

To: Shaun Bates, Lisa Sireno

**Dept: Missouri Department of Elementary and
Secondary Education**

Location: Missouri

**Subject: Analysis of Item Response Time and
Test Time for MAP: ELA, Mathematics, and
Science**

From DRC: Joanna Tomkowicz

Dept: Psychometric Services

Location: Maple Grove, Minnesota

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This document presents the results of the analysis of the item response time by item type and the analysis of student total test time for Missouri summative assessments in English Language Arts/Literacy (ELA), Mathematics, and Science. The response times for individual items and the total test time were captured during the on-line test administration. The analyses were done separately for each content area. The analyses were done on regular forms only: core (CA) forms and performance event (PA) forms. Items on the Spanish version of the Mathematics assessment were excluded from the data analyses due to very low number of students (typically fewer than 50) who took these forms. Braille, Large Print, and paper-and-pencil forms were also excluded from the data analysis. Student responses to items included in these forms were 'transcribed' by a teacher to an on-line system; therefore the captured time for 'transcribed' forms reflects transcription time and not actual student response time.

Analysis of item response time by item type

Analysis of frequency distributions of response times to individual items show some very extreme times for individual students. Very long response times to multiple choice items may be resulting, for example, from students taking breaks in the middle of the test or may be due to unexpected internet connectivity interruption in which case student responses are captured and retained until the connectivity is restored. An extremely short response time may indicate that a student skipped an item entirely or clicked on it without reading. To minimize the effect of the response time outliers on the average item response time, the top and bottom 1% of extreme response times were excluded from the data analysis.

The item response times were summarized by item type: multiple-choice items (MC), constructed-response items (CR), and technology-enhanced items (TE). Separate summaries were produced for items included in CA and PA forms. Tables 1, 2, and 3 show the following statistics for ELA, Mathematics, and Science by item type: number of items, mean response time, median response time, standard deviation of the response time, and minimum and maximum response times. All response times are expressed in minutes and rounded to the nearest tenth of a minute.

DRC has also computed the response time summary statistics for individual items. We will be happy to provide these data upon request.

Analysis of total test time

Data for students who were administered on-line summative tests were used to compute the total test summary statistics. The test time for individual students is computed by the eTesting system from the time a student begins the test until he or she either completes the test by using the 'End Test' button or exits the test without completion. A student can log back in to continue the testing multiple times. If a student does not end or pause the test properly (e.g., a student leaves the room without proper test pausing or logging out), the time of test inactivity is counted towards the total test time. Such test will be eventually ended or paused either by a student or a system and the inactivity time will

artificially increase the total test time for this student. Alternatively, if a student navigates through the test without careful reading or answering test items the total test time may be artificially low. In order to minimize the effect of outliers on the average test time the top and bottom 1% of cases with the shortest and longest test times were excluded from the data analysis.

Tables 4, 5, and 6 show the following statistics for ELA, Mathematics, and Science: number of students who took a given test form, mean test time for this form, standard deviation of the test time, minimum and maximum test times, and test time at selected percentiles for this test form. All test times are expressed in minutes and rounded to the nearest tenth of a minute.

Note that in each case the mean is slightly higher than the median (the test time at the 50th percentile) which indicates a positively skewed distribution. This means that the average test times are affected, to some degree, by extreme cases with very long test time. However, the differences between the mean and the median test times are small.

The percentiles indicate the test time (in minutes) below which a given percentage of students fall. For example, the test time at the 50th percentile for ELA Grade 3, Form CA1 is approximately 104 minutes (see Table 4). This means that 50 percent of Grade 3 students who took this form on-line completed it in less than 104 minutes. The 50th percentile (or the median) is the midpoint of the frequency distribution of test time with an equal proportion of students (50%) falling above or below it. It is not affected by the extreme values and accurately reflects the middle of the data set. The test time at the 75th percentile for the same form is approximately 134 minutes meaning that 75 percent of Grade 3 students who were administered form CA1 completed it in less than 134 minutes. If you consider the difference between the test time at the 50th and the 75th percentile, you can conclude that 25 percent of Grade 3 students who took ELA form CA1 spent between 104 and 134 minutes on this form. Percentiles are often used to show the distribution of values.

