



INSIGHT
Happens Here

Addressing Security Concerns through Psychometrics:

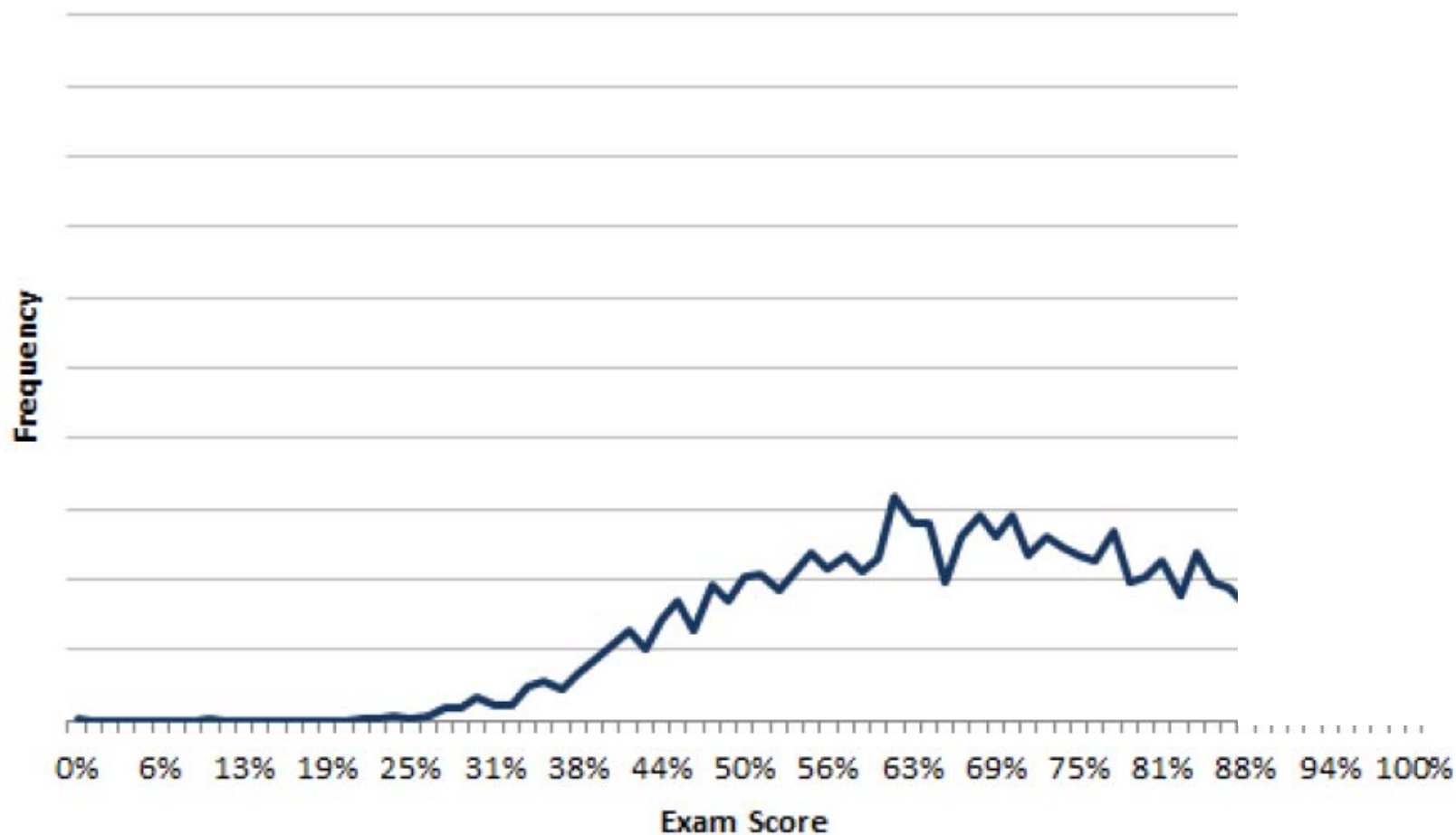
How Differential Person & Item Functioning Can
Identify Suspect Examinees & Aid in Item Development

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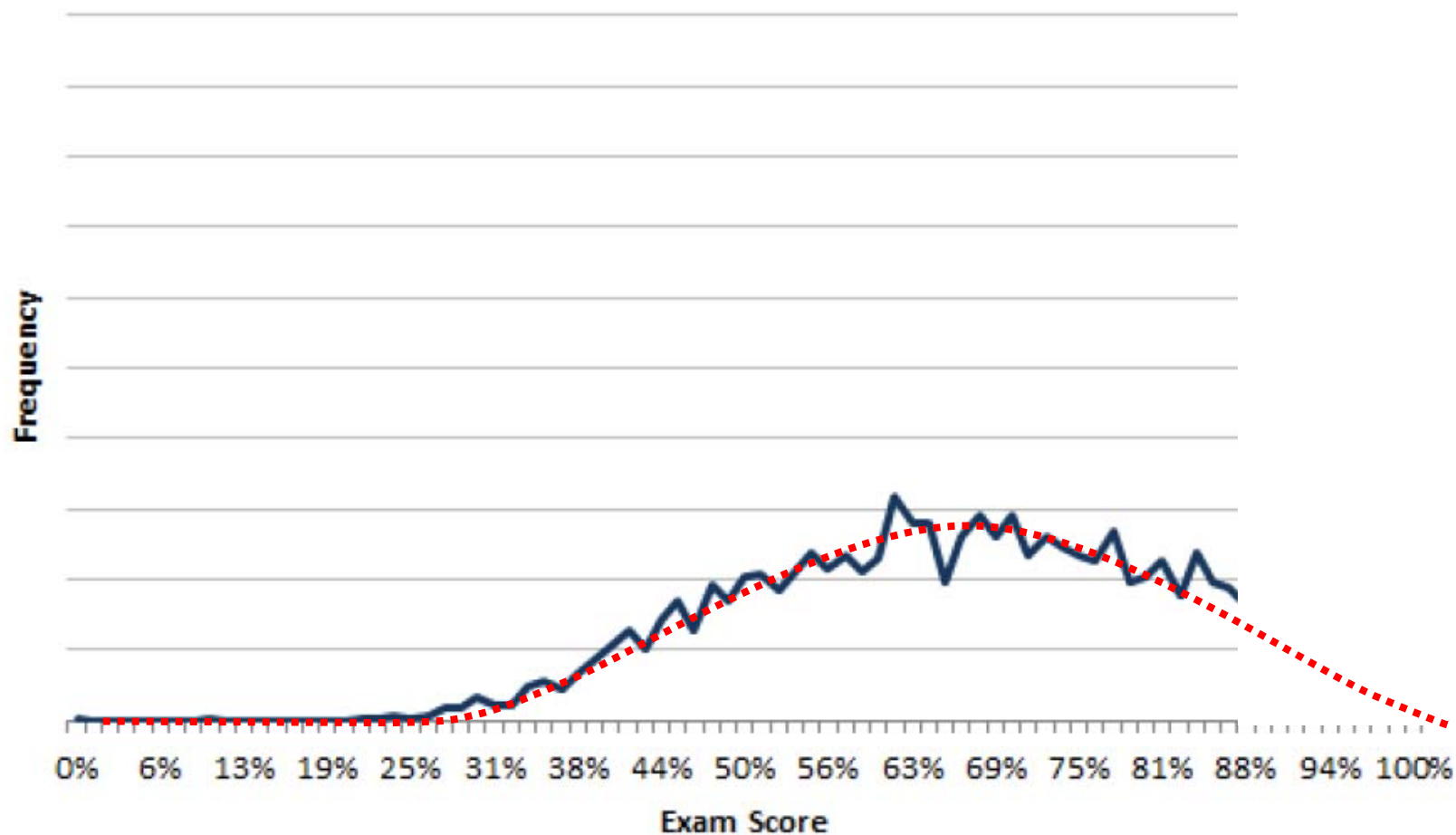
Shock and awe

