After Matching: MAT06

	Unmatched Sample					Matched Sample				
	Mean P.	Mean O.	SD P.	SD O.	Std. Diff	Mean P.	Mean O.	SD P.	SD O.	Std. Diff
N	14654	52132	NA	NA	NA	65838	65838	NA	NA	NA
ScaleScore2017	498.273	498.745	21.453	20.661	0.023	498.738	498.738	20.694	20.694	0.000
LEP2018	0.067	0.054	0.249	0.226	-0.057	0.050	0.055	0.218	0.228	0.022
ecodis2018	0.349	0.305	0.477	0.461	-0.095	0.323	0.314	0.468	0.464	-0.021
sped2018	0.201	0.175	0.401	0.380	-0.068	0.172	0.175	0.378	0.380	0.008
yrs5inmass2018	0.925	0.930	0.264	0.255	0.021	0.938	0.930	0.241	0.255	-0.031
Race_White	0.522	0.638	0.500	0.481	0.240	0.619	0.617	0.486	0.486	-0.004
Race_Black	0.121	0.076	0.326	0.264	-0.172	0.083	0.084	0.275	0.278	0.007
Race_Hispanic	0.228	0.189	0.420	0.392	-0.100	0.199	0.195	0.400	0.396	-0.011
Race_Multiple	0.034	0.037	0.182	0.188	0.013	0.031	0.036	0.172	0.185	0.027
Race_Pacific	0.001	0.001	0.035	0.025	-0.024	0.001	0.001	0.024	0.024	0.000
Race_Asian	0.092	0.059	0.289	0.235	-0.141	0.067	0.066	0.250	0.248	-0.006
Gender_M	0.502	0.513	0.500	0.500	0.022	0.502	0.509	0.500	0.500	0.014
Gender_F	0.498	0.487	0.500	0.500	-0.022	0.498	0.491	0.500	0.500	-0.014

3.2 Propensity Score Matching Population Representativeness

Table 3.2.1: Population Representativeness After Matching: ELA03

	Population		Paper		Online		Std. Diff	
	Mean	SD	Mean	SD	Mean	SD	Paper	Online
ScaleScore2017	499.06	21.21	498.90	21.17	499.09	21.20	-0.01	0.00
LEP2018	0.14	0.34	0.14	0.34	0.14	0.34	0.01	0.00
ecodis2018	0.34	0.47	0.34	0.47	0.34	0.47	0.00	-0.00
sped2018	0.16	0.37	0.16	0.37	0.16	0.37	0.00	0.00
yrs5inmass2018	0.05	0.21	0.05	0.21	0.05	0.21	0.00	0.00
Race_White	0.58	0.49	0.58	0.49	0.58	0.49	-0.00	0.00
Race_Black	0.09	0.28	0.09	0.29	0.09	0.28	0.00	-0.00
Race_Hispanic	0.21	0.41	0.21	0.41	0.21	0.41	0.00	0.00
Race_Multiple	0.04	0.20	0.04	0.20	0.04	0.20	-0.00	-0.00
Race_Pacific	0.00	0.03	0.00	0.03	0.00	0.03	-0.00	0.00
Race_Asian	0.07	0.26	0.07	0.26	0.07	0.26	0.00	-0.00
Gender_M	0.51	0.50	0.51	0.50	0.51	0.50	0.00	0.00
Gender_F	0.49	0.50	0.49	0.50	0.49	0.50	-0.00	-0.00

Table 3.2.2: Population Representativeness After Matching: ELA06

	Population		Paper		Online		Std. Diff	
	Mean	SD	Mean	SD	Mean	SD	Paper	Online
ScaleScore2017	498.82	20.44	498.82	20.29	498.82	20.29	0.00	0.00
LEP2018	0.06	0.23	0.05	0.22	0.05	0.23	-0.01	-0.01
ecodis2018	0.32	0.46	0.33	0.47	0.32	0.46	0.03	0.00
sped2018	0.18	0.38	0.17	0.37	0.18	0.38	-0.03	-0.01
yrs5inmass2018	0.93	0.26	0.93	0.26	0.93	0.25	0.00	0.01
Race_White	0.61	0.49	0.61	0.49	0.61	0.49	-0.00	0.00
Race_Black	0.08	0.28	0.08	0.28	0.08	0.28	-0.01	-0.00
Race_Hispanic	0.20	0.40	0.20	0.40	0.20	0.40	0.02	0.00
Race_Multiple	0.04	0.19	0.03	0.17	0.04	0.19	-0.02	0.00
Race_Pacific	0.00	0.03	0.00	0.03	0.00	0.02	-0.00	-0.01
Race_Asian	0.07	0.25	0.07	0.25	0.06	0.25	0.00	-0.00
Gender_M	0.51	0.50	0.49	0.50	0.51	0.50	-0.03	-0.00
Gender_F	0.49	0.50	0.51	0.50	0.49	0.50	0.03	0.00

Table 3.2.3: Population Representativeness After Matching: MAT03

	Population		Paper		Online		Std. Diff	
	Mean	SD	Mean	SD	Mean	SD	Paper	Online
ScaleScore2017	499.37	22.37	499.23	22.35	499.41	22.40	-0.01	0.00
LEP2018	0.14	0.34	0.14	0.35	0.14	0.35	0.01	0.00
ecodis2018	0.34	0.47	0.34	0.47	0.34	0.47	0.00	0.00
sped2018	0.16	0.37	0.16	0.37	0.16	0.37	-0.00	0.00
yrs5inmass2018	0.05	0.21	0.05	0.21	0.05	0.21	0.01	0.00
Race_White	0.58	0.49	0.58	0.49	0.58	0.49	-0.00	0.00
Race_Black	0.09	0.28	0.09	0.29	0.09	0.28	0.00	-0.00
Race_Hispanic	0.21	0.41	0.21	0.41	0.21	0.41	0.00	0.00
Race_Multiple	0.04	0.20	0.04	0.20	0.04	0.20	-0.00	0.00
Race_Pacific	0.00	0.03	0.00	0.03	0.00	0.03	0.00	-0.00
Race_Asian	0.07	0.26	0.07	0.26	0.07	0.26	0.00	-0.00
Gender_M	0.51	0.50	0.51	0.50	0.51	0.50	-0.00	0.00
Gender_F	0.49	0.50	0.49	0.50	0.49	0.50	0.00	0.00

