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Do people with item pre-knowledge really respond faster to items they had prior access?

Murat Kasli & Cengiz Zopluoglu

- Item pre-knowledge ; computer based delivery
- Response time (RT) availability
- Response Time is a potential source of information to identify item pre-knowledge (e.g, Lee, 2018; Qian, Staniewska, Reckase, and Woo, 2016; van der Linden & Krimpen-Stoop, 2003; van der Linden & Guo, 2008)

- Due to the lack of real datasets, simulation is a de facto approach to evaluate the performance of new or existing methods
- These (simulation based) studies have to make assumptions about the response time behavior of people who had prior access to test items
  - Meijer and Sotaridona (2006) reduced the original response time to one-half and one-fourth
  - Van der Linden and Guo (2008) fixed response time to 10, 20, and 30 seconds
  - Lee (2018) draw response time from uniform distribution U(20,30)

- In this study, we tried to understand the response time behavior of unflagged test takers and test takers with item pre-knowledge using a real dataset provided by Cizek and Wollack (2017).
  - Do examinees with item pre-knowledge response faster than the unflagged examinees? If so, to what degree?
  - Does the response time of examinees with item pre-knowledge differ than the unflagged examinees for those items they had prior access?

- The dataset used in the current study comes from Cizek and Wollack (2017) includes two test forms.

- 170 Operational items , 87 Common Items

Merged Form

- **94 respondents** were flagged by the agency as suspicious, and potentially had access to some items.

- **91 items** were flagged by the agency as potentially leaked prior to test

	Form-1	Form-2	Merged
Sample Size	1636	1644	3280
Operational Items	170	170	253

We analyzed the response time using a 2-level random effects model by treating item responses nested within test takers.

$$Y_{ij} = \beta_{0j} + \beta_{1j} * I_i + \varepsilon_{ij}$$ ..... (Level 1)

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * P_j + \mu_{0j}$$
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- P_j is another dummy variable to indicate whether or not the *j*th person is flagged (0: unflagged, 1:flagged).

Table 1. The parameter estimates of the multilevel models fitted to log response time data

Fixed Effects	Model 1	Model 2
γ_{00}	4.019 (0.003) ***	4.025 (0.003) ***
γ_{01}		- 0.199 (0.019) ***
γ_{10}	- 0.128 (0.002) ***	- 0.125 (0.002) ***
γ_{11}		- 0.087 (0.011) ***
Variance Components		
σ_{ε}^{2} (Level 1)	0.352943	0.352943
τ_{00} (Level 2 Intercept)	0.029858	0.028766
τ_{11} (Level 2 Slope)	0.001315	0.001109

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Interaction term is statistically significant : The difference in response time between unflagged test takers and flagged test takers depends on the type of item (flagged vs unflagged)

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$$1 - \frac{.028766}{0.029858} = 3.7\%$$

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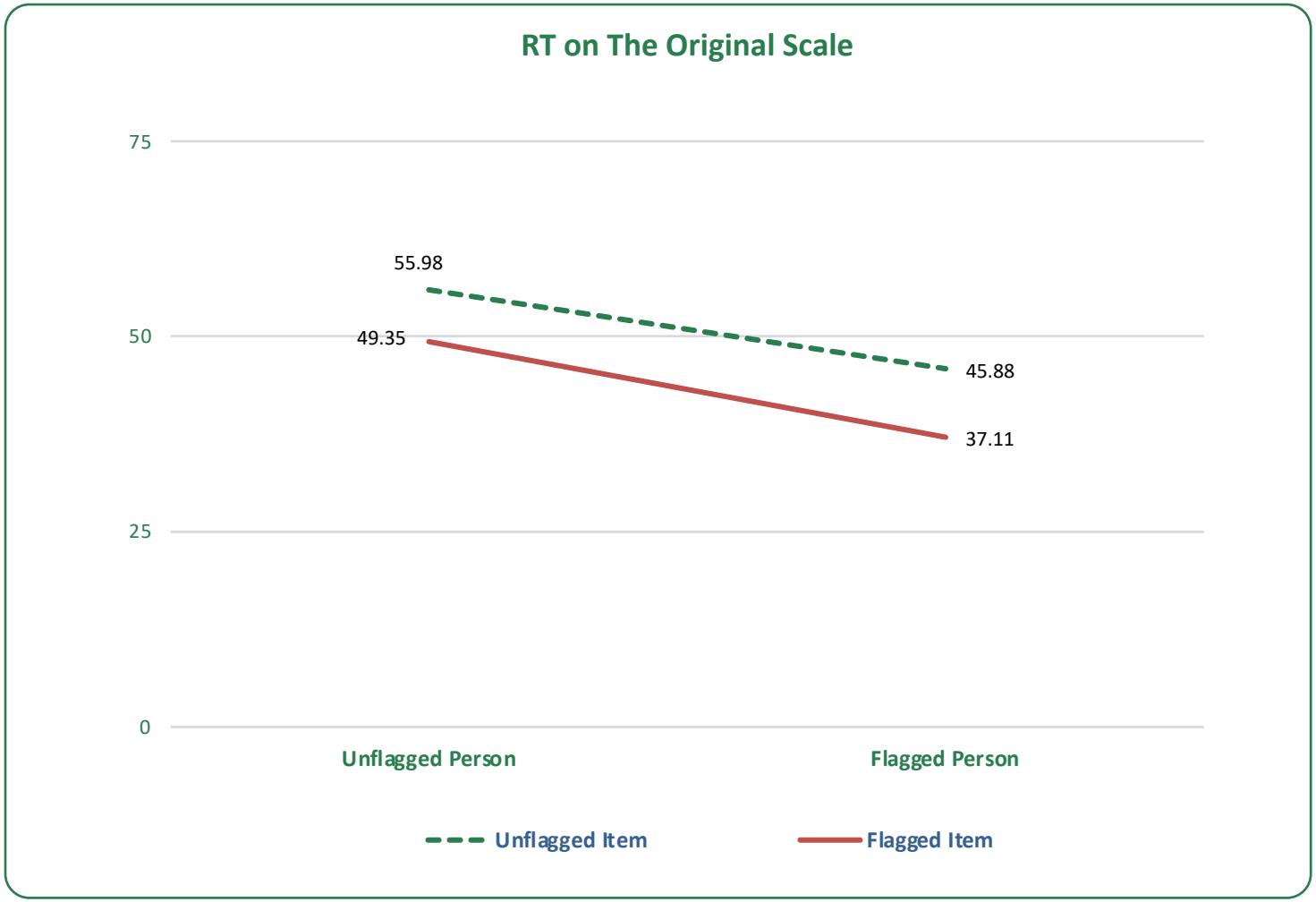
$$1 - \frac{0.001109}{0.001315} = 15.7\%$$

Item Flag	Person Flag: No	Person Flag: Yes
No	$e^{\gamma_{00}}$	$e^{(\gamma_{00}+\gamma_{01})}$
Yes	$e^{(\gamma_{00}+\gamma_{10})}$	$e^{(\gamma_{00}+\gamma_{01}+\gamma_{10}+\gamma_{11})}$

Response time on the original scale

Item Flag	Person Flag: No	Person Flag: Yes
No	55.98	45.88
Yes	49.35	37.11


RT on The Original Scale
75
50
25
0
55.98
49.35
45.88
37.11
Unflagged Person
Flagged Person
Unflagged Item
Flagged Item

Conclusion

- What we found ?
- Why these results are important ?
- What is the next step ?

Thank you!

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