

# When Simpler is Better: Impact of Appropriate Model Selection on Attribute Classification

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## I. Motivation

1. A variety of cognitive diagnosis models (CDMs) have been developed recently. Determining which model is the most appropriate for an item is not always apparent.

|                   | General or saturated CDMs   | Specific or reduced CDMs  |
|-------------------|---|---|
| <b>Examples</b>   | <ul style="list-style-type: none"><li>• G-DINA model (de la Torre, 2011)</li><li>• General Diagnostic Model (von Davier, 2008)</li><li>• Log-linear CDM (Henson, Templin, &amp; Willse, 2009)</li></ul> | <ul style="list-style-type: none"><li>• DINA model (Haertel, 1989)</li><li>• DINO model (Templin &amp; Henson, 2006)</li><li>• <i>Additive</i> CDM (<i>A</i>-CDM; de la Torre, 2011)</li><li>• Linear Logistic Model (LLM; Maris, 1999)</li><li>• Reduced Reparametrized Unified Model (R-RUM; Hartz, 2002)</li></ul> |
| <b>Advantages</b> | <ul style="list-style-type: none"><li>• Always provide better model-data fit</li><li>• Are less likely to cause misfit</li></ul>  | <ul style="list-style-type: none"><li>• Are more stable</li><li>• Have more straightforward interpretations</li><li>• Provide more accurate classification</li></ul>  |

2. Bases for model selection

a) Expert judgment

b) The Wald test (de la Torre & Lee, 2013): Evaluating, item by item, whether a saturated model (i.e., G-DINA) can be replaced by a reduced model without a significant loss to model-data fit

3. Considering that the true model is never known, it is not clear whether selected CDMs based on the Wald test can provide comparable classification rates as the true model.

## II. Goal

To evaluate whether the attribute classification of CDMs selected based on the Wald test is better than that of general CDMs

## III. Study design

### Factors

- Sample size: 500, 1000, 2000
- Test length: 30
- Number of attributes: 5
- Item Quality: High, Moderate, Low
- Attribute distribution: Uniform, Higher-order
- Generating models: DINA, DINO, *A*-CDM, LLM, R-RUM
- Estimating models: True models, selected CDMs based on the Wald test, saturated model (i.e. G-DINA)

## IV. Preliminary results

The CDMs selected by the Wald test have higher correct classification rates than general CDMs, especially when the sample size is small, or the item quality is low.

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