Table 3.2.4: Population Representativeness After Matching: MAT06

	Population		Paper		Online		Std. Diff	
	Mean	SD	Mean	SD	Mean	SD	Paper	Online
ScaleScore2017	498.64	20.84	498.74	20.69	498.74	20.69	0.00	0.00
LEP2018	0.06	0.23	0.05	0.22	0.06	0.23	-0.03	-0.01
ecodis2018	0.32	0.46	0.32	0.47	0.31	0.46	0.02	-0.00
sped2018	0.18	0.38	0.17	0.38	0.17	0.38	-0.02	-0.01
yrs5inmass2018	0.93	0.26	0.94	0.24	0.93	0.26	0.04	0.00
Race_White	0.61	0.49	0.62	0.49	0.62	0.49	0.01	0.01
Race_Black	0.09	0.28	0.08	0.28	0.08	0.28	-0.01	-0.00
Race_Hispanic	0.20	0.40	0.20	0.40	0.20	0.40	0.00	-0.01
Race_Multiple	0.04	0.19	0.03	0.17	0.04	0.18	-0.03	-0.00
Race_Pacific	0.00	0.03	0.00	0.02	0.00	0.02	-0.01	-0.01
Race_Asian	0.07	0.25	0.07	0.25	0.07	0.25	0.00	0.00
Gender_M	0.51	0.50	0.50	0.50	0.51	0.50	-0.02	-0.00
Gender_F	0.49	0.50	0.50	0.50	0.49	0.50	0.02	0.00

3.3 Mode Effect Results

Table 3.3.1: Mode Effect Before and After Adjustment

		Paper		Online			Confidence Interval		
	Adjustment	Mean	SD	Mean	SD	Effect Size	2.5	97.5	Significance
ELA03	Before	506.59	21.47	502.20	20.84	0.21	-0.010	0.011	1
ELA03	After	502.12	20.86	502.20	20.84	-0.00	-0.011	0.011	0
ELA06	Before	506.18	23.65	501.61	23.50	0.19	-0.012	0.011	1
ELA06	After	501.54	23.45	501.61	23.50	-0.00	-0.012	0.011	0
MAT03	Before	500.63	23.12	500.10	23.33	0.02	-0.012	0.009	1
MAT03	After	499.95	23.28	500.10	23.33	-0.01	-0.012	0.009	0
MAT06	Before	500.46	21.84	498.93	21.73	0.07	-0.010	0.011	1
MAT06	After	498.97	21.56	498.93	21.73	0.00	-0.011	0.011	0

3.4 Mode Adjustment

Table 3.4.1: Mode Adjustment for Paper Tests in ELA03

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
0	-3.17	-3.17	440	440	0
1	-3.16	-3.12	440	441	1
2	-3.15	-3.08	440	442	2
3	-3.14	-3.03	441	443	2
4	-3.13	-2.99	441	443	2
5	-2.68	-2.94	449	444	-5
6	-2.36	-2.66	455	450	-5
7	-2.12	-2.30	460	456	-4
8	-1.93	-2.06	463	461	-2
9	-1.76	-1.87	467	464	-3
10	-1.61	-1.72	469	467	-2
11	-1.48	-1.60	472	469	-3
12	-1.36	-1.48	474	472	-2
13	-1.24	-1.37	476	474	-2
14	-1.13	-1.27	478	476	-2
15	-1.03	-1.17	480	478	-2
16	-0.92	-1.08	482	479	-3
17	-0.82	-0.99	484	481	-3
18	-0.72	-0.90	486	483	-3
19	-0.62	-0.81	488	485	-3
20	-0.52	-0.72	490	486	-4
21	-0.41	-0.63	492	488	-4
22	-0.31	-0.53	494	490	-4
23	-0.20	-0.44	496	492	-4
24	-0.08	-0.33	498	493	-5
25	0.03	-0.23	500	495	-5
26	0.16	-0.12	503	498	-5
27	0.29	0.00	505	499	-6
28	0.42	0.13	508	502	-6
29	0.56	0.27	510	505	-5
30	0.71	0.41	513	508	-5
31	0.87	0.57	516	511	-5
32	1.04	0.74	519	514	-5
33	1.22	0.93	523	517	-6
34	1.41	1.13	526	521	-5
35	1.61	1.35	530	525	-5
36	1.83	1.59	534	529	-5
37	2.08	1.86	539	535	-4
38	2.36	2.15	544	540	-4
39	2.66	2.46	550	546	-4
40	3.01	2.80	557	552	-5
41	3.20	3.15	560	559	-1
42	3.20	3.15	560	559	-1
43	3.20	3.15	560	559	-1

Continued on next page

Table 3.4.1: Mode Adjustment for Paper Tests in ELA03

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
44	3.20	3.15	560	559	-1

Table 3.4.2: Mode Adjustment for Paper Tests in ELA06

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
0	-3.17	-3.17	440	440	0
1	-3.15	-3.15	440	440	0
2	-3.13	-3.13	441	441	0
3	-3.12	-3.11	441	441	0
4	-3.10	-3.09	441	442	1
5	-3.08	-3.07	442	442	0
6	-2.74	-2.87	448	446	-2
7	-2.48	-2.59	453	451	-2
8	-2.27	-2.39	457	455	-2
9	-2.10	-2.23	460	458	-2
10	-1.94	-2.08	463	461	-2
11	-1.81	-1.96	466	463	-3
12	-1.68	-1.84	468	465	-3
13	-1.57	-1.73	470	467	-3
14	-1.46	-1.63	473	469	-4
15	-1.35	-1.53	475	471	-4
16	-1.25	-1.44	476	473	-3
17	-1.15	-1.35	478	475	-3
18	-1.05	-1.26	480	476	-4
19	-0.95	-1.17	482	478	-4
20	-0.86	-1.09	484	480	-4
21	-0.76	-1.00	486	481	-5
22	-0.66	-0.91	488	483	-5
23	-0.56	-0.82	490	485	-5
24	-0.47	-0.73	491	486	-5
25	-0.37	-0.64	493	488	-5
26	-0.27	-0.55	495	490	-5
27	-0.17	-0.45	497	492	-5
28	-0.07	-0.35	499	494	-5
29	0.04	-0.25	501	495	-6
30	0.15	-0.15	503	497	-6
31	0.26	-0.04	505	499	-6
32	0.38	0.07	507	502	-5
33	0.50	0.19	510	504	-6
34	0.62	0.32	512	506	-6
35	0.76	0.45	515	509	-6
36	0.89	0.59	517	511	-6
37	1.03	0.74	520	514	-6
38	1.18	0.91	523	517	-6
39	1.33	1.08	525	521	-4
40	1.49	1.26	529	524	-5
41	1.67	1.46	532	528	-4
42	1.87	1.68	536	532	-4
43	2.09	1.92	540	537	-3