Frequency Distribution



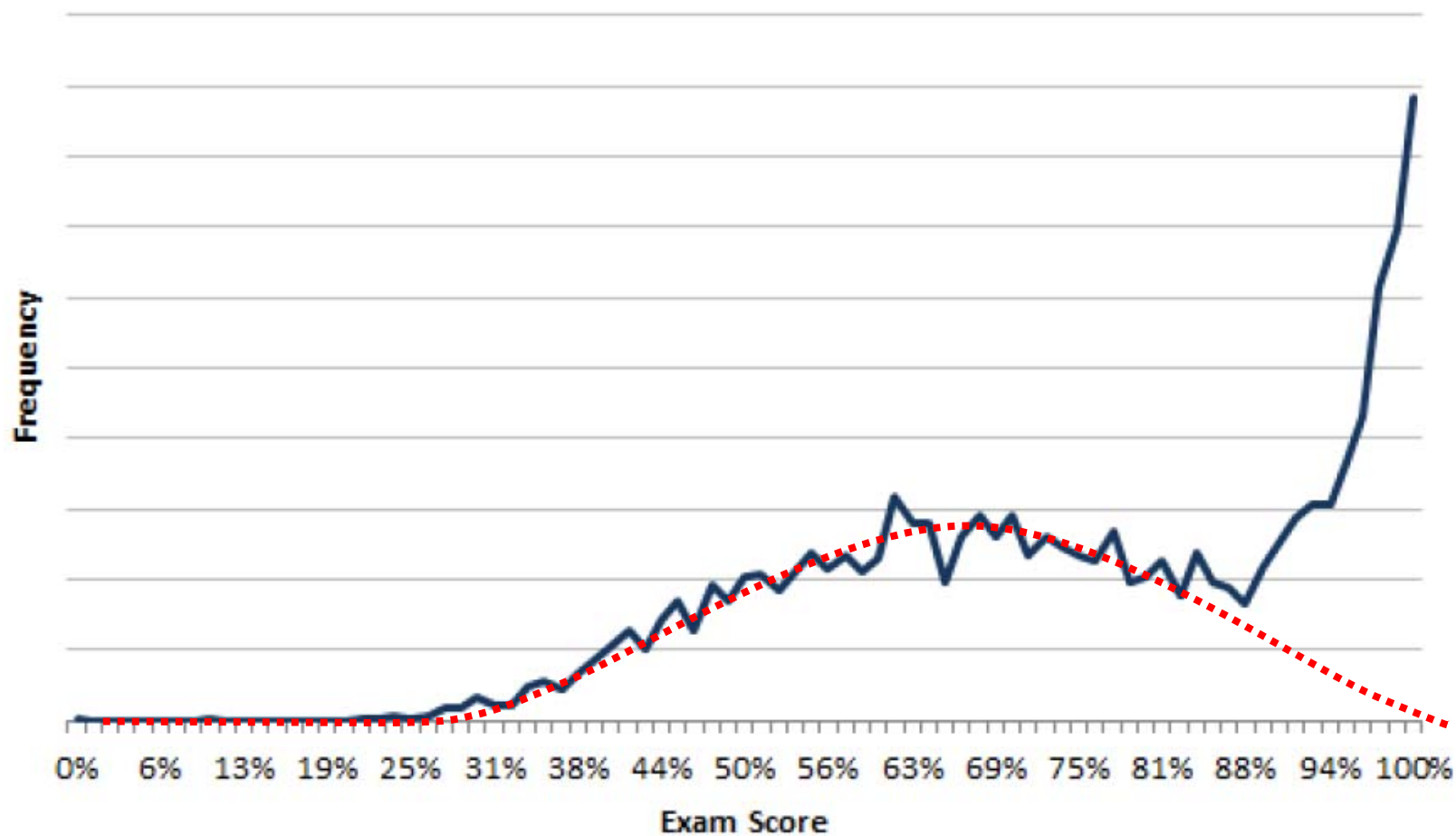
Shock and awe

Frequency Distribution



