

Supplementary Online Materials

Table 1

Demographic Characteristics of Participating Sample

	Grade 3 (n=58)	Grade 5 (n=175)	Grade 6 (n=124)	Grade 7 (n=59)	Grade 8 (n=110)
Gender					
Male	32 (55%)	90 (51%)	55 (44%)	29 (49%)	47 (43%)
Female	26 (45%)	85 (49%)	69 (56%)	30 (51%)	63 (57%)
Ethnicity					
Native	0	2 (1%)	0	0	0
Black or African American	1 (2%)	11 (6%)	5 (4%)	0	22 (20%)
Hispanic or Latino	2 (3%)	11 (6%)	11 (9%)	0	2 (1.8%)
White	21 (36%)	107 (61%)	97 (78%)	54 (92%)	75 (68.2%)
Two or More Races	1 (2%)	13 (7%)	7 (6%)	3 (5%)	3 (2.7%)
Asian	33 (57%)	29 (17%)	4 (3%)	1 (2%)	8 (7.3%)
Economically Disadvantaged	1 (2%)	37 (21%)	50 (40%)	23 (39%)	21 (19%)
Special Education	2 (3 %)	15 (9%)	5 (4%)	4 (7%)	6 (6%)
MSTEP Reading, not proficient	11 (19%)	30 (17%)	35 (28%)	17 (29%)	11 (10%)
MSTEP Writing, not proficient	12 (21%)	26 (15%)	48 (39%)	30 (52%)	18 (16%)
English Language Learner	27 (47%)	8 (5%)	1 (1%)	1 (2%)	2 (2%)

Note. Ethnicity, economically disadvantaged, special education, and English language learner information was missing for two participants in Grade 5 and one participant in Grade 7.

Table 2

Counterbalanced Design of Passage-based Prompts

Grade and Form	Administered first	Administered second	Administered third	<i>n</i>
3a	Thanksgiving	Ice Sculpture	Bats	23
3b	Ice Sculpture	Bats	Thanksgiving	15
3c	Bats	Thanksgiving	Ice Sculpture	20
5a	Veteran	Edible Wrappers	Plastic Bottle Village	36
5b	Edible Wrappers	Plastic Bottle Village	Flies	38
5c	Plastic Bottle Village	Flies	Elevated Buses	40
5d	Flies	Elevated Buses	Veteran	31
5e	Elevated Buses	Veteran	Edible Wrappers	30
6a	Dogs	Volcanoes	Pelican Spider	49
6b	Volcanoes	Pelican Spider	Dogs	39
6c	Pelican Spider	Dogs	Volcanoes	36
7a	Furniture	Thorny Devil	Ghana	23
7b	Thorny Devil	Ghana	Furniture	19
7c	Ghana	Furniture	Thorny Devil	17
8a	Trapped Ants	Emojis	National Parks	39
8b	Emojis	National Parks	Trapped Ants	32
8c	National Parks	Trapped Ants	Emojis	39

Table 3

Variance Decomposition of CIWS Due to Student, Prompt, and Teacher Effects

Grade	Minutes	Variance			Intraclass Correlation		
		Teacher	Prompt	Student	Teacher	Prompt	Student
3	5	27.88	0	322.88	0.08	0.00	0.92
	7	43.33	0	625.15	0.06	0.00	0.94
	15	66.31	0	1805.16	0.04	0.00	0.96
5	5	34.51	19.8	583.95	0.05	0.03	0.91
	7	71.91	40.76	1003.74	0.06	0.04	0.90
	15	407.92	58.85	3481.67	0.10	0.01	0.88
6	5	217.71	23.73	652.73	0.24	0.03	0.73
	7	223.5	57.96	922.69	0.19	0.05	0.77
	15	649.78	61.95	1902.56	0.25	0.02	0.73
7	5	152.76	16.59	2689.14	0.05	0.01	0.94
	7	223.5	57.96	922.69	0.19	0.05	0.77
	15	649.78	61.95	1902.56	0.25	0.02	0.73
8	5		1.92	976.28		0.00	1.00
	7		18.86	1906.74		0.01	0.99
	15		96.33	6148.63		0.02	0.98

Note. There was only one teacher in Grade 8, therefore teacher variance was not modeled.

Table 4

Descriptive Statistics for Writing Prompts for Best Model from Each Dataset

Dataset	Grade	Minutes	<i>n</i>	Prompt 1		<i>n</i>	Prompt 2		<i>n</i>	Prompt 3		Best
				CIWS	SD		CIWS	SD		CIWS	SD	
1	3	5	54	17.91	19.20	56	20.75	20.28	53	17.61	15.29	C
2	3	7	54	24.39	28.46	56	26.02	26.93	52	22.73	20.41	C
3	3	15	54	36.39	50.43	56	34.61	43.83	58	18.79	48.39	C
4	5	5	82	42.34	24.93	92	33.22	23.66	101	42.58	26.53	M
5	5	7	82	57.01	33.01	93	43.73	29.37	101	56.99	34.96	M
6	5	15	82	97.64	59.92	93	77.56	61.00	101	97.05	63.50	M
7	6	5	116	45.08	30.36	120	35.36	25.66	116	35.89	25.25	M
8	6	7	118	58.66	41.60	119	47.47	34.86	116	47.16	34.11	M
9	6	15	118	81.97	60.25	120	70.37	60.02	116	70.76	66.80	M
10	7	5	56	33.64	19.52	59	46.98	25.14	59	47.86	85.02	M
11	7	7	56	45.86	25.89	59	62.78	34.27	59	52.53	36.73	M
12	7	15	56	73.32	36.47	59	92.56	55.90	59	82.39	50.58	C
13	8	5	105	68.43	29.80	105	74.31	31.65	104	74.15	32.21	C
14	8	7	107	88.38	41.45	105	97.62	44.57	104	99.76	44.88	M
15	8	15	107	138.60	72.96	105	148.10	73.48	105	163.07	87.73	C

Note. Minutes = number of minutes writing; CIWS= writing metric: correct minus incorrect writing sequence. Best = Best model selected. C = Configural; M = Metric; S = Scalar; U = Uniqueness.