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Table 3.4.2: Mode Adjustment for Paper Tests in ELA06

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
44	2.34	2.20	545	542	-3
45	2.61	2.51	550	548	-2
46	2.90	2.87	555	555	0
47	3.15	3.14	560	560	0
48	3.15	3.14	560	560	0
49	3.15	3.14	560	560	0
50	3.15	3.14	560	560	0
51	3.15	3.14	560	560	0

Table 3.4.3: Mode Adjustment for Paper Tests in MAT03

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
0	-2.78	-2.78	440	440	0
1	-2.74	-2.74	441	441	0
2	-2.70	-2.70	442	442	0
3	-2.66	-2.66	443	443	0
4	-2.62	-2.62	443	443	0
5	-2.58	-2.58	444	444	0
6	-2.55	-2.54	445	445	0
7	-2.51	-2.41	446	448	2
8	-2.20	-2.20	452	452	0
9	-1.97	-1.99	457	457	0
10	-1.79	-1.82	461	461	0
11	-1.63	-1.66	465	464	-1
12	-1.49	-1.52	468	467	-1
13	-1.37	-1.40	470	469	-1
14	-1.25	-1.29	473	472	-1
15	-1.15	-1.18	475	474	-1
16	-1.05	-1.08	477	476	-1
17	-0.95	-0.99	479	478	-1
18	-0.86	-0.90	481	480	-1
19	-0.77	-0.81	483	482	-1
20	-0.69	-0.72	485	484	-1
21	-0.60	-0.64	487	486	-1
22	-0.52	-0.56	488	487	-1
23	-0.44	-0.48	490	489	-1
24	-0.36	-0.40	492	491	-1
25	-0.28	-0.31	494	493	-1
26	-0.19	-0.23	495	494	-1
27	-0.11	-0.15	497	496	-1
28	-0.03	-0.07	499	498	-1
29	0.05	0.02	501	499	-2
30	0.14	0.10	502	502	0
31	0.23	0.19	504	503	-1
32	0.32	0.28	506	505	-1
33	0.41	0.37	508	507	-1
34	0.51	0.47	510	509	-1
35	0.61	0.57	512	512	0
36	0.71	0.67	515	514	-1
37	0.82	0.79	517	516	-1
38	0.94	0.90	519	519	0
39	1.06	1.03	522	521	-1
40	1.19	1.17	525	524	-1
41	1.34	1.33	528	528	0
42	1.50	1.51	532	532	0
43	1.69	1.72	536	536	0

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Table 3.4.3: Mode Adjustment for Paper Tests in MAT03

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
44	1.92	1.96	540	541	1
45	2.20	2.27	546	548	2
46	2.60	2.60	555	555	0
47	2.84	2.90	560	560	0
48	2.84	2.90	560	560	0

Table 3.4.4: Mode Adjustment for Paper Tests in MAT06

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
0	-3.03	-3.04	440	440	0
1	-2.94	-2.99	442	441	-1
2	-2.86	-2.94	443	442	-1
3	-2.78	-2.89	445	443	-2
4	-2.70	-2.81	447	444	-3
5	-2.61	-2.59	448	449	1
6	-2.53	-2.36	450	453	3
7	-2.22	-2.17	456	457	1
8	-2.00	-1.98	460	461	1
9	-1.81	-1.82	464	464	0
10	-1.66	-1.68	467	467	0
11	-1.52	-1.55	469	469	0
12	-1.40	-1.43	472	472	0
13	-1.29	-1.33	475	474	-1
14	-1.18	-1.23	477	476	-1
15	-1.08	-1.13	479	478	-1
16	-0.99	-1.05	481	479	-2
17	-0.90	-0.96	482	481	-1
18	-0.81	-0.88	484	483	-1
19	-0.73	-0.80	486	484	-2
20	-0.64	-0.73	487	486	-1
21	-0.57	-0.66	489	487	-2
22	-0.49	-0.58	490	489	-1
23	-0.41	-0.51	492	490	-2
24	-0.34	-0.45	493	491	-2
25	-0.27	-0.38	495	493	-2
26	-0.20	-0.31	496	494	-2
27	-0.13	-0.24	498	495	-3
28	-0.06	-0.17	499	497	-2
29	0.01	-0.11	500	498	-2
30	0.08	-0.04	502	499	-3
31	0.15	0.03	503	501	-2
32	0.22	0.09	504	502	-2
33	0.29	0.16	506	503	-3
34	0.36	0.23	507	505	-2
35	0.43	0.30	509	506	-3
36	0.50	0.37	510	508	-2
37	0.57	0.45	511	509	-2
38	0.64	0.52	513	511	-2
39	0.72	0.60	514	512	-2
40	0.79	0.68	516	514	-2
41	0.87	0.76	517	515	-2
42	0.95	0.85	519	517	-2
43	1.04	0.94	521	519	-2

Continued on next page

Table 3.4.4: Mode Adjustment for Paper Tests in MAT06

Raw	Theta	Theta_adjusted	ScaleScore	ScaleScore_adjusted	Adjustment
44	1.13	1.03	523	521	-2
45	1.22	1.13	524	523	-1
46	1.32	1.25	526	525	-1
47	1.44	1.37	529	527	-2
48	1.56	1.51	531	530	-1
49	1.70	1.67	534	533	-1
50	1.86	1.86	537	537	0
51	2.07	2.12	541	542	1
52	2.34	2.50	547	550	3
53	2.80	2.89	556	557	1
54	3.01	3.11	560	560	0