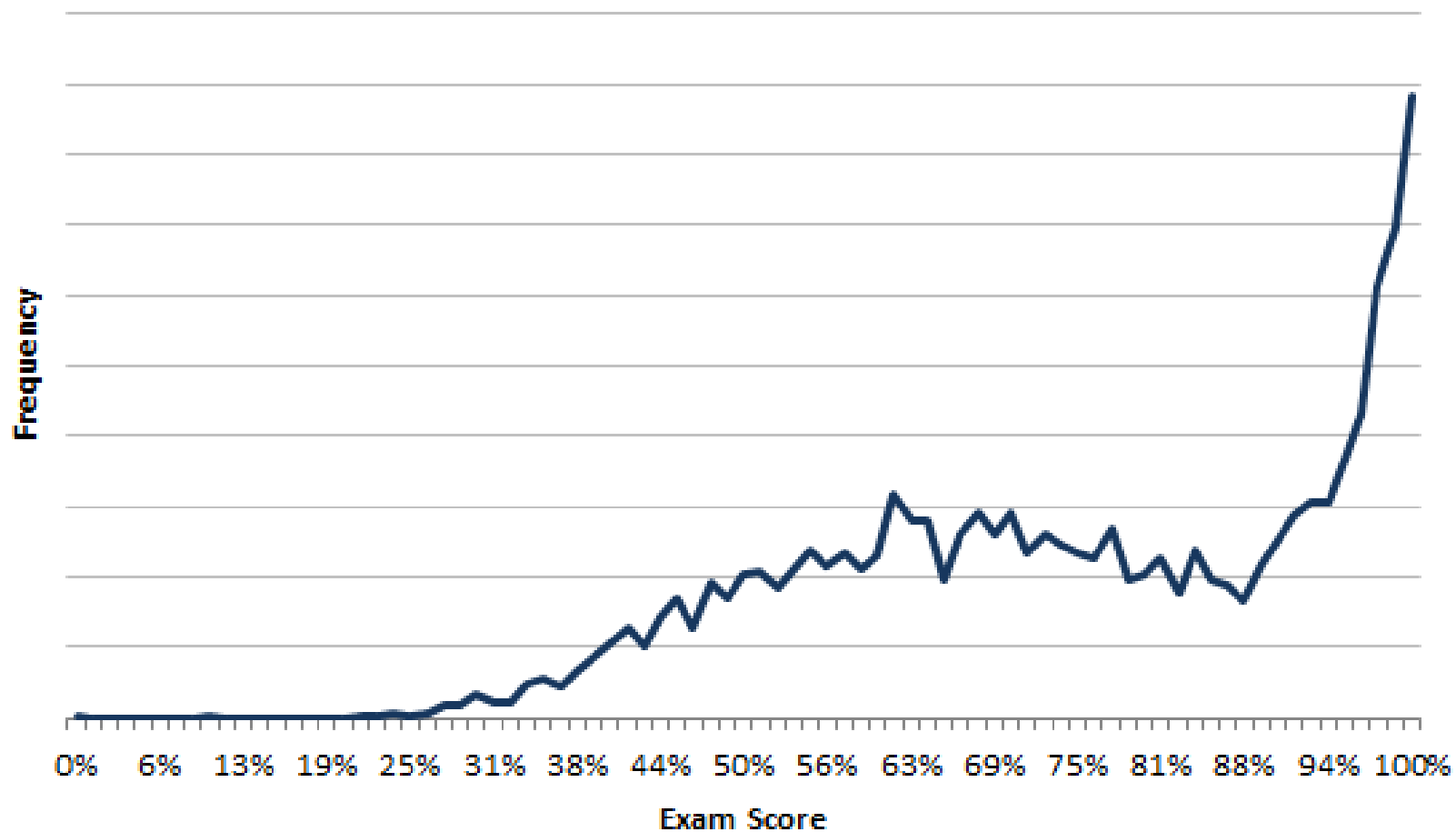
Shock and awe

Frequency Distribution



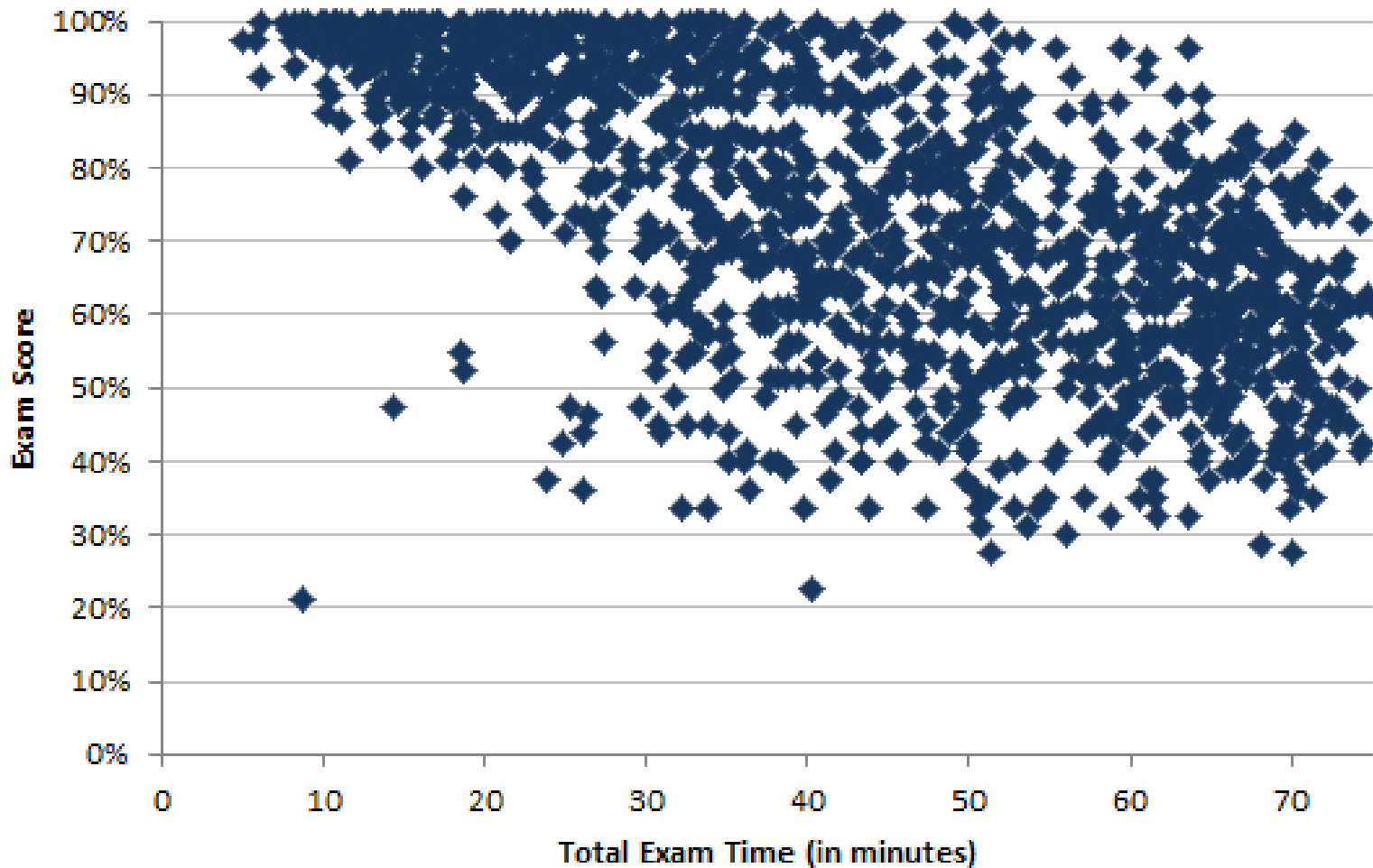
Shock and awe

