CSDE

CONNECTICUT STATE DEPARTMENT OF EDUCATION

Time Spent Taking the Smarter Balanced Assessment

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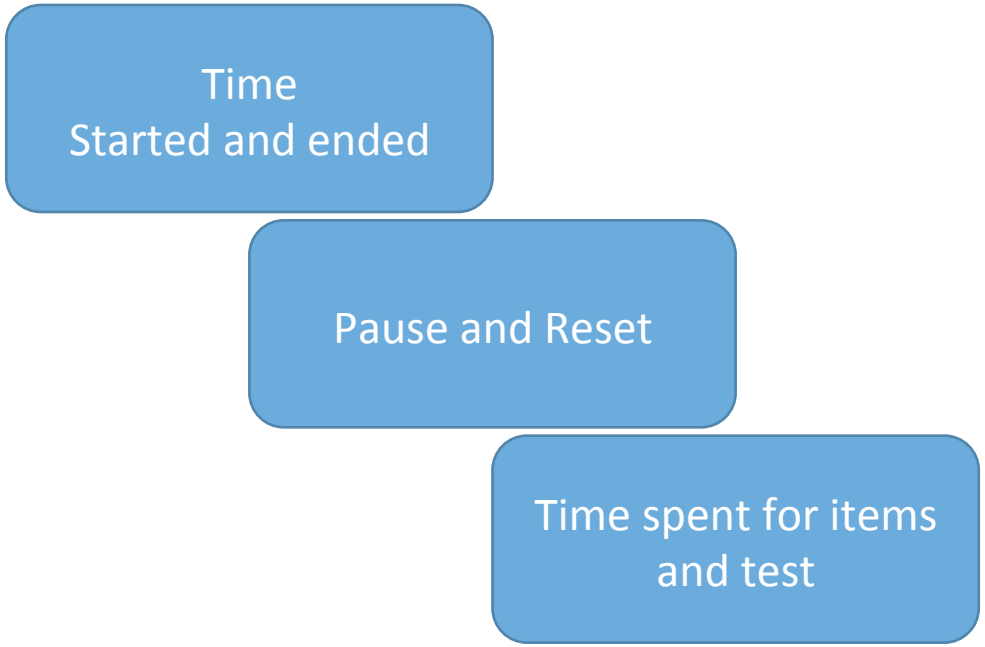
Performance Matters Forum 2018

Introduction—Response Time

- What do we mean response time?

Response time reflects the time it takes a student to complete a test. Computer-based Tests make possible to collect response times of a student on each item.



Introduction—Response Time

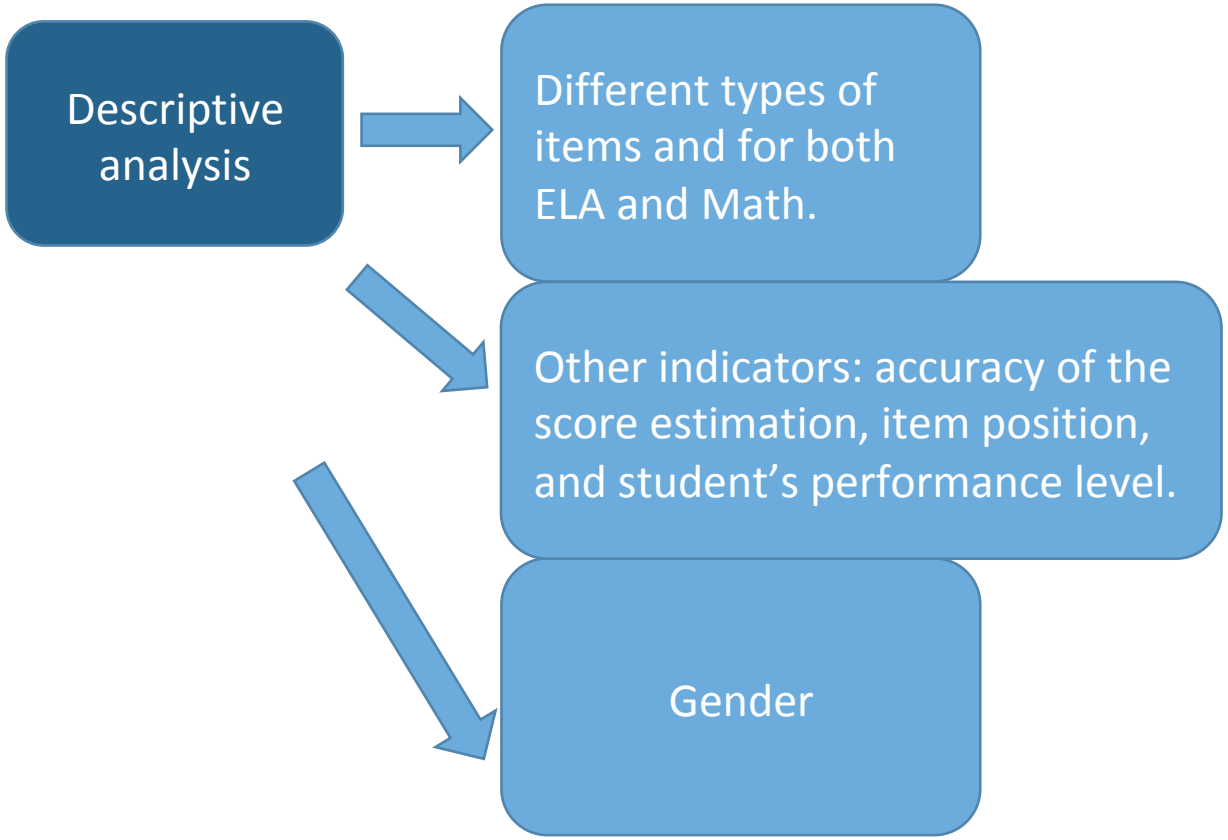
- Why do we care about response time?

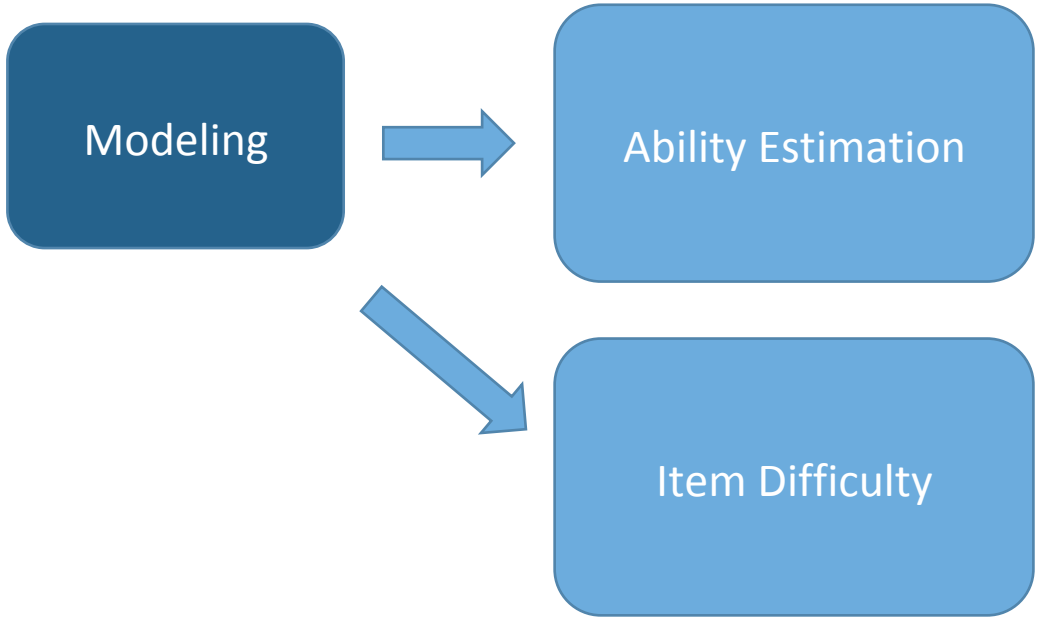
Provide information that can be used to enhance test development and administration.