4. Quality Control and Pearson Replication Analyses

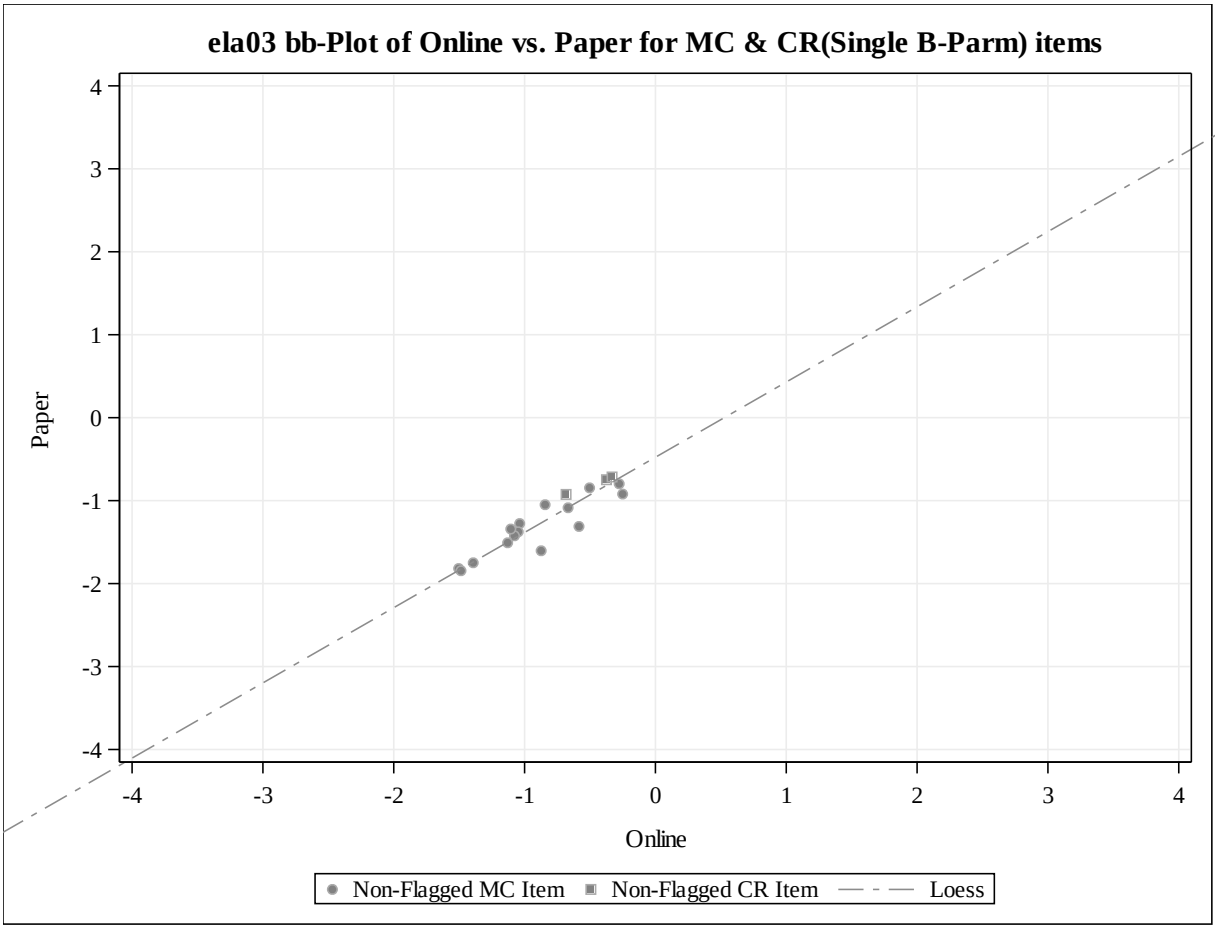
Pearson psychometric team performed the replication analyses as the quality control of the psychometric process for spring 2018 test administration. The IRT calibration, mode linking, and mode adjustment analyses were replicated and validated. The comparison results are summarized and presented in the tables on the following pages.

Section 4.1 Mode Linking Results

Table 4.1.1 Paper to Online Linking IRT Parameter Differences between Measured Progress and Pearson: Mode Linking

Subject	Grade	difference	A	B	C	B1	B2	B3	B4	B5
ELA	3	< 0.05	29	29	29	29	29	29	29	-
	6	< 0.05	29	29	29	29	29	29	29	29
MATH	3	< 0.05	40	40	40	40	40	40	-	-
	6	< 0.05	40	40	40	40	40	40	40	-