Frequency Distribution



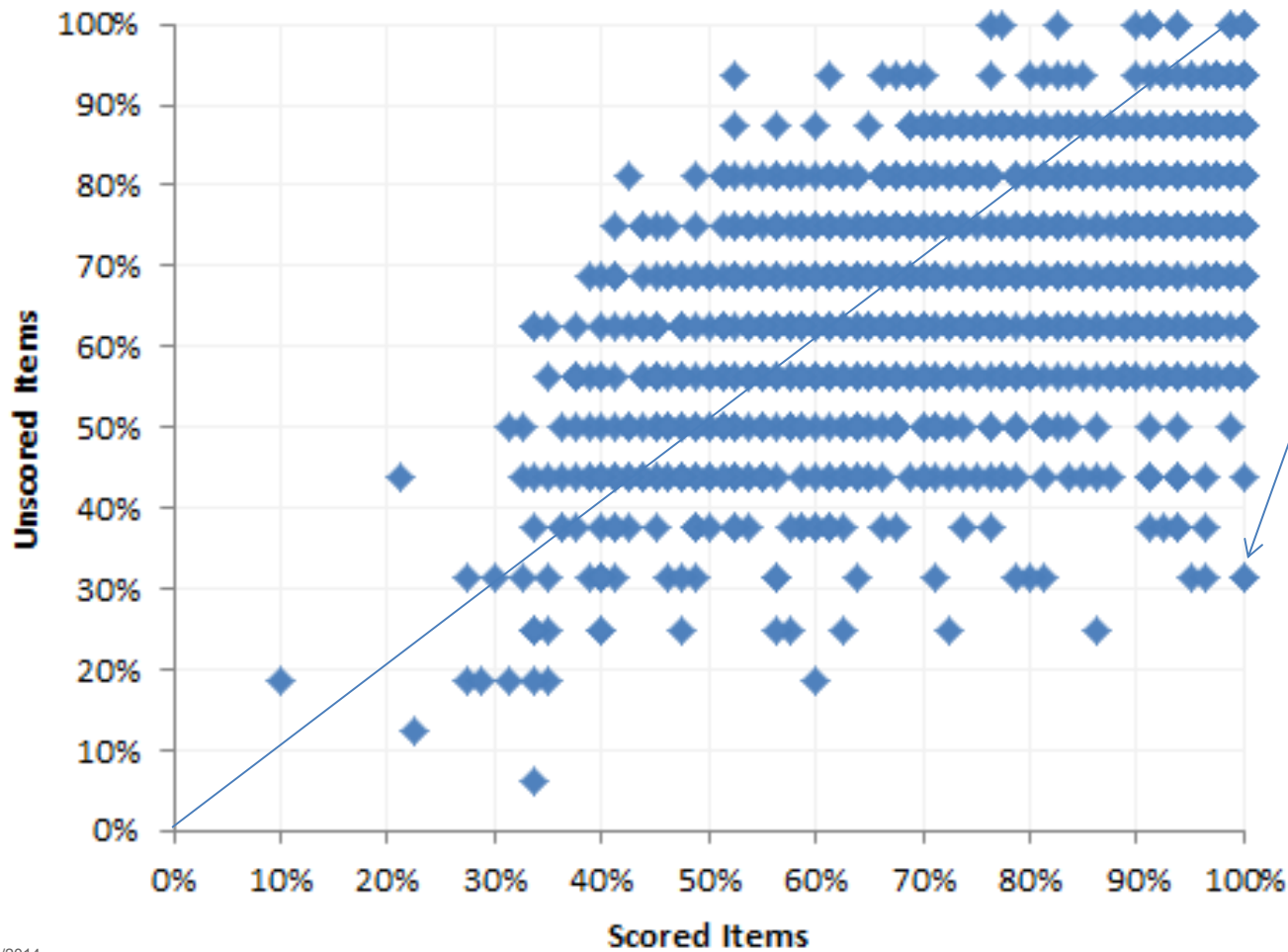
More shock and awe (I could do this all day)