- Identify which item types students spend more time.
- Total time spent during the test.
- Monitor aberrant behaviors, such as cheating and guessing.

Introduction—Current Study

In this study, we examined response time of the Connecticut 2017 Smarter Balanced assessment.





Test Response Time

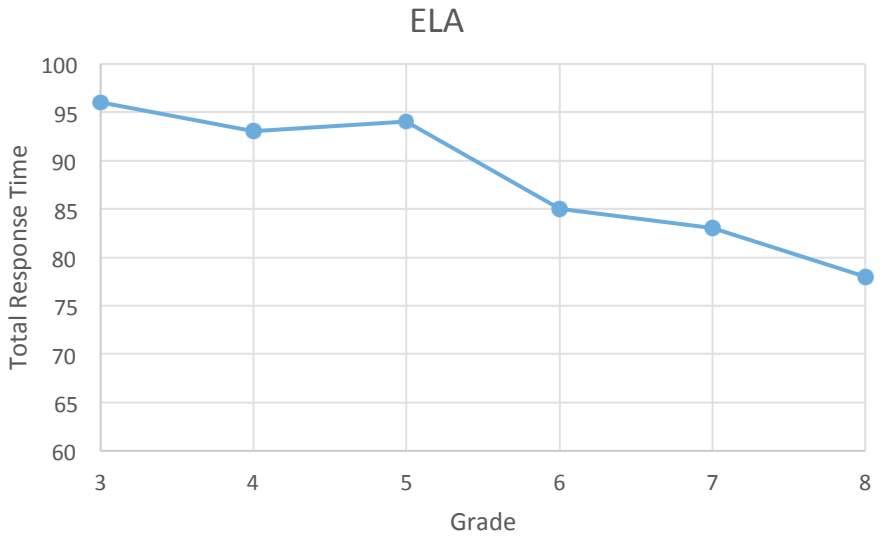
Table 1. Average test response time.		
Grade	ELA (N=40-41)*	MATH (N=34-35)
G3	96	78
G4	93	84
G5	94	83
G6	85	85
G7	83	77
G8	78	78
*** N is the number of items.**		

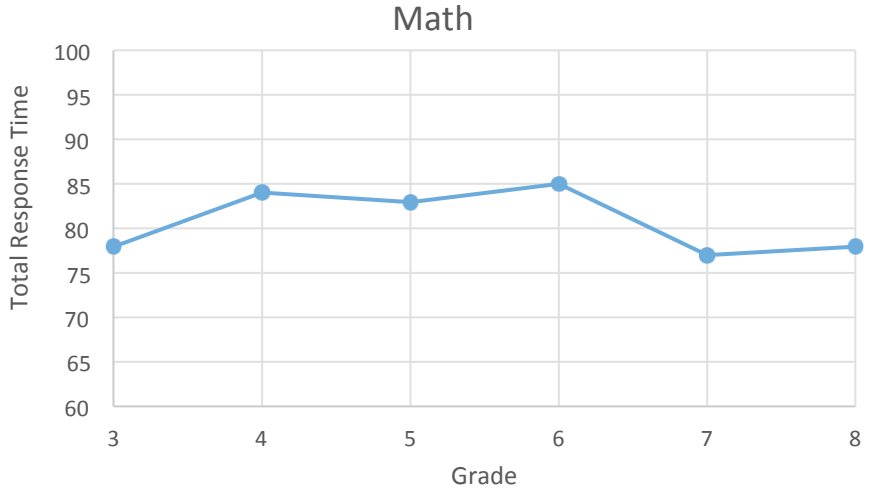
The average test response time (minutes) for students in each grade are and shown in this table.

The average testing time for ELA is around 80 to 96 minutes.

For math, the average testing time is around 80 minutes.