Table 4.1.2 BB Plot for Paper to Online Linking: ELA



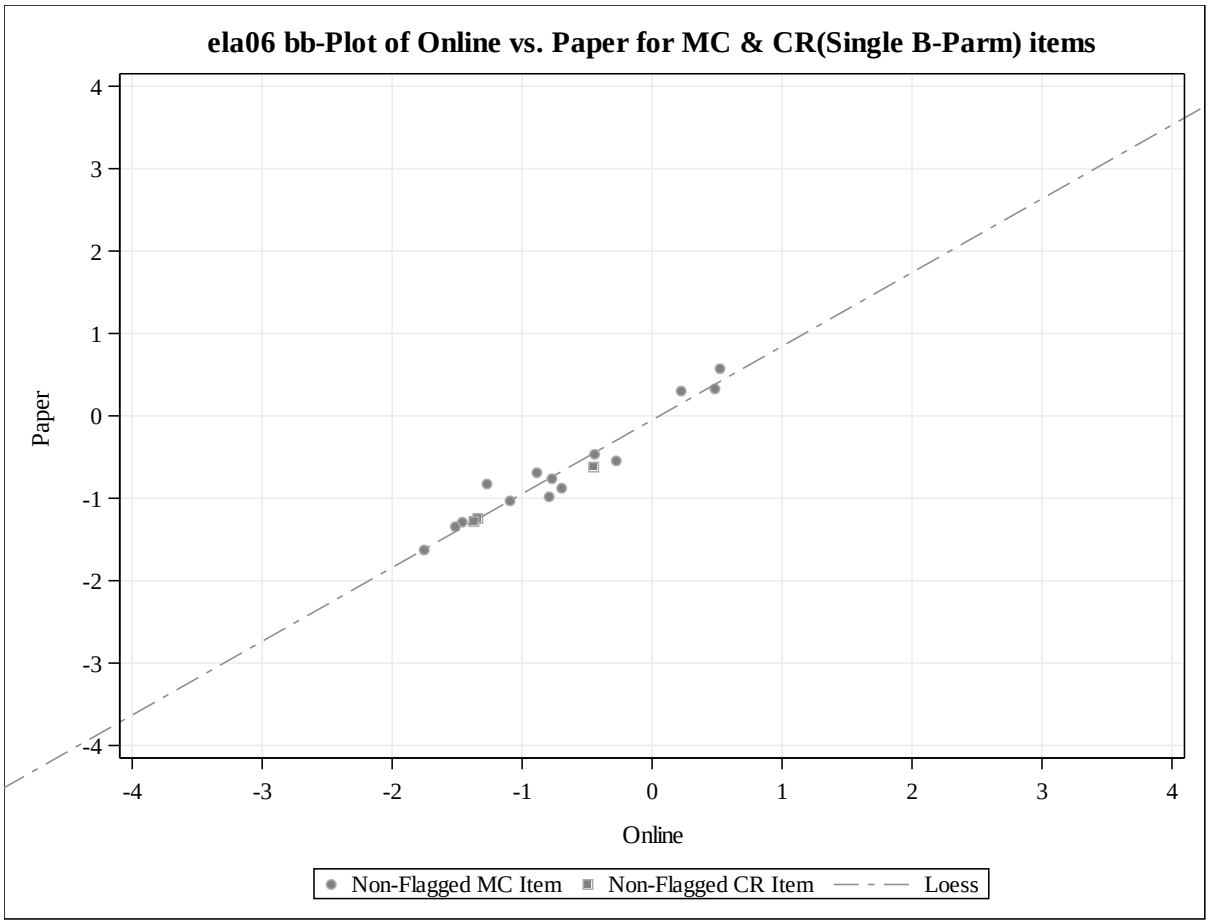
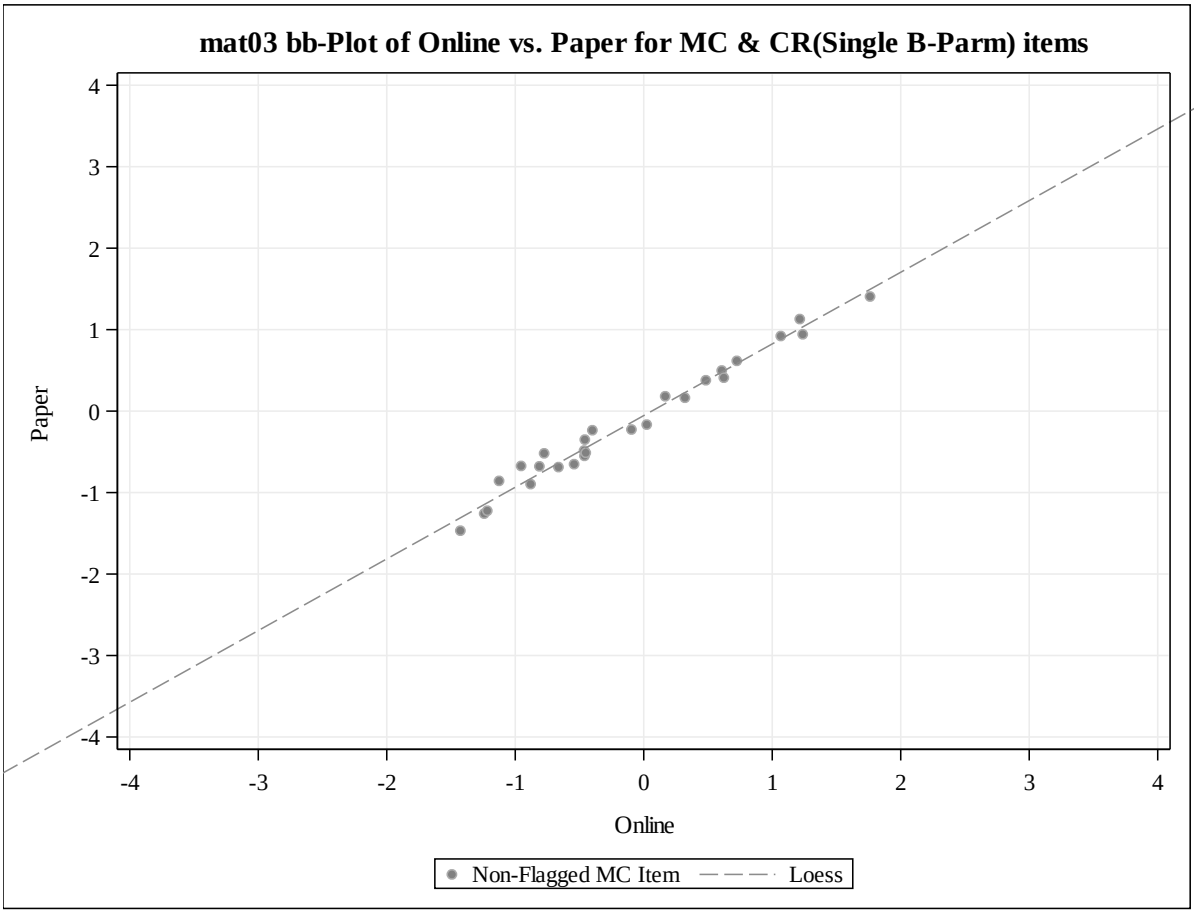

ela06 bb-Plot of Online vs. Paper for MC & CR(Single B-Parm) items
Paper
Online
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
Non-Flagged MC Item
Non-Flagged CR Item
Loess