Total Exam Time by Exam Score



DPF for Detection

Scored vs. Unscored

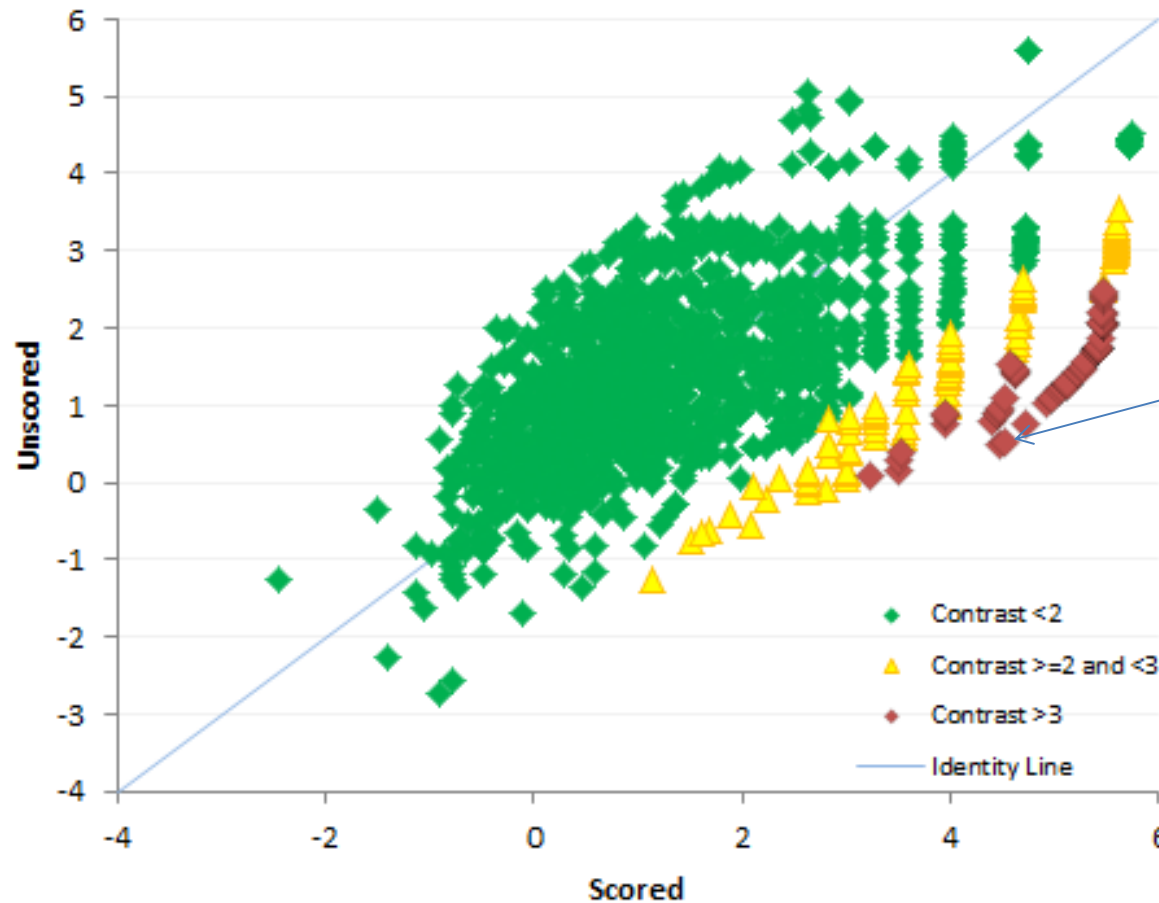


100% on the scored items

31% on the unscored items

DPF for Detection

Candidate Measures on Scored and Unscored Items



Scored item
measure = 4.48

Unscored item
measure = .05

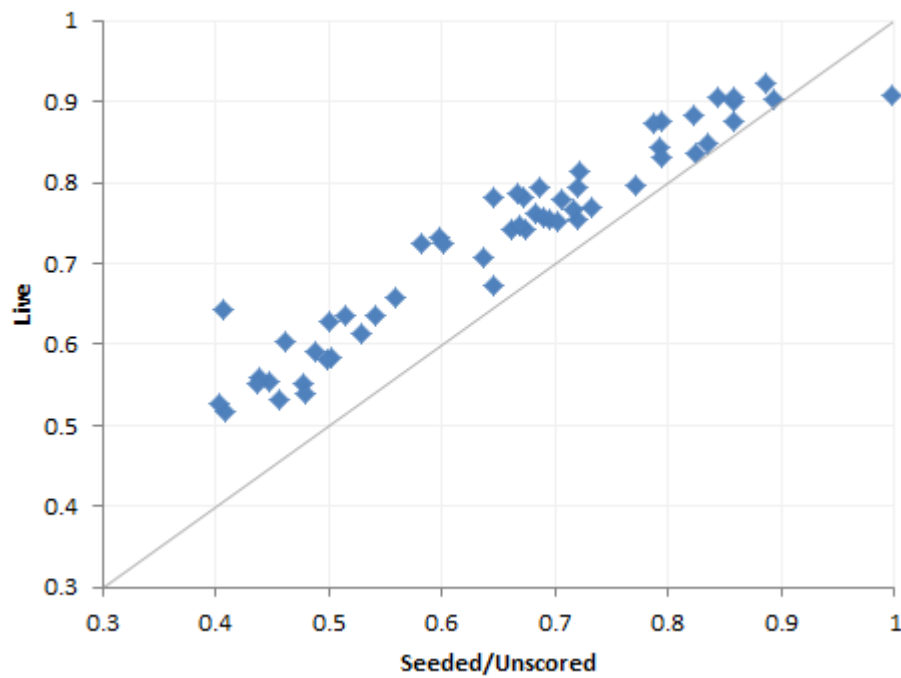
Contrast = 3.98

Probability = .0001

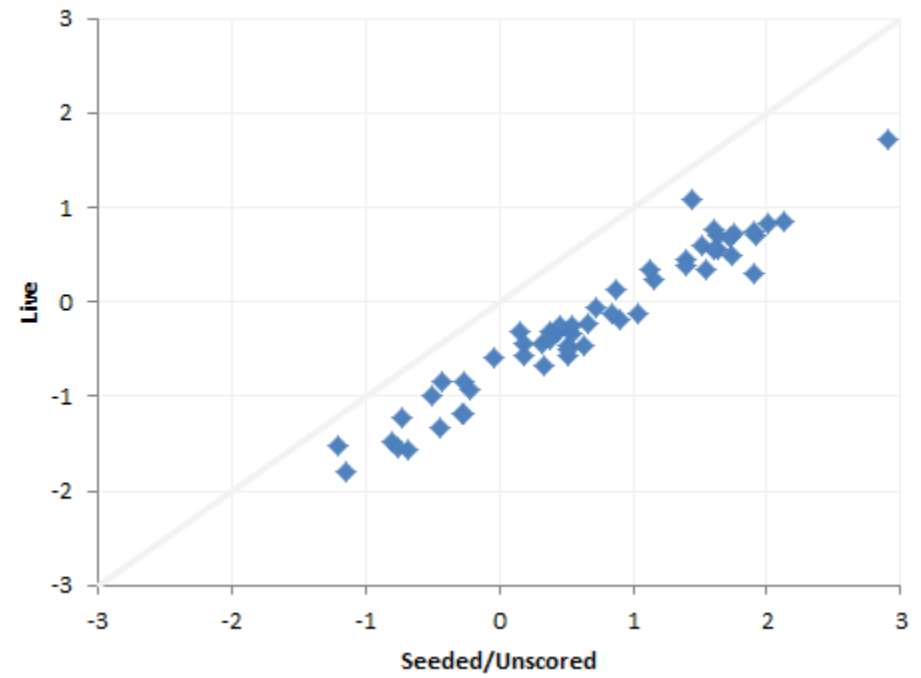
Impact on item analysis

org

P-values



Rasch Measures



Take aways...

- Prevention, detection, enforcement
- Exposure problems lead to other problems
 - Impact on item and form analysis, equating, scaling
 - Psychometricians
 - Test sponsors and decision makers

WHY?

- CompTIA has a robust proactive approach, but we wanted to be more reactive and address the security issues in the industry.
- The statistical data was challenging to interpret, and it was difficult for our stakeholders to make pass/fail decisions based on “skewed” data.
- We need to protect our brand and the industry.