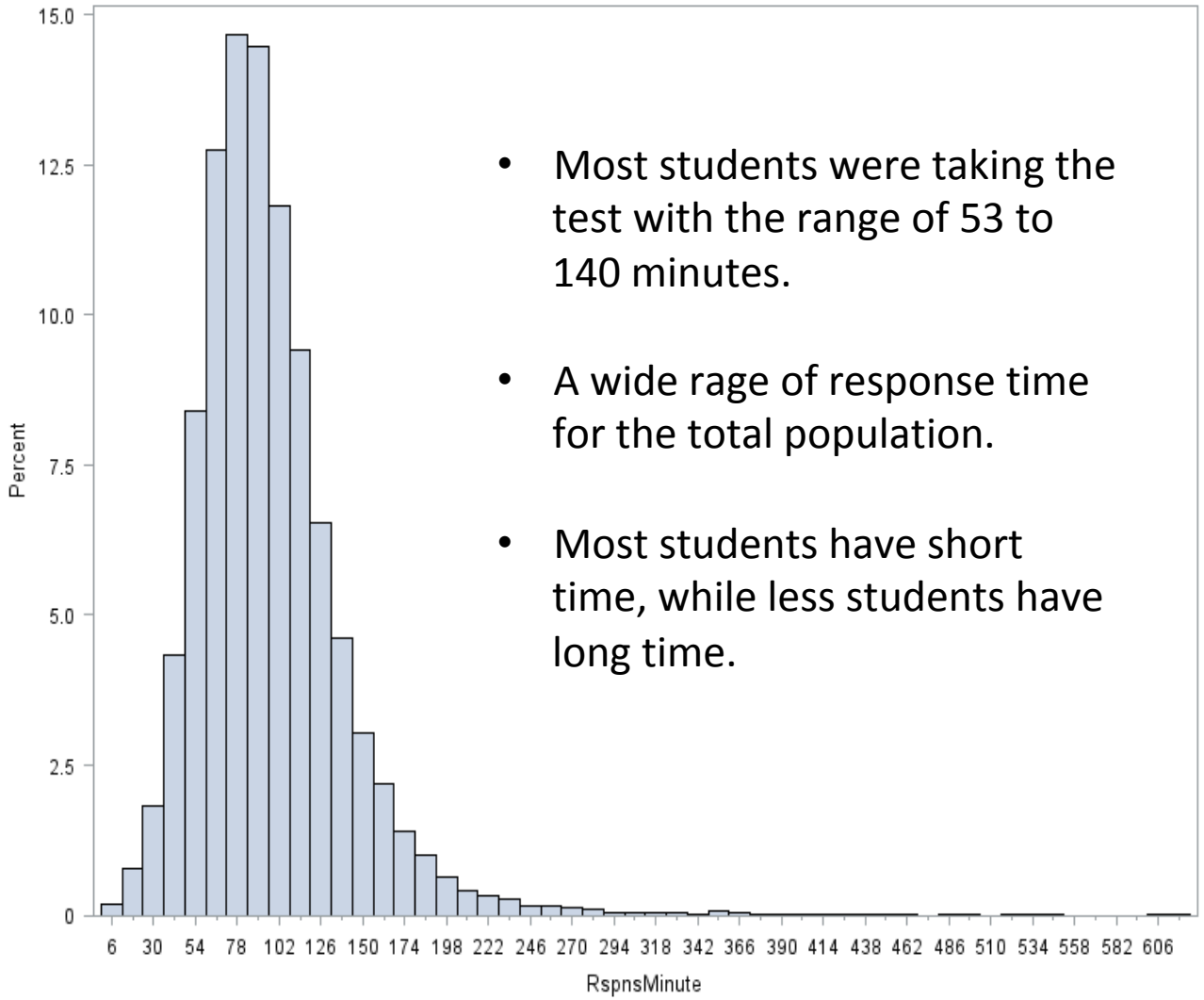
Test Response Time





- Generally, students spend more time in ELA than math. (More items in ELA than math).
- In ELA, as the grades go up, the time spent by students go down.
- In math, there is not much differences among grades.

Characters of Response Time-General Shape



- Most students were taking the test with the range of 53 to 140 minutes.
- A wide rage of response time for the total population.
- Most students have short time, while less students have long time.

Grade 3 ELA	Response Time
Mean	96
SD	43
Median	90
100% Max	621
99%	238
95%	168
90%	144
75% Q3	115
25% Q1	69
10%	53
5%	42
1%	24
0% Min	3.83
N(Male)	19538
N(Female)	1847&
N	38015

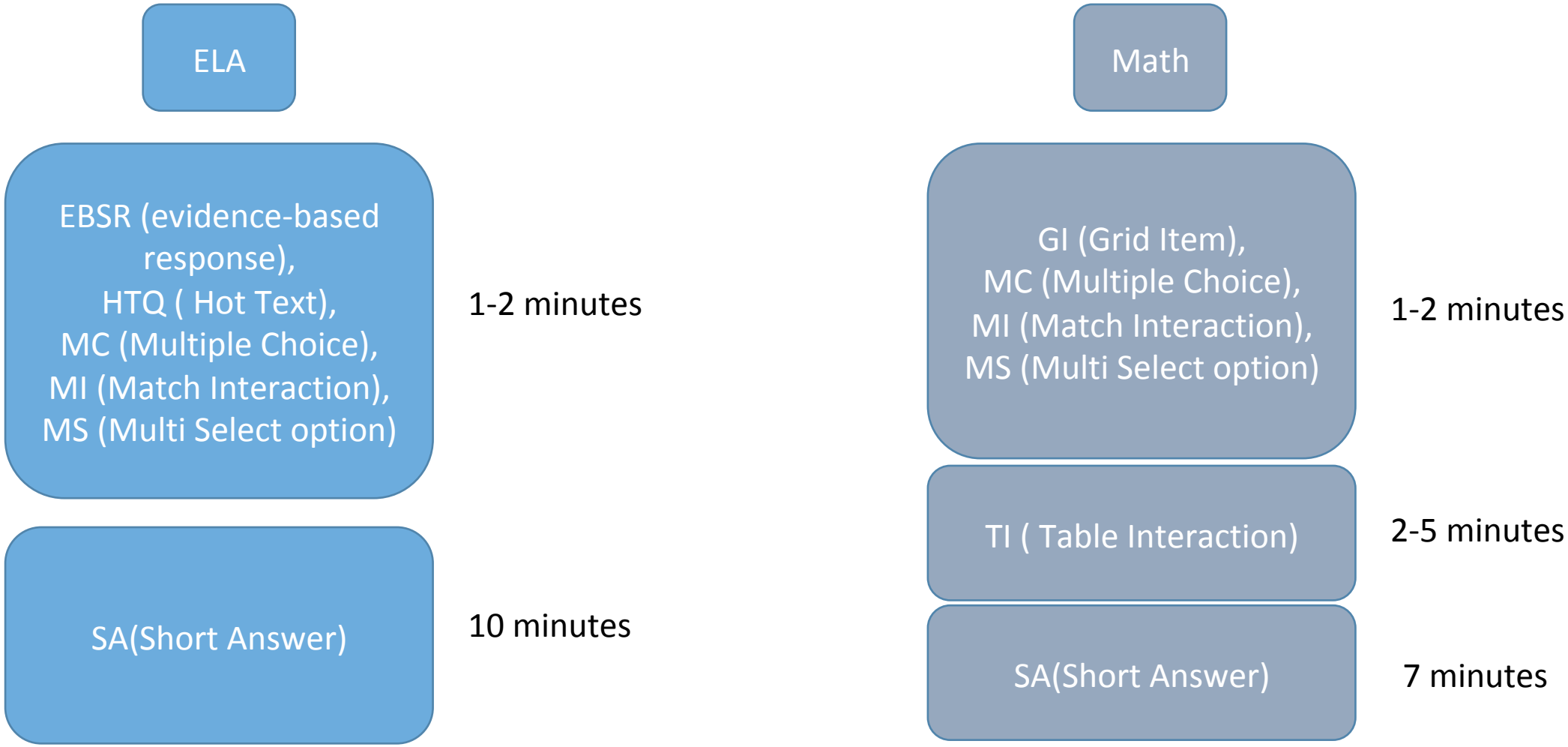
Characters of Response Time- Extreme Time for Different Grades

	Less than 30 min	More than 3 hours
ELA Grade 3	661	1345
ELA Grade 8	1330	338
Math Grade 4	1279	1216
Math Grade 7	1384	512

The number of students with extreme time varies across grades

Response Time for Different Item Types

The average response time for each item type are analyzed.



Average response time for each item type—Multiple Choice

Average Response Time of MC			
	Average Time for MC	Number of Items	Average Time per Item
ELA			
Grade3	38.2	18.7	2.0
Grade4	37.7	17.8	2.1
Grade5	32.1	16.4	2.0
Grade6	35.6	17.2	2.1
Grade7	28.5	15.4	1.8
Grade8	27.4	17.7	1.5
Math			
Grade3	11.8	6.6	1.8
Grade4	11.2	5.6	2.0
Grade5	19.2	11.0	1.7
Grade6	7.5	4.0	1.9
Grade7	10.8	5.8	1.9
Grade8	14.1	9.9	1.4

Six speed-groups in ELA:
fastest 10% to Slowest 10%
Average time in minutes and (Student Count)