Table 4.1.3 BB Plot for Paper to Online Linking: MATH



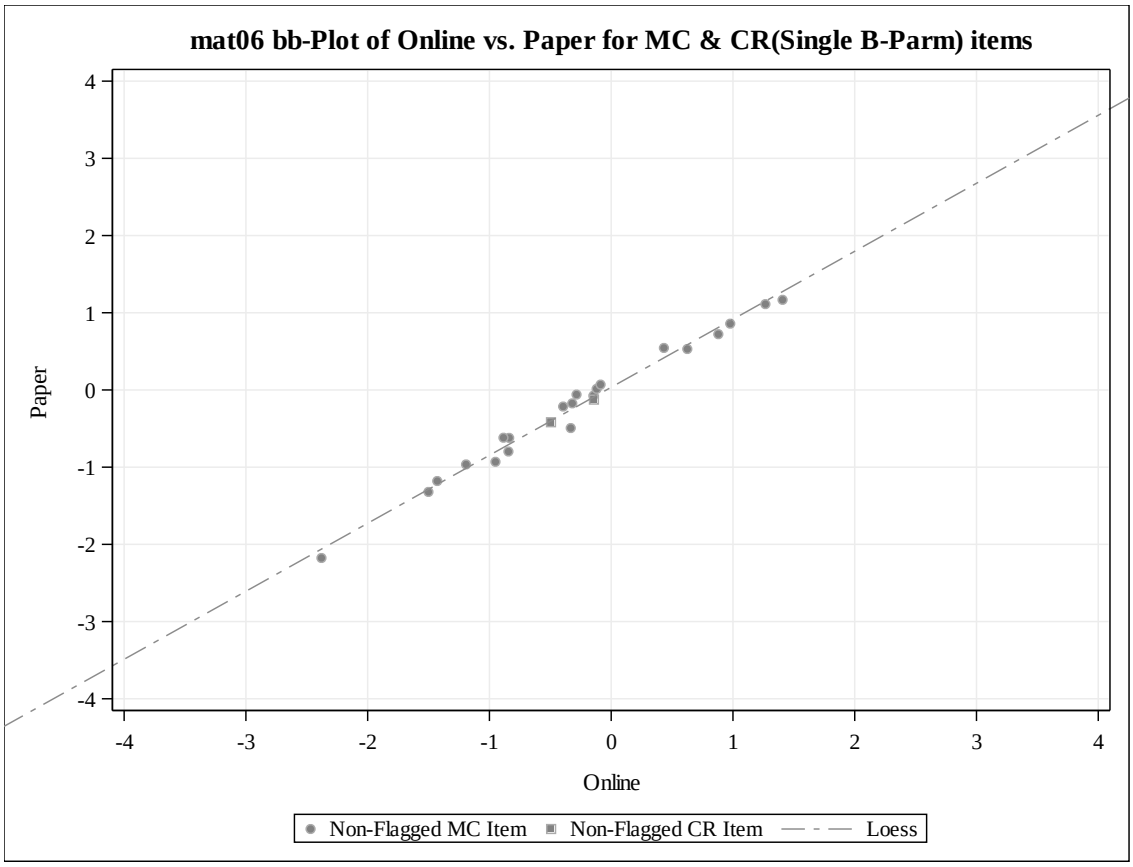
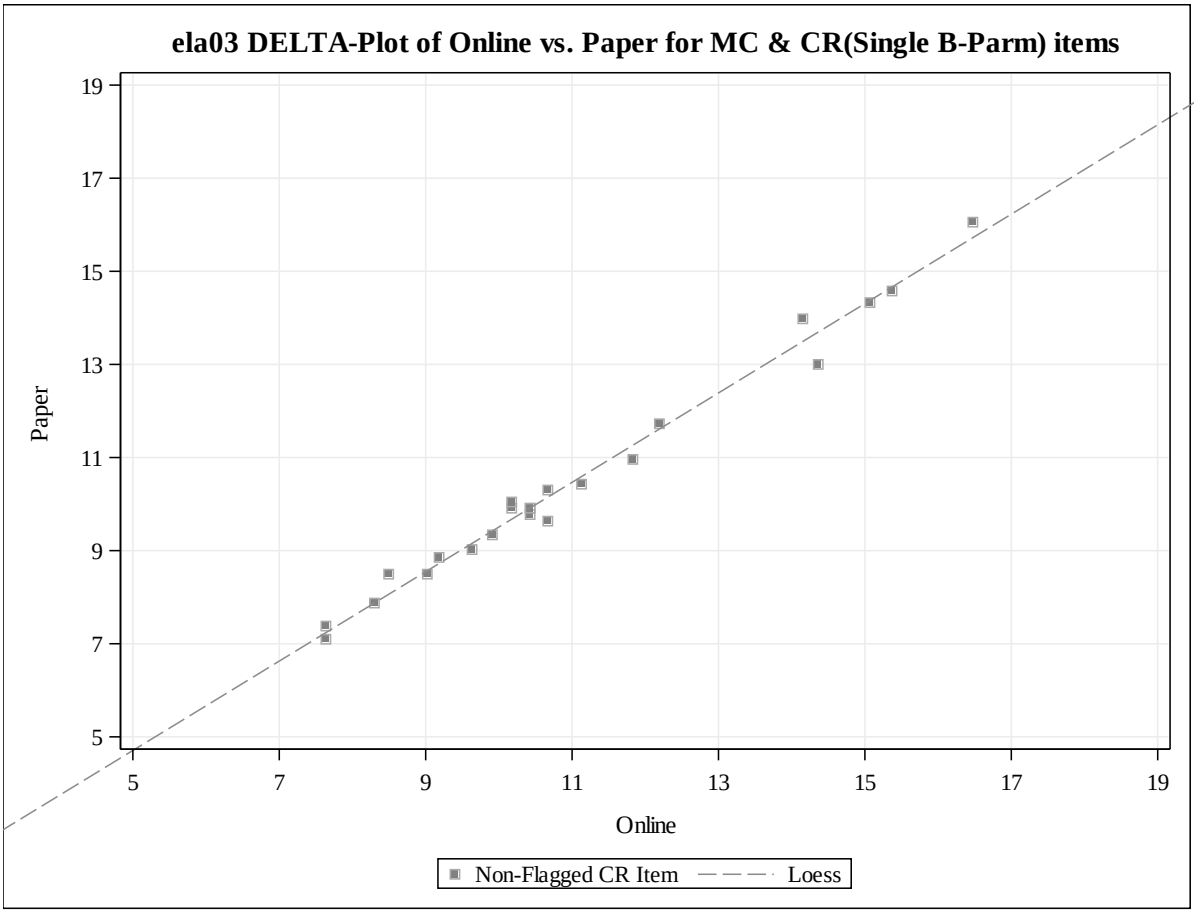

mat06 bb-Plot of Online vs. Paper for MC & CR(Single B-Parm) items
Paper
Online
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
Non-Flagged MC Item
Non-Flagged CR Item
Loess