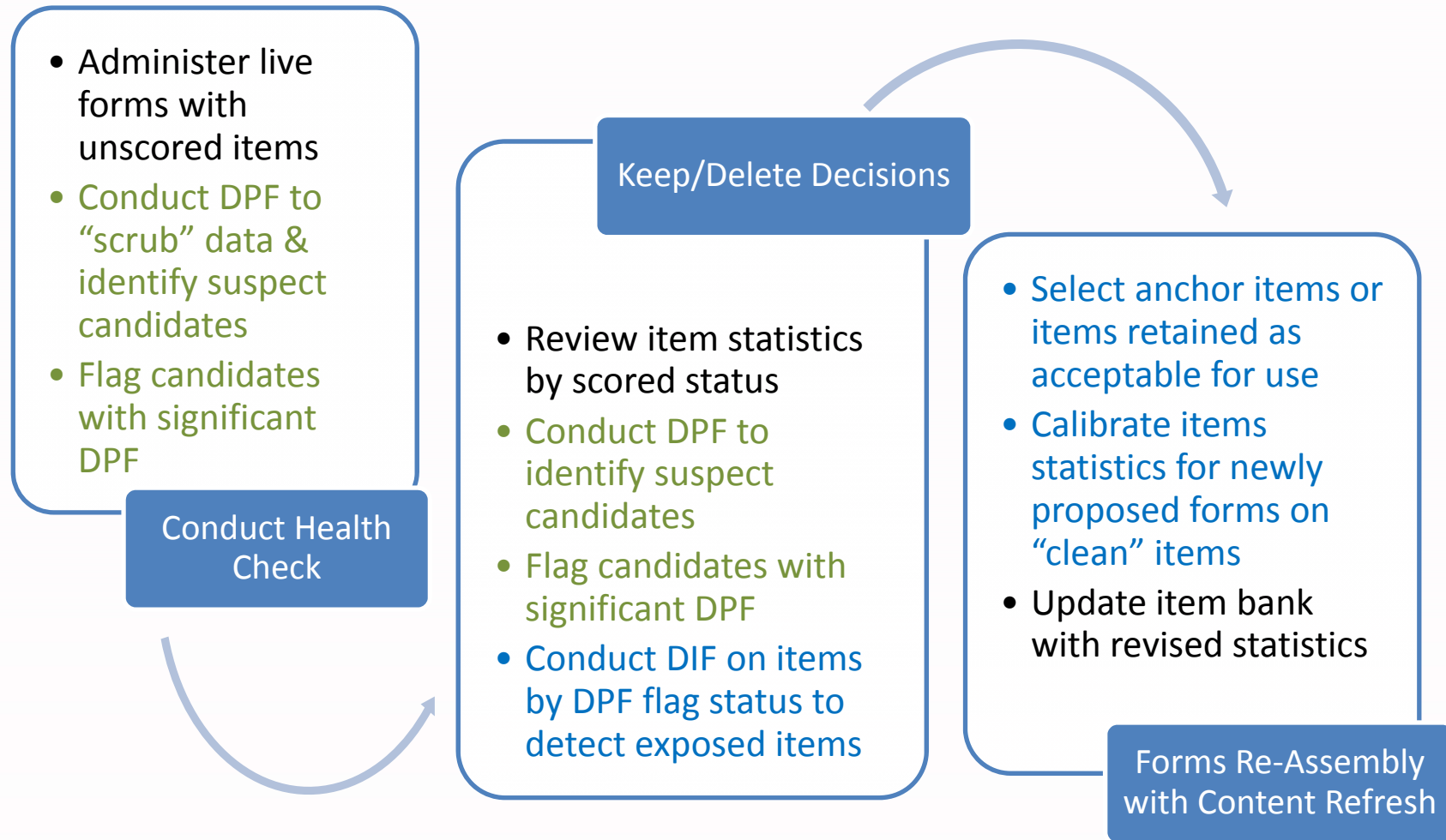
Considerations

- 1. Strong policies and legal agreements
 - 2. Support and approval from key stakeholders
 - 3. A set process for consistency
 - 4. Correct and incorrect ways you should use the data
 - 5. Resources (money and manpower)
-
- This list can go on and on.....

DPF & DIF in Exam Development Process

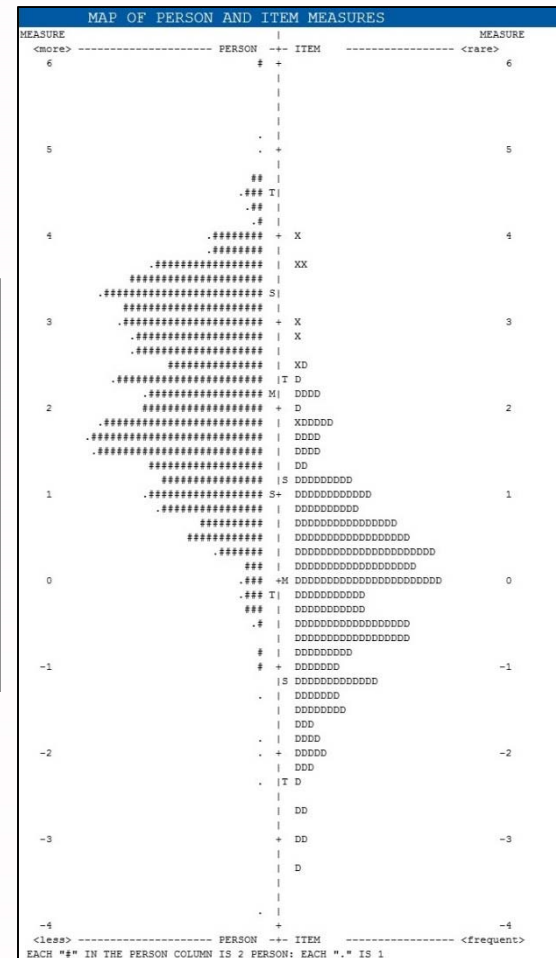
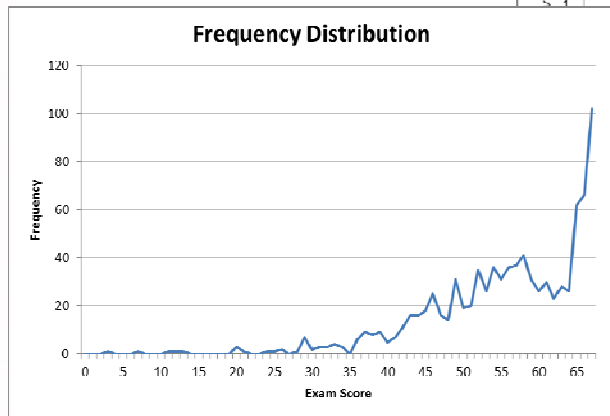
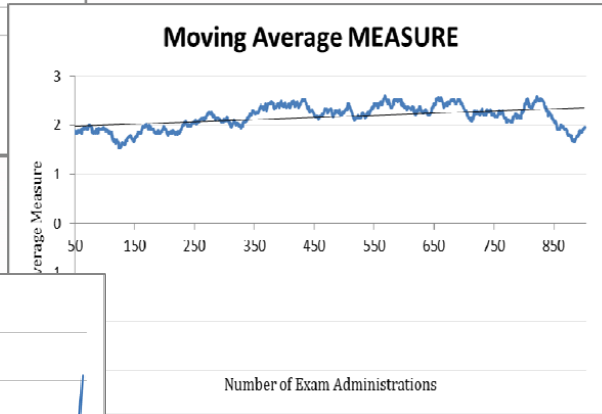
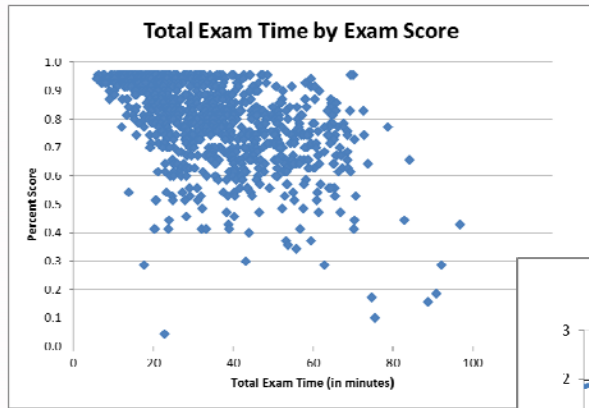
- DPF in conjunction with DIF can be used to:
 1. Detect when security breaches have occurred
 2. Determine the overall extent of item exposure
 3. Build cases against suspect candidates
 4. Corroborate other evidence to support the enforcement of sanctions against candidates
 5. Highlight specific items with compromised content to arrive at a “cleaner” data set
 6. Evaluate appropriate next steps for particular items and entire item banks
- ...all while discussing the relevant psychometric and policy issues for each of these areas*