Grade	Group1 (≤10%)	Group2 (10%<a≤25%)	Group3 (25%<a≤50%)	Group4 (50%<a≤75%)	Group5 (75%<a≤90%)	Group6 (>90%)
3	**40(3802)**	**62 (5701)**	**80(9506)**	**101(9503)**	**128(5702)**	**185(3801)**
4	**44(3916)**	**66(5872)**	**83(9793)**	**105(9789)**	**130(5873)**	**188(3916)**
5	**43(3868)**	**64(5805)**	**80(9668)**	**100(9673)**	**123(5801)**	**170(3870)**
6	**42(3909)**	**63(5856)**	**80(9766)**	**100(9763)**	**125(5861)**	**177(3906)**
7	**38(3911)**	**58(5867)**	**74(9776)**	**93(9776)**	**114(5868)**	**161(3901)**
8	**33(4003)**	**52(6000)**	**67(10008)**	**83(10003)**	**103(6008)**	**143(4000)**

Six speed-groups in Math:
fastest 10% to Slowest 10%
Average time in minutes and (Student Count)

Grade	Group1 (≤10%)	Group2 (10%<a≤25%)	Group3 (25%<a≤50%)	Group4 (50%<a≤75%)	Group5 (75%<a≤90%)	Group6 (>90%)
3	31(3796)	46(5694)	60(9490)	81(9490)	108(5694)	161(3796)
4	32(3912)	49(5868)	65(9781)	87(9780)	116(5870)	177(3900)
5	33(3856)	51(5789)	67(9643)	88(9644)	113(5787)	163(3857)
6	37(3885)	55(5827)	70(9714)	89(9712)	113(5827)	162(3885)
7	32(3892)	49(5836)	63(9728)	81(9728)	104(5837)	151(3891)
8	29(3984)	48(5975)	64(9960)	83(9960)	106(5976)	151(3983)

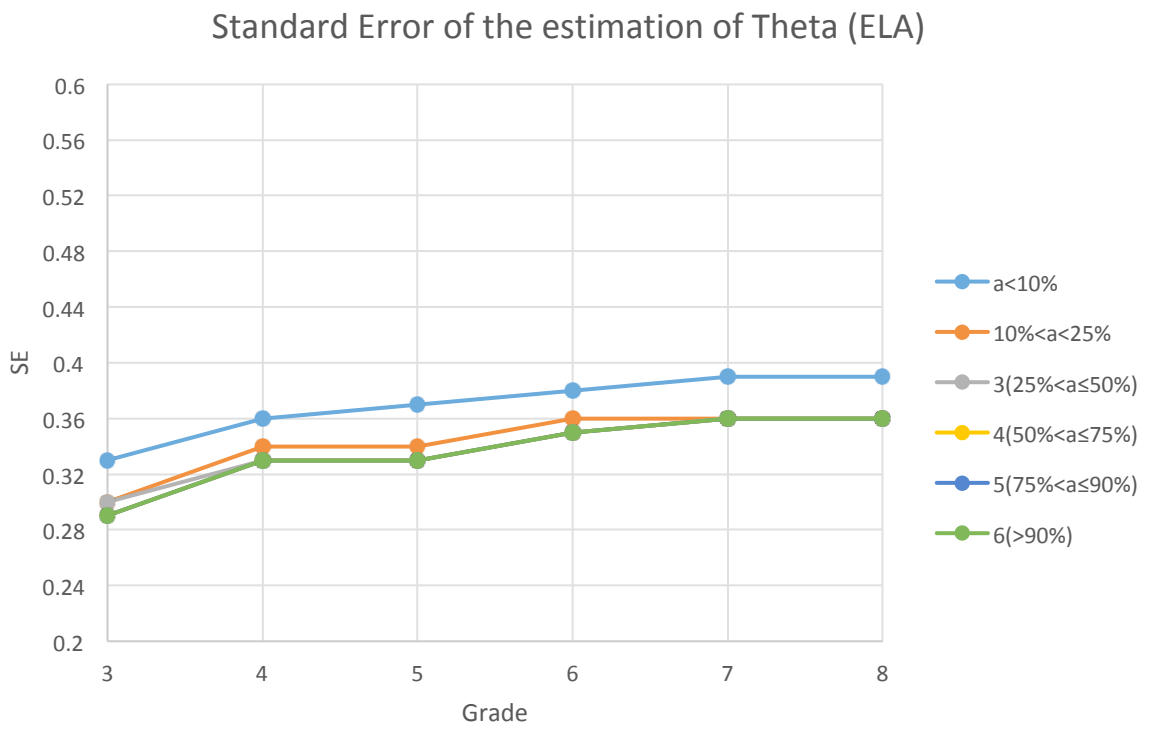
Standard Error of Estimated Abilities

- Standard Error

The accuracy of the estimation of students' proficiencies represents the precision of score estimates. When there is a strange response pattern (e.g. the easy questions were answered wrong but difficult questions were answered correctly/ all the items are wrong), the estimation of the student ability becomes less accurate and then the standard error of the estimation becomes large.

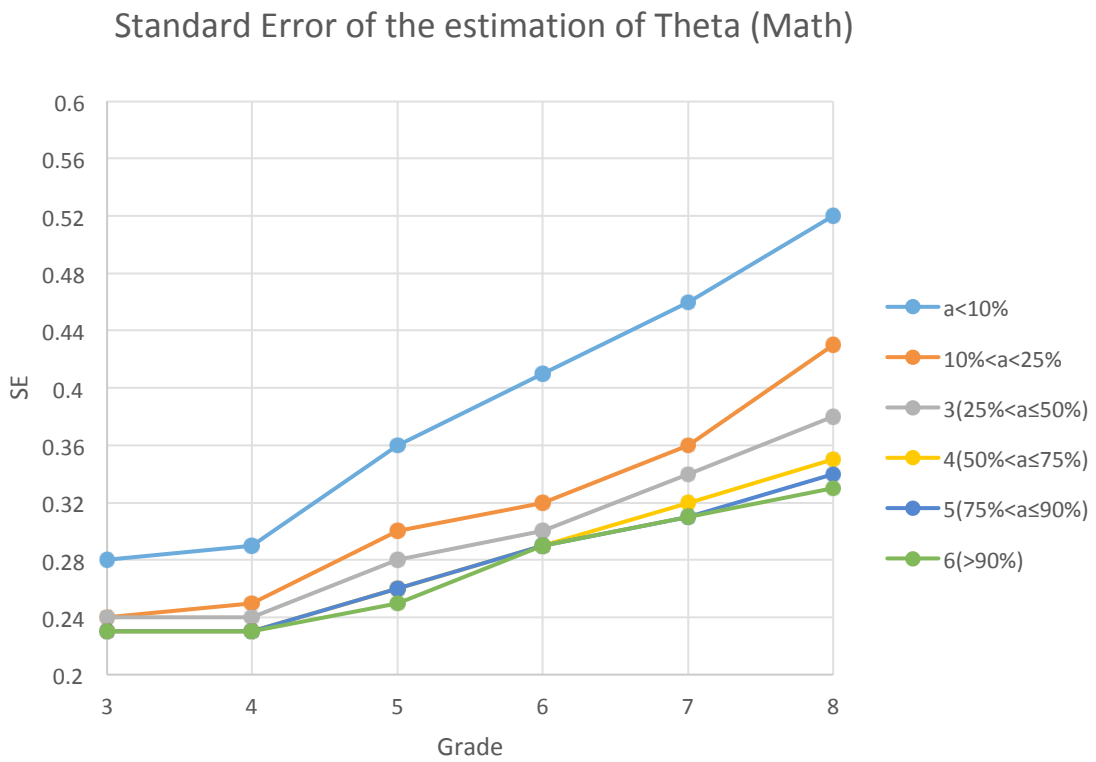
Standard Error of Estimated Abilities across speed groups - ELA