Table 4.1.4 Delta Plot for Paper to Online Linking: ELA



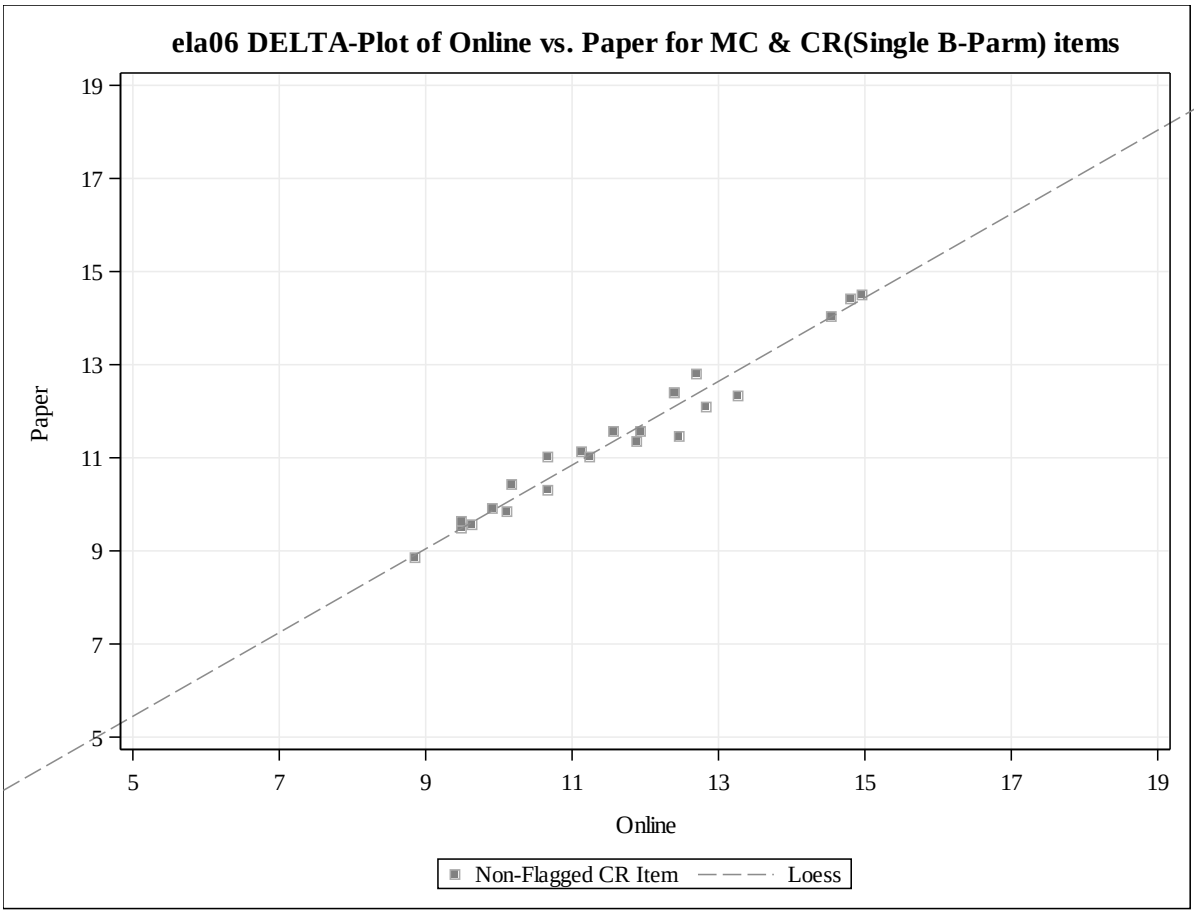
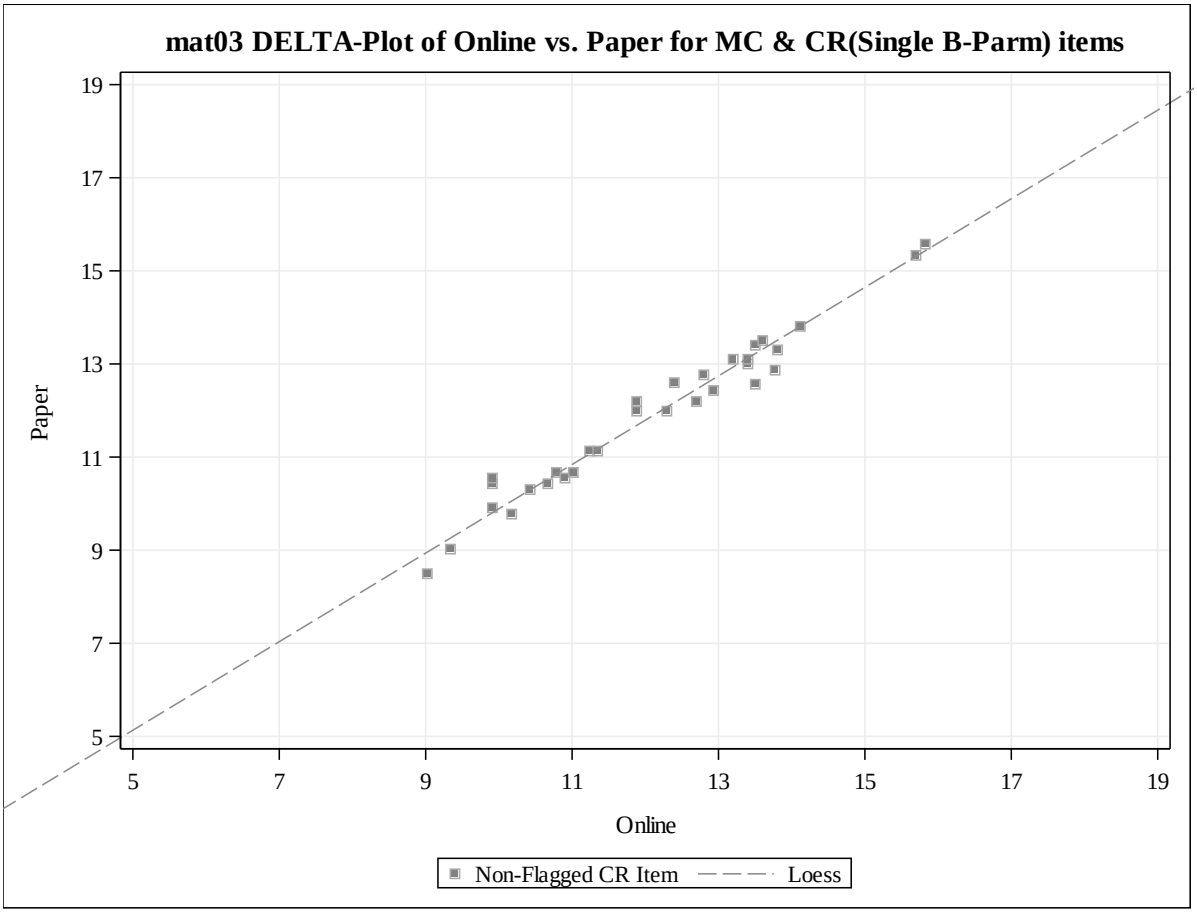

ela06 DELTA-Plot of Online vs. Paper for MC & CR(Single B-Parm) items
Paper
Online
19
17
15
13
11
9
7
5
5
7
9
11
13
15
17
19
Non-Flagged CR Item
Loess