DPF & DIF in Exam Development Process



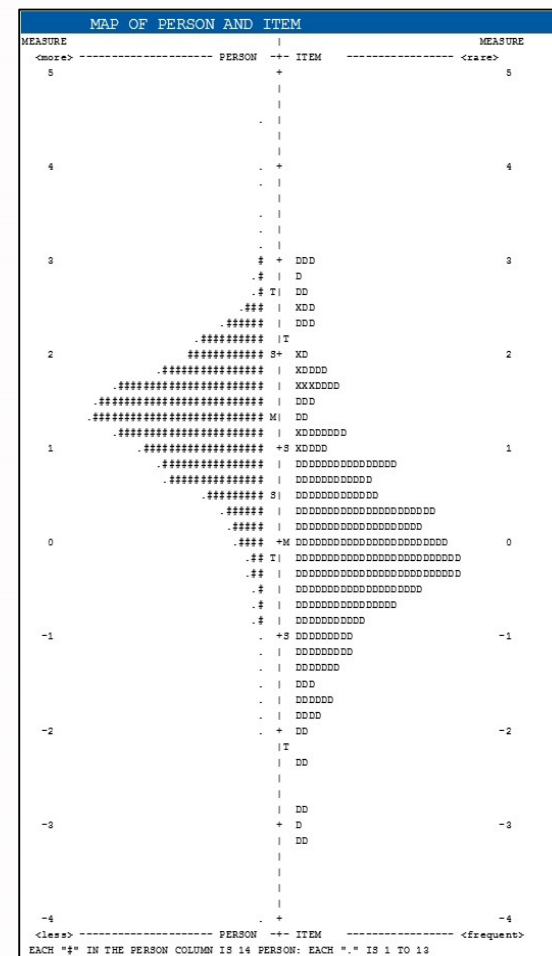
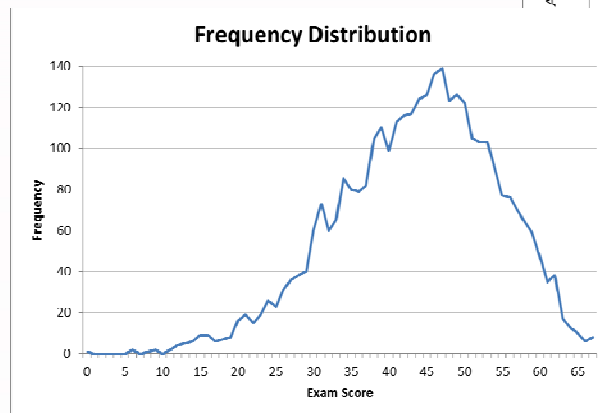
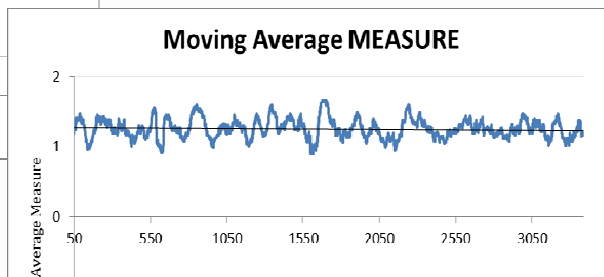
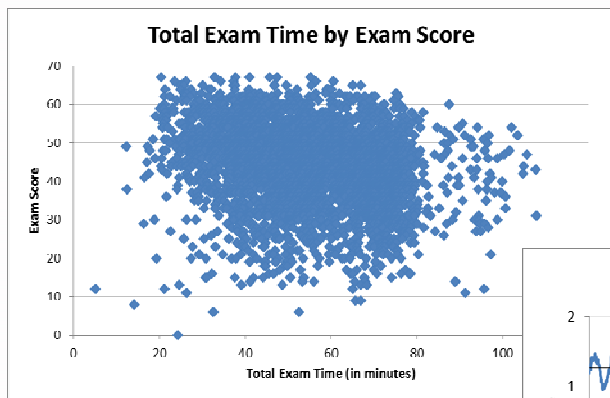
DPF & DIF in Context