Table 1. MAP 2015 ELA/Literacy average response time (in minutes) by item type

Grade	Form	Item Type	N items	Mean	Median	Std. Deviation	Minimum	Maximum
3	CA	CR	7	2.1	1.3	2.5	0.8	7.7
		MC	64	2.2	1.7	1.5	0.7	6.8
		TE	30	2.4	1.5	2.1	0.6	7.6
		Total	101	2.3	1.6	1.8	0.6	7.7
4	CA	CR	6	6.1	6.1	1.5	4.4	7.7
		MC	49	1.7	1.4	1.2	0.6	5.8
		TE	42	2.3	2.0	1.4	1.1	7.5
		Total	97	2.3	1.7	1.7	0.6	7.7
5	CA	CR	5	8.3	8.5	2.2	5.6	11.2
		MC	53	1.6	1.3	1.0	0.6	5.6
		TE	42	2.6	2.0	2.0	0.6	8.4
	PA	CR	9	19.2	11.2	11.0	7.8	33.2
		TE	3	11.9	15.3	6.5	4.4	16.0
	CA/PA	Total	112	4.0	1.8	6.0	0.6	33.2
6	CA	CR	7	6.2	6.0	1.5	4.5	8.3
		MC	52	2.1	1.6	1.6	0.7	6.8
		TE	43	1.9	1.6	0.9	0.7	4.9
		Total	102	2.3	1.7	1.7	0.7	8.3
7	CA	CR	7	5.2	5.0	0.8	4.2	6.4
		MC	44	1.6	1.3	1.2	0.5	6.7
		TE	52	1.9	1.6	1.1	0.6	5.7
		Total	103	2.0	1.6	1.4	0.5	6.7
8	CA	CR	5	5.4	4.4	2.6	3.4	9.7
		MC	51	1.6	1.2	1.3	0.4	6.0
		TE	46	1.9	1.6	1.1	0.6	5.2
	PA	MC	2	2.2	2.2	.3	2.0	2.4
		CR	9	19.9	21.7	9.1	10.2	31.4
	TE	1	12.1	12.1	n/a	12.1	12.1	
CA/PA	Total	114	3.5	1.6	5.7	0.4	31.4	
Total (all grades)	CA	CR	37	5.4	5.2	2.6	0.8	11.2
		MC	313	1.9	1.4	1.3	0.4	6.8
		TE	255	2.1	1.7	1.5	0.6	8.4
	PA	CR	18	19.6	16.8	9.8	7.8	33.2
		MC	2	2.2	2.2	0.3	2.0	2.4
	TE	4	12.0	13.7	5.3	4.4	16.0	
CA/PA	Total	629	2.8	1.7	3.8	0.4	33.2	

Table 2. MAP 2015 Mathematics average response time (in minutes) by item type

Grade	Form	Item Type	N items	Mean	Median	Std. Deviation	Minimum	Maximum
3	CA	MC	11	1.6	1.5	0.6	0.6	2.3
		TE	54	1.8	1.7	0.7	0.6	3.3
		Total	65	1.8	1.7	0.7	0.6	3.3
4	CA	MC	13	1.7	1.7	0.9	0.8	4.2
		TE	54	2.0	1.8	0.9	0.7	5.2
		Total	67	1.9	1.8	0.9	0.7	5.2
5	CA	MC	28	1.4	1.3	0.5	0.6	2.9
		TE	41	2.5	2.1	1.2	0.9	5.8
	PA	CR	6	9.1	8.7	1.7	7.4	11.4
		TE	6	4.3	4.1	0.9	3.4	5.5
	CA/PA	Total	81	2.7	1.9	2.2	0.6	11.4
6	CA	MC	11	1.4	1.4	0.4	0.8	2.1
		TE	55	1.7	1.6	0.7	0.6	3.7
		Total	66	1.7	1.6	0.7	0.6	3.7
7	CA	CR	1	4.2	4.2	n/a	4.2	4.2
		MC	14	1.5	1.2	0.8	0.7	3.0
		TE	47	1.9	1.7	0.8	0.8	4.7
		Total	62	1.8	1.6	0.8	0.7	4.7
8	CA	CR	1	4.5	4.5	n/a	4.5	4.5
		MC	23	1.3	1.4	0.4	0.8	2.4
		TE	40	2.0	2.0	0.7	0.8	3.6
	PA	CR	4	5.2	5.0	0.5	4.7	5.9
		TE	8	3.0	2.9	1.0	1.8	4.4
CA/PA	Total	76	2.1	1.7	1.1	0.8	5.9	
Total (all grades)	CA	CR	2	4.4	4.4	0.2	4.2	4.5
		MC	100	1.5	1.4	0.6	0.6	4.2
		TE	291	2.0	1.8	0.9	0.6	5.8
	PA	CR	10	7.5	7.4	2.4	4.7	11.4
		TE	14	3.6	3.4	1.2	1.8	5.5
	CA/PA	Total	417	2.0	1.7	1.3	0.6	11.4