Response Time Group	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
1(≤10%)	**0.33**	**0.36**	**0.37**	**0.38**	**0.39**	**0.39**
2(10%<a≤25%)	0.30	0.34	0.34	0.36	0.36	0.36
3(25%<a≤50%)	0.30	0.33	0.33	0.35	0.36	0.36
4(50%<a≤75%)	0.29	0.33	0.33	0.35	0.36	0.36
5(75%<a≤90%)	0.29	0.33	0.33	0.35	0.36	0.36
6(>90%)	0.29	0.33	0.33	0.35	0.36	0.36



Standard Error of Estimated Abilities across speed groups - Math

Response Time Group	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
1(≤10%)	**0.28**	**0.29**	**0.36**	**0.41**	**0.46**	**0.52**
2(10%≤25%)	0.24	0.25	0.30	0.32	0.36	0.43
3(25%≤50%)	0.24	0.24	0.28	0.30	0.34	0.38
4(50%≤75%)	0.23	0.23	0.26	0.29	0.32	0.35
5(75%≤90%)	0.23	0.23	0.26	0.29	0.31	0.34
6(>90%)	0.23	0.23	0.25	0.29	0.31	0.33



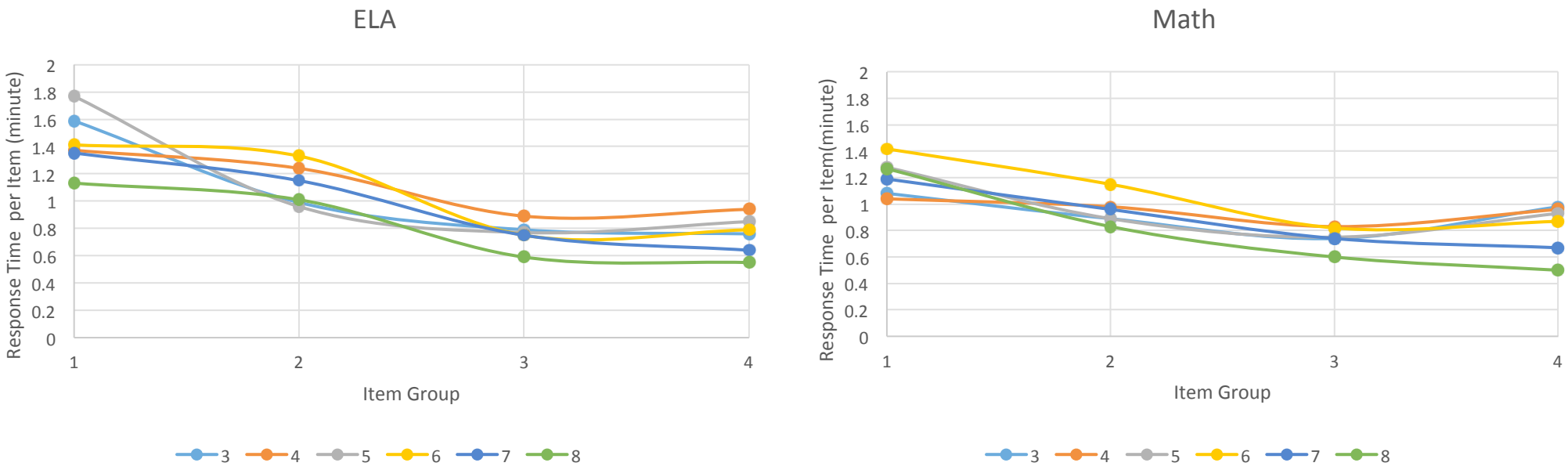
Mean Response Time (Minutes) for The Fastest 10% Student by

ELA Grade	The Fastest 10%
3	40
4	44
5	43
6	42
7	38
8	33

Math Grade	The Fastest 10%
3	31
4	32
5	33
6	37
7	32
8	29

Response Time Analysis with Item Position
(The fastest 10% students)

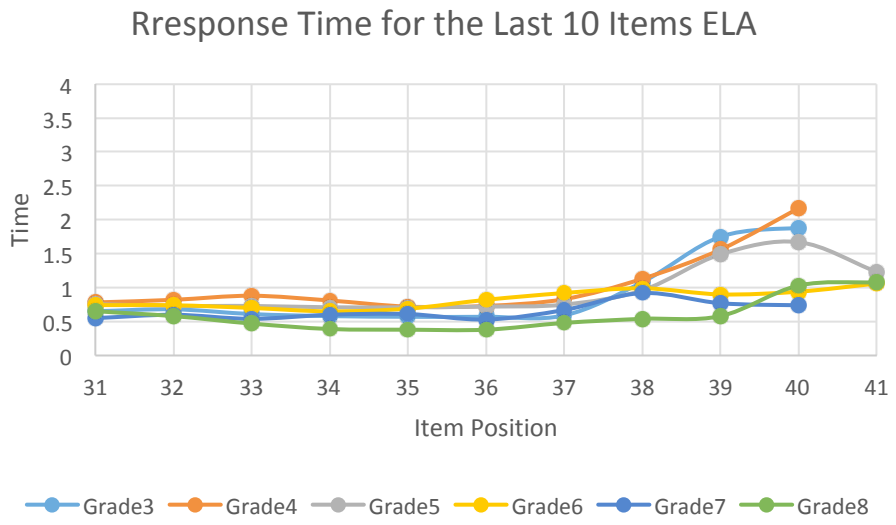
- Items are divided into four groups based on their position (i.e. item 1 to 10 are in group1, item 11 to 20 are in the group 2, item 21 to 30 are in group3, and item 31 to the last item are in the group 4).

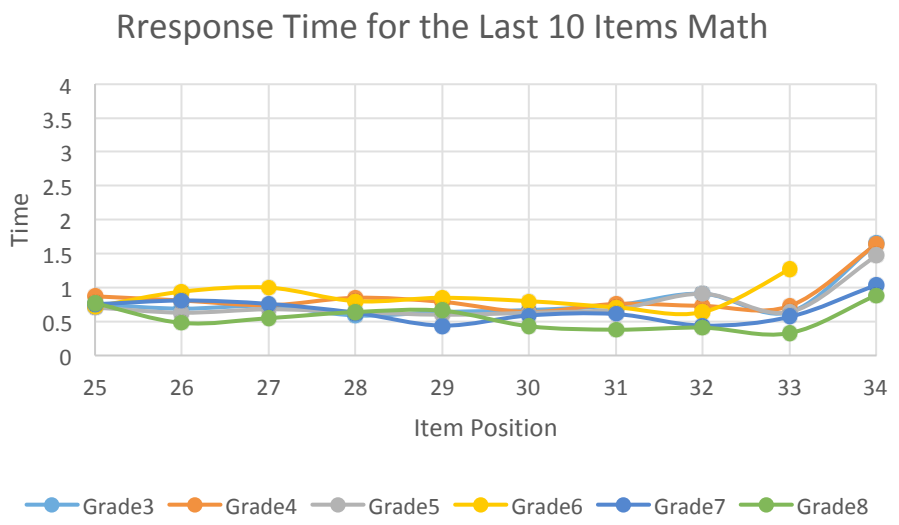


As the test continued, the response time goes down; higher graders tend to have shorter time.