Table 5

Measurement Invariance Models by Grade and Minutes with Model Indices

Dataset	Model	Grade	Minutes	Parameters	LL	AIC	aBIC
1	Uniqueness	3	5	3	-651.84	1309.68	1306.43
	Scalar	3	5	5	-651.79	1313.59	1308.17
	Metric	3	5	7	-649.87	1313.74	1306.15
	Configural	3	5	9	-640.53	1299.07	1289.31
2	Uniqueness	3	7	3	-687.22	1380.43	1377.18
	Scalar	3	7	5	-686.19	1382.38	1376.96
	Metric	3	7	7	-684.98	1383.96	1376.37
	Configural	3	7	9	-671.14	1360.28	1350.52
3	Uniqueness	3	15	3	-778.96	1563.91	1560.66
	Scalar	3	15	5	-778.65	1567.31	1561.89
	Metric	3	15	7	-777.20	1568.40	1560.82
	Configural	3	15	9	-758.90	1535.81	1526.06
4	Uniqueness	5	5	3	-1231.54	2469.08	2468.83
	Scalar	5	5	5	-1230.01	2470.03	2469.60
	Metric	5	5	7	-1219.55	2453.10	2452.51
	Configural	5	5	9	-1219.34	2456.68	2455.92
5	Uniqueness	5	7	3	-1308.85	2623.71	2623.45
	Scalar	5	7	5	-1306.86	2623.72	2623.30
	Metric	5	7	7	-1295.08	2604.16	2603.57
	Configural	5	7	9	-1294.10	2606.19	2605.43
6	Uniqueness	5	15	3	-1476.55	2959.11	2958.86
	Scalar	5	15	5	-1474.42	2958.85	2958.42
	Metric	5	15	7	-1469.40	2952.80	2952.21
	Configural	5	15	9	-1467.18	2952.36	2951.60
7	Uniqueness	6	5	3	-1594.37	3194.75	3193.72
	Scalar	6	5	5	-1586.20	3182.41	3180.70
	Metric	6	5	7	-1576.33	3166.66	3164.27
	Configural	6	5	9	-1575.93	3169.85	3166.78
8	Uniqueness	6	7	3	-1692.89	3391.78	3390.76
	Scalar	6	7	5	-1682.11	3374.22	3372.51
	Metric	6	7	7	-1672.87	3359.73	3357.34
	Configural	6	7	9	-1672.30	3362.60	3359.52

	Model	Grade	Minutes	Parameters	LL	AIC	aBIC
9	Uniqueness	6	15	3	-1862.97	3731.95	3730.92
	Scalar	6	15	5	-1859.79	3729.58	3727.87
	Metric	6	15	7	-1855.42	3724.84	3722.45
	Configural	6	15	9	-1852.58	3723.16	3720.08
10	Uniqueness	7	5	3	-936.37	1878.74	1875.54
	Scalar	7	5	5	-864.76	1739.52	1734.18
	Metric	7	5	7	-855.75	1725.49	1718.02
	Configural	7	5	9	-855.18	1728.36	1718.76
11	Uniqueness	7	7	3	-840.23	1686.46	1683.26
	Scalar	7	7	5	-838.04	1686.08	1680.74
	Metric	7	7	7	-828.94	1671.87	1664.40
	Configural	7	7	9	-825.82	1669.64	1660.04
12	Uniqueness	7	15	3	-898.89	1803.78	1800.58
	Scalar	7	15	5	-897.17	1804.35	1799.01
	Metric	7	15	7	-891.70	1797.39	1789.92
	Configural	7	15	9	-884.00	1785.99	1776.39
13	Uniqueness	8	5	3	-1442.23	2890.46	2889.08
	Scalar	8	5	5	-1440.74	2891.48	2889.18
	Metric	8	5	7	-1437.33	2888.65	2885.44
	Configural	8	5	9	-1435.28	2888.55	2884.41
14	Uniqueness	8	7	3	-1559.01	3124.03	3122.65
	Scalar	8	7	5	-1558.87	3127.74	3125.45
	Metric	8	7	7	-1553.69	3121.37	3118.15
	Configural	8	7	9	-1552.78	3123.56	3119.43
15	Uniqueness	8	15	3	-1724.72	3455.43	3454.05
	Scalar	8	15	5	-1721.97	3453.95	3451.65
	Metric	8	15	7	-1712.69	3439.38	3436.17
	Configural	8	15	9	-1708.38	3434.76	3430.63

Notes. Minutes = number of minutes writing; Parameters = Number of free parameters; LL = Loglikelihood; AIC – Akaike’s Information Criteria; aBIC = Adjusted Bayesian Information Criteria.

Best model for each dataset indicated by dashed box.

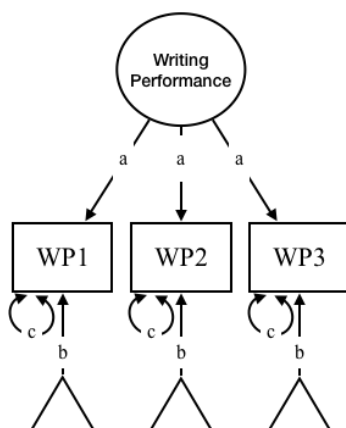


Figure 1. Writing Performance with Each Set of Parameters Constrained to Equality.

Note. a = factor loadings. b = intercepts. c = residual variances