- Multiple indicators of security and item exposure issues



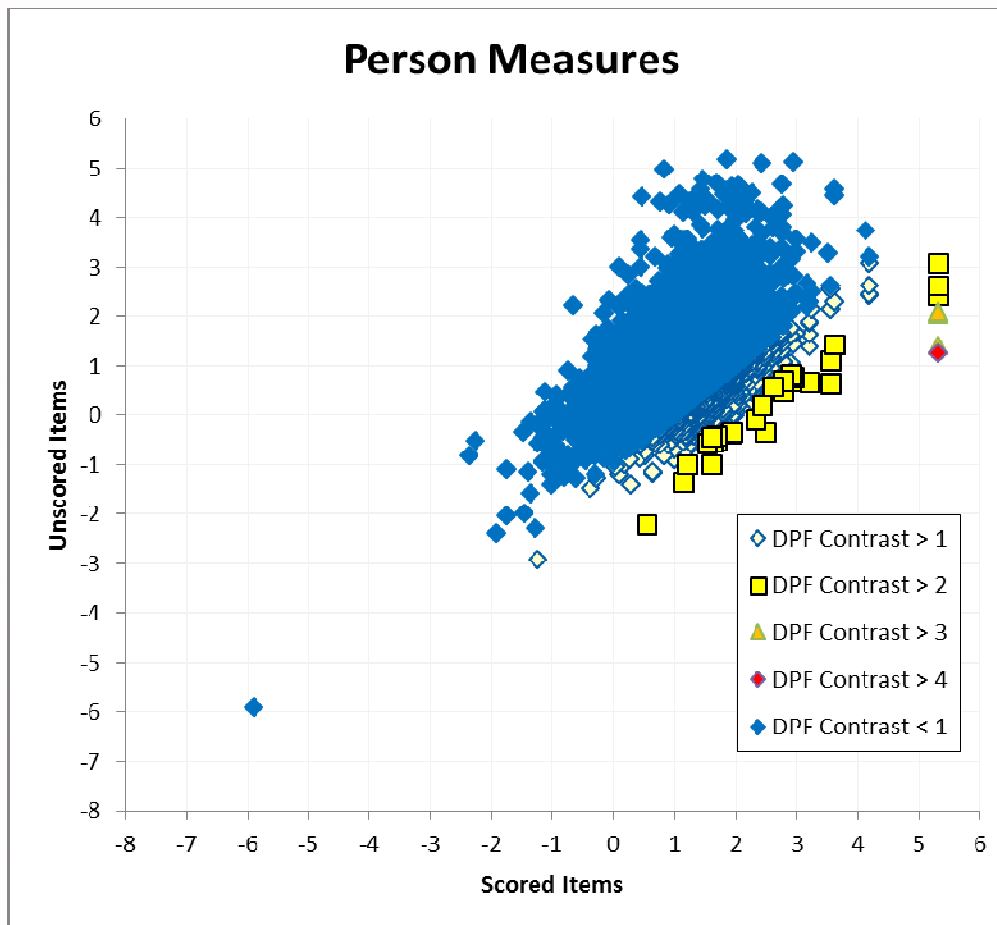
DPF & DIF in Context

- Improvement in security and item exposure indicators



DPF & DIF in Context

- 32 candidates with DPF contrast > 2, 9 flagged with $p < .001$



Reg. ID	DPF Contrast	Prob.	Flag	Exam Score	Unscored Score
200	4.07	0.035		67	14
595	3.92	0.043		67	14
729	3.29	0.092		67	15
69	3.25	0.093		67	14
576	3.23	0.105		67	16
59	2.91	0.147		67	16
239	2.90	0.001		65	11
630	2.81	0.000	<.001	60	7
223	2.75	0.001		32	3
305	2.70	0.172		67	16
350	2.61	0.000	<.001	49	7
732	2.53	0.002		64	11
96	2.48	0.001	<.001	41	4
936	2.45	0.008		65	13
605	2.39	0.001	<.001	59	8
239	2.30	0.002		62	11
352	2.28	0.000	<.001	54	8
207	2.26	0.282		67	17
796	2.25	0.000	<.001	54	8
765	2.24	0.001		60	9
990	2.21	0.004		63	11
552	2.20	0.001	<.001	42	6
300	2.19	0.001	<.001	51	8
305	2.19	0.019		65	13
929	2.17	0.005		63	11
595	2.16	0.001	<.001	50	7
392	2.09	0.002		51	7
556	2.09	0.002		48	6
50	2.08	0.006		63	12
53	2.08	0.004		62	11
905	2.05	0.004		61	10
62	2.02	0.001		49	7

DPF & DIF in Context

- Aggregate anomalous records up to flag suspect test centers
- 4 of 9 flagged candidates from Test Center 67080
 - Most administrations (n=205)
 - Fairly high average contrast, especially given the count
 - Lower average total test time than most test centers with reasonable counts

Test			
Center	Count	Average Contrast	Average Time
67080	205	0.67	44.65
63732	43	1.01	56.49
70940	36	-0.20	50.79
30092	31	0.25	56.01
67767	28	0.80	56.85
40463	28	0.33	58.45
70417	26	0.58	71.97
63930	25	-0.26	52.78
34376	24	0.08	57.14
77013	23	-0.38	53.25
62089	22	-0.03	49.73
70800	21	0.21	56.02
49710	18	-0.06	50.73
71437	17	0.52	51.57
67321	17	0.41	42.00
66477	17	-0.26	55.05
63149	16	-0.06	40.90
72903	16	0.19	56.31
40299	16	-0.32	60.43
67130	15	0.31	60.25
46940	15	-0.06	53.04
62422	15	-0.05	72.12

DPF & DIF in Context

- 10 items displayed DIF

Item ID	Item Status	Person Class	DIF Measure	Person Class	DIF Measure	DIF Contrast	Prob.
1.2.I520444	Unscored	DPF Contrast > 2	2.23<	No DPF Flag	1.00	1.24	0.000
1.4.I552659	Unscored	DPF Contrast > 2	.04<	No DPF Flag	-1.32	1.36	0.000
1.5.I535355	Unscored	DPF Contrast > 2	-.74<	No DPF Flag	-2.02	1.28	0.000
1.8.I525548	Unscored	DPF Contrast > 2	1.70	No DPF Flag	-0.38	2.08	0.022
1.8.I535408	Unscored	DPF Contrast > 2	2.33	No DPF Flag	0.27	2.05	0.038
2.5.I535422	Unscored	DPF Contrast > 2	.53<	No DPF Flag	-0.68	1.21	0.000
2.6.I520835	Unscored	DPF Contrast > 2	3.76<	No DPF Flag	1.68	2.08	0.015
4.5.I520969	Unscored	DPF Contrast > 2	3.21	No DPF Flag	1.30	1.91	0.036
4.5.I525546	Scored	DPF Contrast > 2	2.89	No DPF Flag	0.89	2.00	0.026
4.9.I535622	Scored	DPF Contrast > 2	-0.66	No DPF Flag	1.15	-1.81	0.034

Item Status	Significant DIF		No DIF
	Positive	Negative	
Scored	1	1	125
Unscored	8	0	162

Conclusions

- Psychometricians and test sponsors need to understand the downstream implications of security breaches.
- Security issues should not be considered from just an enforcement perspective because they impact both the approach to and interpretation of psychometric analyses.
- We have had success using DPF and DIF in practice to make better decisions about items, equating, and scaling.
- If the focus is on prevention, the need for psychometrics in detection and enforcement is minimized.

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