Response Time Analysis with Item Position
(The fastest 10% students)

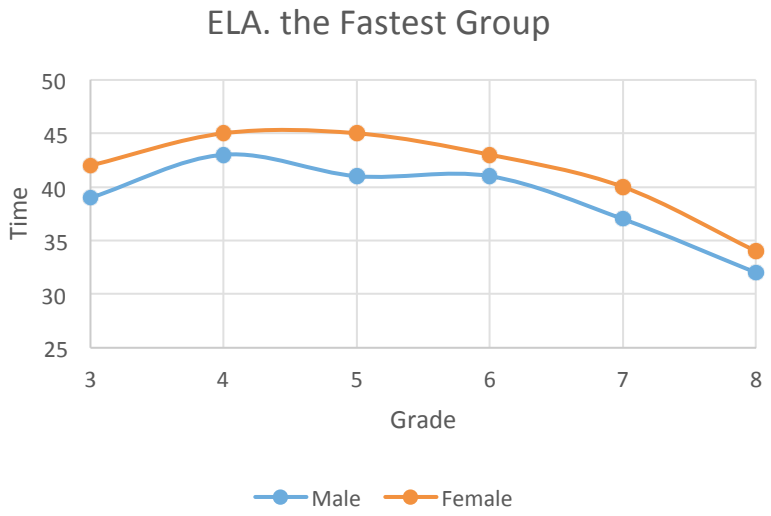
- The last ten questions

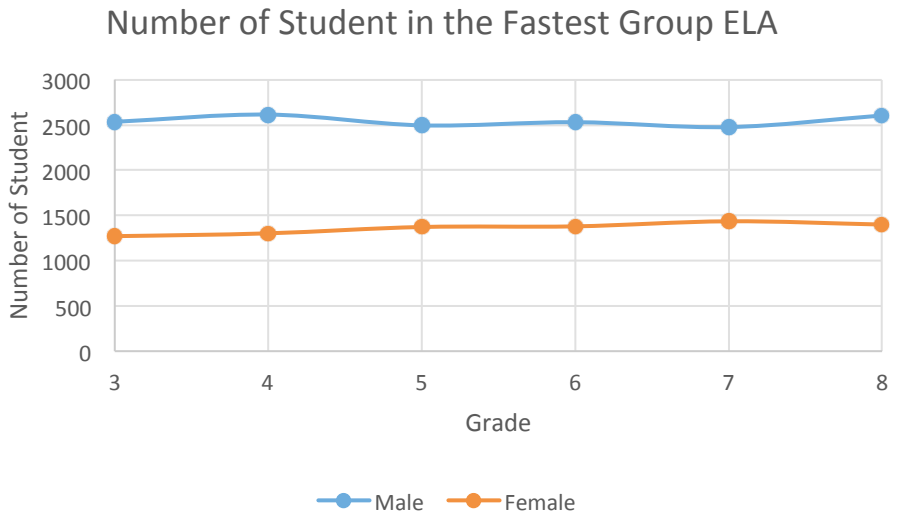




The time for the last couple of items increase.

Comparing students in the first ten percentile by gender-ELA

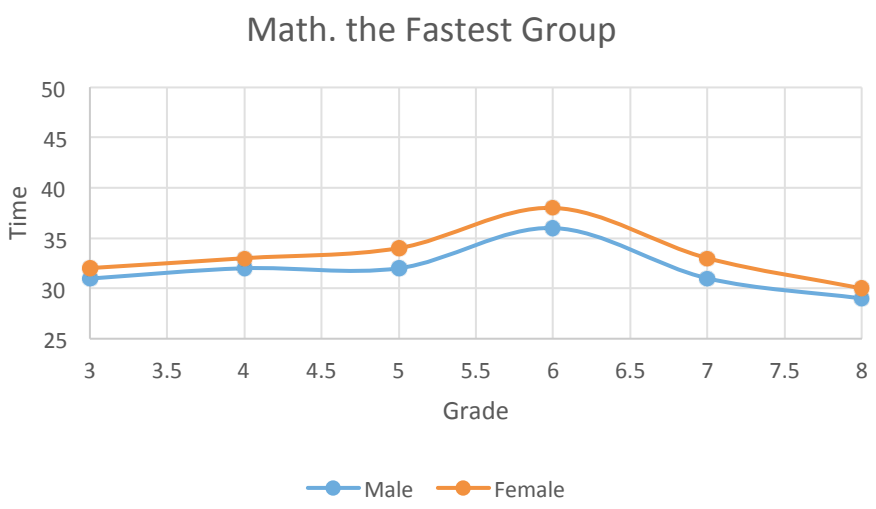


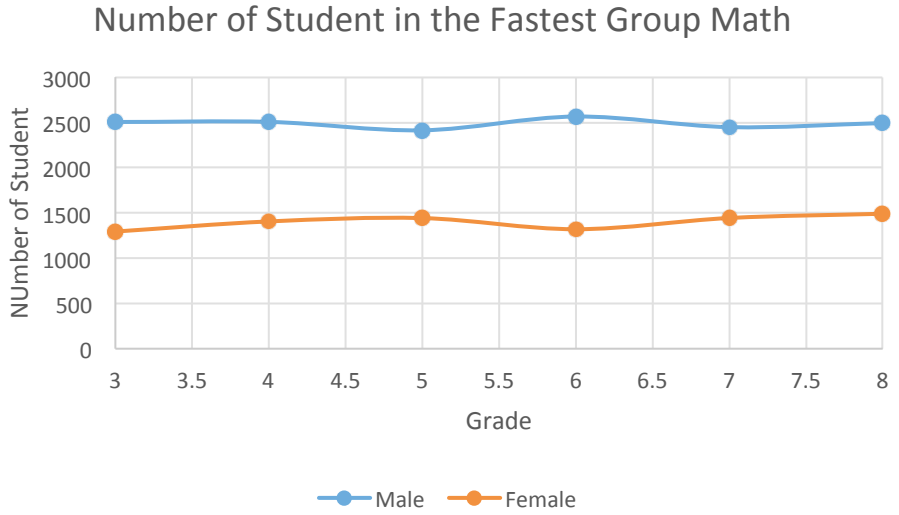


In the fastest group, boys spend less time than girls.

The number of boys in the fastest group is much higher than girls.

Comparing students in the first ten percentile by gender-Math





Similar to ELA

Item response time of item position with different level of ability: The fastest 10% students

- Students' abilities were divided into three levels: high(3), medium(2), and low(1).