Table 3. MAP 2015 Science average response time (in minutes) by item type

Grade	Form	Item Type	N items	Mean	Median	Std. Deviation	Minimum	Maximum
5	CA	CR	32	3.2	3.1	1.2	1.1	6.3
		MC	28	0.7	0.7	0.2	0.5	1.1
		TE	1	7.8	7.8	n/a	7.8	7.8
		Total	61	2.1	1.6	1.7	0.5	7.8
8	CA	CR	34	2.9	2.7	1.1	1.5	6.0
		MC	26	0.6	0.7	0.2	0.3	1.1
		TE	2	5.6	5.6	2.1	4.1	7.1
		Total	62	2.0	1.8	1.5	.3	7.1
Total (all grades)	CA	CR	66	3.0	3.0	1.2	1.1	6.3
		MC	54	0.7	0.7	0.2	0.3	1.1
		TE	3	6.3	7.1	1.9	4.1	7.8
		Total	123	2.1	1.8	1.6	0.3	7.8

Table 4. MAP ELA Total Test Time by Grade and Form

Grade	Form	Student Count	Total Test Time Summary				Total Test Time at Selected Percentiles									
			Mean Test Time	Test Time St. Dev	Min Test Time	Max Test Time	P1	P5	P10	P25	P50 (Median)	P75	P90	P95	P99	
03	CA1	29818	111.6	40.7	40.3	265.8	46.3	57.7	65.8	81.9	104.3	134.1	168.4	190.3	233.3	
03	CA2	18262	114.8	42.0	40.9	280.6	47.8	60.2	68.2	84.7	106.7	137.0	172.2	195.9	245.4	
03	CA3	18217	111.2	39.9	41.9	266.0	47.5	59.0	66.8	82.2	103.8	132.5	166.0	189.4	234.8	
04	CA1	29036	112.3	38.6	43.0	261.3	49.9	61.0	69.1	84.5	105.4	133.1	165.4	187.7	229.8	
04	CA2	18131	111.3	37.5	44.5	252.7	51.0	62.2	69.7	84.0	104.3	131.6	163.4	185.7	225.7	
04	CA3	18143	115.2	39.1	47.6	270.8	53.4	64.1	71.8	87.0	107.9	135.9	168.7	191.8	237.8	
05	CA1	28547	108.5	35.8	42.6	242.5	49.4	60.8	68.1	82.9	102.2	127.8	157.5	178.5	217.2	
05	CA2	18052	107.6	34.5	44.4	240.0	51.8	62.2	69.4	83.1	101.4	125.9	154.9	175.8	212.7	
05	CA3	18136	106.7	34.1	44.4	238.8	50.3	61.3	68.6	82.1	100.9	124.8	153.0	173.4	212.7	
05	PA1	28582	98.0	48.4	17.4	276.4	23.2	35.4	44.4	62.2	88.7	123.8	166.0	194.5	244.8	
05	PA2	18033	96.4	46.0	20.9	266.7	26.7	37.7	45.9	62.8	87.0	120.7	161.5	188.7	236.4	
05	PA3	18094	96.5	47.0	20.1	272.6	25.2	37.0	45.1	62.2	87.2	121.0	161.6	191.1	241.2	
06	CA1	28898	106.8	33.4	41.1	231.6	48.3	61.1	68.8	83.2	101.8	125.3	151.7	171.0	207.8	
06	CA2	17743	113.7	34.5	46.6	244.1	54.7	66.8	74.6	89.2	108.3	132.5	160.5	180.4	218.3	
06	CA3	17784	113.4	34.7	46.0	251.1	52.7	65.5	74.0	89.2	108.4	132.1	159.6	179.7	219.7	
07	CA1	28042	101.6	31.2	38.5	215.0	45.7	57.4	65.2	79.3	97.4	119.5	143.8	160.3	192.2	
07	CA2	18179	96.2	27.8	41.1	195.5	46.8	57.0	63.7	76.0	92.6	112.0	134.3	148.7	177.0	
07	CA3	18124	97.1	27.9	41.4	198.9	47.6	57.9	64.8	77.2	93.2	112.8	134.8	150.3	178.6	
08	CA1	28259	98.5	31.1	31.8	210.0	39.2	53.2	61.8	76.8	95.0	116.3	139.8	156.6	188.6	
08	CA2	18198	95.2	28.3	35.4	200.1	42.3	54.3	61.7	75.2	92.0	111.5	132.8	147.5	177.0	
08	CA3	18364	95.8	28.7	35.4	202.7	42.9	54.6	62.0	75.3	92.8	112.1	133.5	149.1	179.8	
08	PA1	28255	88.8	43.1	13.4	252.1	18.8	30.4	39.6	57.7	81.8	112.9	147.6	171.0	219.8	
08	PA2	18201	90.9	42.0	16.5	244.1	21.8	34.2	42.1	60.2	84.4	114.7	148.1	172.7	217.0	
08	PA3	18301	86.1	39.7	15.4	235.0	21.2	32.6	40.6	57.2	79.7	108.2	140.0	162.7	205.3	