Table 4.1.5 Delta Plot for Paper to Online Linking: MATH



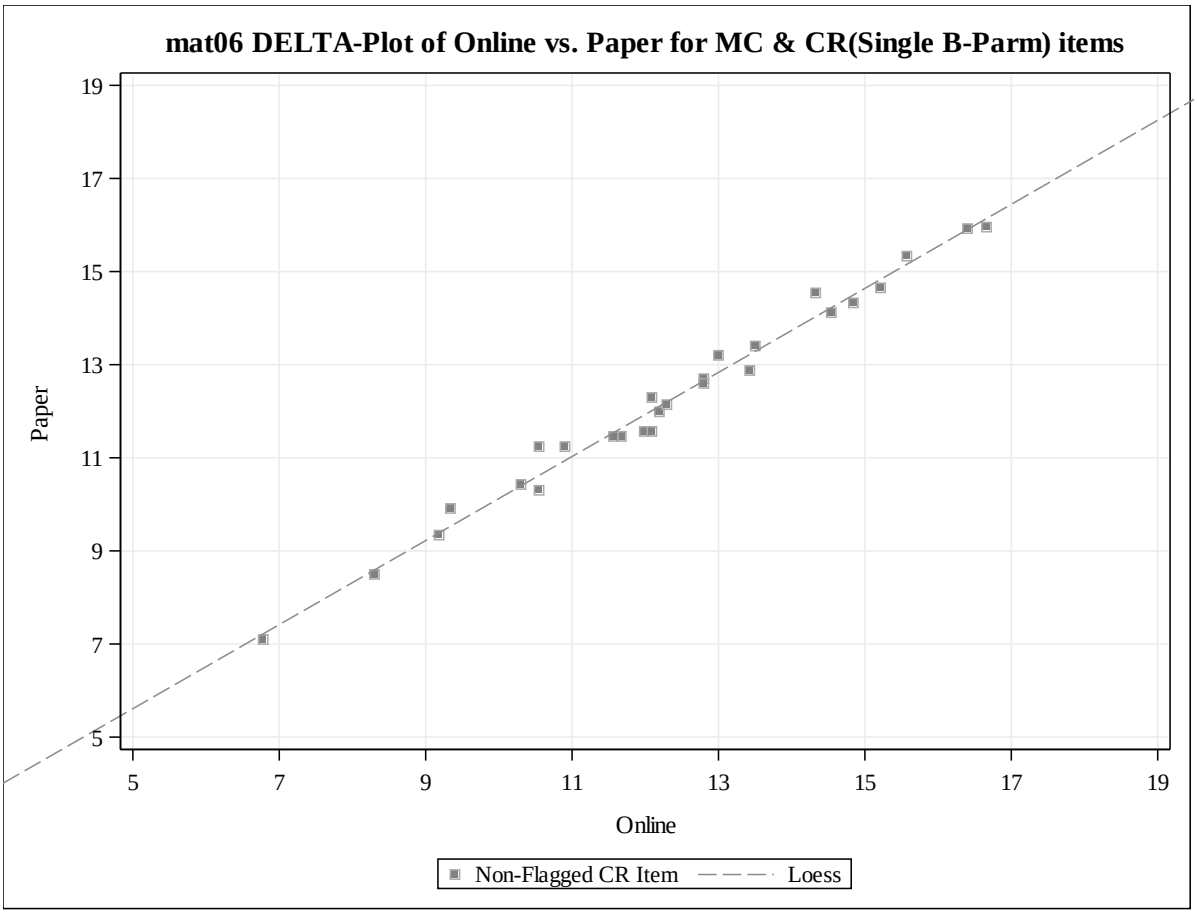

mat06 DELTA-Plot of Online vs. Paper for MC & CR(Single B-Parm) items
Paper
Online
5
7
9
11
13
15
17
19
Non-Flagged CR Item
Loess

Table 4.1.6 Paper to Online Yearly Linking TCC Differences between Measured Progress and Pearson: Mode Linking

Subject	Grade	Mode	TCC Max Difference
ELA	3	Paper	9.375E-6
	6	Paper	9.82E-6
MATH	3	Paper	0.000012
	6	Paper	6.52E-6

Table 4.1.7 Paper to Online Yearly Linking IRT Parameter Differences between Measured Progress and Pearson: Fixed Linking

Subject	Grade	difference	A	B	C	B1	B2	B3	B4	B5
MATH	4	< 0.05	40	40	40	40	40	40	40	-
	5	< 0.05	38	38	40	40	40	40	40	-
		>= 0.10 & < 0.25	0	2	0	0	0	0	0	-
		>= 0.25 & < 0.50	2	0	0	0	0	0	0	-
	7	< 0.05	40	40	40	40	40	40	40	-
	8	< 0.05	40	40	40	40	40	40	40	-

Note. Grades 4, 5, 7, and 8 yearly linking was conducted with fixed item parameter method

Table 4.1.8 Paper to Online Yearly Linking TCC Differences between Measured Progress and Pearson: Fixed Linking

Grade	Subject	Mode	TCC Max Difference
MATH	4	Paper	0.006805
	5	Paper	0.133935
	7	Paper	0.041618
	8	Paper	0.024588

Note. Grades 4, 5, 7, and 8 yearly linking was conducted with fixed item parameter method

Section 4.2 Mode Adjustment Results

Table 4.2.1 Mode Adjustment Differences between Measured Progress and Pearson

Grade	Subject	Number of Adjusted Scale Score Differences > 0
ELA	3	0
	6	0
MATH	3	0
	6	0