ELA G8 Item Ordr group	Ability level	Ave response time	Ave error in measurement	N
1	1	1.10	0.42	2209
2	1	0.88	0.42	
3	1	0.49	0.42	
4	1	0.48	0.42	
1	2	1.16	0.35	1694
2	2	1.15	0.35	
3	2	0.72	0.35	
4	2	0.67	0.35	
1	3	0.94	0.38	100
2	3	1.17	0.38	
3	3	0.83	0.38	
4	3	0.94	0.38	

Item response time and item position with different level of ability: The fastest 10% students

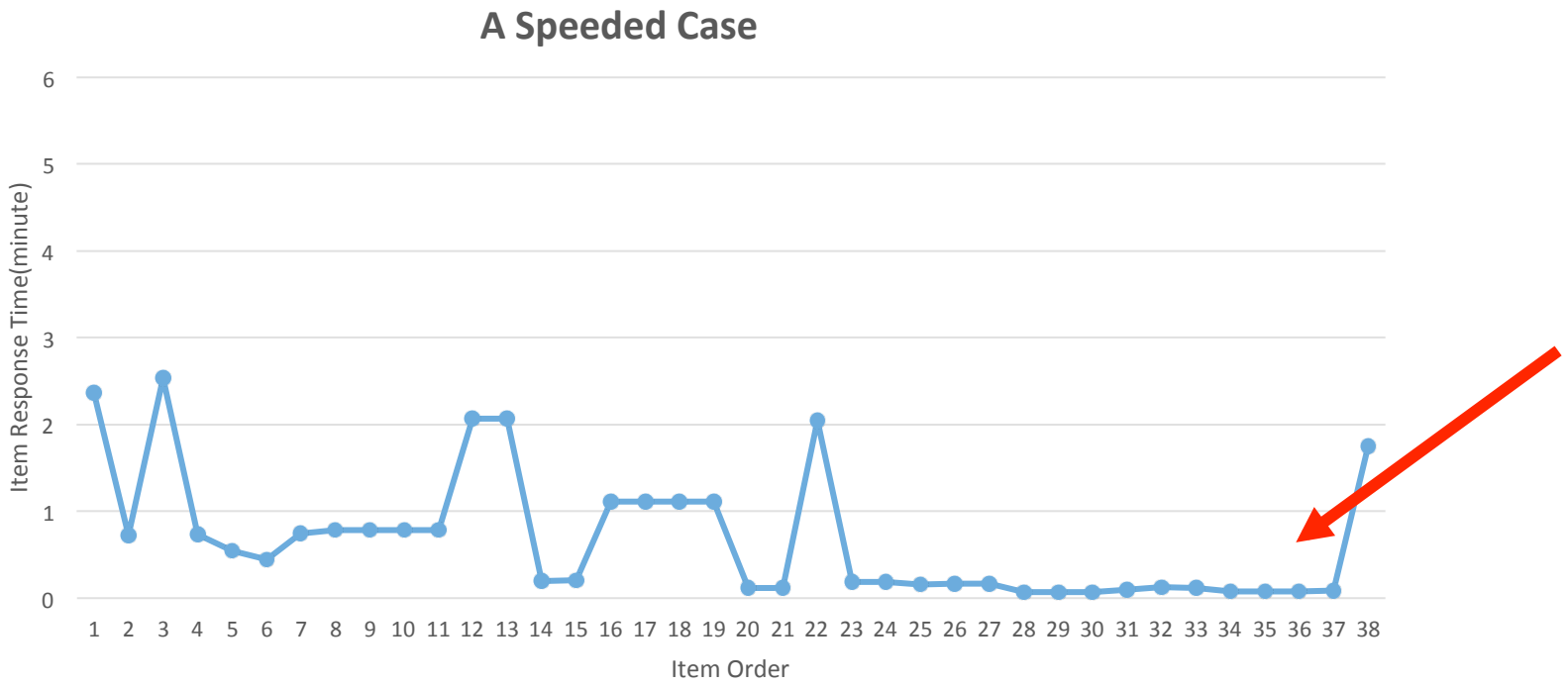
MATH G8 ItemOrdr_group	Ability level	Ave response time	Ave error in measurement	N
1	1	1.23	0.62	2216
2	1	0.69	0.62	
3	1	0.51	0.62	
4	1	0.45	0.62	
1	2	1.30	0.40	1744
2	2	1.02	0.40	
3	2	0.71	0.40	
4	2	0.56	0.40	
1	3	1.05	0.28	24
2	3	1.15	0.28	
3	3	1.14	0.28	
4	3	0.75	0.28	

Comparison of response times across ability groups and test sections

- Response time for higher ability students are more stable during the testing than the other ability groups
- In both subjects, most of the fast 10% are low performing students
- In ELA, only 100 students in the high ability group were in fast group
- In math, only 24 students in high ability group were in fast group

Selected cases

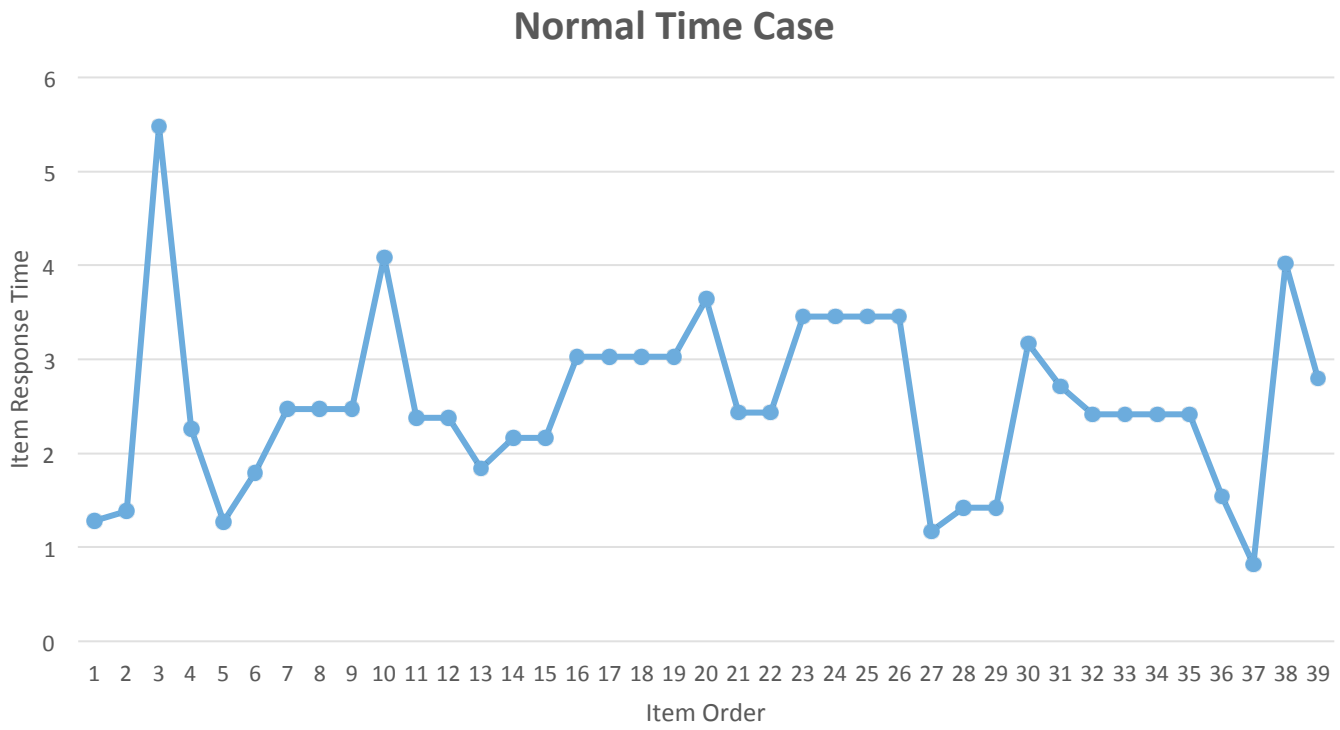
- Case 1: Ability level 1(low), test time 26 minutes, SE 0.57



During item 23 to 37, this student used very short time for each item. Obviously, this student did not make an effort to answer these items.