Table 5. MAP Mathematics Total Test Time by Grade and Form

Grade	Form	Student Count	Total Test Time Summary				Total Test Time at Selected Percentiles									
			Mean Test Time	Test Time St. Dev	Min Test Time	Max Test Time	P1	P5	P10	P25	P50 (Median)	P75	P90	P95	P99	
03	CA1	32118	64.4	27.6	21.9	176.5	24.7	30.3	34.8	44.3	58.5	78.2	102.3	119.7	154.2	
03	CA2	17066	64.7	27.1	24.3	180.7	27.2	32.4	36.4	45.3	58.5	77.4	101.5	119.7	155.2	
03	CA3	17159	64.2	27.2	23.4	178.3	26.0	31.5	35.7	44.5	58.2	77.3	101.2	119.6	155.0	
04	CA1	31246	66.8	27.5	23.5	173.1	26.5	32.5	37.1	46.7	61.1	80.8	104.8	121.7	153.8	
04	CA2	17034	70.0	28.2	26.8	182.7	29.5	35.6	40.1	49.4	63.7	83.7	110.0	127.4	159.6	
04	CA3	17076	69.7	27.3	28.1	186.5	31.0	36.5	40.8	49.9	63.6	83.3	106.6	124.2	158.6	
05	CA1	30576	60.9	24.4	22.0	159.9	25.1	31.1	35.3	43.5	55.4	72.8	94.5	110.0	139.6	
05	CA2	17155	63.9	24.8	26.2	162.7	29.2	34.4	38.2	46.1	58.1	75.5	99.1	114.8	143.5	
05	CA3	17034	64.9	24.7	26.0	164.1	28.9	34.9	39.0	47.1	59.3	77.1	99.3	115.6	143.4	
05	PA1	39086	48.9	23.9	10.5	142.6	13.1	18.5	22.9	31.4	44.4	61.5	81.6	96.2	124.5	
05	PA2	25642	53.4	26.2	13.1	158.6	15.7	21.1	25.2	34.2	47.8	67.0	89.1	105.4	137.8	
06	CA1	29619	58.5	20.6	22.4	144.2	25.6	31.8	36.0	43.8	54.6	68.8	86.6	99.0	124.4	
06	CA2	17393	60.5	20.3	24.4	144.8	28.2	34.2	38.2	46.0	56.8	71.1	88.0	99.9	124.8	
06	CA3	17400	58.3	19.2	24.9	137.4	28.2	33.2	36.8	44.5	54.7	68.3	84.4	95.9	120.2	
07	CA1	28401	65.9	22.4	22.0	152.4	26.5	34.5	40.0	49.9	62.8	78.3	95.8	108.4	133.4	
07	CA2	17497	60.1	20.1	23.1	136.3	26.6	33.0	37.3	45.6	56.9	70.9	87.5	99.0	122.1	
07	CA3	17525	62.9	20.8	23.9	140.7	27.5	34.7	39.4	48.0	59.5	74.0	91.6	104.0	125.6	
08	CA1	23419	60.8	21.0	19.4	143.5	23.4	31.2	36.4	45.8	58.1	72.5	88.7	99.9	124.6	
08	CA2	13988	61.1	20.7	21.0	140.1	25.1	32.3	37.3	46.4	58.1	72.7	88.8	100.3	124.7	
08	CA3	14044	61.0	21.0	20.2	143.8	24.0	31.7	36.9	46.0	58.2	72.7	88.9	101.0	124.3	
08	PA1	30360	26.5	12.6	5.1	79.5	6.8	10.3	12.7	17.6	24.1	33.0	43.4	51.0	66.0	
08	PA2	21004	27.3	12.5	5.8	78.4	7.5	11.1	13.6	18.4	24.9	33.7	44.0	51.6	66.5	

Table 6. MAP Science Total Test Time by Grade and Form

Grade	Form	Student Count	Total Test Time Summary				Total Test Time at Selected Percentiles									
			Mean Test Time	Test Time St. Dev	Min Test Time	Max Test Time	P1	P5	P10	P25	P50 (Median)	P75	P90	P95	P99	
05	CA2	39313	105.9	37.7	40.4	254.5	47.4	58.0	65.1	78.9	98.3	125.0	158.2	180.9	225.3	
05	CA3	25756	96.6	34.0	42.8	236.2	46.8	54.4	60.1	72.0	89.4	113.3	144.2	164.5	205.2	
08	CA2	37953	87.0	27.5	37.1	193.9	42.3	50.8	56.5	67.6	82.1	101.2	124.2	141.3	173.5	
08	CA3	26928	83.9	25.9	36.2	185.1	41.4	49.6	54.7	65.5	79.5	97.7	118.8	134.5	164.0	