Selected cases

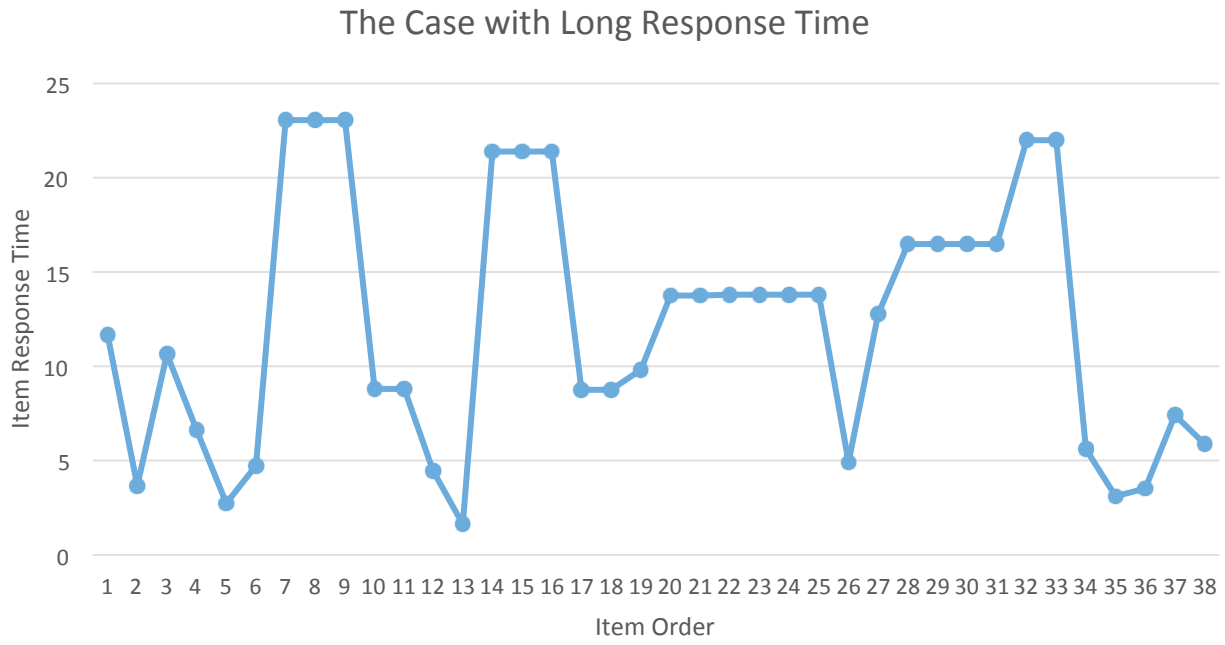
- Case 2. Ability level 3(high), test time 99 minutes, SE 0.26



Response time fluctuates across items . Causes could include item type and difficulty.

Selected cases

- Case 3. Ability level 3(high), test time 460 minutes, SE 0.30.



This student spent long time to finish the test.

Date: May 16th 2017 to May 19th 2017.
This student paused four times during the test, and the test was reset one time.

Relations Between Response Time with Ability Level and Item Difficulty

- Hierarchical Linear Model

  Response Time= Ability Level + Item Difficulty
- Results

  Response Time= 2.92 - 0.006*Ability Level +0.56*Item Difficulty

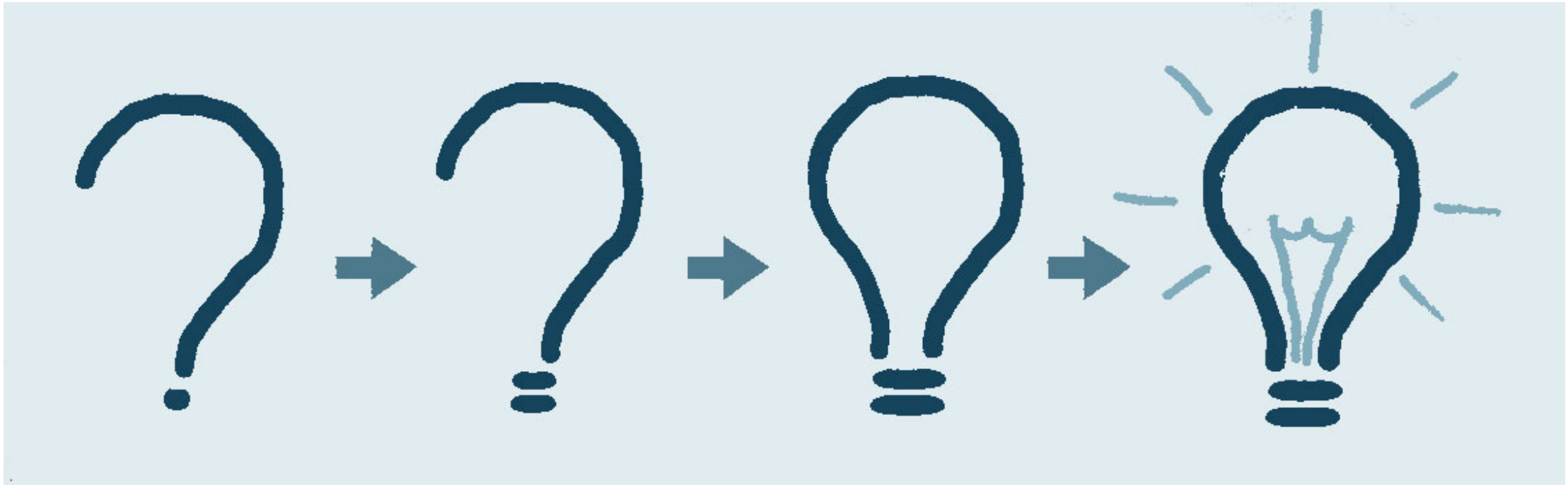
Conclusions

- There is quite wide range of response time among test takers.
- Students in middle school tend to have shorter response times.
- There are more boys in speedy groups than girls.
- Most of the 10% speeded responses come from low performing students than high performing students.
- Speedy cases tend to result in less precision in ability estimates.
- The short time may reflect the aberrant behaviors of test takers, such as guessing and cheating.

Some Insights

- Pay more attention on students with extreme response time.
- Potential aberrant behaviors: Random answer-choices; guessing, cheating, etc.
- Motivate test takers.

Questions and Thoughts




Thank
you !!!

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